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FIELD SURVEY REPORT
COLOMBIA - PERU - CHILE

MARCH 1963

GENERAL ELECTRIC

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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COLOMBIA-PERU-CHILE FIELD SURVEY REPORT

Submitted to

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U.S. DEPARTMENT OF STATE

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INTRODUCTION

This report presents the principal findings and recommendations of Field Surveys conducted in Colombia, Peru and Chile during the period May 3 - June 8, 1962 on the Generation and Utilization of Power in Rural Areas. The investigations were carried out by a Survey Team consisting of George Street, Jr., Engineer - General Electric Company; Frank L. Turner, Economist - Stanford Research Institute; and E. Gordon Alderfer, Program Officer - CARE, Inc., N.Y.C.; plus (part time) Thomas O. Paine, Physicist - General Electric Company; Christopher Ahrens, Engineer - CARE Peace Corps, Bogota; and Henry F. Dobyns, Anthropologist - Cornell-Peru Project.

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.

In this report are the principal findings, conclusions and recommendations of the survey. In addition, the field data gathered in rural villages in Colombia, Peru and Chile, and a review of national rural electrification programs are recorded in Appendices.

Special acknowledgement and thanks are due the host country and U.S. agency personnel whose generous assistance made this work possible. Particular mention should be made of the never-failing cooperation of the U.S. Peace Corps volunteers in Colombia and Chile, and of the Cornell-Peru Project Staff in Peru, who were particularly effective in overcoming transportation and living problems in the remote villages surveyed. A chronological record of the field activity involved in obtaining these data is contained in the accompanying report: Field Survey Trip Logs. This Field Survey Report is one of a series on the Generation and Utilization of Power for Rural Communities in Developing Countries, prepared under contract to the Agency for International Development. Other reports in this series cover 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

CONCLUSIONS

There is a universal desire in rural villages of Colombia, Peru and Chile for electricity. It is equated with social prestige and "progress" (the villager vaguely assumes that industrial activity will somehow automatically follow).

When electricity is introduced into villages, it is first used for household illumination, radios, street lighting, irons, and the village beer cooler and juke box. Later uses include fans, movies, barber clippers and X-ray facilities. Low voltage may block effective use of these equipments.

In villages that have been electrified for as long as forty years, uses of electricity beyond these initial essentially non-productive uses have not generally occurred. Underlying reasons have been the inadequacy and unreliability of power and the inability of villagers to understand how to apply power in a way to produce an economic return.

Electrified villages, consequently, report no apparent economic impact. Rather, electricity is an amenity that costs money. Lighting, contrary to optimistic predictions, could not be shown to have noticeably improved literacy standards in the villages surveyed.

Rural villagers are capable and eager to contribute labor and indigenous materials to the construction of earthworks, small buildings, poles and other items required in the installation of a community electric plant.

Electrified villages accept a wide range of existing tariffs. They also resist strongly any proposals to increase existing rates, which are usually below costs. This leads to overloaded capacity, breakdowns, and inability to keep pace with population growth or to extend service.

The minimum adequate capacity for a rural village is about twenty watts per capita, of which two watts per capita are for street lighting. About fifteen kilowatt-hours per year are used for home lighting.

Indigenous fuels are generally unavailable in the quantities required for village electric power.

The original concept of a small 5-15 Kw generator using indigenous fuels did not prove generally applicable in the rural communities surveyed. Hydroelectric, diesel or gasoline generators are the most practical for local generation where grid power is unavailable.

A village electrification program will not have a positive economic impact unless integrated with a rural development program.

The productive utilization of electricity by rural villagers requires positive load-building demonstration programs. This and other rural development opportunities need much stronger technical support than is now available to the villager.

Electrification and rural development are key political issues.

U.S. Peace Corps Volunteers are playing a strong role in rural community development. Their effectiveness could be increased even further by providing increased technical support.

Indigenous institutions are doing a good job in rural development, but a great deal remains to be done. Particularly needed are more programs that move technical personnel into direct involvement with rural problems.

RECOMMENDATIONS FOR FUTURE WORK

The principal need for future work to increase the impact of power at the rural village level is for programs that will:

- Develop improved devices and equipment for small-scale agricultural processes suitable for the market town (above 2000 population).

- Develop improved village work shop and light industry support equipment suitable for use in rural (primarily agricultural) communities.

- Develop improved hydroelectric and internal combustion generators above 50 Kw rating, specifically designed for rural environmental conditions, including standardization and low cost. Accompany this with distribution and wiring device improvements.

- Carry out pilot electrification field projects integrated with rural development programs, including Peace Corps projects.

- Develop demonstration programs to teach the productive application of power to villagers.

- Provide more effective technical support in general to rural development activities, including Peace Corps projects.

PRINCIPAL FINDINGS

The initial emphasis of this project was on determining the applicability of small (5 to 15 Kw) electric generators to rural communities in less developed countries, where major power shortages exist. It was hypothesized that the development of a new generator capable of utilizing such indigenous fuels as wood and agricultural waste might have a significant impact on rural living standards. The field survey in South America did not confirm the general applicability of this concept.

REQUIREMENTS FOR VIABLE ELECTRIFICATION

It became apparent that a rural village had to meet several requirements to make possible the potential productive application of electricity. First, it had to be above a critical size to contain and support viable economic activity, and be connected to a cash economy market by an effective transport route. Second, the village must have a substantial source of fuel or hydro-energy to operate its power conversion facilities. And lastly, the power that is introduced must be of adequate capacity to provide a meaningful economic factor in village development in productive ways which the villagers can perceive.

Critical Size

The critical village size for viable economic development can not be fixed with precision, but in Colombia, Peru and Chile, it would appear to be above a minimum of about 2000 persons. Such villages are found to be generally integrated into the trade economy in the agricultural sector, and as such, are linked by crude roads to market centers.

Fuel Availability

There is an almost universal shortage of indigenous fuels; agricultural wastes are used for cattle food, wood for building materials, and other local fuels are scarce and have other uses. At the same time, there was found to be a ready access to cheap gaoline, kerosene and even diesel fuels in the most remote areas visited. Hydroelectric and petroleum-fueled energy are the practical sources for these villages.

Capacity Requirements

On the basis of a number of observations, it is estimated that the minimum adequate electric capacity that should be installed in a rural village is 20 watts per capita, or 40 Kw for a village of 2000 population, as discussed in detail elsewhere. These observations belie the thesis that a small (5 - 15 Kw) electric generating plant operating on indigenous

fuels would be likely to have a significant economic impact on rural communities. Rather, villages without access to grid power would appear to be best served by available or improved gasoline, diesel and hydro-electric generators.

Economically Productive Utilization of Power

This is of basic interest because it makes possible a permanent self-supporting power program. The principal productive application opportunity for power perceived by villagers in the predominantly agricultural regions surveyed from Cholchol in southern Chile to San Onofre in northern Colombia was for irrigation pumping to bring additional land under cultivation and to increase crop yields. Pumps directly coupled to engines would be more economical than electric pumps run by small engine-generators, but where larger generators can be justified for other applications, electric pumps run in off-peak load periods become practical, as discussed elsewhere. Other potential productive uses mentioned by villagers included power work shops, food storage facilities, stock breeding and veterinary services, ice-making for fish preservation, dairying, poultry-raising, oil-pressing, milling, feed grinding, coffee processing, fibre processing and weaving. Hopeful suggestions that power should also make possible such local industries as bakeries, beverage bottling, machinery repair, candy-making, leather working, garment making, and food canning were frequently made by Village Leaders and Peace Corps Volunteers, but it was obvious that electric power was only one of the critical resources that would be needed to initiate economically competitive rural industrial activity. This underscored the necessity for making electrification an integral part of rural development programs.

Other Uses of Power

Other power utilization opportunities proposed that would only indirectly increase economic productivity included: lighting for streets, schools, clinics and homes, and power for clinics (sterilizers, refrigerators, and X-ray equipment), radios, movies, juke boxes, manual training shops, irons, sewing machines, hot plates, stoves, and portable water systems.

In general there was little understanding of the possibilities for using electricity for anything much beyond street and home illumination, hot plates and irons, and radios and juke boxes. Unfortunately, electricity limited to these uses is more likely to prove an economic burden on the village than a development asset. The need for an education program to develop awareness of productive uses through demonstration is clear. This is analogous to U.S. experience with T.V.A., as discussed elsewhere, and re-emphasizes the importance of integrating rural electrification and rural development programs.

INCREASED TECHNICAL SUPPORT FOR RURAL DEVELOPMENT

The rural villagers visited in South America showed a general receptivity to modern technology and a keen awareness of potential benefits it holds for them. Modern medicine, agriculture, engineering and industry were well accepted as holding the key to a better life. The basic question at issue appeared to be: how can modern technology be made more available to benefit the rural villagers?

Close Relation Between Rural Development and Politics

In the intensely political atmosphere encountered in even the most remote villages visited, with viewpoints oversimplified and hardened into the extremes of propertied-conservative-traditional versus poor-radical-experimental, this question tended to take the explosive form: what political-economic system, and what international diplomatic alignment, is likely to bring villagers soonest the benefits of modern technology? This is an obvious observation, further discussion of which is beyond the scope of this survey.

Hammer and Sickle and Political Slogans on Walls in the Andean Village of Huaras, Peru. Indians brought here to a political rally by truck from a 50-mile radius heard speeches calling for more electricity, schools, hospitals, and water systems. (May 1962)

Contributions of Peace Corps Volunteers

Several dozen Peace Corps Volunteers were visited in Chile and Colombia, and an extremely favorable impression generally received of their work in the villages. A major contribution that these young people are making is in bringing to bear on village problems a different point of view, which assumes that the answer to a problem is probably already known by somebody, somewhere and the thing to do is to go find it, and then experiment. For example, the PCVs in Cholchol, Chile, were not trained in agriculture, but they did contact an agricultural research station near Temuco, found out about some subterranean clover seeds available in Santiago, obtained the seeds with instructions for their germination, and started an experiment to provide the village with a new crop. The Peace Corps is thus one approach to providing technological support to rural villagers. To make this really effective, technical information would have to be made much more readily available to the PCV in the field. He needs sources of rapid, accurate technical information, both indigenous and from the United States, as well as improved communication with other PCVs who are tackling similar problems.

Contributions of Indigenous Institutions

These must provide the major technical support for rural development and a great deal of progress was seen from the work of the Institute for Rural Education in Chile to that of the National Coffee Growers Federation and Accion Comunal in Colombia. The programs of the National University in Bogota on Rural Sociology and Cinva-Ram Building Construction are excellent examples of University support for rural villagers, while the development work on potato storage and agricultural equipment of the Institute for Technical Investigations in Bogota show the contributions that indigenous research institutes can make. These programs tend to be successful to the degree that they succeed in getting technical people away from the cities and right into the problems of the rural environment. Much more needs to be done, and closer working relations established with sister U.S. institutions.

EXPERIENCE WITH RURAL VILLAGE ELECTRIFICATION

Twenty-three rural communities were visted in Colombia, Peru and Chile in the course of the field survey, and information on local experience with electrification obtained by inspection and interviews with responsible local residents. In most cases, the impact of electrification was disappointingly small.

A number of sites had old generating plants installed in the early 1920's. These small plants were generally put in by an entrepreneur or a small group of shareholders. The sale of electricity was on a charge-per-bulb basis, with rates which have tended to remain substantially unchanged, so that today the financial returns are usually inadequate to maintain reliable operation. At the same time, village populations have

grown and outstripped the capacity of the plants to serve them. Consequently, most villages with older plants find themselves in the awkward position of having unreliable, worn-out equipment, and insufficient revenues to provide adequate capacity for existing users, or to extend their systems to new users. The usual situation encountered was one of frequent outages and breakdowns, and severe brown-outs due to system overloading.

Cost of Electricity Relative to Income

An interesting parameter examined is the amount paid for electricity relative to income. Here in the United States a typical consumer spends 1 to 2% of his income for household electricity. It is thought to be a bargain, and the population accepts this rate. It is difficult to compare this on a fair basis to a underdeveloped area, where priorities are obviously quite different: per capita income is low, but living costs are also low. The use of electricity per consumer is low in these areas, but with the high tariffs the amount paid relative to income is comparable to U.S. practice. Table one lists average per capita income, per capita use (by consumers) and the resulting percent of income. Most are near the 2% value, but Cholchol exceeded 10%. On questioning, the villagers stated that even this high relative cost did not deter their desire to use electricity. In fact, while the survey team was at Cholchol the plant had been inoperative for six months and the consumers were continuing payment of tariffs on a per-bulb basis; and on top of this were operating gasoline lanterns.

TABLE 1 -- RELATIVE COST OF ELECTRIC POWER TO SELECTED RURAL VILLAGES

Village	Urban Population	% Elect.	Per Cap. Income ($)	Per Cap. Use (Kw-hr/yr)	Price of Elect. (¢/Kw-hr)	Price Elect. % Income
Taganga	1500	50	45	14.6	3.8	1.23
Andes	6900	100	76	95.5	0.68	0.86
Cholchol	1200	66	19	13.8	14.0	10.2
Acobamba	1961	64	34	11.0	7.5	2.4
Palca	1200	50	30	10.0	1.1	2.7

Use of Electricity as a Function of Price

Some comments may be made on the amount of electricity used by consumers as a function of its relative price. Andes, with its low-price hydroelectric power, has achieved 100% consumer electrification. The other villages average about 50% at their higher price levels. However, with a one-year-old plant, half the village of Taganga has already been connected and at the time of the survey, distribution was being extended to another 5%. Eventually a very major portion of this village will be electrified. Expansion of the systems of the remaining three villages are hampered by equipment break-downs and existing overload, so the effects due to the price factor can not be measured. Certainly, if better equipment of greater capacity were available to these villages, there would be increased participation.

Power Use Patterns

Table two presents typical data for five electrified communities, showing installed load and use patterns.

These systems are representative in that their output is used exclusively for household illumination, radios and street lighting. One would suspect the three older systems were sized for about 20 watts per capita as is the Taganga system just recently installed.

In Acobamba, where severe brown-out is occurring, the 11-watt level is clearly inadequate. The eighteen watts per consumer in Taganga permits good illumination capability in a typical household in the form of one 160-watt tungsten lamp, with an outlet for operating a radio.

Problem and Opportunity Associated with Low Use Factors

The very limited use of electricity, primarily for early evening illumination, throws a large peak demand on the generator for a few hours a day, after which it remains almost idle until dusk the next evening. This leads to the uneconomical operation shown in Table two. At the same time, this situation creates opportunities for developing productive daytime applications using existing installed capacity. A concerted program to build productive loads is needed. This would obviously best be done in concert with a rural development program, as pointed out previously.

Observed Economic Impact of Electrification

In spite of the universal belief that electrification means progress, none of the electrified sites visited could report any positive economic impact attributable to the installation of electric power. The street and home illumination had proven to be very welcome social amenities and, of course, the radios provided entertaining contact with large city regions. Although questioned hopefully on other measures of "progress" --

TABLE II -- POWER USE PATTERNS IN SELECTED RURAL VILLAGES

Village	Plant Rating (Kw)	Year Installed	Connected Load (Kw)	Load Factor (%)	Connected Load Per Consumer (W/Cons.)	Installed Capacity Per Capita (W/ Cap.)	Total Energy Generated (Kw-hrs/Yr.)
Taganga	30 D/E	1961	19.2	8.0	18.0	20.0	111,000
Andes	720 H/E	1957	714	13.4	98.7	104.0	6,630,000
Cholchol	15 D/E (45)	1921	12	10	15.2 (26.0)	12.5	10,900
Acobamba	15 G/T	1920	30	10	11.0	7.6	13,720
Palca	10 H/E	1925	8	10	13.3	8.3	7,280

increased literacy, some minimal industrialization, etc., the answers were essentially negative. The provision of electrification had not proven sufficient to trigger economic development, although undoubtedly making the village a more desirable place in which to live.

COLOMBIA FIELD SURVEY REPORT

APPENDIX A

FIELD DATA FROM SELECTED RURAL COMMUNITIES IN COLOMBIA

Between May 29 and June 3, 1962, the two field survey teams which visited selected rural communities in Colombia obtained local data relevant to the generation and utilization of power in these areas with particular regard to the relation between the provision of power and resulting rural social-economic development. Data from additional communities of interest were collected by U. S. Peace Corps Volunteers stationed at the sites studied, whose cooperation is gratefully acknowledged. Communities with and without power were included in the survey. An effort was made to secure a representative cross section of villages, from seacoast to mountains, arid to wet, tranquil to troubled, coffee-growing to fishing economy, minifundia to latifundia, grid power to local generation, and lengthy experience with electricity to none. Sufficient site data were desired to permit the later preliminary selection of promising villages for possible future village electrification-community development pilot project experiments.

This Appendix contains the community data collected in the course of this program arranged by village name. In general, more information is available for those communities of the greatest interest for possible future field programs. In some cases, photographs are included to better portray village conditions. It is hoped that the raw data contained in this Appendix may be of use to workers interested in rural communities in Colombia in connection with other programs.

Additional information on the gathering of these data is included in the accompanying project report: Field Survey Trip Logs. The Summary Project Report presents the over-all conclusions and recommendations of the project. Comparable information for villages in Peru, Chile, and India are presented in the accompanying Field Survey Reports on those countries.

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Site Name and Location	Municipio of Andes, Antioquia Department, Colombia
Population	6900 Urban, 48,000 Rural
Date Investigated	June 1, 1962
Field Investigation Team	T.O. Paine, General Electric Company C. Ahrens, CARE-Peace Corps, Colombia Frank L. Turner, SRI John Lewis, Peace Corps Volunteer

1. Site Evaluation

The pueblo or market town of Andes appeared to the Survey Team to be a very promising locality for a field pilot project, involving a productive electric load building program and related community improvement programs. The considerations leading to this opinion are summarized in the following paragraphs a. through f., and described more fully in the latter part of this site report.

a. Ample Unutilized Installed Capacity for Daytime Use

Electric power for Andes is now provided by a 720 Kw hydrogenerator with a load factor of about 13.4 percent (see Table 6 near the end of this appendix). The low use of generating capacity is explained by the fact that about 82 percent of all power produced is sold to residential subscribers who consume power principally for lighting in the early evening. During the daylight hours, only a fraction of the generating capacity is used. As shown in Table 6 , the daytime load is based on the requirements of 19 commercial or service establishments, 2 corn mills, the hospital and health center, schools and the public water supply system. Even if these facilities were all to draw power simultaneously up to their maximum connected loads, they would require only 39 Kw as against the generator's rated capacity of 720 Kw.

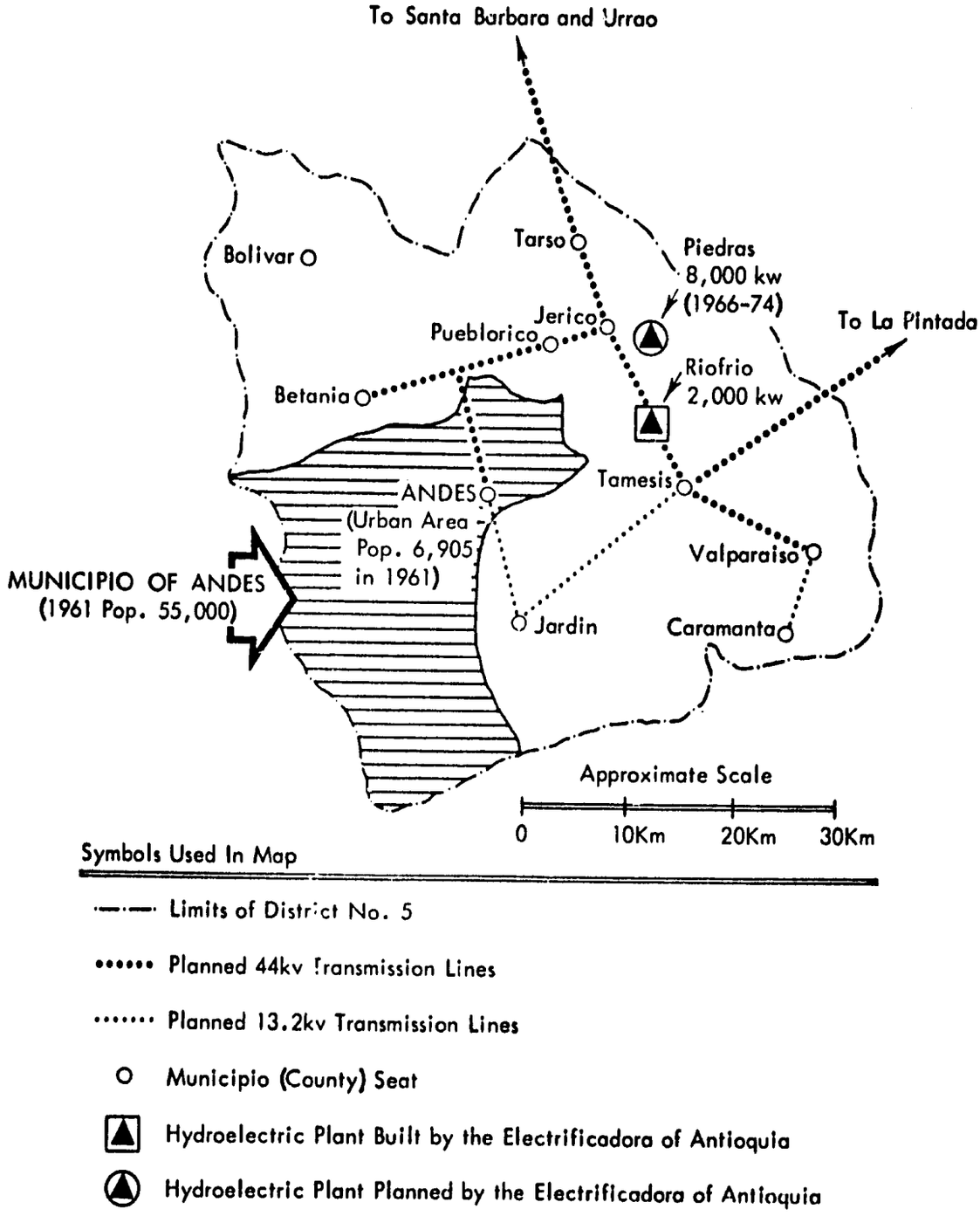
In addition to the above unused capacity, the town is expected to receive very shortly an allocation of additional power by means of a 44 Kw transmission line extending from the 2000 Kw hydro generator at the Rio Frio plant near Tamesis (see Figure 1 on the following page). The extension of a line from Tamesis is needed in Andes to double the evening power supply, according to the local authorities interviewed. This judgment has also been accepted by Electroaguas.

b. Access to Markets

The town of Andes is situated roughly midway between two market centers: Medellin, with a 1960 population of 614,000,

FIGURE 1

PLANNED ELECTRIFICATION OF DISTRICT NUMBER 5 ("JERICO DISTRICT") ANTIOQUIA DEPARTMENT, COLOMBIA, INCLUDING THE MUNICIPIO OF ANDES AS OF JUNE, 1962



located some 86 miles (139 kilometers) to the north, and Manizales about 112 miles (180 kilometers) to the south with a population of 166,000. An unpaved but well-maintained road connects Andes with Medellin and a similar road is projected for near future completion to connect Andes with roads already built and extending to Manizales. A narrow guage railway also connects Andes with the Bolombolo rail junction which in turn is connected with Medellin.

c. Industrial Possibilities

The municipio of Andes has an urban population of 6900 and a rural population of 48,000. The rural dwellers are scattered throughout 29 veredas or villages and isolated family farms in rugged mountainous country. They are economically oriented toward the market town, and look to Andes for the sale of farm products and the purchase of goods. The rural campesinos or peasants are concerned about the inflated prices they pay for manufactured consumer goods now brought in from the capital city of Medellin, and dissatisfied with the low prices they receive from the wholesale brokers who sell their farm products to Medellin. Processing industries are needed in Andes for locally produced meat, poultry, fruits, hides, tallow, corn, cabuya (sisal-like fiber), and other agricultural products. These could increase local value-added, and improve the cash return to Andes farmers by decreasing middlemen transactions. There are a number of consumer goods which might be efficiently made on a small scale locally including work clothes, tiles, metal castings, bottled drinks, sausages, cakes and bread, candy, shoes, and leather goods. Much of the rural population has comparatively ready access to Andes so benefits felt in the town such as added employment, income, or better prices would also be felt by the rural populace. With the exception of such limited facilities as a small mechanics shop, gasoline station, and two corn mills, there is now no industry in Andes. It would appear that the possibilities for developing new industry are well worth further study.

d. Receptivity of Andes to a Development Program

The town has community spirit and a desire to modernize and improve its economic position as evidenced by the presence of a Lions Club, several "4-S" (equivalent to 4-H) Clubs, a church active in seeking community improvements, women's organizations to improve home economics, marketing and buying cooperatives, and representatives of the Cafeteros (National Federation of Coffee Growers) who carry out agricultural extension work in the municipio, and

have sponsored work on schools, aqueducts, bridges, and telephone lines. The Electric Power Authority of the Department, Electrificadora de Antioquia, is planning to increase power available to Andes, as already mentioned, in the belief that power consumption here shows evidences of potential future growth. Government public health programs are active in such areas as preventive medicine, latrines, aqueducts, lectures, public health nurse, and medical services. An effective extension team is working in the town, including an agronomist, three practicos, a veterinarian, a promotor, two mejoradoras, the local Granja (Agricultural Experimental Station) Chief, two U.S. Peace Corps volunteers and a secretary. Good progress is being made and team morale is excellent. The basic difficulties confidentially described by the team in Andes are the usual ones: resistance of campesinos to change, extremely paternalistic clergy, and over 50% illiteracy rate.

e. Mechanism for Encouraging Capital Formation

Although no figures are available on savings and borrowings in the area, the presence of two branch banks in Andes already provides a mechanism for encouraging savings and loans. The presence of these banks also suggests that some capital formation may now be occurring in the community, although lack of capital is cited as a deterrent to development.

f. Need for Improvements in the Vicinity of Andes

Andes is located in the coffee growing area of Colombia's highlands. The campesino has an income which typically ranges from the equivalent of $300 to $400 annually shared by a family of four or five persons. As the price of coffee declines, as it has in recent years, the condition of the campesino worsens. Indicative of the plight of these peasants is the farsighted action being taken by the National Federation of Coffee Growers to diversify crops and to augment rural incomes by introducing better strains of livestock and poultry, the introduction of new animals, and the training of women in better home economics. Despite these efforts, living standards among the peasants are depressed, and the violencia (banditry and terror) still exists in parts of Antioquia. The nearby town of Venecia visited by the team is under military government. Many persons interviewed by the Survey Team, including Colombian Army personnel, felt that a correlation exists between depressed rural living standards and violencia outbreaks. It was stated that the violencia, although originally

political in motivation, had persisted in part because of unfavorable economic opportunities in rural areas. If a successful development program could be demonstrated in Andes, the example could be followed in similar communities elsewhere in Colombia's highlands to improve the conditions of the depressed campesino populace.

2. Environmental Characteristics of Andes

Andes is located in a mountain stream valley at an altitude of 4452 feet. The stream, called the Rio San Juan, is some 50 feet in width and tumbles rapidly through a gorge roughly bisecting the town. The residential area of Andes rises steeply on both sides of the stream and many houses are built on slopes, necessitating stilt-like supports in the form of wooden pillars on the downhill side. A bridge has been built, permitting ready access between the eastern and western parts of town separated by the Rio San Juan.

To the east of Andes is a hilly ridge some six miles distant, and about 20 miles to the west is a mountain range with altitudes of more than 12,000 feet (Mt. San Nicolas). The sloping terrain is farmed wherever possible, but steep inclines and the erosion of top soil due to brush cutting have reduced fertility.

The mean temperature of the town of Andes is 70 deg. F, but more than half of Andes municipio, or 140 square miles, is classified as "cold" or "frigid", while the remaining 100 square miles is classified as "temperate."

The municipio has numerous streams fed by reportedly adequate rainfall. Most of these streams drain into the Rio San Juan, which flows in a northerly direction and joins the Cauca River about 42 miles north of Andes.

The streets of the town are mostly paved. Houses are constructed with wooden frames, plastered adobe or brick walls, and tile roofs. Dominating the town near the highest point is an impressive brick church with two spires about 70 feet high, facing a large open plaza which serves as the center of town activity.

The few passenger vehicles in Andes (mostly taxis) are generally of U.S. manufacture, principally ten to fifteen year old Fords, Chevrolet and Plymouths. Trucks and buses are generally newer; and are reasonably well maintained. The campesinos living in rural areas near Andes use horses and donkeys for riding and packing purposes; motor roads do not yet penetrate to most of the veredas.

3. Per Capita Income

Data on the income of rural workers were obtained by the team from two veredas in the municipio of Andes in the form of ansers to questionnaires filled out by local U.S. Peace Corp volunteers. In one village the standard or acceptable income was considered to be the equivalent of about U.S. $420 per year, or $1.15 per day. Assuming families average 5.5 persons each, the per capita annual income would be $76. In the second village, incomes were lower, the equivalent of $288 per year or 79¢ per day; this would be about $52 per capita annually.

Incomes in the pueblo of Andes appeared to be higher, but local estimates were not obtained. Such people as the proprietors of the following establishments probably enjoy incomes two to five times the rural level: hardware and clothing stores, pharmacy, food store, cantina (restaurant-bar), trucking, bus, and taxi companies, metalworking shop, saddle and leather work store, the two branch banks, woodworking shop, and land owners residing in the town. Similarly the municipal officials, judges, and doctors probably have incomes several times those received in the rural part of the municipio.

In the rural area of Andes surveyed savings were almost unknown. In the vereda of San Pedro Abajo, 27 families out of 38 were in debt for amounts ranging from the equivalent of $58 to $92 because of farm improvement loans, deaths, or illness. In the vereda of La California, where incomes were lowest, debts typically were $23 (as compared with annual income of $288). In both villages no disposable income was reported.

4. Land Holdings

In the two veredas sampled, 60 and 75 percent of the campesinos owned their own land. In the mountainous terrain around La California, the typical land holding was 20 hectares (49.4 acres), onl. a portion of which was arrable. Around San Pedro Abajo, the typical holding was 3 to 4 hectares (7 to 10 acres). This pattern of land holding makes Andes a much more promising site for pilot project work aimed at benefiting the campesinos than the depressed Latifundia (large landlord holding) areas found in otherparts of Colombia.

5. Size and Location of Labor Force and Skills

Of the 1961 population of about 55,000 persons in the municipio, 6905 reside in the pueblo of Andes and the remainder in 5 corregimientos (subordinate market centers for a group of villages) and 29 veredas (villages). See Table 1.)

The population density of the municipio is about 90 per square kilometer (233 per square mile) as compared with the Departmental density for Antioquia of 32, and a national density of 13 per square kilometer, in terms of 1960 population figures. Within Power District Number Five, in which Andes is located, the municipio of Andes ranks fourth in population density out of 10 municipios.

Of the total municipio population of 55,000, the labor force is estimated to consist of 25,000 persons, or about 45 percent of the total population. This percentage is higher than the 1958 national figure of 33 percent, and includes minors in the rural areas, especially where schools are insufficient to permit instruction beyond elementary grades. In the vereda of San Pedro Abajo, the schools provide only first and second grade instruction. Typically, children over 8 or 9 years of age work on the farms, help in carrying firewood or farm products, and tend livestock.

Coffee beans are harvested and processed (grating of hulls) from about October through January. Before and after the coffee season, the campesino is partially employed, namely from February through September. During the period June through August, he is typically not productively employed. Variations in the pattern prevail from village to village, but generally the period of semi-employment begins in February and continues into September, a total of about 8 months.

6. Agriculture and Livestock

The farming population in the municipio is engaged in the production of coffee as the principal cash crop, followed by sugar cane, yucca (for starch), and platano (a small variety of banana). Other crops grown include corn, bananas, beans, and oranges. The most important animals raised are beef cattle, hogs, and chickens. Other animals raised are ducks, geese, horses, mules, a few rabbits (for fur), and guinea pigs (for food).

The population of the pueblo of Andes has declined slightly in recent years, from 7760 persons in 1958 to 6905 in 1961. The rural population has risen somewhat, from 43,138 in 1958 to about 48,000 in 1961. Certain veredas, however, have shown a decline in population due to "hunger, lack of work, lack of good pay, difficulty with the land owner," according to reports of the local Peace Corps volunteers.

The comments of town officials interviewed by the Survey Team indicate that emigration from the town of Andes is attributable to the desire for higher incomes in Medellin and to the failure of young people to return to Andes after receiving a higher education. The violencia has caused significant migration out

Table 1
Estimated Population and Labor Force in Municipio of Andes
1961

Population	Pueblo of Andes	Rural Dwellers	Total
	6905	48,000[a] (45,000 farmers and families)	54,905[b]
Total males (45%)	3107	21,600	24,707
Total females (55%)	3798	26,400	30,198
Total labor force	2244	22,560	24,804[c]
Males	1864[d]	17,280[e]	19,144
Females	380[f]	5,280[g]	5,660

a. Includes estimated 3000 not enegaged in farming, located in 5 corregimentos (subordinate market centers). According to Municipio Office, rural population in 1959 was 44,733. Above figure assumes 3.7 average annual growth based on 1958 to 1959 increase.

b. Peace Corps Volunteer reports total is 55,000, 1961.

c. Includes minors and is 45% of population.

d. 60% of males.

e. 80% of males in rural areas.

f. 10% of females.

g. 20% of females in rural areas.

Sources:
Population figures furnished by Andes Town Office; labor force figures estimated on basis of replies to questionnaires filled out by local U.S. Peace Corp volunteers.

of neighboring municipios, but this was not cited as a cause for the decline in the population of Andes.

7. Potential Industry in Andes

As mentioned at the outset of this site report, there are several characteristics of Andes which suggest a promising potential for small scale industry based on urban markets, rural markets, and services. No specific industry could be recommended without a feasibility study to assess such factors as costs of raw materials, transfer costs to markets, availability of required labor and managerial skills, and the present and potential competition. However, the following factors (a through c) suggest some industrial potential for the community:

a. Andes has adequate access by highway and rail to Medellin and in the near future will have access to Manizales. Both cities are substantial market centers, with combined 1960 populations of 779,910.

b. The successful growth of small scale industries in other towns in Colombia suggests that a similar growth could occur in Andes.

c. Andes already has excess daytime power and will soon have even more when the 44 kv line from the 2000 kw Rio Frio plant is brought in as shown in Figure 2 and tables 2, 3, 4, and 5.

Table 2

Name of Town Served	Number of Residential Subscribers	Kw-hours consumed Annually per Residential Subscriber	1960 Residential Rate
Oriente	2152	1918 kw/hours	0.68¢ (5.9 centavos)
Puerto Berrio	1962	2356 kw/hours	.82¢ (7.1 centavos)
Tamesis	1649	1536 kw/hours	.78¢ (6.8 centavos)
Andes	1390	477 kw/hours	.69¢ (6 centavos)

d. The commercial and banking communities reportedly are interested in promoting economic activity, although virtually no industry exists at present. (See items 3 and 4 of Table 6 regarding commercial and industrial establishments).

e. The labor force of some 25,000 persons in the municipio is only partially employed for about 8 months of the year, and, according to local leaders, would welcome factory employment. The National Federation of Coffee Growers told the Survey Team of their own plans to supplement peasant incomes, and stated that industry would be especially desirable for that purpose.

Table 3
Transformer Substations for District Number 5
"Jerico District," Antioquia, Colombia as
of May 1961

Substations	Transformer Capacity (kva)	Ratio	Cost[a]
Betania)) Bolivar)	2000	44/13.2	$ 34,500
Andes)) Jardin)	2000	44/13.2	$ 34,500
Pueblorico	500	44/13.2	8,625
Jerico)) Tarso)	8000	6.6/44/13.2	$138,000
TOTAL			$215,625

a. Converted at: 1 peso = 11.5 U.S. cents.
Source: Electrificadora of Antioquia.

Table 4
Transmission Plans for District Number 5
"Jerico District," Antioquia, Colombia
as of May 1961

Lines	Length (kilometers)	Tension (kv)	Cost[a]
Jerico-Pueblorico	6	44	$20,224
Pueblorico-Betania	20	44	$67,413
Partidas-Andes	12	44	$40,448
Jerico-Tamesis	20	13.2	$65,780
Tames-Jardin	20	13.2	$65,780
Valparaiso-Caramanta	10	13.2	$32,890
Betania-Bolivar	12	13.2	$39,468
Andes-Jardin	12	13.2	$36,570
Salgar-Bolivar	15	13.2	$45,712
Jerico-Tarso	10	13.2	$25,300
Tamesis-Pintada	15	13.2	$37,950
TOTAL	167		$526,870

a. Converted at: 1 peso = 11.5 U.S. cents.
Source: Electrificadora of Antioquia.

Table 5
Distribution Plans for District Number 5
"Jerico District," Antioquia, Colombia
as of May 1961

Distribution Points	Capacity in Kva 1959	Planned Expansion During 1961-74	Cost[a]
Jerico	1100	2150	$82,225
Pueblorico	250	450	$18,688
Tarso	200	350	$14,950
Tamesis	400	750	$29,900
Caramanta	350	700	$26,163
Valparaiso	300	550	$22,425
Jardin	500	950	$37,375
Andes	850	1700	$63,538
Betania	300	550	$22,425
Bolivar	900	1750	$67,275
TOTAL	5150	9900	$384,964

a. Converted at: 1 peso = 11.5 U.S. cents.
Source: Electrificadora of Antioquia.

Table 6
Estimated Annual Load Factor for 720 Kw Hydrogenerator in Andes, Antioquia Department, Colombia
1962

Type of Load	Assumptions	Yearly Use (kwh)
1 Household illumination	a. Population in area served: 6950 (urban population of Andes, 1961). b. Persons per household: 5 c. Number of subscribers: 1390 with a connected load of 490 watts each. d. Period of use: 6 PM to 11 PM. e. Connected load: 681 kw. f. Daily use at 50 % utilization: 5 hours x 681 kw x .50 = 1703 kwh. g. Yearly use: 365 x 1703 = 621,595 (447 kwh per subscriber annually).	621,595
2 Street Lighting	a. Number of lamps and wattage: 600 lamps, 50 watts each. b. Utilization: 100%, 6 PM to 11 PM (5 hours); 33%, 11 PM to 6 AM (7 hrs.) c. Connected load: 30 kw. d. Daily use: 220 kwh. e. Yearly use: 365 x 220 = 80,300 kwh.	80,300
3 Commercial and service establishments	a. Number of establishments: 19 (hardware, clothing, food, cantina, leather goods, taxi company, trucking company, bus company, stable, gasoline pumping station, mechanics shop, metal-working shop, 2 branch banks, carpenter shop, police station, municipal office, telephone and telegraph office, pharmacy). b. Utilization: 8 AM to 6 PM (10 hrs), 75% c. Connected load: 600 watts per establishment. d. Total connected load: 19 x 600 watts = 11.4 kw. e. Daily use: 10 hours x 11.4 x .75 = 86 kwh. f. Yearly use: 365 x 86 = 31,390 kwh.	31,390
4 Industrial Load	a. Number of industries: 2 corn mills at 5 Hp each b. Connected load: 10 HP x .746 kw = 7.46 kw. c. Utilization: 25%, 90 days per year. d. Daily use: 7.46 kw x 9 hours x .25 = 16.8 kwh. e. Yearly use: 90 days x 16.8 = 1512 kwh.	1,512

Table 6
(Continued)

	Type of Load	Assumptions	Yearly Use (kwh)
5	Miscellaneous Daytime Loads	1. (a) Hospital and Public Health Center have 8 kw connected load, 50% utilization, 8 AM to 6 PM. (b) Daily use: 8 kw x 10 hours x .50 = 40 kwh. (c) Yearly use: 300 days x 40 kwh = 12,000 kwh. 2. (a) Schools have 8 kw connected, 30% utilization, 8 AM to 6 PM. (b) Daily use: 8 Kw x 10 hours x .30 = 24 kwh. (c) Yearly use: 300 days x 24 kwh = 7200 kwh. 3. (a) Public drinking water has 4 kw connected, 10% utilization. (b) Daily use: 4 kw x 10 hours x .10 = 4 kwh. (c) Yearly use: 300 x 4 = 1200 kwh. 4. Total yearly use for above three facilities: 12,000 + 7200 + 1200 = 20,400 kwh.	20,400
6	Miscellaneous Nighttime Loads	1. (a) Police station with 600 watts connected, 80% utilization, 6 PM to 8 AM. (b) Daily use: 600 watts x 14 hours x .80 = 6.7 kwh. (c) Yearly use: 365 x 6.7 = 2445 kwh. 2. (a) Church and community functions with 2000 watts connected, 6 PM to 10 PM, 30% utilization. (b) Daily use: 2000 x 4 hours x .30 = 2.4 kwh. (c) Yearly use: 365 x 2.4 = 876 kwh. 3. Total yearly use for above two facilities: 3321 kwh.	3,321
7	Total estimated annual use (1+2+3+4+5+6		758,518

Table 6
(Continued)

	Type of Load	Assumptions	Yearly Use (kwh)
8	Potential Annual Generation of Andes 720 kw Hydrogenerator	720 x 24 x 365 = 6,307,200 kwh.	6,307,200
9	Effective Capacity of Hydro-generator in Andes	Assuming 10% outage, effective capacity would be reduced by 630,720 kwh to: 5,676,480	5,676,480
10	Load factor for Andes 720 kw Hydrogenerator	758,518/5,676,480 = 13.4%	13.4%

Sources:
Peace Corps reports, interviews in Andes, observations of the Survey Group.

8. Present Utilization of Power in Andes

Power for Andes is generated by a 720 Kw hydroelectric generator installed in 1957, and the rates are comparatively cheap. Rates in Andes are as follows:

Industrial consumers 0.46¢ (4 centavos) per kw/hour.
Residential consumers 0.69¢ (6 centavos) per kw/hour.
Commercial consumers 0.92¢ (8 centavos) per kw/hour.

The above rates can be compared with the average rates for diesel plants sampled in Colombia of 2.65¢, and the average rates for small hydroelectric plants sampled of 0.86¢ per kw/hour.

Table 6 which presents an estimate of the amount of power consumed in the town of Andes, only 13.4% of the installed generating capacity is now being utilized. The amount of power consumed in Andes by residential subscribers is high when compared with the power consumed in communities served by diesel plants in rural Colombia. However, the town authorities felt that consumption was far too low, and told the Survey Team that the present generating capacity of 720 kw should be doubled to meet present needs. This need appeared justified by the experience of nearby communities in the same Department of Antioquia where residential consumers, also benefiting from cheap hydropower sources, are consuming larger amounts of electricity than residential consumers in Andes. The comparison of Andes' residential consumption with that of three other towns of Antioquia is as shown in Table 2.

Table 7 shows that during the evening peak consumption nearly equals the generating capacity. During the period of maximum demand--between 6 and 9 pm--nearly 100 percent utilization of the connected load for illumination can occur, requiring the full output of Andes' 720 kw generator.

Table 7
Connected Loads Likely to be Used During Peak Evening Demand

Type of Load	Kw
Residential illumination	681
Street lighting	30
Police	0.6
Church, etc.	2.0
TOTAL	713.6

Local power authorities in Andes stated that, in fact, the peak demand often exceeded the generator's capacity, resulting in a "brownout." This situation was found to be widespread in the rural communities surveyed by the team in Latin America. Although only a fraction of the total installed capacity is used when calculated on a 24 hour basis, the usual comment was that "the lights aren't bright enough to read by until after 9:00." Power company officials in Andes informed the Survey Team that when additional power is allocated from the Rio Frio plant, one consequence will be a small number of additional subscribers, but the principal result will be an increase in residential consumption. If consumption per subscriber were doubled from the current 447 to 894 kw hours annually, the amount would still fall below the 1649 kw hours consumed annually by residential subscribers in the neighboring town of Tamesis. (see Table 2)

This situation suggests that after the extension of the 44 kv line from the Rio Frio plant, scheduled by Electroaguas for the near future, the added power will be consumed largely by evening residential users, leaving even a greater unused capacity for productive daytime utilization than at present.

As in other rural communities in Colombia, the concept of using power during the day for industry and other productive purposes is not widely understood. The first generator in Andes, a 35 kw unit, was installed in 1915, and during the ensuing 47 years, only a small fraction of the available power has been applied to industrial and service purposes, as shown in Table 6, items 3 and 4.

Conclusion

The municipio of Andes represents a very promising potential site for a pilot project aimed at increasing the productive utilization of power to raise living standards in rural areas.

ALTO DE MENDES

Version No. 1 - May 9, 1962

PREPARED BY D. Jack Elzinga

ADDRESS Yolombo, Antioquia

AGENCY Peace Corps

DATE May, 1962

RESEARCH STUDY ON THE GENERATION AND USE OF ELECTRIC POWER IN RURAL COMMUNITIES - I. G. E. & RELATED AGENCIES

A - Country of Research project - Colombia x Peru ___ Chile ___

B - Basic Village Community Statistics

1 - Village Has ___ Has Not x Electric Power Available.

2 - Name of Village, Vereda, Area Alto de Mendes, Yolombo, Antioquia

3 - Nearest municipality Yolombo

4 - Toward what major city is the village economy oriented?

Medellin, Antioquia

5 - Village classification, that is: mountain x valley x coastal ___ plain ___?

6 - Distance of village to nearest market (estimated in kilometers)
Name of market? Distance 3 kms. Name Yolombo

7 - Type of access roads to village (for example, paved roads, dirt roads, mountain trail) or other type of access (river, airfield or railroad)? 3 kms dirt road, ½ mi. trail.

8 - Village population total? 86 Percentage Male 49 % Female 51% ?

9 - Percentage of population in labor force, (that is number of persons employed or seeking employment? Percentage males 46% females 4.5% .

10.- Percentage of non-productive persons in community extremely elder or otherwise infirm 12% % unemployable children 42% %.

11 - Of persons employed, what percentage are self-employed (that is, persons farming for their own account, owning their own business, etc.) 3.5% what percentage are employed by others 96.5%.

12 - Of persons employed what percentage are engaged in the following activities:
1) agriculture 90.5 2) industry ___ 3) services 9.5 4) government including teachers ___
5) other major category such as fisheries, mining, etc.? Category ___ %

13 - What is considered to be the standard or usually acceptable income per worker in each of the foregoing categories, 1 through 5? Please indicate amounts in pesos on an annual basis Agriculture- 7-9 pesos/day ($0.78-$1.00 USA 2100-2700 pesos annually.

14 - Is the above income spread fairly evenly throughout the year or does it fluctuate seasonally? If it fluctuates, what are the high and low periods of income? Steady

15 - Number of families in the village? 16

16 - Of the total family income, how much is typically available for purposes other than bare subsistence? In other words, where is the disposable income? Of the disposable income, how much is typically put into savings? (In some cases disposable income may be negative if families typically incur indebtedness over and above their income.) 3 families save, 5 have debts of 500 pesos

17 - What is the typical level of debt for a village family? For what purposes are debts usually incurred? (operating loans for farm? funerals, illness, etc. Approx. 500 pesos each taken for emergencies.

18 - Average number of persons born per year? 38.0/1000 Yolombo rate

19 - Average number of deaths of persons in all age groups per year? 11.5/1000 Yolombo rate.

20 - What has been the population growth trend in the village over the past 10 years? over the past two years? 4.2% growth in last two years, 23.2% in last ten years Yolombo rate.

21 - Has there been a tendency for inhabitants to emigrate from the village per cent during the last two years Tendency for children to leave when of age. Percentage not known.

22 - What have typically been the reasons for emigration? To secure better financial or economic conditions.

23 - Has there been a tendency for immigrants to come to the village? If so, what has been the principal motivation? Very slight.

24 - Within the labor force (see question 8 above), what percentage of persons have the following skills: 1) automotive-type equipment repair capabilities 1 2) automotive-type equipment operating capabilities 1 3) education and training capabilities 1 4) agricultural skills 19 5) unskilled ____ 6) administrative ____

25 - What medical skills are available to the inhabitants? Doctor ___ Midwife x Nurse ____

26 - What is the literacy level of the village: 100%___ 75%___ 50%x 25%___ 0___ ? Exactly.

27 - Any comments on land ownership in this area? As far as the land which contains the houses, it is usually owned by the dweller, but the surrounding land is owned and utilized by big land owners.

28 - What facilities does the village have for the disposal of human waste, for example, latrines, no special facilities. Almost all have latrines.

29 - What is the method of obtaining water for the village____ wells____ streams x surface ponds____ other water storage____

30 - Is the water supply potable? No

31 - Is the water supply sufficient for household needs? yes for irrigation? yes for other purposes (please specify)? Perhaps for power. 45gpm with a maximum fall of about 20 meters. Water supply 500 meters distant from community.

C - POLITICAL AND SOCIAL ORGANIZATIONS WITHIN THE COMMUNITY

1 - Briefly describe the following community facilities: Clinic, school, community center, cooperative None

2 - What is the form of village government - incorporated Junta x unincorporated Junta____ Other____

3 - What organization or group in the village is likely to be the most effective in cooperating to install, maintain and manage a future source of power generation and distribution? The Junta x The Church____ A cooperative___ Other____

D- INDUSTRY AND INCOME RESOURCES OF VILLAGE OR COMMUNITY

1 - What is the number and percentage of farmers cultivating their own land 88% e.i. 14 of 16.

2 - What is the size of the typical plot per farmer? 1.3 hectares.

3 - Of the total number of farmers cultivating their own land, what percentage own less than one hectare 55% 1 to 2 hectares 40% more than 2 hectares 5%.

4 - What type of food and cash crops are grown by farmers of the village? Cage, cane, platano, beans, corn.

5 - What type of industry, including handicrafts, exist in the village? 1 carpenter, 1 seamstress; both on side.

6 - In the event that power was available for what purposes would the inhabitants believe they would use electric power? Domestic lighting x work shops x irrigation x pumping of drinking water x small scale industries ____ health clinic ____ food preservation ____ other _____

E - INTEREST IN POWER

1 - Is the village likely to be interested in acquiring a source of electric power? Would the village be at present enthusiastic about access to power ____ indifferent ____ opposed ____ ? Enthusiastic.

2 - Would the village display a sense of responsibility toward the maintenance, management and financing of a local source of power if one became available? Yes, have collected 2000 pesos to install water.

3 - Would there be persons in the village interested in learning about the maintenance of power equipment? Would there be persons capable of teaching mechanical techniques required for maintaining equipment? _____ One man is a truck driver and mechanic.

F - FUEL POTENTIAL FOR POWER

a) We are interested in learning about the availability of various materials which are not being used at present for fuels but which could be used for fuels. In the village vicinity, for example, by-products such as coffee hulls, branches, twigs, leaves which are residual after trees are trimmed for timber; waste fibers resulting from weaving waste trimmings of reeds from mat manufacture; cattle dung, other agricultural waste? _____ coffee hulls, dried cane stalks.

b) Are there any outcroppings of coal or surface crude oils? no.

c) With respect to cattle dung, what is it currently being used for? How many cattle are in the village? Approx. 5 Is composting practiced? 4 practice it.

d) For the various types of potential fuels what comments do you have as to quantities available? Coffee hulls perhaps not sufficient; cane hulls perhaps yes.

e) What are the potential hydro-power resources available, such as water falls, streams and rivers. Are these resources continuous, intermittent, and what are the general fluctuations from season to season? Have any stream flow records been maintained? If so, how long? No, one check in March, 43.4 gpm. It is said it does not fluctuate much.

f) Is it possible in the village neighborhood to build a reservoir for hydro-power purposes? Yes

g) In anticipation of possible future power applications, we are interested in local wind conditions. To be useful as a source of energy for power, winds should be predictably available every day at a velocity of at least 10 miles per hour for at least one-third of the day. No

h) With respect to possible solar power for the future, how many days of sunshine are expected per year? Very few.

Prepared May, 1962

D. Jack Elzinga

SITE: CARACOLI

PROGRAM FOR ADVANCED TECHNICAL SUPPORT
FOR VILLAGE DEVELOPMENT

CHECK LIST OF FIELD INFORMATION

Version No. 3 - October 17, 1962

SURVEY DATE: Mo 29, 1962

FIELD TEAM MEMBERS: (incl. association)
E. G. Alderfer - CARE inc.
J. Lebedef - CARE/Barranquilla
T. W. Bentley - Peace Corps Leader/Colombia
G. Street - G. E. Co.

INFORMANTS: (incl. titles, etc.)
Padre Agudelo - Priest/Sto. Tomas
Julio del Portillo - Inspector
Alfonso Donado - Pres. Junta

I. VITAL STATISTICS

Village: Caracoli — Province: Malambo
Department: Atlantico — Country: Colombia
Type of Government: Junta
Population: Urban: 1800 — Rural: ---- — Total: ----
Urban families: 150 +
Birth rate: ---- — Death rate: ----
Population growth rate: ----
Net emigration: Stable — Why: Already in environs of Barranquilla
Literacy level: Est. 40%

II. ENVIRONMENTAL CHARACTERISTICS

Name and distance of nearest town: Malambo - 6 km.
Name and distance of nearest market: 9 km.
Geographical classification: Coastal Plain
Type of access road: All weather dirt road
Other access routes: ----

Sewage facilities: Few latrines, most use fields
Drinking water sources: Open spring - swells - ground water(questionable purity - 3-10 meters deep)
Stream and river sources: None close by

Fuel cost and availability:

Reg. gasoline	1.00 peso/gal.
Kerosene	1.10 peso/gal.
Diesel fuel	1.00 peso/gal.
Crude oil	Scarce
Coal	None

Available indigenous fuels: Wood - Scarce
Agriculture wastes - cattle feed
Dung - fertilizer

Wind and its utilization: See Remarks

Sunshine and its utilization: See Remarks

Availability of medical skills:

Resident doctors	No
Itinerant doctors	No
Dentists	No
Nurses	No
Midwifes	Yes
Pharmacists	No
Herbalists	Yes

Clinic: None

Schools: 1 - 5 grade school - alternate days for boys and girls - 3 teachers 130 students. Night school for 30 adults.

Community Center: None

Cooperatives: None

III. ECONOMIC CHARACTERISTICS

Work force pattern - percent of total population: _____

Section	Percent	Avg. Income
Agriculture	70%	150 pesos/month
Industries (Unskilled)	30%	150 pesos/month
Services		
Mining		
Fishing		
Others		
Unemployed		
Non productive		
% Self employed	70%	% Employed 30%

Income fluctuation: Fairly evenly

Typical Debt: None Why: Considered bad financial risks

Typical Savings: None Form: ----

Subsistence level: Bare subsistence

Types of farm crops: Yuca - corn - millo
(Indicate major cash crops) Yuca grown for starch products

Types of farm animals raised: 300 to 400 cattle
(include numbers)

Typical size of farm plots: 2-1/2 to 10 hectares

% Farmers owning land Few % Renting Majority from large landowner.

Latifundia Minifundia X

Composting practiced No

Types of industries: None
(Including size)

Handicrafts:

Types of services: 1 or 2 stores and restaurants

Available Tech. Skills: 30% of males work at unskilled job at airport and in Barranquilla
Few auto mechanics
8-10 auto operators
1- radio technician
70% agriculture 1- hired promotor

Cooperative community works:
Church repair

IV. PRESENT ELECTRIFICATION

Year of installation: None

Type of electric power: _____

Distance to and cost of electric grid power: 6 km. - 24 ctvs/kw-hr.

Nearest town with grid accessibility: Malambo

Power plant rating: _____

Phases: _____ Volts: _____ Freq.: _____

Power plant ownership: _____

operator: _____

Use of electricity and connected loads:

Household illumination _____

Radios _____

Street lighting _____

Industries

Irrigation

Others

Operational time: _____

Type rate, price and source of fuel: _____

Rate, price and source of lube oil: _____

Fuel transport: _____

Power plant maintenance: _____

Availability of spare parts: _____

Maintenance problems: _____

Are power plant records kept? _____ How? _____

Installation cost of power plant: _____

Operation costs: _____

Maintenance costs: _____

Fuel and oil costs: _____

Tariff schedules: _____

Yearly revenue: _____

V. PROBLEM, NEEDS, OPPORTUNITIES

What are major problems: 1 Crop per year limitation - used for irrigation
Obtain in-village agricultural processing industries

What are felt needs:
Irrigation
Agricultural diversity
Yuca crusher for preliminary starch processing
Pure water supply
Electrification of school and clinic
Vocational workshop

What are obvious opportunities: Very good land in tropic zone with shallow ground water makes irrigation and diverse crops an opportunity to compete with Barranquilla imports from Bogota savanna

Does village desire electrification: Yes

VI. REMARKS

- This village, it was learned subsequently, is not planned to be tied into electric grid. It is out of the mainstream of Barranquilla progress because of its remoteness from main roads. The dependence of Barranquilla/Caracoli on imported food stuffs from Bogota 500 miles away, and the resultant high prices, make a golden opportunity for a village such as Caracoli to install irrigation and go to 2, 3 or 4 crop productions and be an economic source of fresh foods to the metropolitan region. Further analysis should determine the economies of this situation.

Caracoli is a corregimiento of the municipio of Malambo. It has a population of about 1,800. It is located in flat, hot country, 6 kilometers west of Malambo and 13 kilometers south of Barranquilla. It has an elevation of 10 meters above mean sea level. The entire municipio of Malambo covers an area of 110 square kilometers. Caracoli has a mean yearly temperature of 28.3°C which drops to 25°C at night. The climate is isothermic in that the mean temperature will vary less than 3° throughout the year. However, there is a great variation in the yearly distribution of rainfall. The mean annual rainfall is 705.7 mm, 95% of which falls during the wet months of June to October. The dry season is generally accompanied by strong SW winds. The winds start in late November and are a symptom of the oncoming dry season. In late November the winds average 5 meters per second, in December they reach a velocity of 8 to 12 meters per second. During the wet season winds blow at 2 to 3 meters per second from the NW.

Caracoli is largely an agricultural community. The main crops are yuca, maiz, and millo. Although water can be found throughout the area at about 3 meters below ground surface, the farmers depend almost entirely on natural

VI. REMARKS (continued)

rainfall for watering their crops. There are five wells in the corregimiento, all of which are used for home consumption. The proximity of the water table, combined with the flatness of the land would seem to make irrigation entirely feasible With irrigation, the area could easily become a "truck garden" for nearby Barranquilla, providing any number of fruits and vegetables which at present are imported from the Sabana de Bogota at an extremely high transportation cost.

Some of the people work at the airport of Soledad and in Barranquilla at unskilled and semi-skilled jobs having an average monthly income of $150.00 (pesos). Unlike the municipios of in-land Colombia, those of Atlantico are characterized by an urban or semi-urban society The people live in the cabeceras and corregimientos and travel to their farms or cities during the day to do whatever work is necessary, returning to their families as soon as possible It is estimated that in the whole departamento, less than 4% of the total population lives in the campo

There is a lack of public activities or services in Caracoli. There is no electricity, running water, sewage system or medical facilities Bus service to Caracoli is poor and taxi service is practically non-existent. The town is reached by going south out of Barranquilla as far as Soledad on a paved road (6 km) and then taking a Sandy dirt road for the remaining distance (7 km) The road is in fair condition during the entire year

Caracoli has been selected as a Peace Corps site PCV's assigned will be Dennis Salgado and Steve Denlinger.

Version No. 1 - May 9, 1962

PREPARED BY Dennis Salgado

ADDRESS c/o CARE - Apartado Aereo 16-49

AGENCY Barranquilla

DATE May, 1962

RESEARCH STUDY ON THE GENERATION AND USE OF ELECTRIC POWER IN RURAL COMMUNITIES - I. G. E. & RELATED AGENCIES

A - Country of Research project - Colombia x Peru ___ Chile ___

B - Basic Village Community Statistics

1 - Village Has ___ Has Not x Electric Power Available.

2 - Name of Village, Vereda, Area Caracoli, Atlantico

3 - Nearest municipality Malambo

4 - Toward what major city is the village economy oriented?

Soledad

5 - Village classification, that is: mountain ___ valley ___ coastal X plain ___?

6 - Distance of village to nearest market (estimated in kilometers) Name of market? Distance 10 or 15 km. Name Soledad.

7 - Type of access roads to village (for example, paved roads, dirt roads, mountain trail) or other type of access (river, airfield or railroad)? Dirt road (sandy)

8 - Village population total? 1500 Percentage Male 50 Female 50 ?

9 - Percentage of population in labor force, (that is number of persons employed or seeking employment? Percentage males -- females --.

10.- Percentage of non-productive persons in community extremely elder or otherwise infirm 25 % unemployable children 60 %.

11 - Of persons employed, what percentage are self-employed (that is, persons farming for their own account, owning their own business, etc.) 40% what percentage are employed by others 60%.

12 - Of persons employed what percentage are engaged in the following activities: 1) agriculture 95 2) industry 5 3) services ___ 4) government including teachers ___ 5) other major category such as fisheries, mining, etc.? Category ___ %

Interview of villagers on steps of church in Caracoli. Condition of church is indicative of community spirit.

Main road into Caracoli. Cantina and store on the left. School building to the right.

Padre Azudela, Priest of Santo Thomas interpreting for survey team.

Inspecting house made available by Caracoli for Peace Corps men. This was probably the finest house in the village.

13 - What is considered to be the standard or usually acceptable income per worker in each of the foregoing categories, 1 through 5? Please indicate amounts in pesos on an annual basis 150 pesos/month 1,000 pesos/year.

14 - Is the above income spread fairly evenly throughout the year or does it fluctuate seasonally? If it fluctuates, what are the high and low periods of income?

_____

15 - Number of families in the village? 225-250

16 - Of the total family income, how much is typically available for purposes other than bare subsistence? In other words, where is the disposable income? Of the disposable income, how much is typically put into savings? (In some cases disposable income may be negative if families typically incur indebtedness over and above their income.)

17 - What is the typical level of debt for a village family? For what purposes are debts usually incurred? (operating loans for farm? funerals, illness, etc.

_____

18 - Average number of persons born per year? _____

19 - Average number of deaths of persons in all age groups per year? _____

20 - What has been the population growth trend in the village over the past 10 years? over the past two years? _____

21 - Has there been a tendency for inhabitants to emigrate from the village: per cent during the last two years _____

22 - What have typically been the reasons for emigration? _____

_____

23 - Has there been a tendency for immigrants to come to the village? If so, what has been the principal motivation? Yes. Farming, plus a peaceful place.

_____

24 - Within the labor force (see question 8 above), what percentage of persons have the following skills: 1) automotive-type equipment repair capabilities 5 2) automotive-type equipment operating capabilities 3 3) education and training capabilities ____ 4) agricultural skills 85 5) unskilled ____ 6) administrative 5.

25 - What medical skills are available to the inhabitants? Doctor ___ Midwife X Nurse ____

26 - What is the literacy level of the village: 100%___ 75% X 50%___ 25%___ 0___?

27 - Any comments on land ownership in this area? _____
Good relationship between big land owners and small farmer.

28 - What facilities does the village have for the disposal of human waste, for example, latrines, no special facilities. A few latrines.

29 - What is the method of obtaining water for the village____ wells X streams____ surface ponds X other water storage____

30 - Is the water supply potable? Yes--all

31 - Is the water supply sufficient for household needs? yes for irrigation? no for other purposes (please specify)? There is a great need for water to irrigate the land. Water supply 500 meters away from community.

C - POLITICAL AND SOCIAL ORGANIZATIONS WITHIN THE COMMUNITY

1 - Briefly describe the following community facilities: Clinic, school, community center, cooperative 1 school no center

2 - What is the form of village government - incorporated Junta X unincorporated Junta____ Other None

3 - What organization or group in the village is likely to be the most effective in cooperating to install, maintain and manage a future source of power generation and distribution? The Junta X The Church____ A cooperative X Other____

D- INDUSTRY AND INCOME RESOURCES OF VILLAGE OR COMMUNITY

1 - What is the number and percentage of farmers cultivating their own land 80%.

2 - What is the size of the typical plot per farmer? _____

3 - Of the total number of farmers cultivating their own land, what percentage own less than one hectare_____ 1 to 2 hectares_____ more than 2 hectares_____

4 - What type of food and cash crops are grown by farmers of the village? _____

5 - What type of industry, including handicrafts, exist in the village? None.

6 - In the event that power was available for what purposes would the inhabitants believe they would use electric power? Domestic lighting____ work shops____ irrigation____ pumping of drinking water_X_ small scale industries____ health clinic____ food preservation_X_ other_For all of the above._____

E - INTEREST IN POWER

1 - Is the village likely to be interested in acquiring a source of electric power? Would the village be at present enthusiastic about access to power____ indifferent____ opposed____? _Enthusiastic._____

2 - Would the village display a sense of responsibility toward the maintenance, management and financing of a local source of power if one became available? Yes.

3 - Would there be persons in the village interested in learning about the maintenance of power equipment? Would there be persons capable of teaching mechanical techniques required for maintaining equipment?_Yes._____

F - FUEL POTENTIAL FOR POWER

a) We are interested in learning about the availability of various materials which are not being used at present for fuels but which could be used for fuels. In the village vicinity, for example, by-products such as coffee hulls; branches, twigs, leaves which are residual after trees are trimmed for timber; waste fibers resulting from weaving waste trimmings of reeds from mat manufacture; cattle dung, other agricultural waste?_____
People here make coal by burning green stick (wood).

b) Are there any outcroppings of coal or surface crude oils?_____

c) With respect to cattle dung, what is it currently being used for? How many cattle are in the village? 50 Is composting practiced?_Yes_____

d) For the various types of potential fuels what comments do you have as to quantities available? Most anything can be had from nearby Barranquilla.

e) What are the potential hydro-power resources available, such as water falls, streams and rivers. Are these resources continuous, intermittent, and what are the general fluctuations from season to season? Have any stream flow records been maintained? If so, how long?_None._____

f) Is it possible in the village neighborhood to build a reservoir for hydro-power purposes? Would take a more careful study.

g) In anticipation of possible future power applications, we are interested in local wind conditions. To be useful as a source of energy for power, winds should be predictably available every day at a velocity of at least 10 miles per hour for at least one-third of the day. Wind is available in certain months.

h) With respect to possible solar power for the future, how many days of sun-shine are expected per year? 290 or more.

Site Name and Location	Ebejico, Antioquia Department, located 68 kilometers northwest of Medellin, Colombia.
Population	About 5000 in the central pueblo (market town) and 10,000 in the surrounding rural areas.
Date Investigated	May 30, 1962
Field Investigation Team	T.O. Paine, General Electric Company C. Ahrens, CARE-Peace Corps, Bogota Frank Turner, Stanford Research Institute Richard Fiedler, U.S. Peace Corps Volunteer.

Ebejico is typical of a number of pueblos (rural market towns) in the upland coffee-growing regions. It is located within general access to major manufacturing and market centers. It is likely to undergo a number of changes in the next few years arising from its improved access to Medellin (1960 population 614,000). The principal north-south highway running from Medellin northward to Turbo is only 23 kilometers away, and the connecting road to Ebejico leading through rugged mountain terrain has recently been opened.

Plans of the central power authority (Instituto de Aprovechamiento de Aguas y Fomento de Electrico) call for the extension of a 13.2 Kv transmission line from the town of San Jeronimo, only 15 kilometers away so that Ebejico will ultimately benefit from 3 phase, 60 cycle, 120/208 volt power. The Instituto plans to carry out the above extension in 1962, but there are doubts that power will be furnished so quickly. These improvements, the local resources described below, the presence of two U.S. Peace Corps volunteers, and the cafeteros programs all suggest that Ebejico is a promising community for development.

1. Vital Statistics

The central pueblo contains 5000 persons, or 830 families averaging 6 persons per household; the rural population of the municipio is 10,000 people, or 2500 families. There are fifteen veredas or villages in addition to the central pueblo, and two corregimientos. Death rates and birth rates in the community are similar to those prevailing elsewhere in Colombia, namely 35 persons are born annually, and 15 die, per 1000 inhabitants. The birth rate for Colombia as a whole has been about 43 and the death rate 13 persons per thousand.

From 1910 until recently there was a gradual increase in population from 3000 to the current figure of 5000, but in the last few years, despite the fact that births are double the number of deaths, Ebejico's population has stayed virtually constant. The recent leveling off is attributable to the tendency

of younger persons, especially males, to migrate from the town, also families have been moving in the last ten years to escape the threat of the violencia, which is still active in neighboring areas.

2. Environmental Characteristics and Power Sources

The pueblo of Ebejico is the seat of the Municipio, and is located ten kilometers east of the Cauca River.

As one views the town from above, the pueblo looks to be about a mile in length and 200-300 yards wide extending along a valley. The valley floor slopes gently down to the Cauca River, but both sides of the valley are steep, rising sharply to 7000 feet as compared with the altitude of the town itself of 3600 feet. The floor of the valley and the foothill region extending from the town to the river is satisfactory pasture-land, and forms the basis for the local cattle industry.

Ebejico has two sources of electric power at the present time, both of which are used only for early evening illumination, with only a fractional load for other applications, which include: small household appliances, about three coolers (for carbonated drinks, drugs and butter) and a few radios. Even if both power plants are operated at their combined capacity of 77.5 kw, the lights are so dim from low voltage due to excess demand that it is impossible to read before 9:30 PM.

The first source of power is a hydro-electric generator installed in 1918 which is now characterized by chronic maintenance problems. The generator is a 37.5 kw, 3 phase, 2300 volt, 9.4 ampere, 60 cycle, 1200 rpm Westinghouse unit. A simple control panel made in Medellin includes two 15 ampere Ammeters and a 250 volt voltmeter. The turbine is supplied from 13" diameter penstocks. Water flows through a concrete raceway from a nearby stream with a roughly estimated 50 cu. ft. per second stream flow in the wet season and about 34 cu. ft. per second in the dry season.

The hydro plant is constantly in need of repairs, especially with respect to leakage in the badly rusted 13" pipes bringing water down to the turbine. Supplementing the hydro-electric generator is a more recent small diesel plant which operates from 7:30 PM to 10:30 PM. The diesel plant is a 100 Hp 40 kw unit. The principal load on the combined system consists of an estimated 3340 light bulbs averaging 25 watts each, or a total peak of 83 kw for lighting alone. The diesel unit operates only in "emergencies" but according to the local inhabitants the lighting power is insufficient even when both units are operating.

There are a number of ways in which the energy sources of Ebejico could be improved. The first is by the introduction of grid power from the Guadalupe system and other sources near Medellin. According to local authorities and to officials of the Electrificadora de Antioquia (public power authority) in Medellin (June 1 interview with Dr. Mejia), grid power for Ebejico will be delayed some years. However, according to the Instituto de Aprovechamiento de Aguas y Fomento de Electrico in Bogotá, firm plans have been made for the introduction during 1962 of grid power by means of a 15 kilometer line coming from the town of San Jerinimo carrying 13.2 kv (3 phase, 120/308 volts, 60 cycle) into Ebejico. The 15 kilometer transmission line, lightening arrestors, transformers, and other related items are estimated to cost 420,000 pesos ($48,300).

Subsequent interviews (Dr. Pisano, Director of Accion Comunal and officials of the AID Mission) led to the conclusion that the 1962 grid extension was possibly too optimistic in view of the characteristic lag in the receipt of government appropriations for rural areas. At the same time, however, it is clear that the Guadalupe grid is moving forward rapidly and the extension from San Jeronimo to Ebejico can be accomplished with a minimum of engineering difficulty and at reasonable cost.

A potential source of additional power for the community is a waterfall located 3 km from the satellite vereda (village) of La Gramala some 5 km from Ebejico. This waterfall drops a total of about 250 feet in two stages. According to rough estimates and not by actual measurement, the waterfall has a volume of some 20 to 40 cubic feet per second. Although no local stream flow records are available, village informants stated that the volume of water flow remained virtually constant throughout the year.

There are no sources of local fuel, the farmers utilize every available "piece of organic material" for compost. Almost no wood is available, except for small diameter shrubs growing above the valley. The removal of such undergrowth would aggravate erosion problems and would therefore be ill-advised.

No unusual wind or solar energy characteristics were evident. The average mean temperature is 73 deg. F. Water is brought into the village by means of an aquaducto or pipeline extending from the village upward to (polluted) mountain stream sources nearby. The local water is definitely not potable and strong local pressures have been brought to bear on AID, the government and other groups to introduce chlorination. Despite contamination, the water is freely consumed, leading to a high incidence of intestinal parasites.

3. Economic Characteristics

a. Agriculture and Livestock

The campesinos population of about 10,000 in the municipio rely on coffee beans as their principal source of income. The annual production of about 5 million pounds is sold through the Cafateros (National Federation of Coffee Growers). Secondary income is derived from other crops, including yucca (for starch), sugarcane, bananas, cacao, cabuja (for fique fiber) and platanos. Some nectarines and mangosteens are grown, but few are sold because of the problem of spoilage prior to reaching the market.

The valley floor, extending in a westerly direction for ten kilometers from Ebejico to the Cauca river, provides grazing land for cattle and horses. These animals plus hogs total some 30,000 head. In addition most of the campesinos have some poultry.

b. Industry

There is no industry in the municipio of Ebejico of a manufacturing nature, but service industries and small shops exist. Because of the local meat demand, a few cattle not sold outside Ebejico, are slaughtered, but only in sufficient quantity to meet the day-to-day demands of the urban community.

The local "Transportes ECO" line owns two 12 ton trucks and carries goods to and from Medellin. The same line operates a bus service with four daily trips to Medellin. There are some small service shops run by artisans, a shoemaker, a barber, a drugstore (quite well stocked with ethical drugs brought in from Medellin), and at least two cantinas (restaurant-bar).

c. Potential Small Industries

Although each possibility will require further study, the following small industries were identified as promising for Ebejico: manufacture of bricks and tile, rope, bag, and rug making from fique fibers, fruit processing based on local nectarines (principally juicing and canning), carbonated drinks, meat processing based on local beef cattle and poultry, manufacture of meat by-products such as sausages, hides, casein, candles and eventually tanning and shoe manufacture. Service industries, particularly metalworking, forging, casting and welding would probably be needed if economic expansion occurred. Richard

Fiedler, local U.S. Peace Corps volunteer, believed that the abundant local "Mexican Tree Fern" (cyathea arborea) could be readily developed for profitable export to florists in the United States.

The initial market for these industries would be primarily local, but as industries become more advanced, the market could extend to Medellin, especially if activities supporting Medellin firms were established in Ebejico.

d. Power Utilization

Of the foregoing potential industries, all but the tile and brick industry could use electric power, and even that industry could adopt electric equipment. Other non-industrial needs for power would include probably some five to six times as much power as is now available for domestic use. The 40 bed hospital in Ebejico needs more electricity for the equipment installed. Irrigation pumping is not practiced in the area because of the natural stream flow.

e. Size of Labor Force and Skills

Labor for industry, although predominantly unskilled at present, is relatively abundant. Of the 5000 urban population, some 1600 persons, including teenaged youths can be considered as constituting the labor force under present conditions. Of these, 200 to 300 adults and teenage males are virtually unemployed, since they are the sons or immediate relatives of landowners and feel little incentive to work at available tasks. Campesino labor, both male and female, would be available especially during the off-season of the coffee crop. According to the nearby office of the Coffee Growers Federation, small industry would be warmly welcomed to supplement the income of the campesinos.

Judging by data on the vereda of LaGramala, about 20 percent of the campesino female population are working or willing to work, and some 80 percent of the men seek or have some employment. The percentage of persons working or seeking work in the pueblo is smaller. On this basis the potential labor force in the urban and non-urban part of the municipio would be roughly as shown in Table 1. These figures include children who are typically employed in rural areas for farm chores, hauling wood, tending poultry and livestock, etc.

Table 1
Estimated Labor Force in Ebejico

	Pueblo	Rural	Total
Total Population	5000	10,000	15,000
Total Males (45%)	2250	4,500	6,750
Total Females (55%)	2750	5,500	8,250
Total Labor Force	1625	4,700	6,325
Males	1350 (60%	3,600 (80%)	4,950
Females	275 (10%)	1,100 (20%)	1,375

Of the male labor force in the pueblo of some 1600 persons, about half are land owners and half are in retail shops and in the wholesaling of farm products. A few are artisans (cobblers, carpenters) but probably only six or eight could be considered mechanically or technically skilled. There are two persons connected with the local hospital, and about 15 teachers for some 950 school children from the entire municipio who attend the newly constructed girl's high school, an elementary girl's school, and an elementary boy's school.

f. Per Capita Income

The rural worker considers an annual income of 3160 pesos as standard, which means from 7 to 9 pesos per day, or about the equivalent of U.S. $.81 to $1.03. The pueblo annual income for salaried workers is about 7 pesos per day (U.S. $0.81). Actual campesino cash incomes may be much lower than the above figures, but are supplemented in kind by the campesinos' crops and livestock.

The income of persons associated with the landowner group or with the brokerage of crops and livestock is estimated as being well above these figures. According to local observers, members of these two groups at harvest time show surprising amounts of cash at cock fights or other gambling events; their individual incomes are possibly 10 or more times those of the campesino.

g. Per Capita Savings

There are no banks in Ebejico. According to local estimates, five percent of the campesino's income is considered disposable, but none is aved. Possibly the urban inhabitants of Ebejico are saving money in the sense that they are lending funds to retail establishments and occasionally to rural inhabitants, or investing in the local bus and truck firm "Transportes Eco." No estimates of savings were obtained.

i. Land Holdings

Information on the municipio as a whole was not available, but in one of the villages, about 60 percent of the campesinos own their own land. The typical land plot is only one half hectare (1.2 acres). Of the farmers cultivating their own land, 70 percent own less than one hectare (2.47 acres), about 25 percent own from 1 to 2 hectares, while 5 percent own more than 2 hectares.

Conclusion

The municipio of Ebejico offers an opportunity for a pilot project using an integrated systems approach to the productive utilization of power to raise rural living standards.

Version No. 1 - May 9, 1962

PREPARED BY Jim Gregory

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AGENCY Peace Corps

DATE May 22, 1962

RESEARCH STUDY ON THE GENERATION AND USE OF ELECTRIC POWER IN RURAL COMMUNITIES - I. G. E. & RELATED AGENCIES

A - Country of Research project - Colombia X Peru ___ Chile ___

B - Basic Village Community Statistics

1 - Village Has ___ Has Not X Electric Power Available.

2 - Name of Village, Vereda, Area El Salado, Campamente, Rumipmaba.

3 - Nearest municipality Consaca

4 - Toward what major city is the village economy oriented?

Pasto

5 - Village classification, that is: mountain X valley ___ coastal ___ plain ___?

6 - Distance of village to nearest market (estimated in kilometers)
Name of market? Distance 6 kms. Name Consaca

7 - Type of access roads to village (for example, paved roads, dirt roads, mountain trail) or other type of access (river, airfield or railroad)? dirt roads, mountain trails

8 - Village population total? see remarks Percentage Male 52.4 Female 47.6 ?

9 - Percentage of population in labor force, (that is number of persons employed or seeking employment? Percentage males ___ females ___. See remarks.

10 - Percentage of non-productive persons in community extremely elder or otherwise infirm 2.6 % unemployable children 18.4 %.

11 - Of persons employed, what percentage are self-employed (that is, persons farming for their own account, owning their own business, etc.) 20% what percentage are employed by others 80%.

12 - Of persons employed what percentage are engaged in the following activities:
1) agriculture 90% 2) industry 9% 3) services ___ 4) government including teachers 1%
5) other major category such as fisheries, mining, etc.? Category ___ %

13 - What is considered to be the standard or usually acceptable income per worker in each of the foregoing categories, 1 through 5? Please indicate amounts in pesos on an annual basis 1) $730. 2) $1280. 3) $--- 4) $6,000-$7,200.

14 - Is the above income spread fairly evenly throughout the year or does it fluctuate seasonally? If it fluctuates, what are the high and low periods of income? High - May-June Low - August-Sept.

15 - Number of families in the village? See remarks

16 - Of the total family income, how much is typically available for purposes other than bare subsistence? In other words, where is the disposable income? Of the disposable income, how much is typically put into savings? (In some cases disposable income may be negative if families typically incur indebtedness over and above their income.) None.

17 - What is the typical level of debt for a village family? For what purposes are debts usually incurred? (operating loans for farm? funerals, illness, etc. $300 - $500.

18 - Average number of persons born per year? 10

19 - Average number of deaths of persons in all age groups per year? 5-6

20 - What has been the population growth trend in the village over the past 10 years? over the past two years? 10.1%

21 - Has there been a tendency for inhabitants to emigrate from the village: per cent during the last two years Yes - 1%.

22 - What have typically been the reasons for emigration? Lack of work - cannot purchase land.

23 - Has there been a tendency for immigrants to come to the village? If so, what has been the principal motivation? Coffee harvest - small industry.

24 - Within the labor force (see question 8 above), what percentage of persons have the following skills: 1) automotive-type equipment repair capabilities 0 2) automotive-type equipment operating capabilities 1 3) education and training capabilities 3 4) agricultural skills 25 5) unskilled 700 6) administrative ____

25 - What medical skills are available to the inhabitants? Doctor X Midwife ___ Nurse X (In the municipio.

26 - What is the literacy level of the village: 100%___ 75% X 50%___ 25%___ 0___ ?

27 - Any comments on land ownership in this area? The land is all minifundias--the land is owned by the head of the family--it is passed on to the sons. It is divided evenly--therefore, each succeeding generation farms a smaller plot of land.

28 - What facilities does the village have for the disposal of human waste, for example, latrines, no special facilities. Few latrines.

29 - What is the method of obtaining water for the village____ wells____ streams X surface ponds____ other water storage____

30 - Is the water supply potable? No.

31 - Is the water supply sufficient for household needs? X for irrigation?____ for other purposes (please specify)? Water supply 500 meters away from community.

C - POLITICAL AND SOCIAL ORGANIZATIONS WITHIN THE COMMUNITY

1 - Briefly describe the following community facilities: Clinic, school, community center, cooperative See remarks.

2 - What is the form of village government - incorporated Junta X unincorporated Junta____ Other School junta.

3 - What organization or group in the village is likely to be the most effective in cooperating to install, maintain and manage a future source of power generation and distribution? The Junta X The Church____ A cooperative___ Other____

D- INDUSTRY AND INCOME RESOURCES OF VILLAGE OR COMMUNITY

1 - What is the number and percentage of farmers cultivating their own land 100%--250.

2 - What is the size of the typical plot per farmer? 2.5 hectares

3 - Of the total number of farmers cultivating their own land, what percentage own less than one hectare 5% 1 to 2 hectares 30% more than 2 hectares 65%.

4 - What type of food and cash crops are grown by farmers of the village? Coffee, sugar cane, corn, beans, yucca, bananas.

5 - What type of industry, including handicrafts, exist in the village? Trapiches, Panama hats.

6 - In the event that power was available for what purposes would the inhabitants believe they would use electric power? Domestic lighting X work shops X irrigation ____ pumping of drinking water ____ small scale industries X health clinic ____ food preservation ____ other _____

E - INTEREST IN POWER

1 - Is the village likely to be interested in acquiring a source of electric power? Would the village be at present enthusiastic about access to power ____ indifferent ____ opposed ____? They are very interested and have asked us to help them in acquiring it.

2 - Would the village display a sense of responsibility toward the maintenance, management and financing of a local source of power if one became available? Yes.

3 - Would there be persons in the village interested in learning about the maintenance of power equipment? Would there be persons capable of teaching mechanical techniques required for maintaining equipment? Yes.

F - FUEL POTENTIAL FOR POWER

a) We are interested in learning about the availability of various materials which are not being used at present for fuels but which could be used for fuels. In the village vicinity, for example, by-products such as coffee hulls, branches, twigs, leaves which are residual after trees are trimmed for timber; waste fibers resulting from weaving waste trimmings of reeds from mat manufacture; cattle dung, other agricultural waste? Coffee hulls, sugar cane leaves are about the only products that could be used but these are used presently for fertilizer.

b) Are there any outcroppings of coal or surface crude oils? no

c) With respect to cattle dung, what is it currently being used for? How many cattle are in the village? approx. 130 Is composting practiced? No.

d) For the various types of potential fuels what comments do you have as to quantities available? Nothing other than hydroelectric power is available and this is in good supply.

e) What are the potential hydro-power resources available, such as water falls, streams and rivers. Are these resources continuous, intermittent, and what are the general fluctuations from season to season? Have any stream flow records been maintained? If so, how long? There are several small streams amd waterfalls in the area with an even flow.

f) Is it possible in the village neighborhood to build a reservoir for hydro-power purposes? No.

g) In anticipation of possible future power applications, we are interested in local wind conditions. To be useful as a source of energy for power, winds should be predictably available every day at a velocity of at least 10 miles per hour for at least one-third of the day. It is possible but doubtful.

h) With respect to possible solar power for the future, how many days of sunshine are expected per year? 300 days.

Remarks:

I have submitted a report for three veredas giving statistics on each vereda as well as all. The reason is that these three veredas are all within one kilometer of each other and could easily have a plant in between the three villages and would not need be any bigger than 10-30 kilowatts. The people are very anxious to have electricity and I feel that it would benefit this area greatly. The company of CEDENAR has agreed to put in the power line network if we can obtain a power source.

E-8 - Village population total?

Rumipamba	520
El Salado	210
Campamento	295
Total	1025

E-9 - Number of families in the village?

Rumipamba--78 families
El Salado----35 families
Campamento-44 families

C-1 - In this area there are no clinics. The school in El Salado is now being improved by the Coffee Federation. In Rumipamba the school is for both Rumipamba and Campamento. It is new and fairly large with three rooms. There is no community center and no co-operative in this area. Sandona has a co-operative that covers all of the area.

Due to the proximity of the villages, I have made some of the figures rather general as they apply to all of the villages.
The people would be will ng to help in any manner possible in installing and maintaining such a plant.
The area is very poor and has received very little aid from the government or other agencies. The people are willing to form workdays to help in any type of project.

GUADUAL

Version No. 1 - May 9, 1962

PREPARED BY A. W. Lewis, Jr.

ADDRESS Rivera Hunta, Colombia

AGENCY CARE - Peace Corps

DATE May, 1962

RESEARCH STUDY ON THE GENERATION AND USE OF ELECTRIC POWER IN RURAL COMMUNITIES - I. G. E. & RELATED AGENCIES

A - Country of Research project - Colombia X Peru ___ Chile ___

B - Basic Village Community Statistics

1 - Village Has ___ Has Not X Electric Power Available.

2 - Name of Village, Vereda, Area Veredas: Guadual, Ulloa, Honda

3 - Nearest municipality Rivera, Huila

4 - Toward what major city is the village economy oriented?

Rivera, Huila

5 - Village classification, that is: mountain ___ valley X coastal ___ plain ___?

6 - Distance of village to nearest market (estimated in kilometers) Name of market? Distance 7 kms. Name Rivera

7 - Type of access roads to village (for example, paved roads, dirt roads, mountain trail) or other type of access (river, airfield or railroad)? dirt road, mountain trails

8 - Village population total? 6000 Percentage Male 40% Female 60% ?

9 - Percentage of population in labor force, (that is number of persons employed or seeking employment? Percentage males 95% females 60%.

10.- Percentage of non-productive persons in community extremely elder or otherwise infirm 10 % unemployable children 70 %.

11 - Of persons employed, what percentage are self-employed (that is, persons farming for their own account, owning their own business, etc.) 80% what percentage are employed by others 20%.

12 - Of persons employed what percentage are engaged in the following activities: 1) agriculture 85% 2) industry -- 3) services 5% 4) government including teachers 10% 5) other major category such as fisheries, mining, etc.? Category --- %

13 - What is considered to be the standard or usually acceptable income per worker in each of the foregoing categories, 1 through 5? Please indicate amounts in pesos on an annual basis 1) $4000 3) $1500 4) $7500

14 - Is the above income spread fairly evenly throughout the year or does it fluctuate seasonally? If it fluctuates, what are the high and low periods of income?
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15 - Number of families in the village? 850

16 - Of the total family income, how much is typically available for purposes other than bare subsistence? In other words, where is the disposable income? Of the disposable income, how much is typically put into savings? (In some cases disposable income may be negative if families typically incur indebtedness over and above their income.) $500 - savings negligible.

17 - What is the typical level of debt for a village family? For what purposes are debts usually incurred? (operating loans for farm? funerals, illness, etc. $200 - farm loans, illness.

18 - Average number of persons born per year? 500

19 - Average number of deaths of persons in all age groups per year? 100

20 - What has been the population growth trend in the village over the past 10 years? over the past two years? 2,000 in 10 years - 500 in two years.

21 - Has there been a tendency for inhabitants to emigrate from the village: per cent during the last two years 150

22 - What have typically been the reasons for emigration? for work, study, lack of transportation, business.

23 - Has there been a tendency for immigrants to come to the village? If so, what has been the principal motivation? Very little.

24 - Within the labor force (see question 8 above), what percentage of persons have the following skills: 1) automotive-type equipment repair capabilities .005% 2) automotive-type equipment operating capabilities 10% 3) education and training capabilities 2% 4) agricultural skills 40% 5) unskilled 70% 6) administrative ---

25 - What medical skills are available to the inhabitants? Doctor ___ Midwife X Nurse X .

26 - What is the literacy level of the village: 100%___ 75%___ 50% X 25%___ 0___ ?

27 - Any comments on land ownership in this area? Very little land owned outright. Rent from Latifundistas.

28 - What facilities does the village have for the disposal of human waste, for example, latrines, no special facilities. Few latrines only.

29 - What is the method of obtaining water for the village____ wells____ streams X surface ponds____ other water storage____

30 - Is the water supply potable? X

31 - Is the water supply sufficient for household needs? X for irrigation? X for other purposes (please specify)? --- Water supply 50 meters from community.

C - POLITICAL AND SOCIAL ORGANIZATIONS WITHIN THE COMMUNITY

1 - Briefly describe the following community facilities: Clinic, school, community center, cooperative Schools only - clinic, cooperative projected.

2 - What is the form of village government - incorporated Junta____ unincorporated Junta____ Other Conseto; Alcalde, etc.

3 - What organization or group in the village is likely to be the most effective in cooperating to install, maintain and manage a future source of power generation and distribution? The Junta X The Church____ A cooperative___ Other City Officials

D- INDUSTRY AND INCOME RESOURCES OF VILLAGE OR COMMUNITY

1 - What is the number and percentage of farmers cultivating their own land 1500 (25%).

2 - What is the size of the typical plot per farmer? 1 hectare.

3 - Of the total number of farmers cultivating their own land, what percentage own less than one hectare 60% 1 to 2 hectares 30% more than 2 hectares 10%.

4 - What type of food and cash crops are grown by farmers of the village? Cacao, cane, fruits, flowers.

5 - What type of industry, including handicrafts, exist in the village? ---N.A.

5 - In the event that power was available for what purposes would the inhabitants believe they would use electric power? Domestic lighting X work shops ____ irrigation X pumping of drinking water X small scale industries X health clinic ____ food preservation ____ other Night adult education, recreation (movies, etc.

E - INTEREST IN POWER

1 - Is the village likely to be interested in acquiring a source of electric power? Would the village be at present enthusiastic about access to power ____ indifferent ____ opposed ____? Extremely enthusiastic -- NOW.

2 - Would the village display a sense of responsibility toward the maintenance, management and financing of a local source of power if one became available? Definitely - conscientious people.

3 - Would there be persons in the village interested in learning about the maintenance of power equipment?* Would there be persons capable of teaching mechanical techniques required for maintaining equipment? * Yes No.

F - FUEL POTENTIAL FOR POWER

a) We are interested in learning about the availability of various materials which are not being used at present for fuels but which could be used for fuels. In the village vicinity, for example, by-products such as coffee hulls; branches, twigs, leaves which are residual after trees are trimmed for timber; waste fibers resulting from weaving waste trimmings of reeds from mat manufacture; cattle dung, other agricultural waste? Leaves from cacao, waste from cane are available in abundance.

b) Are there any outcroppings of coal or surface crude oils? No

c) *With respect to cattle dung, what is it currently being used for? How many cattle are in the village? 1000 head Is composting practiced? Yes * Fertilizer.

d) For the various types of potential fuels what comments do you have as to quantities available? Waste from trees and cane are best bets.

e) What are the potential hydro-power resources available, such as water falls, streams and rivers. Are these resources continuous, intermittent, and what are the general fluctuations from season to season? Have any stream flow records been maintained? If so, how long? Continuous water supply but not enough power to do this type of project.

f) Is it possible in the village neighborhood to build a reservoir for hydro-power purposes? Definitely.

g) In anticipation of possible future power applications, we are interested in local wind conditions. To be useful as a source of energy for power, winds should be predictably available every day at a velocity of at least 10 miles per hour for at least one-third of the day.
Wind velocity is available at least 1/3 of day.

h) With respect to possible solar power for the future, how many days of sunshine are expected per year? 270 days.

Version No. 1 - May 9, 1962

PREPARED BY Michael Lanigan

ADDRESS Federcafe Extension Andes Antioquia

AGENCY Peace Corps

DATE May 21, 1962

RESEARCH STUDY ON THE GENERATION AND USE OF ELECTRIC POWER IN RURAL COMMUNITIES - I. G. E. & RELATED AGENCIES

A - Country of Research project - Colombia X Peru ___ Chile ___

B - Basic Village Community Statistics

1 - Village Has X Has Not ___ Electric Power Available.

2 - Name of Village, Vereda, Area Vereda of "La California"

3 - Nearest municipality Andes, Antioquia

4 - Toward what major city is the village economy oriented?

Andes, Medellin

5 - Village classification, that is: mountain X valley ___ coastal ___ plain ___?

6 - Distance of village to nearest market (estimated in kilometers)
Name of market? Distance 15 km Name ___

7 - Type of access roads to village (for example, paved roads, dirt roads, mountain trail) or other type of access (river, airfield or railroad)? Dirt road, mountain trail.

8 - Village population total? 340 Percentage Male 160 Female 180 ?

9 - Percentage of population in labor force, (that is number of persons employed or seeking employment? Percentage males 80% females ___.

10.- Percentage of non-productive persons in community extremely elder or otherwise infirm 15% % unemployable children 20% %. (They work before and after)

11 - Of persons employed, what percentage are self-employed (that is, persons farming for their own account, owning their own business, etc.) 70% what percentage are employed by others 30%

12 - Of persons employed what percentage are engaged in the following activities:
1) agriculture ___ 2) industry ___ 3) services ___ 4) government including teachers ___
5) other major category such as fisheries, mining, etc.? Category ___ %
100%.

13 - What is considered to be the standard or usually acceptable income per worker in each of the foregoing categories, 1 through 5? Please indicate amounts in pesos on an annual basis 2,000-2,500 pesos per year

14 - Is the above income spread fairly evenly throughout the year or does it fluctuate seasonally? If it fluctuates, what are the high and low periods of income? High - Oct., Nov., Dec. Low - May, June, July, August.

15 - Number of families in the village? 70 families

16 - Of the total family income, how much is typically available for purposes other than bare subsistence? In other words, where is the disposable income? Of the disposable income, how much is typically put into savings? (In some cases disposable income may be negative if families typically incur indebtedness over and above their income.) Subsistence living and less.

17 - What is the typical level of debt for a village family? For what purposes are debts usually incurred? (operating loans for farm? funerals, illness, etc. 200 pesos for food, clothes, farm improvement.

18 - Average number of persons born per year? 20-25

19 - Average number of deaths of persons in all age groups per year? 4-6

20 - What has been the population growth trend in the village over the past 10 years? over the past two years? 10 years, growing - 2 years, growing even more.

21 - Has there been a tendency for inhabitants to emigrate from the village: per cent during the last two years There has been an outflow of people

22 - What have typically been the reasons for emigration? No work; lack of good pay; difficulty with the patrone.

23 - Has there been a tendency for immigrants to come to the village? If so, what has been the principal motivation? Very few

24 - Within the labor force (see question 8 above), what percentage of persons have the following skills: 1) automotive-type equipment repair capabilities 0 2) automotive-type equipment operating capabilities 0 3) education and training capabilities 0 4) agricultural skills 100% 5) unskilled 0 6) administrative 0

25 - What medical skills are available to the inhabitants? Doctor x Midwife x Nurse x Doctors and nurses available but births mostly with midwife

26 - What is the literacy level of the village: 100%___ 75%___ 50%___ 25%___ 0___ ? 60%

27 - Any comments on land ownership in this area? The ownership is recognized. The fincas are too small and not used to best advantage

28 - What facilities does the village have for the disposal of human waste, for example, latrines, no special facilities. 10-15 latrines; trash just thrown wherever

29 - What is the method of obtaining water for the village____ wells____ streams X surface ponds____ other water storage Home-made bamboo aqueducts

30 - Is the water supply potable? No

31 - Is the water supply sufficient for household needs? X for irrigation?____ for other purposes (please specify)? Enough; wash, drink, clean; not used for irrigation. Water sources all throughout the community.

C - POLITICAL AND SOCIAL ORGANIZATIONS WITHIN THE COMMUNITY

1 - Briefly describe the following community facilities: Clinic, school, community center, cooperative 70-student school; Junta of Accion Comunal; The family and local bars are the major social units.

2 - What is the form of village government - incorporated Junta____ unincorporated Junta____ Other Vereda under jurisdiction of Municipio of Andes but for most part have no control. The Junta is not strong.

3 - What organization or group in the village is likely to be the most effective in cooperating to install, maintain and manage a future source of power generation and distribution? The Junta X The Church____ A cooperative___ Other____

D- INDUSTRY AND INCOME RESOURCES OF VILLAGE OR COMMUNITY

1 - What is the number and percentage of farmers cultivating their own land 70% cultivate their own farms.

2 - What is the size of the typical plot per farmer? 20 hectares

3 - Of the total number of farmers cultivating their own land what percentage own less than one hectare 0 1 to 2 hectares 3% more than 2 hectares 97%

4 - What type of food and cash crops are grown by farmers of the village? To eat - corn, potato, platano, yucca; To sell - coffee, yucca, corn.

5 - What type of industry, including handicrafts, exist in the village? No industry

6 - In the event that power was available for what purposes would the inhabitants believe they would use electric power? Domestic lighting X work shops ____ irrigation ____ pumping of drinking water ____ small scale industries ____ health clinic ? food preservation ____ other _____

E - INTEREST IN POWER

1 - Is the village likely to be interested in acquiring a source of electric power? Would the village be at present enthusiastic about access to power ____ indifferent ____ opposed ____ ? Yes; they have already approached us to help them get LIGHT. They will help with the work.

2 - Would the village display a sense of responsibility toward the maintenance, management and financing of a local source of power if one became available? Not the whole vereda but several interested people.

3 - Would there be persons in the village interested in learning about the maintenance of power equipment? Would there be persons capable of teaching mechanical techniques required for maintaining equipment? Yes, there is a 2-3 kw generator serving two houses now. This is the gas-powered type.

F - FUEL POTENTIAL FOR POWER

a) We are interested in learning about the availability of various materials which are not being used at present for fuels but which could be used for fuels. In the village vicinity, for example, by-products such as coffee hulls, branches, twigs, leaves which are residual after trees are trimmed for timber; waste fibers resulting from weaving waste trimmings of reeds from mat manufacture, cattle dung, other agricultural waste? Horse, mule, cattle dung; sugar cane leaves and pulp, fast running river

b) Are there any outcroppings of coal or surface crude oils? No coal

c) With respect to cattle dung, what is it currently being used for? How many cattle are in the village? 100 cows; 40-50 40-50 mules; 70 horses Is composting practiced? Field fertilizer.

d) For the various types of potential fuels what comments do you have as to quantities available? It is there for the picking but scattered all over the municipio

e) What are the potential hydro-power resources available, such as water falls, streams and rivers. Are these resources continuous, intermittent, and what are the general fluctuations from season to season? Have any stream flow records been maintained? If so, how long? There is a river with fast current year round. As far as could be found out, there has been no flow records kept.

f) Is it possible in the village neighborhood to build a reservoir for hydro-power purposes? Yes

g) In anticipation of possible future power applications, we are interested in local wind conditions. To be useful as a source of energy for power, winds should be predictably available every day at a velocity of at least 10 miles per hour for at least one-third of the day. There is almost a 10-15 km breeze in this area.

h) With respect to possible solar power for the future, how many days of sunshine are expected per year? There is almost always sun in this region.

Version No. 1 - May 9, 1962

PREPARED BY Richard Fiedler

ADDRESS Federcafe Extension

AGENCY Ebejico, Antioquia Cuerpo de Paz

DATE May, 1962

RESEARCH STUDY ON THE GENERATION AND USE OF ELECTRIC POWER IN RURAL COMMUNITIES - I. G. E. & RELATED AGENCIES

A - Country of Research project - Colombia X Peru ___ Chile ___

B - Basic Village Community Statistics

1 - Village Has ___ Has Not X Electric Power Available.

2 - Name of Village, Vereda, Area LaGramala

3 - Nearest municipality Ebejico

4 - Toward what major city is the village economy oriented?

Medellin

5 - Village classification, that is: mountain X valley ___ coastal ___ plain ___ ?

6 - Distance of village to nearest market (estimated in kilometers)
Name of market? Distance 55 Name Medellin

7 - Type of access roads to village (for example, paved roads, dirt roads, mountain trail) or other type of access (river, airfield or railroad)? dirt road to village from Medellin; trails to houses in village.

8 - Village population total? 1,050 Percentage Male 45% Female 55% ?

9 - Percentage of population in labor force, (that is number of persons employed or seeking employment? Percentage males 80% females 20% .

10.- Percentage of non-productive persons in community extremely elder or otherwise infirm 5 % unemployable children 10 %.

11 - Of persons employed, what percentage are self-employed (that is, persons farming for their own account, owning their own business, etc.) 95% what percentage are employed by others 5%

12 - Of persons employed what percentage are engaged in the following activities:
1) agriculture 99 2) industry ___ 3) services ___ 4) government including teachers 1
5) other major category such as fisheries, mining, etc.? Category Agriculture, 99%

13 - What is considered to be the standard or usually acceptable income per worker in each of the foregoing categories, 1 through 5? Please indicate amounts in pesos on an annual basis 1)Agriculture-3160 pesos annual; 4)Teachers-4800 pesos; 81/cap.

14 - Is the above income spread fairly evenly throughout the year or does it fluctuate seasonally? If it fluctuates, what are the high and low periods of income? 1)Agriculture-Coffee seasons. 4)Even throughout the year.

15 - Number of families in the village? 175

16 - Of the total family income, how much is typically available for purposes other than bare subsistence? In other words, where is the disposable income? Of the disposable income, how much is typically put into savings? (In some cases disposable income may be negative if families typically incur indebtedness over and above their income.) 5% is disposable - None.

17 - What is the typical level of debt for a village family? For what purposes are debts usually incurred? (operating loans for farm? funerals, illness, etc. 1% - Illness

18 - Average number of persons born per year? 35

19 - Average number of deaths of persons in all age groups per year? 15

20 - What has been the population growth trend in the village over the past 10 years? over the past two years? Growth of 3 to 1

21 - Has there been a tendency for inhabitants to emigrate from the village: per cent during the last two years None

22 - What have typically been the reasons for emigration?

23 - Has there been a tendency for immigrants to come to the village? If so, what has been the principal motivation? No

24 - Within the labor force (see question 8 above), what percentage of persons have the following skills: 1) automotive-type equipment repair capabilities 1% 2) automotive-type equipment operating capabilities 1% 3) education and training capabilities 1% 4) agricultural skills 95% 5) unskilled 1% 6) administrative 1%

25 - What medical skills are available to the inhabitants? Doctor X Midwife ___ Nurse X

26 - What is the literacy level of the village: 100%___ 75%___ 50% X 25%___ 0___ ?

27 - Any comments on land ownership in this area? Land passed on from father to son. Very few outright titles to land.

28 - What facilities does the village have for the disposal of human waste, for example, latrines, no special facilities. Latrines only.

29 - What is the method of obtaining water for the village____ wells____ streams X surface ponds X other water storage____

30 - Is the water supply potable? Yes. No aqueduct at present.

31 - Is the water supply sufficient for household needs? No for irrigation? No for other purposes (please specify)? -

32-How far away from the community is the water supply? 7 Km.

C - POLITICAL AND SOCIAL ORGANIZATIONS WITHIN THE COMMUNITY

1 - Briefly describe the following community facilities: Clinic, school, community center, cooperative No clinic, community center, cooperative. Has two schools.

2 - What is the form of village government - incorporated Junta____ unincorporated Junta X Other____

3 - What organization or group in the village is likely to be the most effective in cooperating to install, maintain and manage a future source of power generation and distribution? The Junta X The Church____ A cooperative___ Other Possibly a cooperative

D- INDUSTRY AND INCOME RESOURCES OF VILLAGE OR COMMUNITY

1 - What is the number and percentage of farmers cultivating their own land 102-60%

2 - What is the size of the typical plot per farmer? 1/2 Hectare

3 - Of the total number of farmers cultivating their own land what percentage own less than one hectare 70% 1 to 2 hectares 25% more than 2 hectares 5%

4 - What type of food and cash crops are grown by farmers of the village? Coffee, sugar cane, yucca

5 - What type of industry, including handicrafts, exist in the village? None

6 - In the event that power was available for what purposes would the inhabitants believe they would use electric power? Domestic lighting X work shops ____ irrigation ____ pumping of drinking water ____ small scale industries X health clinic X food preservation ____ other _____

E - INTEREST IN POWER

1 - Is the village likely to be interested in acquiring a source of electric power? Would the village be at present enthusiastic about access to power X indifferent ____ opposed ____?

2 - Would the village display a sense of responsibility toward the maintenance, management and financing of a local source of power if one became available? This village definitely would show a sense of responsibility.

3 - Would there be persons in the village interested in learning about the maintenance of power equipment? Would there be persons capable of teaching mechanical techniques required for maintaining equipment? Yes, in the municipio.

F - FUEL POTENTIAL FOR POWER

a) We are interested in learning about the availability of various materials which are not being used at present for fuels but which could be used for fuels. In the village vicinity, for example, by-products such as coffee hulls; branches, twigs, leaves which are residual after trees are trimmed for timber; waste fibers resulting from weaving waste trimmings of reeds from mat manufacture, cattle dung, other agricultural waste? As of present, every piece of organic material is used for compost under trees for mulch.

b) Are there any outcroppings of coal or surface crude oils? None at present have been located.

c) With respect to cattle dung, what is it currently being used for? How many cattle are in the village? Nothing-200 Is composting practiced? No

d) For the various types of potential fuels what comments do you have as to quantities available? Very little quantity of wood available. No other fuels.

e) What are the potential hydro-power resources available, such as water falls, streams and rivers. Are these resources continuous, intermittent, and what are the general fluctuations from season to season? Have any stream flow records been maintained? If so, how long? There is a waterfalls 3 Kms from village which flows continuously all year, same rate of over 200 gallons a minute. No records kept all year.

f) Is it possible in the village neighborhood to build a reservoir for hydro-power purposes? Yes, it is possible.

g) In anticipation of possible future power applications, we are interested in local wind conditions. To be useful as a source of energy for power, winds should be predictably available every day at a velocity of at least 10 miles per hour for at least one-third of the day. No winds generally speaking.

h) With respect to possible solar power for the future, how many days of sunshine are expected per year? Approximately 250 days a year.

LA PINUELA

Version No. 1 - May 9, 1962

PREPARED BY Bradford H. Whipple

ADDRESS El Valle de San Jose-Santander, Colombia

AGENCY Peace Corps

DATE May, 1962

RESEARCH STUDY ON THE GENERATION AND USE OF ELECTRIC POWER IN RURAL COMMUNITIES - I. G. E. & RELATED AGENCIES

A - Country of Research project - Colombia X Peru ___ Chile ___

B - Basic Village Community Statistics

1 - Village Has X Has Not ___ Electric Power Available.

2 - Name of Village, Vereda, Area La Pinuela

3 - Nearest municipality El Valle de San Jose (5 Kms.)

4 - Toward what major city is the village economy oriented?

San Gil, or 100 kilometers south of Bucaramanga

5 - Village classification, that is: mountain X valley ___ coastal ___ plain ___?

6 - Distance of village to nearest market (estimated in kilometers)
Name of market? Distance 19 Name San Gil

7 - Type of access roads to village (for example, paved roads, dirt roads, mountain trail) or other type of access (river, airfield or railroad)? Dirt road and trail.

8 - Village population total? 500 Percentage Male 45% Female 55% ?

9 - Percentage of population in labor force, (that is number of persons employed or seeking employment? Percentage males 25% females 20% .

10.- Percentage of non-productive persons in community extremely elder or otherwise infirm 10 % unemployable children 45 %.

11 - Of persons employed, what percentage are self-employed (that is, persons farming for their own account, owning their own business, etc.) 100% what percentage are employed by others -

12 - Of persons employed what percentage are engaged in the following activities:
1) agriculture 100 2) industry - 3) services - 4) government including teachers ___
5) other major category such as fisheries, mining, etc.? Category - %

13 - What is considered to be the standard or usually acceptable income per worker in each of the foregoing categories, 1 through 5? Please indicate amounts in pesos on an annual basis 2400 pesos a year

14 - Is the above income spread fairly evenly throughout the year or does it fluctuate seasonally? If it fluctuates, what are the high and low periods of income? Evenly spread

15 - Number of families in the village? 60

16 - Of the total family income, how much is typically available for purposes other than bare subsistence? In other words, where is the disposable income? Of the disposable income, how much is typically put into savings? (In some cases disposable income may be negative if families typically incur indebtedness over and above their income.) Bare subsistence only. Nothing in positive or negative.

17 - What is the typical level of debt for a village family? For what purposes are debts usually incurred? (operating loans for farm? funerals, illness, etc. Few long term debts - when sustained, are for illness and funerals.

18 - Average number of persons born per year? 55

19 - Average number of deaths of persons in all age groups per year? 35

20 - What has been the population growth trend in the village over the past 10 years? over the past two years? Remain same.

21 - Has there been a tendency for inhabitants to emigrate from the village: per cent during the last two years Yes-10%.

22 - What have typically been the reasons for emigration? Search of work, land.

23 - Has there been a tendency for immigrants to come to the village? If so, what has been the principal motivation? No (overpopulation)

24 - Within the labor force (see question 8 above), what percentage of persons have the following skills: 1) automotive-type equipment repair capabilities - 2) automotive-type equipment operating capabilities 5% 3) education and training capabilities - 4) agricultural skills 40% 5) unskilled 55% 6) administrative -

25 - What medical skills are available to the inhabitants? Doctor ___ Midwife X Nurse ___

26 - What is the literacy level of the village: 100%___ 75%___ 50%___ 25%___ 5%X 0___?

27 - Any comments on land ownership in this area? Many small land owners - no large scale farms or properties.

28 - What facilities does the village have for the disposal of human waste, for example, latrines, no special facilities. No special facilities.

29 - What is the method of obtaining water for the village____ wells____ streams X surface ponds____ other water storage aqueduct based on stream fed storage reservoir.

30 - Is the water supply potable? No

31 - Is the water supply sufficient for household needs? Yes for irrigation? No for other purposes (please specify)? -

32-How far away from the community is the water supply? 7 Km & aqueduct to homes.

C - POLITICAL AND SOCIAL ORGANIZATIONS WITHIN THE COMMUNITY

1 - Briefly describe the following community facilities: Clinic, school, community center, cooperative School, community center with library.

2 - What is the form of village government - incorporated Junta X unincorporated Junta____ Other____

3 - What organization or group in the village is likely to be the most effective in cooperating to install, maintain and manage a future source of power generation and distribution? The Junta X The Church____ A cooperative___ Other____

D- INDUSTRY AND INCOME RESOURCES OF VILLAGE OR COMMUNITY

1 - What is the number and percentage of farmers cultivating their own land 100% additionally vassal or renting - land lease system.

2 - What is the size of the typical plot per farmer? 2-4 acres

3 - Of the total number of farmers cultivating their own land what percentage own less than one hectare 20% 1 to 2 hectares 75% more than 2 hectares 5%

4 - What type of food and cash crops are grown by farmers of the village? coffee, sugar cane, corn, sorghum, hemp, vegetables

5 - What type of industry, including handicrafts, exist in the village? processing of hemp fiber, straw weaving

6 - In the event that power was available for what purposes would the inhabitants believe they would use electric power? Domestic lighting X work shops X irrigation ____ pumping of drinking water ____ small scale industries X health clinic ____ food preservation X other _____

E - INTEREST IN POWER

1 - Is the village likely to be interested in acquiring a source of electric power? Would the village be at present enthusiastic about access to power X indifferent ____ opposed ____?

2 - Would the village display a sense of responsibility toward the maintenance, management and financing of a local source of power if one became available? Yes

3 - Would there be persons in the village interested in learning about the maintenance of power equipment? Would there be persons capable of teaching mechanical techniques required for maintaining equipment? Yes - to an extent already exists - limited knowledge.

F - FUEL POTENTIAL FOR POWER

a) We are interested in learning about the availability of various materials which are not being used at present for fuels but which could be used for fuels. In the village vicinity, for example, by-products such as coffee hulls, branches, twigs, leaves which are residual after trees are trimmed for timber; waste fibers resulting from weaving waste trimmings of reeds from mat manufacture; cattle dung, other agricultural waste? Coffee hulls used for compost fertilizing; all other fuels are available.

b) Are there any outcroppings of coal or surface crude oils? Very little coal.

c) With respect to cattle dung, what is it currently being used for? How many cattle are in the village? 20 Is composting practiced? Yes

d) For the various types of potential fuels what comments do you have as to quantities available? Not substantial enough for prolonged use of major quantity.

e) What are the potential hydro-power resources available, such as water falls, streams and rivers. Are these resources continuous, intermittent, and what are the general fluctuations from season to season? Have any stream flow records been maintained? If so, how long? Several small streams, but dry periods reduce flow to just cover drinking purposes.

f) Is it possible in the village neighborhood to build a reservoir for hydro-power purposes? On a small scale, yes.

g) In anticipation of possible future power applications, we are interested in local wind conditions. To be useful as a source of energy for power, winds should be predictably available every day at a velocity of at least 10 miles per hour for at least one-third of the day. Not constant.

h) With respect to possible solar power for the future, how many days of sunshine are expected per year? 250-280

G - For Those Communities With Power Only.

1 - With available, what is the power used for? household illuminating and appliances X community use such as street lighting X schools X clinics X for industries X for agriculture ___ for other uses? _____

2 - What is the cost of power to consumers? -

3 - How many kilowatt hours are supplied annually to the village? -

4 - In the village that has a source of power we would like comments on the "before and after" situation. Possibly the best way to describe the changes which may have occurred as the result of power would be to describe the economic returns and social returns as follows:

Economic Returns

a - Has there been any change in employment? -

b - Has there been any change in the rateof immigration or emmigration? -

c - Does the village manufacture any new products? No, but efficiency in production is evident.

d - Do the inhabitants benefit from higher income? Yes

5 - To help us in estimating the monetary value or the economic benefit of power to the village community we want to obtain some measure of the changes in the village's "gross product" and then relate these changes to the cost of power. In other words we want to establish a "cost/benefit" ratio. (We can derive the "cost" from questions above; the following relates to the "benefit" part of the ratio.)

Probably the best approach to this would be to esimate the value of production and services before power was available and estimate the same values for the period after power was installed as follows:

	Estimated Values in the Year Before Power was Available (State Year)	Estimated Current Values per Year
Value of Agricultural Production	_____	_____
Value of Industrial Production	_____	_____
Value of Services	_____	_____
Value of Other Production	_____	_____
Salaries to Govt. and Church	_____	_____
TOTAL	_____	_____

In estimating the value of industrial production, it would be desirable to deduct the value of raw materials used so that the figure for industrial production is the so-called "value added".

In estimating the value of services, the easiest approach would be to multiply the income of persons engaged in services by the number of persons so engaged.

6 - Has the availability of power increased the number of local skills, mechanical, managerial; has power increased literarcy?
Yes, slightly.

7 - Has power increased production for local use? Yes, considerably.

8 - Has power increased production for shipment of goods outside the community? Yes, considerably.

9 - Has power had any effect on credit facilities? More borrowing or less borrowing? Unknown

10 - Has power increased agricultural output per man? per hectare? Doubtful

11 - Have any other changes affecting the living standards occurred? More social interchange due to longer periods of light (power).

Social Returns

12 - Has the availability of power strengthened community services: education, lighting, community meetings, voluntary community projects? Has power served to improve the effectiveness of local government? Any other comment? Yes-night school for adults.

13 - In village with power plant, please comment on the following:

a - Who owns the power plant? A private company, "Cascada" of San Gil.

b - How was the power plant paid for? Stocks and capital investment .

c - Are charges made to the consumers for the use of electricity and what are the charges? Yes

d - How is the power plant maintained? -

e - What are the major maintenance problems? -

f - Is there a mechanic available to maintain the equipment? Yes - efficiently maintained.

g - How is the mechanic paid? How much? -

h - How is the operator of the power plant paid? How much? -

i - Are power plant operation and maintenance reports kept? By whom? -

j - Are spare parts available? Where? -

k - How is the power plant protected from the weather and from tampering? -

l - What is the power plant rating in terms of name plate kilowatts? _____ - _____

m - Is the output AC or DC? _____ - _____

n - What is the output voltage? What is the frequency (cycles per second)? _____ - _____

o - At what voltage does the consumer use power? (Is there a transformer in the line to drop the voltage below the rated generator output?) _____ 770 _____

14 - Fuel Used for Power

a - What type of fuel is used? What does it cost? At what rate is fuel consumed by the generator; for examples, gallons per month, or liters per month? _____ - _____

b - Where is the fuel purchased? _____ - _____

c - How is the fuel transported to the village? _____ - _____

d - What are the major problems in obtaining fuel? For example, ability to pay for the fuel, difficulties of transportation and amount to be transported. _____ - _____

e - In addition to the fuel used by the power generator, what other fuels are available in the village or its vicinity including gasoline, diesel oil, kerosene, crude oil, coal wood, etc.? _____ - _____

f - What do the above fuels cost in the village? _____ - _____

g - How readily available are such fuels? _____ - _____

h - What are any of the above fuels used for: heating, cooking, lighting? _____ - _____

LA TUPIA

Version No. 1 - May 9, 1962

PREPARED BY Roland Yoeger

ADDRESS Apartado Aerio, Pradera, LaTupia

AGENCY Peace Corps

DATE May, 1962

RESEARCH STUDY ON THE GENERATION AND USE OF ELECTRIC POWER IN RURAL COMMUNITIES - I. G. E. & RELATED AGENCIES

A - Country of Research project - Colombia X Peru ___ Chile ___

B - Basic Village Community Statistics

1 - Village Has X Has Not ___ Electric Power Available.

2 - Name of Village, Vereda, Area La Tupia

3 - Nearest municipality Candelaria

4 - Toward what major city is the village economy oriented?

Cali

5 - Village classification, that is: mountain ___ valley ___ coastal ___ plain X ?

6 - Distance of village to nearest market (estimated in kilometers)
Name of market? Distance 4 Km. Name Candelaria

7 - Type of access roads to village (for example, paved roads, dirt roads, mountain trail) or other type of access (river, airfield or railroad)? Dirt road.

8 - Village population total? 1000 Percentage Male 55% Female 45% ?

9 - Percentage of population in labor force, (that is number of persons employed or seeking employment? Percentage males ___ females ___.
All self-employed - coffee growers.

10 - Percentage of non-productive persons in community extremely elder or otherwise infirm ___% unemployable children ___%. 20% non-productive - children work.

11 - Of persons employed, what percentage are self-employed (that is, persons farming for their own account, owning their own business, etc.) 80% what percentage are employed by others 20%

12 - Of persons employed what percentage are engaged in the following activities:
1) agriculture 80 2) industry 15 3) services 3 4) government including teachers 2
5) other major category such as fisheries, mining, etc.? Category ___ %

13 - What is considered to be the standard or usually acceptable income per worker in each of the foregoing categories, 1 through 5? Please indicate amounts in pesos on an annual basis Sugar cane workers get about 10 pesos a day.

14 - Is the above income spread fairly evenly throughout the year or does it fluctuate seasonally? If it fluctuates, what are the high and low periods of income? Steady

15 - Number of families in the village? 200

16 - Of the total family income, how much is typically available for purposes other than bare subsistence? In other words, where is the disposable income? Of the disposable income, how much is typically put into savings? (In some cases disposable income may be negative if families typically incur indebtedness over and above their income.) What is left over goes into drinking.

17 - What is the typical level of debt for a village family? For what purposes are debts usually incurred? (operating loans for farm? funerals, illness, etc. Various - to pay big debts.

18 - Average number of persons born per year? _____

19 - Average number of deaths of persons in all age groups per year? _____

20 - What has been the population growth trend in the village over the past 10 years? over the past two years? _____

21 - Has there been a tendency for inhabitants to emigrate from the village: per cent during the last two years Tendencies to move has been noted.

22 - What have typically been the reasons for emigration? Better work, family disagreements - instability

23 - Has there been a tendency for immigrants to come to the village? If so, what has been the principal motivation? Long visits with families - freeload

24 - Within the labor force (see question 8 above), what percentage of persons have the following skills. 1) automotive-type equipment repair capabilities ____ 2) automotive-type equipment operating capabilities _____ 3) education and training capabilities ____ 4) agricultural skills X (mostly) 5) unskilled X (quite a few) 6) administrative ____

25 - What medical skills are available to the inhabitants? Doctor ___ Midwife X Nurse 2

26 - What is the literacy level of the village: 100%___ 75% X 50%___ 25%___ 0___ ?

27 - Any comments on land ownership in this area? Very good - the people have land and this means security - they will have food and if they work and organize, they could have handsome profits - some men do and live good.

28 - What facilities does the village have for the disposal of human waste, for example, latrines, no special facilities. No facilities

29 - What is the method of obtaining water for the village____ wells____ streams____ surface ponds____ other water storage____ Streams to wash - one main community well for drinking.

30 - Is the water supply potable?_____

31 - Is the water supply sufficient for household needs? Yes for irrigation? No for other purposes (please specify)?_____

C - POLITICAL AND SOCIAL ORGANIZATIONS WITHIN THE COMMUNITY

1 - Briefly describe the following community facilities: Clinic, school, community center, cooperative School - 2 teachers - well equipped - soon water project - we have light in 2/3 of the village - soon health center.

2 - What is the form of village government - incorporated Junta X unincorporated Junta____ Other____
(90% women)

3 - What organization or group in the village is likely to be the most effective in cooperating to install, maintain and manage a future source of power generation and distribution? The Junta X The Church____ A cooperative___ Other____

D- INDUSTRY AND INCOME RESOURCES OF VILLAGE OR COMMUNITY

1 - What is the number and percentage of farmers cultivating their own land 80%

2 - What is the size of the typical plot per farmer? 1 plaza

3 - Of the total number of farmers cultivating their own land, what percentage own less than one hectare_____ 1 to 2 hectares_____ more than 2 hectares_____

4 - What type of food and cash crops are grown by farmers of the village? Coffee, cocoa

5 - What type of industry, including handicrafts, exist in the village? Near are three sugar ingenios

9 - In the event that power was available for what purposes would the inhabitants believe they would use electric power? Domestic lighting x work shops____ irrigation____ pumping of drinking water____ small scale industries____ health clinic____ food preservation____ other_____

E - INTEREST IN POWER

1 - Is the village likely to be interested in acquiring a source of electric power? Would the village be at present enthusiastic about access to power____ indifferent____ opposed____?

2 - Would the village display a sense of responsibility toward the maintenance, management and financing of a local source of power if one became available?

3 - Would there be persons in the village interested in learning about the maintenance of power equipment? Would there be persons capable of teaching mechanical techniques required for maintaining equipment?_____

F - FUEL POTENTIAL FOR POWER

a) We are interested in learning about the availability of various materials which are not being used at present for fuels but which could be used for fuels. In the village vicinity, for example, by-products such as coffee hulls, branches, twigs, leaves which are residual after trees are trimmed for timber; waste fibers resulting from weaving waste trimmings of reeds from mat manufacture, cattle dung, other agricultural waste? All burnable materials go for the kitchen

b) Are there any outcroppings of coal or surface crude oils? No

c) With respect to cattle dung, what is it currently being used for? How many cattle are in the village? Few Is composting practiced?_____

d) For the various types of potential fuels what comments do you have as to quantities available? Conventional hulls available.

e) What are the potential hydro-power resources available, such as water falls, streams and rivers. Are these resources continuous, intermittent, and what are the general fluctuations from season to season? Have any stream flow records been maintained? If so, how long?_____

f) Is it possible in the village neighborhood to build a reservoir for hydro-power purposes? No.

g) In anticipation of possible future power applications, we are interested in local wind conditions. To be useful as a source of energy for power, winds should be predictably available every day at a velocity of at least 10 miles per hour for at least one-third of the day. Very little.

h) With respect to possible solar power for the future, how many days of sunshine are expected per year? Very good possibilities.

G - For Those Communities With Power Only

1 - With available, what is the power used for? household illuminating and appliances X community use such as street lighting ____ schools ____ clinics ____ for industries ____ for agriculture ____ for other uses juke box.

2 - What is the cost of power to consumers 10 pesos/month

3 - How many kilowatt hours are supplied annually to the village? -

4 - In the village that has a source of power we would like comments on the "before and after" situation. Possibly the best way to describe the changes which may have occurred as the result of power would be to describe the economic returns and social returns as follows:

Economic Returns

a - Has there been any change in employment? No

b - Has there been any change in the rate of immigration or emmigration? No

c - Does the village manufacture any new products? No

d - Do the inhabitants benefit from higher income? -

5 - To help us in estimating the monetary value or the economic benefit of power to the village community we want to obtain some measure of the changes in the village's "gross product" and then relate these changes to the cost of power. In other words we want to establish a "cost/benefit" ratio. (We can derive the "cost" from Questions above; the following relates to the "benefit" part of the ratio.)

SITE: LOMARENA

PROGRAM FOR ADVANCED TECHNICAL SUPPORT
FOR VILLAGE DEVELOPMENT

CHECK LIST OF FIELD INFORMATION

Version No. 3 - October 17, 1962

SURVEY DATE: May 30, 1962

FIELD TEAM MEMBERS: E. G. Alderfer - CARE, Inc.
(incl. association) G. Street - G. E. Co.

INFORMANTS:
(incl. titles, etc.) Tom Bentley - Peace Corps Leader/Colombia

I. VITAL STATISTICS

Village Lomarena Province: Santa Catalina
Department: Atlantico Country: Colombia
Type of Government: ---
Population: Urban: 1500 Rural: --- Total: ---
Urban families: 100 plus
Birth rate: --- Death rate: ---
Population growth rate: ---
Net emigration: stable Why: ---
Literacy level: ---

II. ENVIRONMENTAL CHARACTERISTICS

Name and distance of nearest town: Santa Catalina 18 km
Name and distance of nearest market: Santa Catalina 18 km
Geographical classification: Arid Coastal Plain
Type of access road: Unrepaired paved road
Other access routes: ---

Sewage facilities: 50% have outhouses - others use fields
Drinking water sources: From fresh water lagoon (potability questionable)

Stream and river sources: Fresh water river and lagoon

Fuel cost and availability:

Regular gasoline	1.00 peso/gal.
Kerosene	1.10 peso/gal.
Charcoal	very expensive
Diesel fuel	none
Crude oil	none
Coal	none

Available indigenous fuels: Wood - scarce - for cooking

Wind and its utilization: Dry months SW 5 to 12 meters/sec.
Wet season NW 3 meters/sec.
Night and day continuous

Sunshine and its utilization:
See Caracoli

Availability of medical skills:

2 to 3 doctors available at Galerazamba - 6 km away.

Resident doctors	None
Itinerant doctors	None
Dentists	None
Nurses	None
Midwifes	None
Pharmacists	None
Herbalists	None

Clinic: Plans to construct health clinic with a nurse and visiting doctor.

Schools: Plan to build a 5 grade school.

Community Center: None

Cooperatives: None

III. ECONOMIC CHARACTERISTICS

Work force pattern - percent of total population: _____

Section	Percent		Avg. Income
Agriculture	None		
Industries	None		
Services	None		
Mining	None		
Fishing	100%	)	1200 pesos/yr.
Others Salt Mining	100% part time	)	
Unemployed	---		
Non productive	---		
% Self employed	100%	% Employed	Part time(salt mining)

Income fluctuation: Seasonal - Fishing and salt mining

Typical Debt: None Why: not good risks
Typical Savings: None Form:

Subsistence level: bare subsistence

Types of farm crops: Yuca, iguana, corn
~~(Indicate major cash-crops)~~ subsistence - garden crops

Types of farm animals raised: Poultry
(include numbers) Pigs
Few cattle

Typical size of farm plots: New vollage will occupy 11 Hectare for 100 families.
No farm land

% Farmers owning land ---- % Renting ----

Latifundia ---- Minifundia X

Composting practiced No

Types of industries: None
(Including size)

Handicrafts: None

Types of services: None

Available Tech. Skills: Fishing
Unskilled labor
Boat repair and crude construction

Cooperative community works: In process of building new towns

IV. PRESENT ELECTRIFICATION

Year of installation: None

Type of electric power: _____

Distance to and cost of electric grid power: 15 km. - 24 ctvos/kw hrs.

Nearest town with grid accessibility: Santa Catalina

Power plant rating: _____

Phases: _____ Volts: _____ Freq.: _____

Power plant ownership: _____

operator: _____

Use of electricity and connected loads:

Household illumination _____

Radios _____

Street lighting _____

Industries

Irrigation

Others

Operational time: _____

Type rate, price and source of fuel: _____

Rate, price and source of lube oil: _____

Fuel transport: _____

Power plant maintenance: _____

Availability of spare parts: _____

Maintenance problems: _____

Are power plant records kept? _____ How? _____

Installation cost of power plant: _____

Operation costs: _____

Maintenance costs: _____

Fuel and oil costs: _____

Tariff schedules: _____

Yearly revenue: _____

V. PROBLEM, NEEDS, OPPORTUNITIES

What are major problems: Present village site is being washed away by the sea - They are moving town to a new location.

What are felt needs:
Fish preservation
Boat building and repair
Irrigation for garden crops

What are obvious opportunities:
Garden crop irrigation
Improvised fishing boats
See Taganga notes

Does village desire electrification: Would like it

VI. REMARKS

- Lomarena is a corregimiento of the municipio of Santa Catalina. It is a coastal fishing village of approximately 1500 people, located in the northeast corner of the departmento about 16 kilometers from the cabecera of Santa Catalina and about 4 kilometers northeast of Gartegena on the highway to Barranquilla. Lomarena has a mean yearly temperature of 28.7°C. The climate can be said to be isothermic since the mean annual temperature will vary less than 3° during the year. There is a mean annual rainfall of about 550mm, 94.8% of which falls during the months of May through November.

Lomarena is primarily a fishing village with sources of salt-water fish from the ocean and fresh-water fish from the Cienaga de Totuno. During the time of the salt harvest at the nearby Salinas de Galerazamba, all the people work at the salt flats which are operated by the Banco de la Republica. There they chip loose the salt that has settled in the flats and load it into trucks which carry it to nearby salt mills. When all the salt has been gathered, the flats are flooded with sea water. The sea water is evaporated by the sun, leaving a new layer of salt in the flat basins. However, the salt harvest is a seasonal event, lasting only 2 months of the year. Since there is very little other work available, the people are extremely poor.

During the last 8 years and especially during the last year and a half, the ocean has been steadily eroding away the shore line. Over half the village of Lomarena has been destroyed by the sea. The people have been forced to abandon their homes and move up to higher ground where many are presently living in makeshift housing. A study was made of the problem and the conclusion was that this erosion would continue until the shore line was moved inland to a point

VI. REMARKS (continued)

corresponding the location of harder, rockier soil. It was decided that since the cost of a sea wall was prohibitive, the town should be moved to safer ground about 1/2 kilometer away. The people of the village are determined to build a new, clean town at this new location where it will be safe from the destroying force of the sea. During the latter part of the last year and the early part of this year, Dr. Triana, the coordinator for the Division de Accion Comunal and Dr. Gamboa, the departmental promotor at the time, were working on the preparations necessary for the construction of this new town. At the present date, the actual construction has not yet begun, but a great deal of ground work is completed. There are 80 to 100 families in the village who have promised to provide all the necessary labor and to pay 100.00 pesos for each home. The community has agreed to provide such indigenous materials as sand, rock, and wood. The municipio of Santa Catalina purchased eleven hectares of land valued at 5,000.00 pesos for the new town and has set aside an additional 10,000.00 pesos of the budget for this project. The Departmento de Salud Publica has promised to give all the necessary technical assistance, transportation, tools, cinva-ram machines and a carpentry shop in which to build the necessary doors, windows, etc. They have also agreed to furnish a latrine for each of the new houses. The Secretaria de Obras Publicas has offered to provide a dump truck in which to carry materials, wheelbarrows, concrete forms and other items for the construction of the town. The Banco dela Republica has tentatively agreed to furnish 1,500 sacks of cement for the construction of the cinva-ram blocks. The people have formed work brigades which will provide 16 workers every day until the town is built. An engineer came out and staked out the location of each lot, the roads and the other public areas. The first stage was to be the construction of 50 houses, later an additional 50 houses were to be build along with a new school, a health center, and possibly a chapel. But with the transfer of Dr. Triana and the resignation of Gamboa, the project has come to a standstill. The promised cinva-ram machines were sent to another site and the people who are eager to begin work are unable to do so because of lack of equipment. Dr. Yezid Velasquez, the new departmental promotor, has not yet visited the site and things are just sitting there waiting for a little leadership and direction. Although the Cabacera of Santa Catalina has its own problems, the civil authorities there are extremely enthusiastic about the program and have promised their complete cooperation. The alcalde and members of the consejo are all very dynamic people and are sold on the idea of community action.

Village of Lomarena, showing extensive shoreline erosion.

Crude fishing boats along the Cienaga de Totuno.

Entrance to Village of Lomarena.

Typical housing in Village of Lomarena.

Version No. 1 - May 9, 1962

PREPARED BY J. Tenaglia

ADDRESS A. A. 780 - Santa Marta

AGENCY Peace Corps - Colombia

DATE May 13, 1962

RESEARCH STUDY ON THE GENERATION AND USE OF ELECTRIC POWER IN RURAL COMMUNITIES - I. G. E. & RELATED AGENCIES

A - Country of Research project - Colombia X Peru ___ Chile ___

B - Basic Village Community Statistics

1 - Village Has ___ Has Not X Electric Power Available.

2 - Name of Village, Vereda, Area Minca

3 - Nearest municipality Santa Martz

4 - Toward what major city is the village economy oriented?

Santa Marta.

5 - Village classification, that is: mountain X valley ___ coastal ___ plain ___ ?

6 - Distance of village to nearest market (estimated in kilometers)
Name of market? Distance 20 Name Santa Martz

7 - Type of access roads to village (for example, paved roads, dirt roads, mountain trail) or other type of access (river, airfield or railroad)? Dirt road.

8 - Village population total? 500 Percentage Male 50 Female 50 ?

9 - Percentage of population in labor force, (that is number of persons employed or seeking employment? Percentage males 30 females 20 .

10.- Percentage of non-productive persons in community extremely elder or otherwise infirm 10 % unemployable children 20 %.

11 - Of persons employed, what percentage are self-employed (that is, persons farming for their own account, owning their own business, etc.) 60 what percentage are employed by others 40

12 - Of persons employed what percentage are engaged in the following activities:
1) agriculture 95 2) industry ___ 3) services 5 4) government including teachers .001
5) other major category such as fisheries, mining, etc.? Category ___ %

13 - What is considered to be the standard or usually acceptable income per worker in each of the foregoing categories, 1 through 5? Please indicate amounts in pesos on an annual basis 500 pesos.

14 - Is the above income spread fairly evenly throughout the year or does it fluctuate seasonally? If it fluctuates, what are the high and low periods of income? Fluctuates - High--coffee harvest in Jan.

15 - Number of families in the village? 75

16 - Of the total family income, how much is typically available for purposes other than bare subsistence? In other words, where is the disposable income? Of the disposable income, how much is typically put into savings? (In some cases disposable income may be negative if families typically incur indebtedness over and above their income.) Negligible.

17 - What is the typical level of debt for a village family? For what purposes are debts usually incurred? (operating loans for farm? funerals, illness, etc. Low debts - mostly farming.

18 - Average number of persons born per year? 50

19 - Average number of deaths of persons in all age groups per year? 20 (mostly infants.)

20 - What has been the population growth trend in the village over the past 10 years? over the past two years? Slight increase.

21 - Has there been a tendency for inhabitants to emigrate from the village: per cent during the last two years No--on the contrary, to the village and veredos.

22 - What have typically been the reasons for emigration? _____

23 - Has there been a tendency for immigrants to come to the village? If so, what has been the principal motivation? Very much - to escape the violence in the interior.

24 - Within the labor force (see question 8 above), what percentage of persons have the following skills: 1) automotive-type equipment repair capabilities 1 2) automotive-type equipment operating capabilities 1 3) education and training capabilities 10 4) agricultural skills 80 5) unskilled 5 6) administrative 3.

25 - What medical skills are available to the inhabitants? Doctor X Midwife ___ Nurse X Public Health Center.

26 - What is the literacy level of the village: 100%___ 75% X 50%___ 25%___ 0___ ?

27 - Any comments on land ownership in this area? Much of the land is owned by an upper income group who live in the city of Santa Marta.

28 - What facilities does the village have for the disposal of human waste, for example, latrines, no special facilities. Most families have privies.

29 - What is the method of obtaining water for the village____ wells X streams X surface ponds____ other water storage springs.

30 - Is the water supply potable? No (only deep wells)

31 - Is the water supply sufficient for household needs? no for irrigation? yes for other purposes (please specify)? Sufficient for hydroelectric power (approx. 50 kw. Water supply in village

C - POLITICAL AND SOCIAL ORGANIZATIONS WITHIN THE COMMUNITY

1 - Briefly describe the following community facilities: Clinic, school, community center, cooperative Have all facilities.

2 - What is the form of village government - incorporated Junta____ unincorporated Junta X Other None official - administered by Santa Martz

3 - What organization or group in the village is likely to be the most effective in cooperating to install, maintain and manage a future source of power generation and distribution? The Junta X The Church X A cooperative X Other Federation of Cafeteros.

D- INDUSTRY AND INCOME RESOURCES OF VILLAGE OR COMMUNITY

1 - What is the number and percentage of farmers cultivating their own land 99

2 - What is the size of the typical plot per farmer? 10 - 25 H.

3 - Of the total number of farmers cultivating their own land, what percentage own less than one hectare_____ 1 to 2 hectares 30 more than 2 hectares 60%.

4 - What type of food and cash crops are grown by farmers of the village? Coffee, Cabbage, Yucca, Potatoes

5 - What type of industry, including handicrafts, exist in the village? Almost none

6 - In the event that power was available for what purposes would the inhabitants believe they would use electric power? Domestic lighting X work shops ____ irrigation ____ pumping of drinking water X small scale industries ____ health clinic ____ food preservation ____ other ____

E - INTEREST IN POWER

1 - Is the village likely to be interested in acquiring a source of electric power? Would the village be at present enthusiastic about access to power ____ indifferent ____ opposed They are very interested and enthusiastic.

2 - Would the village display a sense of responsibility toward the maintenance, management and financing of a local source of power if one became available? Moderately responsible (needs constant supervision)

3 - Would there be persons in the village interested in learning about the maintenance of power equipment? Would there be persons capable of teaching mechanical techniques required for maintaining equipment? Yes

F - FUEL POTENTIAL FOR POWER

a) We are interested in learning about the availability of various materials which are not being used at present for fuels but which could be used for fuels. In the village vicinity, for example, by-products such as coffee hulls; branches, twigs, leaves which are residual after trees are trimmed for timber; waste fibers resulting from weaving waste trimmings of reeds from mat manufacture; cattle dung, other agricultural waste? All items are available in moderate supply

b) Are there any outcroppings of coal or surface crude oils? No

c) With respect to cattle dung, what is it currently being used for? How many cattle are in the village? 200 Is composting practiced? No - used mostly for fertilizer.

d) For the various types of potential fuels what comments do you have as to quantities available? Available in large quantities especially coffee hulls in January and February.

e) What are the potential hydro-power resources available, such as water falls, streams and rivers. Are these resources continuous, intermittent, and what are the general fluctuations from season to season? Have any stream flow records been maintained? If so, how long? A large constantly flowing stream is available.

f) Is it possible in the village neighborhood to build a reservoir for hydro-power purposes? Yes

g) In anticipation of possible future power applications, we are interested in local wind conditions. To be useful as a source of energy for power, winds should be predictably available every day at a velocity of at least 10 miles per hour for at least one-third of the day. Constant wind at 10 - 15 mph. during most of year.

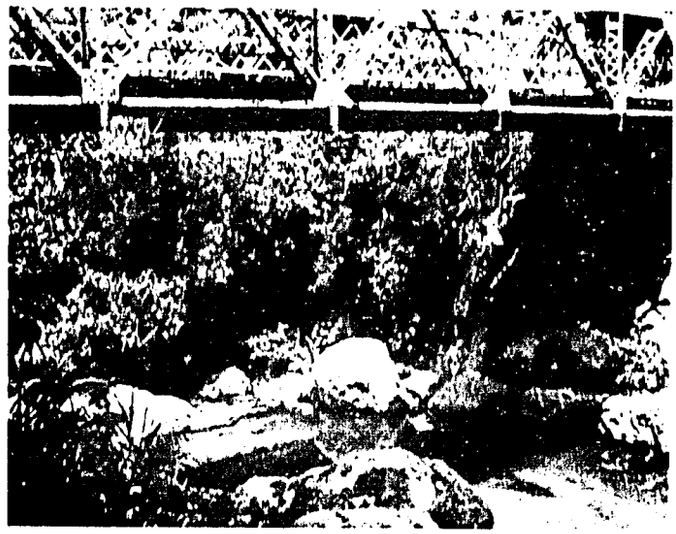
h) With respect to possible solar power for the future, how many days of sunshine are expected per year? about 320.

NOTE.

As a Peace Corps Community Developmen. Project, I am working on the possibilities of installing a new 50 KW hydroelectric plant in Minca to replace the present 5 KW plant which is not operating. All facilities are available: water, housing, etc. The obtaining of mat erials and their consequent installation by the people of the village is what remains to be done.

Subsequent to filling out this questionnaire, it was learned that the project to install the 50 KW hydroelectric plant had become stagnated, due to the possibility of Minca being a candidate for AID supplied engine generator. Later, we understand, Minca was not chosen as such a site. At any rate, when the survey team visited Minca on May 31, 1962, no community action was being directed toward the hydroelectric plant installation or other cooperative projects of the Peace Corpsmen assigned.

Stream running through Village of Minca.



Probable location of dam for 50-kw hydro-electric plant under bridge in Minca.

Version No. 1 - May 9, 1962

PREPARED BY A. Estrin

ADDRESS Concentracion Cafetera

AGENCY Gigante, Huica, Colombia, S. A. - Peace Corps

DATE May 15, 1962

RESEARCH STUDY ON THE GENERATION AND USE OF ELECTRIC POWER IN RURAL COMMUNITIES - I. G. E. & RELATED AGENCIES

A - Country of Research project - Colombia X Peru ___ Chile ___

B - Basic Village Community Statistics

1 - Village Has ___ Has Not X Electric Power Available.

2 - Name of Village, Vereda, Area Pescado

3 - Nearest municipality Gigante, Huila

4 - Toward what major city is the village economy oriented?

Gigante or Neiva

5 - Village classification, that is: mountain X valley ___ coastal ___ plain ___ ?

6 - Distance of village to nearest market (estimated in kilometers)
Name of market? Distance 17 KM Name Gigante

7 - Type of access roads to village (for example, paved roads, dirt roads, mountain trail) or other type of access (river, airfield or railroad)? Dirt Road

8 - Village population total? 200 Percentage Male 40% Female 60% ?

9 - Percentage of population in labor force, (that is number of persons employed or seeking employment? Percentage males 30% females 15% .

10.- Percentage of non-productive persons in community extremely elder or otherwise infirm 15 % unemployable children 35 %.

11 - Of persons employed, what percentage are self-employed (that is, persons farming for their own account, owning their own business, etc.) 80 what percentage are employed by others 20

12 - Of persons employed what percentage are engaged in the following activities:
1) agriculture 8 2) industry 10 3) services 5 4) government including teachers 3
5) other major category such as fisheries, mining, etc.? Category 2 %

13 - What is considered to be the standard or usually acceptable income per worker in each of the foregoing categories, 1 through 5? Please indicate amounts in pesos on an annual basis 3,000 pesos/year

14 - Is the above income spread fairly evenly throughout the year or does it fluctuate seasonally? If it fluctuates, what are the high and low periods of income?
Even

15 - Number of families in the village? 30

16 - Of the total family income, how much is typically available for purposes other than bare subsistence? In other words, where is the disposable income? Of the disposable income, how much is typically put into savings? (In some cases disposable income may be negative if families typically incur indebtedness over and above their income.) 30%

17 - What is the typical level of debt for a village family? For what purposes are debts usually incurred? (operating loans for farm? funerals, illness, etc.

18 - Average number of persons born per year? 50

19 - Average number of deaths of persons in all age groups per year? 30

20 - What has been the population growth trend in the village over the past 10 years? over the past two years? 8%

21 - Has there been a tendency for inhabitants to emigrate from the village: per cent during the last two years 10%

22 - What have typically been the reasons for emigration? No work

23 - Has there been a tendency for immigrants to come to the village? If so, what has been the principal motivation? Seeking jobs

24 - Within the labor force (see question 8 above), what percentage of persons have the following skills: 1) automotive-type equipment repair capabilities 2 2) automotive-type equipment operating capabilities 20 3) education and training capabilities 5 4) agricultural skills 50 5) unskilled 20 6) administrative 3

25 - What medical skills are available to the inhabitants? Doctor X Midwife X Nurse X

26 - What is the literacy level of the village: 100%___ 75%___ 50% X 25%___ 0___ ?

27 - Any comments on land ownership in this area? _____

28 - What facilities does the village have for the disposal of human waste, for example, latrines, no special facilities. None

29 - What is the method of obtaining water for the village____ wells____ streams X surface ponds____ other water storage____

30 - Is the water supply potable? Yes

31 - Is the water supply sufficient for household needs? yes for irrigation? yes for other purposes (please specify)? Water supply 200 meters from community.

C - POLITICAL AND SOCIAL ORGANIZATIONS WITHIN THE COMMUNITY

1 - Briefly describe the following community facilities: Clinic, school, community center, cooperative School, Local Government

2 - What is the form of village government - incorporated Junta X unincorporated Junta____ Other____

3 - What organization or group in the village is likely to be the most effective in cooperating to install, maintain and manage a future source of power generation and distribution? The Junta X The Church____ A cooperative___ Other____

D- INDUSTRY AND INCOME RESOURCES OF VILLAGE OR COMMUNITY

1 - What is the number and percentage of farmers cultivating their own land 100 - 60%

2 - What is the size of the typical plot per farmer? 5 hectares

3 - Of the total number of farmers cultivating their own land, what percentage own less than one hectare 50 1 to 2 hectares 30 more than 2 hectares 20

4 - What type of food and cash crops are grown by farmers of the village? Coffee, platano, yucca

5 - What type of industry, including handicrafts, exist in the village? None

6 - In the event that power was available for what purposes would the inhabitants believe they would use electric power? Domestic lighting X work shops X irrigation X pumping of drinking water X small scale industries X health clinic X food preservation X other _____

E - INTEREST IN POWER

1 - Is the village likely to be interested in acquiring a source of electric power? Would the village be at present enthusiastic about access to power ____ indifferent ____ opposed ____? Enthusiastic.

2 - Would the village display a sense of responsibility toward the maintenance, management and financing of a local source of power if one became available? Most definitely.

3 - Would there be persons in the village interested in learning about the maintenance of power equipment? Would there be persons capable of teaching mechanical techniques required for maintaining equipment? Certainly

F - FUEL POTENTIAL FOR POWER

a) We are interested in learning about the availability of various materials which are not being used at present for fuels but which could be used for fuels. In the village vicinity, for example, by-products such as coffee hulls; branches, twigs, leaves which are residual after trees are trimmed for timber; waste fibers resulting from weaving waste trimmings of reeds from mat manufacture; cattle dung, other agricultural waste? Water power, lumber.

b) Are there any outcroppings of coal or surface crude oils? No

c) With respect to cattle dung, what is it currently being used for? How many cattle are in the village? 75 Is composting practiced? Yes

d) For the various types of potential fuels what comments do you have as to quantities available? Good water power - constant and forceful.

e) What are the potential hydro-power resources available, such as water falls, streams and rivers. Are these resources continuous, intermittent, and what are the general fluctuations from season to season? Have any stream flow records been maintained? If so, how long? There is a small river there, constant water.

f) Is it possible in the village neighborhood to build a reservoir for hydro-power purposes? Yes

g) In anticipation of possible future power applications, we are interested in local wind conditions. To be useful as a source of energy for power, winds should be predictably available every day at a velocity of at least 10 miles per hour for at least one-third of the day. Yes

h) With respect to possible solar power for the future, how many days of sunshine are expected per year? 300 days.

Version No. 1 - May 9, 1962

PREPARED BY John Kuhns

ADDRESS La Plata Huila

AGENCY CARE - Peace Corps

DATE May, 1962

RESEARCH STUDY ON THE GENERATION AND USE OF ELECTRIC POWER IN RURAL COMMUNITIES - I. G. E. & RELATED AGENCIES

A - Country of Research project - Colombia X Peru ___ Chile ___

B - Basic Village Community Statistics

1 - Village Has ___ Has Not X Electric Power Available.

2 - Name of Village, Vereda, Area San Andres

3 - Nearest municipality La Plata

4 - Toward what major city is the village economy oriented?

Neiva, Huila

5 - Village classification, that is: mountain X valley X coastal ___ plain ___?

6 - Distance of village to nearest market (estimated in kilometers)
Name of market? Distance 13 Name LaPlata

7 - Type of access roads to village (for example, paved roads, dirt roads, mountain trail) or other type of access (river, airfield or railroad)? Trails, dirt roads.

8 - Village population total? 400 Percentage Male 50 % Female 50 % ?

9 - Percentage of population in labor force, (that is number of persons employed or seeking employment? Percentage males 150 females 100 .

10.- Percentage of non-productive persons in community extremely elder or otherwise infirm 25 % unemployable children 75 %.

11 - Of persons employed, what percentage are self-employed (that is, persons farming for their own account, owning their own business, etc.) 95% what percentage are employed by others 5%

12 - Of persons employed what percentage are engaged in the following activities:
1) agriculture 99.75% 2) industry ___ 3) services ___ 4) government including teachers .25%
5) other major category such as fisheries, mining, etc.? Category ___ %

13 - What is considered to be the standard or usually acceptable income per worker in each of the foregoing categories, 1 through 5? Please indicate amounts in pesos on an annual basis 1) from crops 2,000 per finca - 8 for daily workers - 2000 plus average supplement @ 8 daily = 3,000 pesos annual/family.

14 - Is the above income spread fairly evenly throughout the year or does it fluctuate seasonally? If it fluctuates, what are the high and low periods of income? Seasonal.

15 - Number of families in the village? 65

16 - Of the total family income, how much is typically available for purposes other than bare subsistence? In other words, where is the disposable income? Of the disposable income, how much is typically put into savings? (In some cases disposable income may be negative if families typically incur indebtedness over and above their income.) 500 pesos.

17 - What is the typical level of debt for a village family? For what purposes are debts usually incurred? (operating loans for farm? funerals, illness, etc. Very low - funerals

18 - Average number of persons born per year? 15

19 - Average number of deaths of persons in all age groups per year? 10

20 - What has been the population growth trend in the village over the past 10 years? over the past two years? No immigration - only increase by birth.

21 - Has there been a tendency for inhabitants to emigrate from the village: per cent during the last two years No--negligible.

22 - What have typically been the reasons for emigration? Search for better income.

23 - Has there been a tendency for immigrants to come to the village? If so, what has been the principal motivation? No

24 - Within the labor force (see question 8 above), what percentage of persons have the following skills: 1) automotive-type equipment repair capabilities____ 2) automotive-type equipment operating capabilities 1 person 3) education and training capabilities 3.4 4) agricultural skills 98% 5) unskilled____ 6) administrative 1-2 person

25 - What medical skills are available to the inhabitants? Doctor___ Midwife X Nurse____

26 - What is the literacy level of the village: 100%___ 75% X 50%___ 25%___ 0___ ?
65+

27 - Any comments on land ownership in this area? All own some land. Some own more than they are utilizing; others could use more. There are no absentee land-holders.

28 - What facilities does the village have for the disposal of human waste, for example, latrines, no special facilities. Many latrines

29 - What is the method of obtaining water for the village____ wells____ streams X surface ponds____ other water storage There is an aqueduct that services all houses but the flow is weak due to inadequate piping.

30 - Is the water supply potable? Yes

31 - Is the water supply sufficient for household needs? yes for irrigation? no / but sufficient rain for crops. for other purposes (please specify)? yes --good source for power but below town.

32 - 1) aqueduct supply 200 m. 2) power supply - 1 km. from community.

C - POLITICAL AND SOCIAL ORGANIZATIONS WITHIN THE COMMUNITY

1 - Briefly describe the following community facilities: Clinic, school, community center, cooperative Church, casa cural where meetings are held. New school under construction.

2 - What is the form of village government - incorporated Junta____ unincorporated Junta X Other____

3 - What organization or group in the village is likely to be the most effective in cooperating to install, maintain and manage a future source of power generation and distribution? The Junta X The Church____ A cooperative___ Other____

D- INDUSTRY AND INCOME RESOURCES OF VILLAGE OR COMMUNITY

1 - What is the number and percentage of farmers cultivating their own land All families (65)

2 - What is the size of the typical plot per farmer? 1 - 2 hectares average - no more than 3-4.

3 - Of the total number of farmers cultivating their own land, what percentage own less than one hectare 75% 1 to 2 hectares_____ more than 2 hectares 25%.

4 - What type of food and cash crops are grown by farmers of the village? Cafe, chikens, eggs, yucca, platano

5 - What type of industry, including handicrafts, exist in the village? Carpentry.

6 - In the event that power was available for what purposes would the inhabitants believe they would use electric power? Domestic lighting X work shops X irrigation X pumping of drinking water ____ small scale industries X health clinic X food preservation X other music - loud speaker - movies.

E - INTEREST IN POWER

1 - Is the village likely to be interested in acquiring a source of electric power? Would the village be at present enthusiastic about access to power ____ indifferent ____ opposed ____? Enthusiastic.

2 - Would the village display a sense of responsibility toward the maintenance, management and financing of a local source of power if one became available? Yes

3 - Would there be persons in the village interested in learning about the maintenance of power equipment? Would there be persons capable of teaching mechanical techniques required for maintaining equipment? yes

F - FUEL POTENTIAL FOR POWER

a) We are interested in learning about the availability of various materials which are not being used at present for fuels but which could be used for fuels. In the village vicinity, for example, by-products such as coffee hulls; branches, twigs, leaves which are residual after trees are trimmed for timber; waste fibers resulting from weaving waste trimmings of reeds from mat manufacture; cattle dung, other agricultural waste? Coffee hulls, branches, wood, cattle dung, assorted trimmings.

b) Are there any outcroppings of coal or surface crude oils? No

c) With respect to cattle dung, what is it currently being used for? Fertilizer. How many cattle are in the village? 30 Is composting practiced? Yes

d) For the various types of potential fuels what comments do you have as to quantities available? Wood would be the most abundant source, coffee hulls 2nd, cattle dung 3rd. Combining wood for fuel with a small carpentry industry and a reforestation program would minimize waste.

e) What are the potential hydro-power resources available, such as water falls, streams and rivers. Are these resources continuous, intermittent, and what are the general fluctuations from season to season? Have any stream flow records been maintained? If so, how long? One good strea, 10% drop - 50 M^3/min. rainy season which we measured. It slows down for dry season but not too much.

f) Is it possible in the village neighborhood to build a reservoir for hydro-power purposes? Yes, good site 1 km from town, natural walls, good drop.

g) In anticipation of possible future power applications, we are interested in local wind conditions. To be useful as a source of energy for power, winds should be predictably available every day at a velocity of at least 10 miles per hour for at least one-third of the day. Insufficient.

h) With respect to possible solar power for the future, how many days of sun-shine are expected per year? 300 days.

REMARKS:

I like this vereda because 1) they have an effectively functioning junta which draws representative turnouts, 2) they have a history of community works with very little reliance on outside help, 3) the physical set-up is such that nearly all houses are near the central concentration and, therefore, there is frequent contact and communication among all, 4) the land tenure is such that there is some available land belonging to local residents which they are not really using, 5) when the new school is completed, there will be two 10' x 25' zinc buildings at community disposal, as is already the casa cural, 6) they are held back so by low agricultural production that they would be eager to adopt any alternative that presented itself.

Version No. 1 - May 9, 1962

PREPARED BY Michael Lanigan

ADDRESS Andes Antioquia

AGENCY Peace Corps

DATE May, 1962

RESEARCH STUDY ON THE GENERATION AND USE OF ELECTRIC POWER IN RURAL COMMUNITIES - I. G. E. & RELATED AGENCIES

A - Country of Research project - Colombia X Peru ___ Chile ___

B - Basic Village Community Statistics

1 - Village Has ___ Has Not X Electric Power Available.

2 - Name of Village, Vereda, Area San Pedro Abajo

3 - Nearest municipality Andes, Antioquia

4 - Toward what major city is the village economy oriented?

Andes & Medellin

5 - Village classification, that is: mountain X valley ___ coastal ___ plain ___ ?

6 - Distance of village to nearest market (estimated in kilometers)
Name of market? Distance 15 km. Name Andes

7 - Type of access roads to village (for example, paved roads, dirt roads, mountain trail) or other type of access (river, airfield or railroad)? Carretera and herradura (horse trail)

8 - Village population total? 180 Percentage Male 45 Female 55 ?

9 - Percentage of population in labor force, (that is number of persons employed or seeking employment? Percentage males 80% females (all are housewives or kids

10.- Percentage of non-productive persons in community extremely elder or otherwise infirm 10-15 % unemployable children --- %.

11 - Of persons employed, what percentage are self-employed (that is, persons farming for their own account, owning their own business, etc.) 75% what percentage are employed by others 25%

12 - Of persons employed what percentage are engaged in the following activities:
1) agriculture 100 2) industry ___ 3) services ___ 4) government including teachers 1
5) other major category such as fisheries, mining, etc.? Category ___ %

13 - What is considered to be the standard or usually acceptable income per worker in each of the foregoing categories, 1 through 5? Please indicate amounts in pesos on an annual basis 3500 pesos per year is avg. for farmers.

14 - Is the above income spread fairly evenly throughout the year or does it fluctuate seasonally? If it fluctuates, what are the high and low periods of income? High--Oct. through Jan.; Low--June-Aug.

15 - Number of families in the village? 38

16 - Of the total family income, how much is typically available for purposes other than bare subsistence? In other words, where is the disposable income? Of the disposable income, how much is typically put into savings? (In some cases disposable income may be negative if families typically incur indebtedness over and above their income.) Less than is necessary.

17 - What is the typical level of debt for a village family? For what purposes are debts usually incurred? (operating loans for farm? funerals, illness, etc. 70% are in debt of 500-800 pesos for farm improvement, sickness, food & clothes.

18 - Average number of persons born per year? 60

19 - Average number of deaths of persons in all age groups per year? 15-20 malnutrition.

20 - What has been the population growth trend in the village over the past 10 years? over the past two years? up and up.

21 - Has there been a tendency for inhabitants to emigrate from the village: per cent during the last two years 20%

22 - What have typically been the reasons for emigration? Hunger, lack of work.

23 - Has there been a tendency for immigrants to come to the village? If so, what has been the principal motivation? 7-8 per year looking for the better life.

24 - Within the labor force (see question 8 above), what percentage of persons have the following skills: 1) automotive-type equipment repair capabilities 0 2) automotive-type equipment operating capabilities 0 3) education and training capabilities 10 4) agricultural skills 100 5) unskilled 0 6) administrative 2

25 - What medical skills are available to the inhabitants? Doctor X Midwife ___ Nurse X available but seldom used as they can't be afforded.

26 - What is the literacy level of the village: 100%___75%___50%___25%___0___? 60%

27 - Any comments on land ownership in this area? The land ownership is recognized by all, The area is too small on each finca and the land they have is not used to best advantage.

28 - What facilities does the village have for the disposal of human waste, for example, latrines, no special facilities. 20% have latrines. The trash and garbage is thrown on the ground

29 - What is the method of obtaining water for the village____ wells____ streams X surface ponds____ other water storage Bamboo aqueducts to most of the houses.

30 - Is the water supply potable? No

31 - Is the water supply sufficient for household needs? yes for irrigation?____ for other purposes (please specify)?_____

32 - The water runs through the community.

C - POLITICAL AND SOCIAL ORGANIZATIONS WITHIN THE COMMUNITY

1 - Briefly describe the following community facilities: Clinic, school, community center, cooperative 1st and 2nd grade schooling.

2 - What is the form of village government - incorporated Junta____unincorporated Junta X Other____

3 - What organization or group in the village is likely to be the most effective in cooperating to install, maintain and manage a future source of power generation and distribution? The Junta X The Church____ A cooperative___Other____

D- INDUSTRY AND INCOME RESOURCES OF VILLAGE OR COMMUNITY

1 - What is the number and percentage of farmers cultivating their own land 25 land owners

2 - What is the size of the typical plot per farmer? 3-4 hectares.

3 - Of the total number of farmers cultivating their own land, what percentage own less than one hectare 10 1 to 2 hectares 10 more than 2 hectares 5

4 - What type of food and cash crops are grown by farmers of the village? Food--Yucca, platano, cafe, cane Cash - Same.

5 - What type of industry, including handicrafts, exist in the village? None

6 - In the event that power was available for what purposes would the inhabitants believe they would use electric power? Domestic lighting X work shops ____ irrigation ____ pumping of drinking water ____ small scale industries ____ health clinic ____ food preservation ____ other _____

E - INTEREST IN POWER

1 - Is the village likely to be interested in acquiring a source of electric power? Would the village be at present enthusiastic about access to power ____ indifferent ____ opposed ____? 100% interest

2 - Would the village display a sense of responsibility toward the maintenance, management and financing of a local source of power if one became available? Yes.

3 - Would there be persons in the village interested in learning about the maintenance of power equipment? Would there be persons capable of teaching mechanical techniques required for maintaining equipment? Yes

F - FUEL POTENTIAL FOR POWER

a) We are interested in learning about the availability of various materials which are not being used at present for fuels but which could be used for fuels. In the village vicinity, for example, by-products such as coffee hulls; branches, twigs, leaves which are residual after trees are trimmed for timber; waste fibers resulting from weaving waste trimmings of reeds from mat manufacture; cattle dung, other agricultural waste? Sugar cane leaves and pulp, river, some animal dung but not much, coffee husk.

b) Are there any outcroppings of coal or surface crude oils? No

c) With respect to cattle dung, what is it currently being used for? How many cattle are in the village? Few Is composting practiced? 2 or 3 compost coffee husk.

d) For the various types of potential fuels what comments do you have as to quantities available? The sugar cane is being cut throughout the year. The coffee is ground during the months of October, November, December.

e) What are the potential hydro-power resources available, such as water falls, streams and rivers. Are these resources continuous, intermittent, and what are the general fluctuations from season to season? Have any stream flow records been maintained? If so, how long? Fast running stream goes by this area.

f) Is it possible in the village neighborhood to build a reservoir for hydro-power purposes? Yes

g) In anticipation of possible future power applications, we are interested in local wind conditions. To be useful as a source of energy for power, winds should be predictably available every day at a velocity of at least 10 miles per hour for at least one-third of the day. Not much wind.

h) With respect to possible solar power for the future, how many days of sunshine are expected per year? Most days are sunny.

SITE: SAN ONOFRE

PROGRAM FOR ADVANCED TECHNICAL SUPPORT
FOR VILLAGE DEVELOPMENT

CHECK LIST OF FIELD INFORMATION

Version No. 3 - October 17, 1962

SURVEY DATE: June 2, 1962

FIELD TEAM MEMBERS: (incl. association)
H. Volgeneau - Pt. 4 Aid Mission/Colombia
Alfonso Escobar - Sec'y CARE/Cartegena
G. Street - G. E. Co.

INFORMANTS: (incl. titles, etc.)
Amaury Cavelier - Hacienda Owner.

I. VITAL STATISTICS

Village: San Onofre
Province: ----
Department: Bolivar
Country: Colombia
Type of Government: City Council
Population: Urban: 12000 Rural: 13000 Total: 25000
Urban families: ~1500
Birth rate: ----
Death rate: ----
Population growth rate: Growing
Net emigration: out of village
Why: To Venzuela oil fields, but return disillusioned or with little money.
Literacy level: 25%

II. ENVIRONMENTAL CHARACTERISTICS

Name and distance of nearest town: Maria La Baja - 40kms.
Name and distance of nearest market: Sincelejo - 66kms.
Geographical classification: Coastal Plain
Type of access road: Firm surface all weather dirt
Other access routes: ----

Sewage facilities: No special facilities - Few latrines
Drinking water sources: Few artesan wells - Catch rain - Some water trucked in - not considered potable.

Stream and river sources: 3 Rivers (2 are continuous) good for irrigation but not power. Ground water 30 to 40 Ft. down.

Fuel cost and availability:

Reg. Gasoline	1.05 pesos/gal.
Kerosene	.90 pesos/gal.
Diesel Fuel	.90 pesos/gal. (in Quantity)
Crude Oil	None
Coal	Small amounts for forging
Charcoal	None
Propane	Very few users

Available indigenous fuels: Wood - 90% used for cooking

Wind and its utilization: Wind operated pump - 5 in area
Average capacity 6 cu. meters/day - cattle watering
(Cost 3000 pesos used)

Sunshine and its utilization: Good sunshine most of year except for rainy season.

Availability of medical skills:

Resident doctors	6
Itinerant doctors	----
Dentists	2 to 3
Nurses	10 to 12
Midwifes	----
Pharmacists	See doctors
Herbalists	----

Clinic: There is a maternity clinic. Each doctor has own clinic. People enjoy seeing doctor and taking medicine.

Schools: 6 or 7 Government built schools. 2 Private schools. Several go to 7th and 8th grade.

Community Center: None

Cooperatives: None

III. ECONOMIC CHARACTERISTICS

Work force pattern - percent of total population: Essentially all

Section	Percent		Avg. Income
Agriculture	40% Rented Land		
Industries			
Services	20%		
Mining			
Fishing			
Others *Cowboys	20%	)	2500 to 3000 pesos/yr.
*Land Clearing	20%	)	
Unemployed			
Non productive			
% Self employed	60%	*% Employed	40% (or Hacienda)

Income fluctuation: -----

Typical Debt: ---- Why: ----

Typical Savings: ---- Form: ----

Subsistence level: Above bare subsistence

Types of farm crops: Rice, Corn, Bananas, Plantians
(Indicate major cash crops) Platino, Yucca - all cash crops

Types of farm animals raised: ~4000 Village cattle and other animals
(include numbers)

Hacienda raises cattle (numbers not included) for market.

Typical size of farm plots: 10 Hectares rented from Hacienda
2 Hectares are intensively farmed.

% Farmers owning land 0 % Renting All

Latifundia X Minifundia

Composting practiced ----

Types of industries: Ice cream factory (own power plant)
(Including size) Dairy Products

Handicrafts:

Types of services: Maternity Clinic - Several hospital clinics
About 9 schools
Electric Power Plant

Available Tech. Skills: 1 Electrician, 1 Diesel Mechanic, 3-4 Auto Mechanics, 20 Can Operate Auto Equipment; 90% associated with cattle raising. Very little administrative capability.

Cooperative community works: -----

IV. PRESENT ELECTRIFICATION

Year of installation: 1956 (to replace old equipment)
Type of electric power: ONAN Diesel Engine Generator
Distance to and cost of electric grid power: 40kms
Nearest town with grid accessibility: Maria La Boja

Power plant rating: 90Kw
Phases: 3 Volts: 110V. A.C. Freq.: 60 Cycles

Power plant ownership: City Council
operator: City Council - at one time had contracted independent operator with better success.

Use of electricity and connected loads:
Household illumination Yes (connected loads unobtainable)
Radios Yes Typically a residence evil
Street lighting Yes Have 1- 25 w. bulb
Industries - No 1- 75w. bulb
1- outlet for radio

Irrigation No

Others - Movie theater (but not schools or clinics)

Operational time: 6 P.M. to 12 P.M. except for plant outages

Type rate, price and source of fuel: Diesel fuel trucked to San Onofre from Cartegena at price of 90 pesos/gal.
Rate, price and source of lube oil: ----

Fuel transport: Truck
Power plant maintenance: By movie theater operator - paid

Availability of spare parts: Yes - in Sincelejo and Cartegena

Maintenance problems: Fuel Injectors

Are power plant records kept? Yes How? City Council

Installation cost of power plant: ----

Operation costs: ----

Maintenance costs: ----

Fuel and oil costs: ----

Tariff schedules: 3.50 pesos/month for 1- 25w. bulb 1- 75w. bulb and radio

Yearly revenue: ----

V. PROBLEM, NEEDS, OPPORTUNITIES

What are major problems: Gross inactivity during non-working hours.
Poor farming practices

What are felt needs: Irrigation will improve farming yields -
Wood and Metal work shops -
Milk preservation and processing would open up Cartegena market.

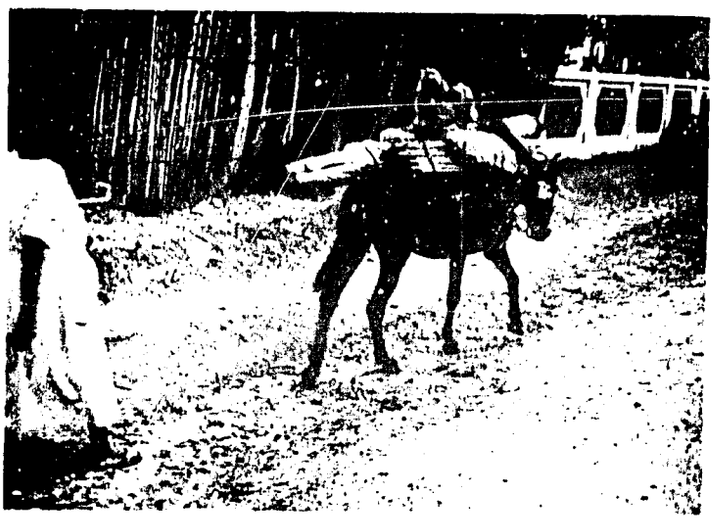
What are obvious opportunities: Supplement cattle raising with growing of rice on Hacienda scale.

Does village desire electrification: ----

VI. REMARKS

This region was once a major rice growing area and exported up and down coast. Volgeneau suggested application by Hacienda owner for Point 4 help to develop this capability again by irrigation concepts, etc.

Main road through San Onofre.



Local transport in San Onofre.

Hacienda of San Onofre land owner,
several kms outside of town.

Version No. 1 - May 9, 1962

PREPARED BY Ronald Schwarz

ADDRESS Comite de Cafeteros, Bucaramanga, Santander

AGENCY Colombia, S. A. - Peace Corps

DATE May, 1962

RESEARCH STUDY ON THE GENERATION AND USE OF ELECTRIC POWER IN RURAL COMMUNITIES - I. G. E. & RELATED AGENCIES

A - Country of Research project - Colombia X Peru ___ Chile ___

B - Basic Village Community Statistics

1 - Village Has ___ Has Not X Electric Power Available.

2 - Name of Village, Vereda, Area Santa Cruz

3 - Nearest municipality Matanza

4 - Toward what major city is the village economy oriented?

Bucaramanga

5 - Village classification, that is: mountain X valley ___ coastal ___ plain ___?

6 - Distance of village to nearest market (estimated in kilometers)
Name of market? Distance 22 Name Municipio of Rio Negro

7 - Type of access roads to village (for example, paved roads, dirt roads, mountain trail) or other type of access (river, airfield or railroad)? Good dirt road.

8 - Village population total? 250 Percentage Male 40 Female 60 ?
But there are about 2,000 in the whole area.

9 - Percentage of population in labor force, (that is number of persons employed or seeking employment? Percentage males 40% females ___.

10 - Percentage of non-productive persons in community extremely elder or otherwise infirm 5% % unemployable children 0 %.

11 - Of persons employed, what percentage are self-employed (that is, persons farming for their own account, owning their own business, etc.) 90% what percentage are employed by others 10%

12 - Of persons employed what percentage are engaged in the following activities:
1) agriculture 95% 2) industry ___ 3) services ___ 4) government including teachers 5%
5) other major category such as fisheries, mining, etc.? Category ___ %
About 10 people are engaged in a lumber industry--cutting trees and shaping planks.

13 - What is considered to be the standard or usually acceptable income per worker in each of the foregoing categories, 1 through 5? Please indicate amounts in pesos on an annual basis 1) From 3,000 to 30,000 pesos a year. 5) 700 pesos a month.

14 - Is the above income spread fairly evenly throughout the year or does it fluctuate seasonally? If it fluctuates, what are the high and low periods of income? High - Nov., Dec., Jan. Low - May, June.

15 - Number of families in the village? 40

16 - Of the total family income, how much is typically available for purposes other than bare subsistence? In other words, where is the disposable income? Of the disposable income, how much is typically put into savings? (In some cases disposable income may be negative if families typically incur indebtedness over and above their income.) 5%

17 - What is the typical level of debt for a village family? For what purposes are debts usually incurred? (operating loans for farm? funerals, illness, etc. Little debt - for farm improvements and animals.

18 - Average number of persons born per year? _____

19 - Average number of deaths of persons in all age groups per year? _____

20 - What has been the population growth trend in the village over the past 10 years? over the past two years? _____

21 - Has there been a tendency for inhabitants to emigrate from the village: per cent during the last two years Very small.

22 - What have typically been the reasons for emigration? Better jobs, more pay, live in city.

23 - Has there been a tendency for immigrants to come to the village? If so, what has been the principal motivation? No tendency to migrate to Santa Cruz.

24 - Within the labor force (see question 8 above), what percentage of persons have the following skills: 1) automotive-type equipment repair capabilities 3 2) automotive-type equipment operating capabilities 4 or 5 3) education and training capabilities ____ 4) agricultural skills ____ 5) unskilled ____ 6) administrative about 10.

25 - What medical skills are available to the inhabitants? Doctor ___ Midwife ___ Nurse ___ None

26 - What is the literacy level of the village: 100%___ 75%___ 50%_X_ 25%___ 0___ ?

27 - Any comments on land ownership in this area? A wealthy area considering the Colombian average - most fincas are between 5 and 50 hectares. Most people own and work their own land. During the coffee harvest the smaller landowners also work the larger fincas.

28 - What facilities does the village have for the disposal of human waste, for example, latrines, no special facilities. Latrines.

29 - What is the method of obtaining water for the village____ wells____ streams____ surface ponds____ other water storage Aqueduct

30 - Is the water supply potable? Yes

31 - Is the water supply sufficient for household needs? Yes for irrigation?____ for other purposes (please specify)? In the village proper water is only needed for household uses. In the veradas water is used to wash coggee. Water supply is 1500M away.

C - POLITICAL AND SOCIAL ORGANIZATIONS WITHIN THE COMMUNITY

1 - Briefly describe the following community facilities: Clinic, school, community center, cooperative 3 school rooms

2 - What is the form of village government - incorporated Junta____ unincorporated Junta____ Other No consejo, only governmental authority is police inspector. We have an accion comunal Junta that has legal status.

3 - What organization or group in the village is likely to be the most effective in cooperating to install, maintain and manage a future source of power generation and distribution? The Junta X The Church____ A cooperative___ Other (Accion Comunal)

D- INDUSTRY AND INCOME RESOURCES OF VILLAGE OR COMMUNITY

1 - What is the number and percentage of farmers cultivating their own land 150 - 95%

2 - What is the size of the typical plot per farmer? 8 hectares

3 - Of the total number of farmers cultivating their own land, what percentage own less than one hectare 0 1 to 2 hectares 0 more than 2 hectares 100%

4 - What type of food and cash crops are grown by farmers of the village? Coffee, yucca, platano

5 - What type of industry, including handicrafts, exist in the village? None

6 - In the event that power was available for what purposes would the inhabitants believe they would use electric power? Domestic lighting X work shops ____ irrigation ____ pumping of drinking water ____ small scale industries X health clinic X food preservation ____ other Some running of coffee washing machinery, running of a movie projector.

E - INTEREST IN POWER

1 - Is the village likely to be interested in acquiring a source of electric power? Would the village be at present enthusiastic about access to power ____ indifferent ____ oppos .d ____ ? Enthusiastic - they want it bad.

2 - Would the village display a sense of responsibility toward the maintenance, management and financing of a local source of power if one became available? Yes

3 - Would there be persons in the village interested in learning about the maintenance of power equipment? Would there be persons capable of teaching mechanical techniques required for maintaining equipment? There would be people interested in learning and they could be taught by the local electric company or at the new sena school

F - FUEL POTENTIAL FOR POWER

a) We are interested in learning about the availability of various materials which are not being used at present for fuels but which could be used for fuels. In the village vicinity, for example, by-products such as coffee hulls; branches, twigs, leaves which are residual after trees are trimmed for timber; waste fibers resulting from weaving waste trimmings of reeds from mat manufacture; cattle dung, other agricultural waste? All the above are available except for reeds.

b) Are there any outcroppings of coal or surface crude oils? No

c) With respect to cattle dung, what is it currently being used for? How many cattle are in the village? 200 Is composting practiced? Very little

d) For the various types of potential fuels what comments do you have as to quantities available? Coffee hulls in great quantities but not all year round. Although the other items are available, transporting them to the village would be a problem

e) What are the potential hydro-power resources available, such as water falls, streams and rivers. Are these resources continuous, intermittent, and what are the general fluctuations from season to season? Have any stream flow records been maintained? If so, how long? A river - lots of mountain streams.

f) Is it possible in the village neighborhood to build a reservoir for hydro-power purposes? Yes

g) In anticipation of possible future power applications, we are interested in local wind conditions. To be useful as a source of energy for power, winds should be predictably available every day at a velocity of at least 10 miles per hour for at least one-third of the day. Little wind.

h) With respect to possible solar power for the future, how many days of sunshine are expected per year? 250 full days of sun - 90 half days - 25 days of little or no sun.

Santo Tomas and Palmar De Varela, Atlantico Depto, Colombia

Santo Tomas and Palmar de Varela are two small municipos with a population of about 5500 inhabitants in each town. They are situated about 3 kilometers away from each other with Santo Tomas being the closer to Barranquilla at a distance of about 24 kilometers. They are both located in flat sandy country on the "carretera de la cordialidad" which goes south out of Barranquilla. Both are a short distance from the Magdalena River at an elevation of 8 meters above mean sea level. Santo Tomas with its corresponding corregimiento of Uvito has an area of 65 square kilometers, while Palmar de Varela covers an area of 106 square kilometers. Both towns have a mean yearly temperature of 28.5^{o} centigrade which drops to about 26° at night The climate can be said to be isothermic since the mean temperature will vary less than 3° throughout the year. However, unlike the temperature, there is a great variation in the yearly distribution of rainfall. There is a total average yearly rainfall of approximately 700 mm, 95% of which falls during the months of May, June, July, September, October and November The dry season is generally accompanied by strong winds blowing toward the northeast. These winds start in late November and are a symptom of the oncoming dry season During late November these winds have an average velocity of 5 meters per second, but in December they reach a velocity of 8 to 12 meters per second. During the wet season around the months of June and October, the winds blow in a southeasterly direction at a mean velocity of 2 to 3 meters per second.

Both of these towns are basically agro-fishing villages. The main crops are yucca, maize and ajonjoli. Santo Tomas along with the areas of Juan de Acosta and Candelaria, produces 40% of the total production of ajonjoli of the departamento Palmar de Varela is beginning to cultivate tomatoes on a commercial scale. The proximity of the Magdalena makes the river a ready source of a large part of the total food consumed in the area. However, not all the adult workers are engaged in farming or fishing. A large number of the adults work at the nearby airport of Soledad or in Barranquilla during the day at various unskilled and semi-skilled jobs having a low monthly income of approximately $150.00 (pesos). Unlike the municipios of inland Colombia, the municipios of Atlantico are characterized by an urban or semi-urban society. The people live in the cabeceras or corregimientos and travel to their farms or nearby cities to do whatever work is necessary, returning to their homes at the end of the work day. It is estimated that the whole departamento, less than 4% of the total population lives in the campos.

Both towns can be reached by paved road in approximately 30 minutes from Barranquila. Since both towns are located on a major highway, there is no

problem of transportation, with buses scheduled to run about every half hour or less. Both municipios have telegraph and mail service to the cabecera. Santo Tomas has a functioning electric power system. There is no sewage system or running water in either town. Medical facilities are inadequate in both municipios but the availability of complete medical service in Barranquilla within a half hour ride, makes this a relatively minor problem.

There are juntas formed in each of the municipios. At present there is no promotor living in either town. Dr. Cabrera, the departmental promotor has been instrumental in forming the juntas and guiding their development in each town. The junta in Palmar de Varela has been trying to raise funds for the construction of a bridge over a cafo that runs between the town and the Magdalena River. Being a fishing community, the town would benefit greatly in the easier access to the river that would be made possible by the construction of the bridge. Both towns are concerned about the lack of running water and want to construct a common water system to service both areas. They are determined that they will do this by community action. Both towns are also working to raise funds for the construction of a school-restaurant in each town.

The survey team visited Padre Agudelo, the parish priest for both municipios. The padre is very enthusiastic and showed us the results of his school, and community building programs. This site has been chosen for Peace Corp activities, particularly to establish a community water system.

The bulk of this information was submitted by T. W. Bentley, PCV leader, Baranquilla, Colombia.

Probably the best approach to this would be to estimate the value of production and services before power was available and estimate the same values for the period after power was installed as follows:

	Estimated Values in the Year Before Power was Available (State Year)	Estimated Current Values per Year
Value of Agricultural Production		
Value of Industrial Production		
Value of Services		
Value of Other Production		
Salaries to Govt. and Church		
TOTAL		

In estimating the value of industrial production, it would be desirable to deduct the value of raw materials used so that the figure for industrial production is the so-called "value added".

In estimating the value of services, the easiest approach would be to multiply the income of persons engaged in services by the number of persons so engaged.

6 - Has the availability of power increased the number of local skills, mechanical, managerial; has power increased literacy? No

7 - Has power increased production for local use? No

8 - Has power increased production for shipment of goods outside the community? No

9 - Has power had any effect on credit facilities? More borrowing or less borrowing? No

10 - Has power increased agricultural output per man? per hectare? No

11 - Have any other changes affecting the living standards occurred? Has affected behavior - people stay up later and dance more - radio full time.

Social Returns

12 - Has the availability of power strengthened community services: education, lighting, community meetings, voluntary community projects? Has power served to improve the effectiveness of local government? Any other comment? I think that the community junta is dependent on power - social functions too.

13 - In village with power plant, please comment on the following:

a - Who owns the power plant? The sugar ingenios

b - How was the power plant paid for? -

c - Are charges made to the consumers for the use of electricity and what are the charges? Small monthly payments.

d - How is the power plant maintained? Mechanic

e - What are the major maintenance problems? Don't know

f - Is there a mechanic available to maintain the equipment? Yes

g - How is the mechanic paid? How much? -

h - How is the operator of the power plant paid? How much? -

i - Are power plant operation and maintenance reports kept? By whom? Office of Ingenio

j - Are spare parts available? Where? -

k - How is the power plant protected from the weather and from tampering? Inside building.

l - What is the power plant rating in terms of name plate kilowatts? -

m - Is the output AC or DC? -

n - What is the output voltage? What is the frequency (cycles per second)? _____-_____

o - At what voltage does the consumer use power? (Is there a transformer in the line to drop the voltage below the rated generator output?) _____-_____

14 - Fuel Used for Power

a - What type of fuel is used? What does it cost? At what rate is fuel consumed by the generator; for examples, gallons per month, or liters per month?_____

b - Where is the fuel purchased? ___Cali_____

c - How is the fuel transported to the village? ___Truck_____

d - What are the major problems in obtaining fuel? For example, ability to pay for the fuel, difficulties of transportation and amount to be transported. _____-_____

e - In addition to the fuel used by the power generator, what other fuels are available in the village or its vicinity including gasoline, diesel oil, kerosene, crude oil, coal, wood, etc.? _____All available._____

f - What do the above fuels cost in the village? _Gas - $.50/qt.;_ _Kerosene - $.30/qt._

g - How readily available are such fuels?_____-_____

h - What are any of the above fuels used for: heating, cooking, lighting? _____-_____

La Bola Arternal, a village near mine, is without light - it is near a municipio and could absorb current from there - but are lacking funds for wire. In a small village, it is hard to find someone bright enough and active (not lazy) to start the village water pump for public consumption. It would be a good place to experiment!

Version No. 1 - May 9, 1962

PREPARED BY John F. Luoma

ADDRESS Tenza, Boyaca

AGENCY Division of Accion Comunal

DATE May, 1962

RESEARCH STUDY ON THE GENERATION AND USE OF ELECTRIC POWER IN RURAL COMMUNITIES - I. G. E. & RELATED AGENCIES

A - Country of Research project - Colombia X Peru ___ Chile ___

B - Basic Village Community Statistics

1 - Village Has X Has Not ___ Electric Power Available.

2 - Name of Village, Vereda, Area Tenza, Boyaca

3 - Nearest municipality _____

4 - Toward what major city is the village economy oriented?

Bogota

5 - Village classification, that is: mountain X valley ___ coastal ___ plain ___?

6 - Distance of village to nearest market (estimated in kilometers)
Name of market? Distance _____ Name _____

7 - Type of access roads to village (for example, paved roads, dirt roads, mountain trail) or other type of access (river, airfield or railroad)? Dirt Roads

8 - Village population total? 7000+ Percentage Male _____ Female _____?

9 - Percentage of population in labor force, (that is number of persons employed or seeking employment? Percentage males 75% females 40%.

10 - Percentage of non-productive persons in community extremely elder or otherwise infirm 20 % unemployable children 30 %.

11 - Of persons employed, what percentage are self-employed (that is, persons farming for their own account, owning their own business, etc.) 80% what percentage are employed by others 10%

12 - Of persons employed what percentage are engaged in the following activities:
1) agriculture 90% 2) industry ___ 3) services 10% 4) government including teachers ___
5) other major category such as fisheries, mining, etc.? Category _____ %

13 - What is considered to be the standard or usually acceptable income per worker in each of the foregoing categories, 1 through 5? Please indicate amounts in pesos on an annual basis 1) 700-1000 pesos 3) 3000-4000 pesos.

14 - Is the above income spread fairly evenly throughout the year or does it fluctuate seasonally? If it fluctuates, what are the high and low periods of income? Harvesting of Main Crop in October-December.

15 - Number of families in the village? 2000+

16 - Of the total family income, how much is typically available for purposes other than bare subsistence? In other words, where is the disposable income? Of the disposable income, how much is typically put into savings? (In some cases disposable income may be negative if families typically incur indebtedness over and above their income.) None--sub-marginal agriculture.

17 - What is the typical level of debt for a village family? For what purposes are debts usually incurred? (operating loans for farm? funerals, illness, etc.

18 - Average number of persons born per year?

19 - Average number of deaths of persons in all age groups per year?

20 - What has been the population growth trend in the village over the past 10 years? over the past two years? Population has remained static over ten year period. Population decrease over two years.

21 - Has there been a tendency for inhabitants to emigrate from the village: per cent during the last two years

22 - What have typically been the reasons for emigration? Education and better jobs in cities. No chance for advancement as stictly "minifundio" area.

23 - Has there been a tendency for immigrants to come to the village? If so, what has been the principal motivation? No

24 - Within the labor force (see question 8 above), what percentage of persons have the following skills: 1) automotive-type equipment repair capabilities -- 2) automotive-type equipment operating capabilities -- 3) education and training capabilities 1% 4) agricultural skills 80% 5) unskilled 17½% 6) administrative 1½%.

25 - What medical skills are available to the inhabitants? Doctor X Midwife X Nurse X

26 - What is the literacy level of the village: 100%___ 75%___ 50% X 25%___ 0___ ?

27 - Any comments on land ownership in this area? 50% owned by landlords parceling land into ½ - 2 hectare lots and collecting high rents.

28 - What facilities does the village have for the disposal of human waste, for example, latrines, no special facilities. No special facilities.

29 - What is the method of obtaining water for the village____ wells____ streams x surface ponds____ other water storage____

30 - Is the water supply potable? Yes, at times.

31 - Is the water supply sufficient for household needs? Yes for irrigation?____ for other purposes (please specify)? For water systems to the veredas. Water supply 5 km from community.

C - POLITICAL AND SOCIAL ORGANIZATIONS WITHIN THE COMMUNITY

1 - Briefly describe the following community facilities: Clinic, school, community center, cooperative

2 - What is the form of village government - incorporated Junta____ unincorporated Junta____ Other____

3 - What organization or group in the village is likely to be the most effective in cooperating to install, maintain and manage a future source of power generation and distribution? The Junta X The Church X A cooperative___ Other____

D- INDUSTRY AND INCOME RESOURCES OF VILLAGE OR COMMUNITY

1 - What is the number and percentage of farmers cultivating their own land 50%

2 - What is the size of the typical plot per farmer? ½ - 1 hectare.

3 - Of the total number of farmers cultivating their own land, what percentage own less than one hectare 80% 1 to 2 hectares 15% more than 2 hectares 5%.

4 - What type of food and cash crops are grown by farmers of the village? Fruit and vegetable crops of nearly all types.

5 - What type of industry, including handicrafts, exist in the village? Basket making.

6 - In the event that power was available for what purposes would the inhabitants believe they would use electric power? Domestic lighting X work shops X irrigation ____ pumping of drinking water X small scale industries X health clinic X food preservation ____ other _____

E - INTEREST IN POWER

1 - Is the village likely to be interested in acquiring a source of electric power? Would the village be at present enthusiastic about access to power ____ indifferent ____ opposed ____?

2 - Would the village display a sense of responsibility toward the maintenance, management and financing of a local source of power if one became available?

3 - Would there be persons in the village interested in learning about the maintenance of power equipment? Would there be persons capable of teaching mechanical techniques required for maintaining equipment? _____

F - FUEL POTENTIAL FOR POWER

a) We are interested in learning about the availability of various materials which are not being used at present for fuels but which could be used for fuels. In the village vicinity, for example, by-products such as coffee hulls; branches, twigs, leaves which are residual after trees are trimmed for timber; waste fibers resulting from weaving waste trimmings of reeds from mat manufacture; cattle dung, other agricultural waste? Possibility of coal and water power.

b) Are there any outcroppings of coal or surface crude oils? No

c) With respect to cattle dung, what is it currently being used for? How many cattle are in the village? _____ Is composting practiced? Not feasible because of small number of livestock.

d) For the various types of potential fuels what comments do you have as to quantities available? Coal in quantity as well as hydroelectric possibility.

e) What are the potential hydro-power resources available, such as water falls, streams and rivers. Are these resources continuous, intermittent, and what are the general fluctuations from season to season? Have any stream flow records been maintained? If so, how long? Continuous.

f) Is it possible in the village neighborhood to build a reservoir for hydro-power purposes? Yes.

g) In anticipation of possible future power applications, we are interested in local wind conditions. To be useful as a source of energy for power, winds should be predictably available every day at a velocity of at least 10 miles per hour for at least one-third of the day.

h) With respect to possible solar power for the future, how many days of sunshine are expected per year? 200.

TUNIA

Version No. 1 - May 9, 1962

PREPARED BY Thomas C. Whalen

ADDRESS Fed. Nal. de Cafeteros--Popayan, Cauca

AGENCY Cuerpo de Paz, Peace Corps

DATE May, 1962

RESEARCH STUDY ON THE GENERATION AND USE OF ELECTRIC POWER IN RURAL COMMUNITIES - I. G. E. & RELATED AGENCIES

A - Country of Research project - Colombia X Peru ___ Chile ___

B - Basic Village Community Statistics

1 - Village Has ___ Has Not X Electric Power Available.

2 - Name of Village, Vereda, Area Tunia, Cauca, Colombia

3 - Nearest municipality Piendamo, Cauca

4 - Toward what major city is the village economy oriented?

Popayan, Cauca

5 - Village classification, that is: mountain X valley ___ coastal ___ plain ___ ?

6 - Distance of village to nearest market (estimated in kilometers)
Name of market? Distance 5 km. Name Piendamo

7 - Type of access roads to village (for example, paved roads, dirt roads, mountain trail) or other type of access (river, airfield or railroad)? Very good national road running between Cali and Popayan.

8 - Village population total? 450 Percentage Male 50 Female 50 ?

9 - Percentage of population in labor force, (that is number of persons employed or seeking employment? Percentage males 95 females (domestic work)

10.- Percentage of non-productive persons in community extremely elder or otherwise infirm 2 % unemployable children 50 %.

11 - Of persons employed, what percentage are self-employed (that is, persons farming for their own account, owning their own business, etc.) 80 what percentage are employed by others 20

12 - Of persons employed what percentage are engaged in the following activities:
1) agriculture 80 2) industry ___ 3) services 15 4) government including teachers 5
5) other major category such as fisheries, mining, etc.? Category ___ %

13 - What is considered to be the standard or usually acceptable income per worker in each of the foregoing categories, 1 through 5? Please indicate amounts in pesos on an annual basis 1) 1500 2)-- 3) 4500 4) 5400 (Assuming full employment which is unfair assumption.

14 - Is the above income spread fairly evenly throughout the year or does it fluctuate seasonally? If it fluctuates, what are the high and low periods of income? High--May, June, July, August, Sept. Low--rest of year.

15 - Number of families in the village? 120

16 - Of the total family income, how much is typically available for purposes other than bare subsistence? In other words, where is the disposable income? Of the disposable income, how much is typically put into savings? (In some cases disposable income may be negative if families typically incur indebtedness over and above their income.) Agriculture--None Other--10%.

17 - What is the typical level of debt for a village family? For what purposes are debts usually incurred? (operating loans for farm? funerals, illness, etc. 400-500 pesos - Farm, funerals, illness, weddings, education

18 - Average number of persons born per year? 50

19 - Average number of deaths of persons in all age groups per year? 10

20 - What has been the population growth trend in the village over the past 10 years? over the past two years? Population has risen about 50 people in ten years - 10 people

21 - Has there been a tendency for inhabitants to emigrate from the village: per cent during the last two years Yes.

22 - What have typically been the reasons for emigration? Young people with some education leave for city

23 - Has there been a tendency for immigrants to come to the village? If so, what has been the principal motivation? Yes--people leaving violence areas to the North.

24 - Within the labor force (see question 8 above), what percentage of persons have the following skills: 1) automotive-type equipment repair capabilities 1-3% 2) automotive-type equipment operating capabilities 15% 3) education and training capabilities 10% 4) agricultural skills 50% 5) unskilled 30% 6) administrative 10%.

25 - What medical skills are available to the inhabitants? Doctor___ Midwife X Nurse___

26 - What is the literacy level of the village: 100%___ 75%___ 50%___ 25%___ 0___ ?
97% of the village -- Lower in surrounding countryside.

27 - Any comments on land ownership in this area?
Minifundia in some areas. Other areas average ownership per family - 20 acres or more. No batifundia problem here.

28 - What facilities does the village have for the disposal of human waste, for example, latrines, no special facilities. Sewage for half of town. Latrines for rest.

29 - What is the method of obtaining water for the village____ wells____ streams X surface ponds____ other water storage____ Aqueduct carries water to town.

30 - Is the water supply potable? Yes

31 - Is the water supply sufficient for household needs? Yes for irrigation? Yes for other purposes (please specify)? Water supply ½ km from community

C - POLITICAL AND SOCIAL ORGANIZATIONS WITHIN THE COMMUNITY

1 - Briefly describe the following community facilities: Clinic, school, community center, cooperative Clinic--none; schools--3; community center--none cooperative--1; agriculture coop.

2 - What is the form of village government - incorporated Junta X unincorporated Junta____ Other____

3 - What organization or group in the village is likely to be the most effective in cooperating to install, maintain and manage a future source of power generation and distribution? The Junta X The Church____ A cooperative___ Other____

D- INDUSTRY AND INCOME RESOURCES OF VILLAGE OR COMMUNITY

1 - What is the number and percentage of farmers cultivating their own land 90%

2 - What is the size of the typical plot per farmer? 2½ acres

3 - Of the total number of farmers cultivating their own land, what percentage own less than one hectare 5 1 to 2 hectares 80 more than 2 hectares 15

4 - What type of food and cash crops are grown by farmers of the village?
coffee, figue, citrus fruits, yucca, platanos

5 - What type of industry, including handicrafts, exist in the village?
Carpentry, candy making factory (small family owned.)

6 - In the event that power was available for what purposes would the inhabitants believe they would use electric power? Domestic lighting X work shops X irrigation ____ pumping of drinking water ____ small scale industries X health clinic X food preservation ____ other Health clinic is under construction - Money has been raised to start small factory for making coffee bags from figue when electricity is available.

E - INTEREST IN POWER

1 - Is the village likely to be interested in acquiring a source of electric power? Would the village be at present enthusiastic about access to power ____ indifferent ____ opposed ____? Very enthusiastic--have been trying to get power company to extend lines for several years without success

2 - Would the village display a sense of responsibility toward the maintenance, management and financing of a local source of power if one became available? Yes

3 - Would there be persons in the village interested in learning about the maintenance of power equipment? Would there be persons capable of teaching mechanical techniques required for maintaining equipment? Yes--interest. No--no one knows anything about mechanical techniques at this time.

F - FUEL POTENTIAL FOR POWER

a) We are interested in learning about the availability of various materials which are not being used at present for fuels but which could be used for fuels. In the village vicinity, for example, by-products such as coffee hulls; branches, twigs, leaves which are residual after trees are trimmed for timber; waste fibers resulting from weaving waste trimmings of reeds from mat manufacture; cattle dung, other agricultural waste? All of above are available. Their use would depend on amount needed and method of alloting the supplies, what quantity.

b) Are there any outcroppings of coal or surface crude oils? No

c) With respect to cattle dung, what is it currently being used for? How many cattle are in the village? Several hundredIs composting practiced? No. Cow dung used for plastering homes.

d) For the various types of potential fuels what comments do you have as to quantities available? A lot of cattle dung--coffee husks generally used for fertilizer--a lot of lumber is cut so twigs, etc. should be available.

e) What are the potential hydro-power resources available, such as water falls, streams and rivers. Are these resources continuous, intermittent, and what are the general fluctuations from season to season? Have any stream flow records been maintained? If so, how long? Some now use river for this purpose. River constant in flow. No records in Tunia, is possible there are in Piendamo.

f) Is it possible in the village neighborhood to build a reservoir for hydro-power purposes? Yes--there is a lake at the top of a hill overlooking the town.

g) In anticipation of possible future power applications, we are interested in local wind conditions. To be useful as a source of energy for power, winds should be predictably available every day at a velocity of at least 10 miles per hour for at least one-third of the day. Very little wind. Not constant, not every day.

h) With respect to possible solar power for the future, how many days of sunshine are expected per year? Even during rainy season there is sun several hours per day.

SITE: TAGANGA

PROGRAM FOR ADVANCED TECHNICAL SUPPORT
FOR VILLAGE DEVELOPMENT

CHECK LIST OF FIELD INFORMATION

Version No. 3 - October 17, 1962

SURVEY DATE: May 31, 1962

FIELD TEAM MEMBERS: (incl. association)
G. Street - G. E. Co.
M. Taylor - CARE/Santa Marta

INFORMANTS: (incl. titles, etc.)
Estiban Marcos Vasquez - Secretary to Constable

I. VITAL STATISTICS

Village: Taganga Province: Santa Marta
Department: Magdelena Country: Colombia
Type of Government: Junta
Population: Urban: 1500 Rural: 0 Total: 1500(65% male)
Urban families: 150
Birth rate: ---- Death rate: ----
Population growth rate: Definitely increasing
Net emigration: None Why: Emigration is static
Literacy level: 90%

II. ENVIRONMENTAL CHARACTERISTICS

Name and distance of nearest town: Santa Marta - 3 km.
Name and distance of nearest market: Santa Marta - 3 km.
Geographical classification: Coastal Valley
Type of access road: Unimproved mountain dirt road trails
Other access routes:

Sewage facilities: Few outhouses
Drinking water sources: Trucked in from Santa Marta in 55 gallon drums, 1.50 pesos per drum
Stream and river sources: None

Fuel cost and availability:

Available indigenous fuels: Scrub wood for cooking

Wind and its utilization: See Caracoli

Sunshine and its utilization: Intense sunshine - cloudy during wet season

Availability of medical skills:

Resident doctors	No
Itinerant doctors	From Santa Marta
Dentists	No
Nurses	One
Midwifes	See nurse
Pharmacists	No
Herbalists	No

Clinic: Health center with one nurse - extension of Santa Marta health center for doctors services.

Schools: 2 Room school, plus 2 rented houses; 70 boys - 60 girls Kindergarten, 1, 2 and 3rd grades.

Community Center: None

Cooperatives: None

III. ECONOMIC CHARACTERISTICS

Work force pattern - percent of total population: All

Section	Percent	Avg. Income
Agriculture	3%	4000 pesos/year
Industries	None	
Services		
Mining	None	
Fishing	97%	4000 pesos/year
Others		
Unemployed		
Non productive		
% Self employed	Essentially 100%	% Employed ----

Income fluctuation: Seasonal - March to July good fishing. Remainder of year - poor fishing.

Typical Debt: ---- Why: ----

Typical Savings: ---- Form: ----

Subsistence level: Above subsistence, but low

Types of farm crops: 3% Who farm do so 15 miles distant and for Santa Marta
(Indicate major cash crops) market

Types of farm animals raised: Very few animals
(include numbers) Few pigs, poultry, 40 head of cattle, etc. - generally for family consumption

Typical size of farm plots: Village lands are claimed to be sterile - there is no ground water or stream. No crops or garden vegetables are grown.

% Farmers owning land All % Renting

Latifundia Minifundia X

Composting practiced ----

Types of industries: Fishing - essentially entire village - use dug-out
(Including size) canoes and crude equipment.

Handicrafts:

Types of services: Diesel engine generator set clinic

Available Tech. Skills: Crude boat building, fishing, 1 bus driver, 3% farming.

Cooperative community works: ----

IV. PRESENT ELECTRIFICATION

Year of installation: June 1961
Type of electric power: Diesel generator ACPM Deutz
Distance to and cost of electric grid power: 3 km - 24 ctvs/kw-hr.
Nearest town with grid accessibility: Santa Marta

Power plant rating: 33.5 KVA
Phases: 3-4 wire system Volts: 133/231 volts Freq.: 60 Cycles (1800 RPM)
Power plant ownership: Santa Marta municipality
operator: Taganga Community Junta

Use of electricity and connected loads:
Household illumination 76 homes - 2- 60W bulbs - 4.12 kw.
Radios Large number of radios (prize possession)
Street lighting ----
Industries - None

Irrigation None

Others - Few illegal irons

Operational time: 6 P.M. to 12 P.M. weekdays, 2 P.M. to 12 P.M. Sunday and fair days.
Type rate, price and source of fuel: Diesel fuel 4-5 (55 gal.) drums per month - 106 gals. fuel 100 pesos - trucked from Santa Marta.
Rate, price and source of lube oil: 10 pts. each 140 hrs. of operation 45 pesos for 10 pts.
Fuel transport: Truck in 55 gal. drums
Power plant maintenance: Technician from Santa Marta

Availability of spare parts: In Santa Marta

Maintenance problems: No major problems to date
Are power plant records kept? Yes How? By Junta
Installation cost of power plant: ----
Operation costs: Operator unpaid
Maintenance costs: None to date
Fuel and oil costs: 540 pesos for lube oil - 4800 for fuel
Tariff schedules: 8.00 pesos per month per consumer

Yearly revenue: 7286 pesos

V. PROBLEM, NEEDS, OPPORTUNITIES

What are major problems: Spoilage of fish

What are felt needs: Fish preservation
Wood working shop

What are obvious opportunities: Refrigeration for fish
Pure water source in village
Motorize fishing boats
Boat building facility
Lobster fishing

Does village desire electrification: Yes

VI. REMARKS

- Santa Marta Power Company had investigated grid extension but concluded too expensive. Households are now permitted to install one 60 watt and one 100 watt bulb. Consumers are now doing this implying that shortly the consumer connected load will be 12.15 kw. Claim was made that light switches never turned off. Witnessed start up of equipment and observed watt meters registering a total load of about 15 kw. Junta is presently installing an additional 2000 meters of #2 distribution wire for about 8 new consumers. All water and fresh vegetables and ice (for fish) purchased in Santa Marta.

Village is in blind, hot valley at head of Bahia Taganga.

It is rumored that this coastal area is plentiful in both fish and lobster although only fish are caught.

During November to January is the tourist season. Colombiana tourists visit this bay for swimming and to witness the Fiesta of the Sea. The village has constructed bath houses and a small restaurant for tourist use.

Site Name and Location	Corregimiento of Taganga, Santa Marta Municipio, Magdalena Dept., Colombia.
Population	1500
Date Investigated	May 31, 1962
Field Investigation Team	Martin Taylor, CARE Field Representative George Street, General Electric Co. Senor Esteban Marcos Vasquez, Secretary to the Village Police Officer

Taganga is a growing village situated 3 kilometers northeast of Santa Marta in a blind valley of approximately 10,000 square meters floor area at the head of Bahia Taganga on the Carribean coast. A steep high ridge separates Taganga from the city of Santa Marta, and they are connected by a precipitous single-lane dirt road. Other access is by sea and a few mountain trails. Otherwise Taganga communicates with no other community, being a relatively remote satellite of Santa Marta.

The climate is tropical, and it is extremely hot in the arid valley. There are no streams, and it was reported that there was no fresh ground water. The vegetation is desert-like and scrubby. The land is claimed to be sterile and what farming is done (3% of population) is some 20 kms distant.

Taganga's major enterprise is fishing, carried out by 97% of the working population, and this is their only source of income. March through July is the good fishing season, the balance of the year is bad. The people must save income from the good season to cover the total years expenses. They use dugout canoes in which it is safe to venture only a short distance offshore. If the wind is right the canoes may mount a sail, but mostly they are paddled. Ice must be imported over the mountain from Santa Marta for fish preservation, but a considerable amount of the catch inevitably spoils before delivery (Santa Marta is notorious throughout Colombia as a place where one must be cautious when eating fish.) The waters around Taganga abound in fish and lobster, but the present primitive status of the fishing enterprise is unable to exploit this resource. Fish from Taganga is sold at times as far away as Medellin and Bogota, in spite of the severe transport and spoilage problems. A few cattle (40 head vaccinated), goats, pigs and chickens are raised for family consumption, but all other food, vegetables, and fresh water must be trucked in from Santa Marta.

The village appears neat and well organized, and is definitely above the bare subsistance level. It was reported that average yearly income was 4000 pesos per family, implying a per capita income (average of 10 persons per family) of $45/year. There is a church, a 3 grade-2 room school and 2 rented houses for extra school rooms for 120 students, a health center with nurse, and a small diesel engine electric plant for village and household illumination. A number of the residents have radios (a prized possession) and would obtain electric irons if the local junta would permit their use. A significant number of houses are new and built of brick imported from Santa Marta. Streets are laid out in block fashion ending on a clean beach where the boats are drawn up. Colombian tourists occasionally visit Taganga to enjoy the swimming, particularly during the winter months. During this time Taganga celebrates its Fiesta of the Sea. Bath house facilities and a small restaurant have been built for the tourists.

Water Import

All of the fresh water must be trucked in from Santa Marta. Average consumption is 55 gallons per day per family, or 6 gallons per day per capita. The cost of a 55 gallon drum of water is 1.50 pesos, or U.S. $3.08 per 1000 gallons. On this basis a family must expend about 550 pesos per year for water, out of its 4000 peso income .

Major Needs

It was reported their major need was a means to better preserve their fish catch for unspoiled delivery to Santa Marta. They had not seriously thought of using electric refrigeration because of load requirement and capital cost.

They would also like to expand woodworking capability for boat repair and building and furniture making for Taganga.

Other opportunities were apparent to the Survey Team, these are listed as follows:

Obviously Taganga's only importance is that of fishing. Its environment and complete dependence for life necessities on Santa Marta eliminate all other possibilities. In addition, before launching into concepts to improve their fishing enterprises, a question must be considered: should the fishing activity be centered at Santa Marta or Taganga, for if Santa Marta also improves fishing operations, Taganga may no longer be competitive.

In relation to Taganga there is an obvious need to:

Obtain a more economic community water supply (possible use of waste heat or solar energy)

Minimize spoilage of fish (possible use of available electricity).

Improve fishing canoe stability by lashing two together (similar to Polynescia catamaraus) and thereby extending fishing grounds.

Motorize fishing canoes, for direct fish delivery to Santa Marta docks.

Institute boat building industry for manufacture of larger, more worthy fishing boats (possible use of available electricity).

Expand operations into Lobster fishing (not now exploited).

These points are generally applicable to the majority of fishing villages encountered along the north coast of Colombia.

Electric Power Supply

Taganga has a diesel engine generator that was installed by the Santa Marta Municipality in June 1961. The electric company supplying Santa Marta had investigated the possibility of extending a grid into Taganga, but concluded that it would be too costly. Instead it was decided to install, free of capital charges to Taganga, an 1800 rpm, 42 HP, three cylinder, ACPM Dentz diesel engine driving a 60 cycle, 4 wire 3 phase, 230/133 volt generator. This is housed in a small brick building erected by Taganga community labor. Santa Marta Municipality performs major overhauls without labor charges, and Taganga in turn operates the equipment and charges consumers on the basis of household connection, for fuel, lubricating oil, spare parts, minor maintenance, distribution line capitalization and maintenance, and the operator's wages, if any. The Santa Marta Municipality owns the power plant, and the Taganga Community Junta owns the distribution system. The consumer installs his own wiring, outlets and bulbs; the power is not metered.

Generation is by a 33.5 KVA, 1800 rpm, 60 cycle, 4 wire, 3 phase output, 230/133 volt AC. Distribution is by a 4 wire, 3 phase, 230/133 volt AC system using #2 uninsulated wire on wooden poles. The electricity is used only for community street lighting, household illumination, radios, and ironing (illegal). The plant operates from 6 PM to 12 PM on weekdays, and from 2 PM to 12 PM on Sundays and fiesta days. In the following section the load, duty and cost factors are roughly estimated subject to later revision.

Estimated Connected Load and Duty Factors

If we assume that there are 9 fiesta days/year, 52 Sundays/year, 20 maintenance days/year, and 284 weekdays/year, then the power

plant will be operated 2315 hours/year. There are about forty 50 watt bulbs for community street lighting, giving a connected load of 2.0 Kw, with an assumed duty factor of 100%, leading to an energy use of 4630 kw/hours/year (the street lights are always on when the power plant is in operation).

There are 76 homes electrified in Taganga, each with a 60 watt bulb and a 100 watt bulb, giving a connected home lighting load of 12.2 kw. Although the flat statement was made that "no consumer ever turns a switch off here," we should allow for some discretion on the part of consumers for not everyone stays up until 12 PM or leaves his lights burning when he makes a trip outside the village. Assuming a duty factor of 50%, the annual home illumination energy use in Taganga should total 14,000 kw/hours/year.

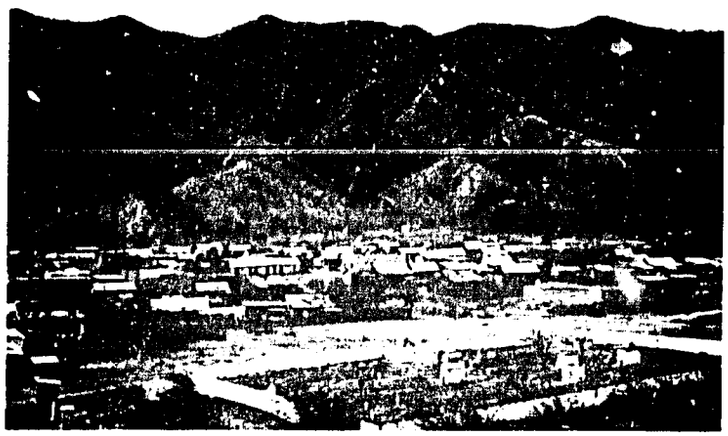
The radio and illicit ironing loads probably total about 5 kw leading to an estimated energy use of 3000 kw/hours/year in this category. All of these loads are resistance loads, implying a power factor close to unity. Summing these values we arrive at an estimated total connected load for Taganga of 19.2 kw, and an estimated energy consumption of 21,730 kw/hours/year. With an allowance for maintenance outages, this leads to a power plant load factor of about 8%.

The Survey Team found that each electrified household is charged 8.00 pesos/month, yielding a total yearly revenue of 7300 pesos. Thus the estimated effective cost of the electricity is 33.6 ctvs/kw/hour, or at 8.85 pesos per U.S. dollar, 3.8¢ kw/hour. This can be compared to the cost of electrical energy from the power grid servicing Santa Marta 3 to 4 kms distant of 24 ctvs/kw/hour.

The estimated annual operating costs reported can be tabulated as follows:

Fuel consumption	4-5 tanks/month, or 2860 gallons per year.
Fuel costs	@ 106 gals for 100 pesos=2700 pesos/year.
Lubricating oil	10 pints/month at 4.50 pesos/pt = 540 pesos/year.

Costs for spare parts and minor maintenance were unavailable because the plant had been in service for only 10 months since installation, during which it had been maintenance free. No wages are paid to the operators. This leads to a lower limit of effective operating costs of 3240 pesos/year, giving a net cash balance of



Village of Taganga.

Typical village street in Taganga.
Church on the right.

Village-built health clinic - Taganga.

4060 pesos/year. The village is now using this balance to extend the distribution system to new consumers. Very shortly they expected an additional 5 to 10 customers.

These rough engineering estimates are only intended to record the field data obtained by the Survey Team in this isolated village, and the cost estimates are preliminary, to be refined later.

Conclusions

The village of Taganga represents a promising pilot project site for a study of the impact of the productive application of power to a rural seacoast community which now engages in primitive fishing. Opportunities here would include: carpentry and blacksmithery shops for boatbuilding and outboard motor maintenance, sea water distillation for community water, refrigeration for ice-making and fish freezing, and related small industry activities, including the support of some tourist activities.

Version No. 1 - May 9, 1962

PREPARED BY Dennis Grubb

ADDRESS Zipacon, Cundi, Colombia

AGENCY Peace Corps

DATE May 15, 1962

RESEARCH STUDY ON THE GENERATION AND USE OF ELECTRIC POWER IN RURAL COMMUNITIES - I. G. E. & RELATED AGENCIES

A - Country of Research project - Colombia X Peru ___ Chile ___

B - Basic Village Community Statistics

1 - Village Has X Has Not ___ Electric Power Available.

2 - Name of Village, Vereda, Area Zipacon

3 - Nearest municipality Zipacon

4 - Toward what major city is the village economy oriented?

Bogota, Colombia

5 - Village classification, that is: mountain X valley ___ coastal ___ plain ___?

6 - Distance of village to nearest market (estimated in kilometers)
Name of market? Distance 15 km Name Facatativa

7 - Type of access roads to village (for example, paved roads, dirt roads, mountain trail) or other type of access (river, airfield or railroad)? Dirt road, train

8 - Village population total? 800 Percentage Male 60 Female 40 ?

9 - Percentage of population in labor force, (that is number of persons employed or seeking employment? Percentage males 40% females 20% .

10.- Percentage of non-productive persons in community extremely elder or otherwise infirm 30% % unemployable children 10% %.

11 - Of persons employed, what percentage are self-employed (that is, persons farming for their own account, owning their own business, etc.) 60 what percentage are employed by others 40

12 - Of persons employed what percentage are engaged in the following activities:
1) agriculture 60 2) industry ___ 3) services ___ 4) government including teachers 2
5) other major category such as fisheries, mining, etc.? Category ___ %

13 - What is considered to be the standard or usually acceptable income per worker in each of the foregoing categories, 1 through 5? Please indicate amounts in pesos on an annual basis 8 pesos daily.

14 - Is the above income spread fairly evenly throughout the year or does it fluctuate seasonally? If it fluctuates, what are the high and low periods of income? Planting and harvesting time.

15 - Number of families in the village? 100

16 - Of the total family income, how much is typically available for purposes other than bare subsistence? In other words, where is the disposable income? Of the disposable income, how much is typically put into savings? (In some cases disposable income may be negative if families typically incur indebtedness over and above their income.) None

17 - What is the typical level of debt for a village family? For what purposes are debts usually incurred? (operating loans for farm? funerals, illness, etc. Funerals, illness - a lot

18 - Average number of persons born per year? 100

19 - Average number of deaths of persons in all age groups per year? 100

20 - What has been the population growth trend in the village over the past 10 years? over the past two years? Losses - people.

21 - Has there been a tendency for inhabitants to emigrate from the village: per cent during the last two years 15%

22 - What have typically been the reasons for emigration? No work

23 - Has there been a tendency for immigrants to come to the village? If so, what has been the principal motivation? No

24 - Within the labor force (see question 8 above), what percentage of persons have the following skills: 1) automotive-type equipment repair capabilities No 2) automotive-type equipment operating capabilities No 3) education and training capabilities 2% 4) agricultural skills 40% 5) unskilled 58% 6) administrative ____

25 - What medical skills are available to the inhabitants? Doctor ___ Midwife ___ Nurse X

26 - What is the literacy level of the village: 100%___75%___50% X 25%___0___?

27 - Any comments on land ownership in this area? Small landholdings.

28 - What facilities does the village have for the disposal of human waste, for example, latrines, no special facilities. Very little

29 - What is the method of obtaining water for the village____ wells____ streams____ surface ponds____ other water storage Aqueduct

30 - Is the water supply potable? No

31 - Is the water supply sufficient for household needs? No for irrigation? No for other purposes (please specify)? Water supply 1 km from community

C - POLITICAL AND SOCIAL ORGANIZATIONS WITHIN THE COMMUNITY

1 - Briefly describe the following community facilities: Clinic, school, community center, cooperative School, cooperative.

2 - What is the form of village government - incorporated Junta____unincorporated Junta____ Other National

3 - What organization or group in the village is likely to be the most effective in cooperating to install, maintain and manage a future source of power generation and distribution? The Junta X The Church____ A cooperative___Other____

D- INDUSTRY AND INCOME RESOURCES OF VILLAGE OR COMMUNITY

1 - What is the number and percentage of farmers cultivating their own land 60%

2 - What is the size of the typical plot per farmer? 2 - 3 hectares

3 - Of the total number of farmers cultivating their own land, what percentage own less than one hectare_____ 1 to 2 hectares_____ more than 2 hectares_____

4 - What type of food and cash crops are grown by farmers of the village? Yucca, potatoes

5 - What type of industry, including handicrafts, exist in the village? None

6 - In the event that power was available for what purposes would the inhabitants believe they would use electric power? Domestic lighting X work shops X irrigation ____ pumping of drinking water ____ small scale industries X health clinic X food preservation ____ other _____

E - INTEREST IN POWER

1 - Is the village likely to be interested in acquiring a source of electric power? Would the village be at present enthusiastic about access to power ____ indifferent ____ opposed ____? Enthusiastic

2 - Would the village display a sense of responsibility toward the maintenance, management and financing of a local source of power if one became available?

Yes

3 - Would there be persons in the village interested in learning about the maintenance of power equipment? Would there be persons capable of teaching mechanical techniques required for maintaining equipment? Yes

F - FUEL POTENTIAL FOR POWER

a) We are interested in learning about the availability of various materials which are not being used at present for fuels but which could be used for fuels. In the village vicinity, for example, by-products such as coffee hulls; branches, twigs, leaves which are residual after trees are trimmed for timber; waste fibers resulting from weaving waste trimmings of reeds from mat manufacture; cattle dung, other agricultural waste? Large coal deposits.

b) Are there any outcroppings of coal or surface crude oils? Yes

c) With respect to cattle dung, what is it currently being used for? * How many cattle are in the village? _____ Is composting practiced? _____

* Fertilizer

d) For the various types of potential fuels what comments do you have as to quantities available? The coal can be exploited commercially.

e) What are the potential hydro-power resources available, such as water falls, streams and rivers. Are these resources continuous, intermittent, and what are the general fluctuations from season to season? Have any stream flow records been maintained? If so, how long? No

f) Is it possible in the village neighborhood to build a reservoir for hydro-power purposes? No

g) In anticipation of possible future power applications, we are interested in local wind conditions. To be useful as a source of energy for power, winds should be predictably available every day at a velocity of at least 10 miles per hour for at least one-third of the day. Yes

h) With respect to possible solar power for the future, how many days of sunshine are expected per year? All - part of the day.

APPENDIX B

RURAL ELECTRIFICATION IN COLOMBIA

National Power Capacity and Trends

A study of the national capacity was completed in August 1961 by the Colombian Government's power planning and regulatory authority, Instituto de Aprovechamiento de Aguas y Fomento Electrico, hereafter referred to by its abbreviated title "Electroaguas." This study and related annexes provide the latest nationwide data available on capacity and generation for the calendar year 1960.

According to the Electroaguas study, Colombia's total installed capacity in 1960 operated by firms serving the public was 669,910 Kw consisting of 31 percent thermal and 69 percent hydro capacity. Broken down regionally, the installed capacity is greatest in three Departments: (1) Antioquia, based on the power load of Medellin, (2) Cundinamarca based on Bogota requirements, and (3) in Valle where a major load is needed for the Cauca Valley's urban and industrial complex. Other major load centers are in Atlantico (Barranquilla) and Caldas (Manizales-Pereira).

The bulk of the capacity, 88 percent, lies in seven Departments inhabited by about 66 percent of the total population. Not included in the Electroaguas statistics is an additional 241,000 Kw of capacity owned by manufacturing or mining concerns and some unreported small scale public service plants in rural areas consisting of generators below 100 Kw capacity.

Table 1

PUBLIC POWER CAPACITY IN COLOMBIA, BY DEPARTMENTS
DECEMBER 31, 1960

Department	Major Load Centers	Total Capacity	Percent of Total Capacity	Percent of Total Population (1960)
Antioquia	Medellin	154,310	23%	14%
Cundinamarca	Bogota	154,136	23	16
Valle	Cali	123,646	19	12
Atlantico	Barranquilla	52,871	8	4
Caldas	Manizales-Pereria	51,482	8	9
Bolivar	Cartagena	28,723	4	5
Santander	Bucaramanga	21,793	3	6
Subtotal		586,961	88%	66%
All others		82,949	12	34
Total		669,910	100%	100%

The number of power plants in Colombia registered with Electroaguas at the end of 1960 was 824, of which 408 or 49.5 percent were hydro plants and 416 or 50.5 percent were thermal. The average capacity of the hydro plants was 1126 Kw and the average capacity of the non-hydro plants was 505 Kw. Plants in the latter group were predominantly diesel.

Generating plants in Colombia are grouped by classes according to capacity. Plants of 25,000 Kw or above are in Class A, while the smallest category of plants, 100 Kw or less, are in Class G. The total capacity by class is shown in Table 2 and illustrates the fact that more than half of Colombia's capacity, 52 percent, consists of large Class A plants. These plants are concentrated in the first three major load centers shown in Table 1 and have industrial loads which exceed the residential lighting load. Industrial loads vary slightly by month but were, for example, 39 percent in Cali and 31 percent in Bogota in July 1960. Plants below 1000 Kw, in Classes E, F, and G are scattered in smaller communities, and the load is primarily residential. Although Electroaguas is attempting to standardize rates and centralize controls, these small, unconnected plants and the companies which control them present a widely differing pattern of rates, capacities, and means of financial support.

The bulk of Colombia's installed capacity is owned and operated by municipal or private companies. The first category of companies (see Table 2) includes firms with a 1960 total capacity of 452,189 Kw or 68 percent of the national total. The firms in this group are (a)

Table 2

GENERATING PLANTS IN COLOMBIA, BY CAPACITY
DECEMBER 31, 1960

Class	Capacity (kw)	Percent of Total Capacity	No. of Plants	Average Capacity (kw)
Class A (25,000 kw or above)	349,815	52%	6	58,303
Class B (10,001 to 25,000 kw)	76,600	11	5	15,320
Class C (5,001 to 10,000 kw)	66,457	10	9	7,384
Class D (1,001 to 5,000 kw)	89,430	14	39	2,293
Class E (501 to 1,000 kw)	32,094	5	43	746
Class F (101 to 500 kw)	35,233	5	152	232
Class G (1 to 100 kw)	20,281	3	570	36
Total	669,910	100%	824	813

Empresas Publicas de Medellin, (b) Empresa de Energia de Bogota, (c) Central de Anchicaya, in the industrial center of Cali in Valle Department and (d) Compania Colombiana de Electricidad with its principal capacity in Barranquilla in Atlantico Department. The latter company is a privately owned subsidiary of the American and Foreign Power Company.

A second category, consisting of two power companies with a combined total of 37,590 Kw capacity in 1960 are located in urban centers with smaller populations than cities served by the first category: (a) Central Hidroelectrica de Caldas centered in Manizales in Caldas Department and (b) the Empresas Publicas de Cartegena located in Bolivar Department.

A third category of companies is composed of affiliate companies of the government-owned Electroaguas. The 19 affiliate companies, seven of which are called "Electrificadora," operated capacity totaling 107,708 Kw or 16 percent of the total in 1960. The fourth category consists of small town-owned companies which account for the remaining 72,423 Kw or 11 percent of the total national capacity in 1960.

In summary, the national capacity in 1960 was operated as follows:

Company Category	Company Description	Capacity (kw)	Percent of Total
I	Major urban areas municipal or private firms (Medellin, Bogota, Cali, Barranquilla)	452,189	67.5%
II	Secondary urban area, largely private firms (Manizales, Cartagena)	37,590	5.6

Table 3

NATIONAL ANNUAL LOAD FACTORS IN SELECTED COUNTRIES

	Year	Installed Public Service Capacity (kw)	Potential Annual Generation (millions kwh)	Actual Generation (millions kwh)	National Annual Load Factor (percent)
Colombia[a]	1960	670,000	5,869	2,795	47.6%
Chile[b]	1959	596,000	5,221	2,838	54.4
Peru[c]	1959	320,000	2,790	971	34.8
India[d]	1959	3,496,000	30,625	12,810	41.8
Pakistan[e]	1957	439,000	3,846	950	24.7

a. Electroaguas, Bogota (does not include self-generation by industry, 241,000 kw).
b. UN Statistical Yearbook.
c. UN Statistical Yearbook.
d. For fiscal year ending April 1, 1959, UN Statistical Yearbook.
e. For fiscal year ending April 1, 1959, UN Statistical Yearbook.

Table 4

GROWTH OF INSTALLED CAPACITY IN COLOMBIA
1960-1970

Calendar Year	New Installed Capacity (mw)	Total Installed Capacity by End of Year Indicated (mw)
1960	10	670
1961	63	733
1962	434 (Guadalupe River)	1,167
1963	61	1,228
1964	25	1,253
1965	149 (Prado, Mayo Rivers plus thermal plants)	1,402
1966	420 (Bogota and Cauca Rivers)	1,822
1967	--	1,822
1968	650 (Mare River)	2,472
1969-70	728 (location not known)	3,200

Note: Names of major rivers for hydro projects are shown in parentheses; source is Electroaguas.

Table 5

COLOMBIA'S POPULATION GROWTH AND WATTS OF INSTALLED CAPACITY PER INHABITANT
1960-1970

Calendar Year	Total Population	Rural Inhabitants	Installed Capacity (mw)	Watts of Installed Capacity per Inhabitant
1960	14,987	8,436	670	45
1965 (est.)	17,207[a]	8,431[b]	1,822[c]	106
1970 (est.)	20,169[d]	8,596[c]	3,200[b]	159

a. 2.8% average annual growth.
b. Assumes that rural population as a percentage of total population will decline from 56% in 1960 to 49% in 1965, and 43% in 1970.
c. Electroaguas forecast.
d. 3.2% average annual growth, Electroaguas forecast.

III	Affiliated Government companies of Electroaguas (in smaller cities than Categories I and II)	107,708	16.1
IV	Tertiary Urban Area Town-owned firms	72,423	10.8
	TOTAL	669,910	100.0%

Measured in terms of its national load factor, Colombia compares favorably with other less developed countries. In 1960, Colombia's 670,000 Kw of installed capacity generated 2.8 billion Kw/hours, representing a national annual load factor of 47.6 percent as shown in Table 3. This is higher than Peru's 1959 load factor of 34.8 percent and India's 1959 load factor of 41.8 percent. Colombia's load factor in 1960 was below the comparable 1959 figure for Chile of 54.4 percent.

Colombia's plans for the future, according to Electroaguas, call for an annual average increase in installed capacity of about 13.5 percent. Also planned is a reduction in the percentage of thermal and diesel capacity from 31 percent in 1960 to about 25 percent by 1965. This additional capacity, including transmission and sub-stations, is estimated to cost some 600 million U.S. dollars. The planned growth of installed public service capacity is shown in Table 4.

On the basis of the planned additions to capacity and anticipated population growth, Colombia's installed capacity per inhabitant is likely to rise from 45 watts in 1960 to 159 watts in 1970, as shown in Table 5.

The Rural Population and Its Access to Power

Now growing at an annual rate of about 2.8 percent, Colombia's total population in 1962 is roughly 15.6 million. Assuming a slightly rising

future growth rate, the nation's population may reach 20 million by 1970. The percentage of persons classified as rural inhabitants has declined slightly in recent years both proportionally and in absolute terms, falling from 8.4 million in 1960 to an estimated 8.1 million in 1962. The decline is caused by the migration from rural to urban areas and to the geographic expansion of urban areas. By 1970 the percentage of rural population to total population should decline even further to possibly 43 percent as compared with 56 percent in 1960.

In 1960, 8 percent of the rural population or 715,000 persons had access to power from Class A capacity plants, i.e., plants of 25,000 Kw capacity or greater. Rural population is defined as persons residing in communities of less than 1600 inhabitants. This group can be described as the portion of the rural population with access to grid power from four major urban area systems: Medellin, Cali, Bogota, and Barranquilla. Another 36 percent of the rural population or 3.0 million persons in 1960 had access to power from smaller generators in Classes B through F, that is, power supplied by plants of 25,000 Kw capacity down to 100 Kw capacity.

A further segment of the rural population, an estimated 2.7 million persons, or 33 percent, had access to G class (supplied by generators of less than 100 Kw capacity)power while the remainder of the rural population, 23 percent or 2.0 million persons, had no access to power. Therefore a total of 92 percent (36, 33, 23 percent) of the rural population, or some 7.7 million persons, were in 1960 residing in communities

Table 6

RURAL POPULATION WITH ACCESS TO ELECTRIC POWER IN 1960 AND ESTIMATES FOR 1970
(Unit: 10^3 Persons)

	1960	Percent	1970	Percent
Total population (rural plus urban)	14,987[a]		20,169[b]	
Rural population	8,436[a]	(100)%	8,596[c]	(100)%
Rural population with grid power	715[d]	(8)	1,719[e]	(20)
Rural population served by B, C, D, E, F Class plants (100 kw to 25,000 kw plants)	3,014[f]	(36)	6,877 (all rural inhabitants outside grid areas)	(80)
Est. rural population served by G Class plants only (less than 100 kw plants)	2,734[g]	(33)		
Est. rural population without access to power	1,973	(23)		

a. Electroaguas estimate.
b. Electroaguas estimate assuming 3% annual average growth.
c. Electroaguas estimate assuming a decline in the percentage of rural population from 56% in 1960 to 43% in 1970.
d. Based on Electroaguas publication, Informe, August 1961, pp. 20 and 21. The "A" Class plants serve the rural population in the vicinity of Medillin, Cali, Bogota, and Baranquilla.
e. Electroaguas estimate.
f. Class B plants range from 10,001 to 25,000 kw; Class C from 5,001 to 10,000 kw; Class D from 1,001 to 5,000; Class E from 501 to 1,000 kw; Class F from 101 to 500 kw.
g. Class G power is produced by generators of less than 100 kw capacity. The figure of 2,734,000 persons served by Class G plants was derived as follows, on the basis of watts of capacity per inhabitant in the next higher generator class. The watts of capacity per inhabitant for Class F generators is 17, according to the Electroaguas Informe cited above, page 29. The total capacity of the Class G generator group is 46,475 kw (Ibid., page 30, pp. 30 and 31). The Class G total capacity divided by 17 watts is 2,734,000 persons.

where grid power was not available.

The number of rural inhabitants covered by grid power, 8 percent in 1960, is of course changing. The Electroaguas forecasts a moderate expansion of rural electrification by means of grid extensions to 1970. The number of rural inhabitants served by grid power is expected to rise from 8 percent or about 715,000 persons in 1960 to 20 percent of 1.7 million persons in 1970. This would leave 6.9 million persons with access to power from local generators or with no power access whatsoever. Even these modest expansion plans can be questioned because of the year-to-year problems of securing budget support and of the rising claims for power in the industrialized urban areas.

It is difficult to say what proportion of the inhabitants having access to power are actual users, but the percentage of users is probably small. This is largely because of the high cost of distribution outside the town limits. Some indication of the low proportion of users can be seen from the fact that in a typical rural area pueblo, a household of five persons often has 120 watts of connected load, suggesting an average of 20 watts per person. However, in Departments where the proportion of rural inhabitants is highest, the installed capacity per person is often lower than 20 watts, as shown in Table 7 and 8. Considering the fact that most of the capacity is for urban area consumption, the national average of watts of installed capacity per rural inhabitant is probably a small fraction of the overall national average of 45 watts per rural and urban inhabitant.

Table 7

WATTS OF INSTALLED CAPACITY IN TEN DEPARTMENTS
HAVING THE HIGHEST PROPORTION OF RURAL INHABITANTS

Department (Or Other Geographical Sub-Division)	Percentage of Rural Inhabitants	Watts of Installed Capacity per Inhabitant
Choco	85%	6
Boyaca	83	11
Cauca	81	17
Intendencias	79	12
Narino	74	16
Tolima	70	17
Magdalena	63	22
Meta	63	16
Santander	62	24
Norte de Santander	59	25
National Average	57	45

Table 8

RELATION BETWEEN INSTALLED CAPACITY OF PUBLIC SERVICE COMPANIES AND POPULATION
1960

Department	Installed Capacity		Population					Watts per Inhabitant
	Kw	% of National Capacity	Total	% of Total Population	Urban	Rural	% Urban	
Antioquia	154,310	23.0%	2,033,790	13.6%	940,960	1,092,830	46.3%	76
Atlantico	52,871	7.9	611,740	4.1	548,741	62,999	89.7	86
Bolivar	28,723	4.3	786,200	5.2	379,211	406,989	48.2	37
Boyaca	9,174	1.4	866,390	5.8	150,326	716,064	17.4	11
Caldas	51,482	7.7	1,377,540	9.2	552,344	825,196	40.1	37
Cauca	8,733	1.3	524,510	3.5	99,949	424,561	19.1	17
Cordoba	5,448	0.8	421,950	2.8	102,297	319,653	24.2	13
Cundinamarca	154,136	23.0	2,330,280	15.6	1,433,611	896,669	61.5	66
Choco	939	0.1	148,970	1.0	22,819	126,151	15.3	6
Huila	6,728	1.0	375,580	2.5	121,798	253,782	32.4	18
Magdalena	11,316	1.7	523,170	3.5	192,762	330,408	36.8	22
Meta	1,279	0.2	80,540	0.5	29,685	50,855	36.9	16
Narino	9,886	1.5	621,070	4.1	159,881	461,189	25.7	16
Norte de Santander	10,968	1.6	439,610	2.9	179,147	260,463	40.8	25
Santander	21,793	3.2	921,530	6.2	352,878	568,652	38.3	24
Tolima	15,171	2.3	871,110	5.8	264,588	606,522	30.4	17
Valle	123,646	18.5	1,776,750	11.9	961,220	815,530	54.1	70
Intendencias and Comisarias	3,307	0.5	276,290	1.8	58,684	217,606	21.2	12
Total	669,910	100.0%	14,987,020	100.0%	6,550,901	8,436,119	43.7	45

Aside from any statistical measures, there is an obvious indicator of low wattage availability in many of Colombia's smaller towns. Power systems are grossly overloaded during the evening period of peak use and the Survey Team typically found it impossible for the inhabitants to read by electric lights until 9 or 10 PM. Thus even the limited watts of capacity per inhabitant is often not available when it is needed the most.

Financing Rural Electrification

To permit the expansion of Colombia's power system to rural areas and to offset some of the uneconomic characteristics of the system, substantial financing assistance is obtained from overseas sources of capital, and from the National, Departmental and local community governments. Much of this financial help comes from the central government's agency for the promotion and regulation of power--the Instituto de Aprovechamiento de Aguas y Fomento Electrico. This agency, known by the abbreviated title, Electroaguas, was established in 1957 and is now engaged in a wide variety of functions related to power, especially for non-urban areas. Some of Electroaguas' functions include: load building through irrigation projects, financing of small power plants, financing grid extensions, purchasing of power from the large urban area power companies for distribution to rural areas, rate investigation and control, raising of domestic and foreign capital for expanded services, and planning the national power system.

Through Electroaguas, funds are channelled to supplement the earnings of local power firms. Funds are provided to Electroaguas

in several ways and are in turn allocated to the affiliated companies (sociedades filiales) in the Departments. The affiliated companies, numbering 19 in all, are usually called "Electrificadoras." These regional companies assist in the establishment of power plants in smaller towns, arrange for grid extensions, and the purchase of power for distribution.

The Electroaguas in 1961 received funds with which to finance its own operations and those of the 19 affiliated companies from the following sources, according to the recent Electroaguas progress report, Informe de Una Administracion, June 1957 to June 1962. Known income in 1961 is noted in parentheses.

1. A portion of the Government revenue from beverage taxes (11.2 million pesos).
2. Direct appropriations from the Government (35.2 million pesos).
3. A portion of the budget for improving municipal services (about 1.4 million pesos).
4. Sale of power facilities to private parties.

Although the report does not specify all items of income, those portions which can be identified for 1961 total 47.8 million pesos, or about U.S. $5.5 million.

The bulk of the budget in 1961, at least 29.0 million pesos or about the equivalent of U.S. $3.3 million, was provided by Electroaguas to the regional affiliated firms. This amount helped to offset the losses of rural area power companies and to finance expanded services.

Funds for future expansion of power systems are obtained through domestic and foreign loans. Since 1959, credits have been received from the National Federation of Coffee Growers (Federacion Nacional de Cafeteros de Colombia), the Banco de Colombia and the Banco de Bogota. These loans totaled $1.9 million U.S., as of June 1962.

Coffee barter arrangements with Finland, Spain, Hungary and Czechoslovakia provide or have provided Electroaguas with drawing rights from 1959 through 1961, equivalent to U.S. $5.2 million. The largest capital drawings from abroad may be yet to come through the International Bank for Reconstruction and Development (World Bank) judging by formal applications by Electroaguas for financing during the period February 1961 to June 1962. These applications seek a total of U.S. $35.5 million. Such funds, if approved, will finance the expansion of generating, and transmitting facilities chiefly in outlying Departments including Bolivar, Norte de Santander, Narino, Cauca, Tolima, Caldas, Santander, Cordoba and Magdalena.

Rural area power firms are helped in less direct ways as well. The municipio often provides personnel to manage or to collect fees, and furnishes buildings to house power plants. Depreciation and fixed costs for invested capital are often a municipio rather than a power company problem. At least no accounting of these items was made by the power companies visited in Venecia, Andes Jardin, and Ebejico in Antioquia Department. Presumably some reserves for depreciation are maintained in the municipio budgets.

The Survey Team sought to determine the level of load factors in two ways: by field interviews and an examination of Electroaguas records. During field visits, interviews were held with officials concerned with power generation in towns visited. Time did not permit a detailed examination of records for power companies and often officials were uninformed of kwh generated because power was not metered. In small communities customers are charged by the number of bulbs connected.

In the municipio of Jardin, Antioquia, visited by the Survey Team, the annual load appeared to be about 800,000 kwh, taking into account the unusually extensive lighting of the church and plaza. As against this load, the local hydro capacity of 350 Kw was capable of generating some 3,066,000 kwh annually, thus suggesting a factor of 26 percent. In Ebejico, also visited by the Survey Team, a diesel plant was used in combination with a hydro generator, and an annual load factor of 15 percent was indicated.

A review of records from Electroaguas revealed more detailed information on load factors. The Survey Team endeavored to obtain the widest possible sample of power company experience from these records in the following way: From a listing of 151 companies, three types of companies were screened (a) those providing power from diesel or steam generating plants only, (b) those operating hydro capacity only, and (c) those operating hydro plants in combination with diesel or steam plants for peaking. The 1960 output data for only certain companies was available from a 1961 Electroaguas survey of fuel costs.

Unfortunately, the output data was not available for most of the 151 companies, but was sufficient for the calculation of load factors for 12 companies operating diesel or steam plants only (Table 9), 6 companies operating hydro facilities only (Table 10) and 3 companies operating mixed hydro-diesel generating plants (Table 11).

In reviewing load factor data, a rough correlation was found between the load factor and the percent of rural population in the area served by various power companies. Judging from the sample of power company data, comments of power company officials and the Survey Team's own observations, the higher the rural population in the area served, the worse the load factor is likely to be. For example in Giradot, 143 kilometers southwest of Bogota, the percentage of rural population in the area served by the local power company is only 8 percent and the load factor was a reasonably high 41 percent. In Sahagun in Cordoba Department, the rural population was 85 percent and the load factor 20 percent. The apparent correlation is illustrated in Table 9 and in the diagram that follows.

There are exceptions, such as the community of Rionegro near Medellin mentioned below where the population is predominantly rural but the load factor is a high 67 percent.

A small sample of power companies producing power from hydroelectric generators only was obtainable from Electroaguas data and is shown in Table 10. As in the case of the companies with diesel power only, the companies in Table 10 are those for which data were

Table 9

ANNUAL LOAD FACTORS AND RURAL POPULATION SERVED FOR COLOMBIAN POWER COMPANIES
USING DIESEL OR STEAM PLANTS ONLY—1960

Name of Company	Location (municipio)	Department	Generating Capacity (kw)	Type of Power (diesel or steam)	Annual Potential Kwh Generation	Actual Generation (kwh)	Population in Zone Served (rural population)	Percent of Rural Population in Zone Served	Annual Load Factor (percent)
Electrificadora de Cordoba	Cerete	Cordoba	842	Diesel	7,375,920	601,453	16,740 (10,496)	62.7%	8.2%
Electrificadora de Cordoba	Lorica	Cordoba	494	Diesel	4,327,440	1,027,590	47,470 (36,979)	77.9	23.7
Electrificadora de Cordoba	Sahagun	Cordoba	300	Diesel	2,628,000	518,624	47,930 (40,788)	85.1	19.7
Electrificadora del Choco	Quibido	Choco	700	Diesel	6,132,000	1,878,983	47,140[a] (36,013)	76.4	30.6
Central Termoelectrico de Calamar	Calamar	Bolivar	380	Diesel	3,328,800	892,960	15,190 (9,858)	64.9	26.8
Electrificadora de Cundinamarca	Billeta	Cundinamarca	209	Diesel	1,830,840	456,427	12,250 (8,893)	72.6	24.9
Empresa de En. Elec. de Magangue	Magangue	Bolivar	1,568	Diesel	13,735,680	2,824,138	48,060 (26,433)	55.0	20.6
Empresas Municipales de Monteria	Monteria	Cordoba	2,520	Diesel	7 775,200	8,513,180	98,800 (68,468)	69.3	38.6
Cia. Colombiana de Electricidad	Giradot	Cundinamarca	5,512	Diesel	48,285,120	19,633,990	52,670 (4,266)	8.1	40.7
Empresas Publicas de Barrancabermeja	Barranca-bermeja	Santander	3,940	Diesel	34,514,400	12,093,840	64,390 (18,931)	29.4	35.0
Empresa de Energia Electrica de Sincelejo	Sincelejo	Bolivar	1,500	Diesel	13,140,000	3,759,810	48,100 (16,643)	34.6	28.6
Central Termoelectrica de Cospique Cartagena	Cospique	Bolivar	10,000	Steam	58,800,000[b]	19,097,366[b]	18,740 (3,405)	18.2	32.5
Total			27,965		216,173,400[b]	71,298,361	517,480 (281,173)	54.3	33.0

a. Includes municipios of Quibido and Bagado.
b. The Cospique plant in 1960 operated only 245 days, starting operations May 1 (58.8 million kwh = 245 days x 24 hours x 10,000 kw).

LOAD FACTORS OF COMPANIES OPERATING DIESEL AND STEAM PLANTS
IN RELATION TO THE PERCENTAGE OF RURAL POPULATION
COLOMBIA, 1960

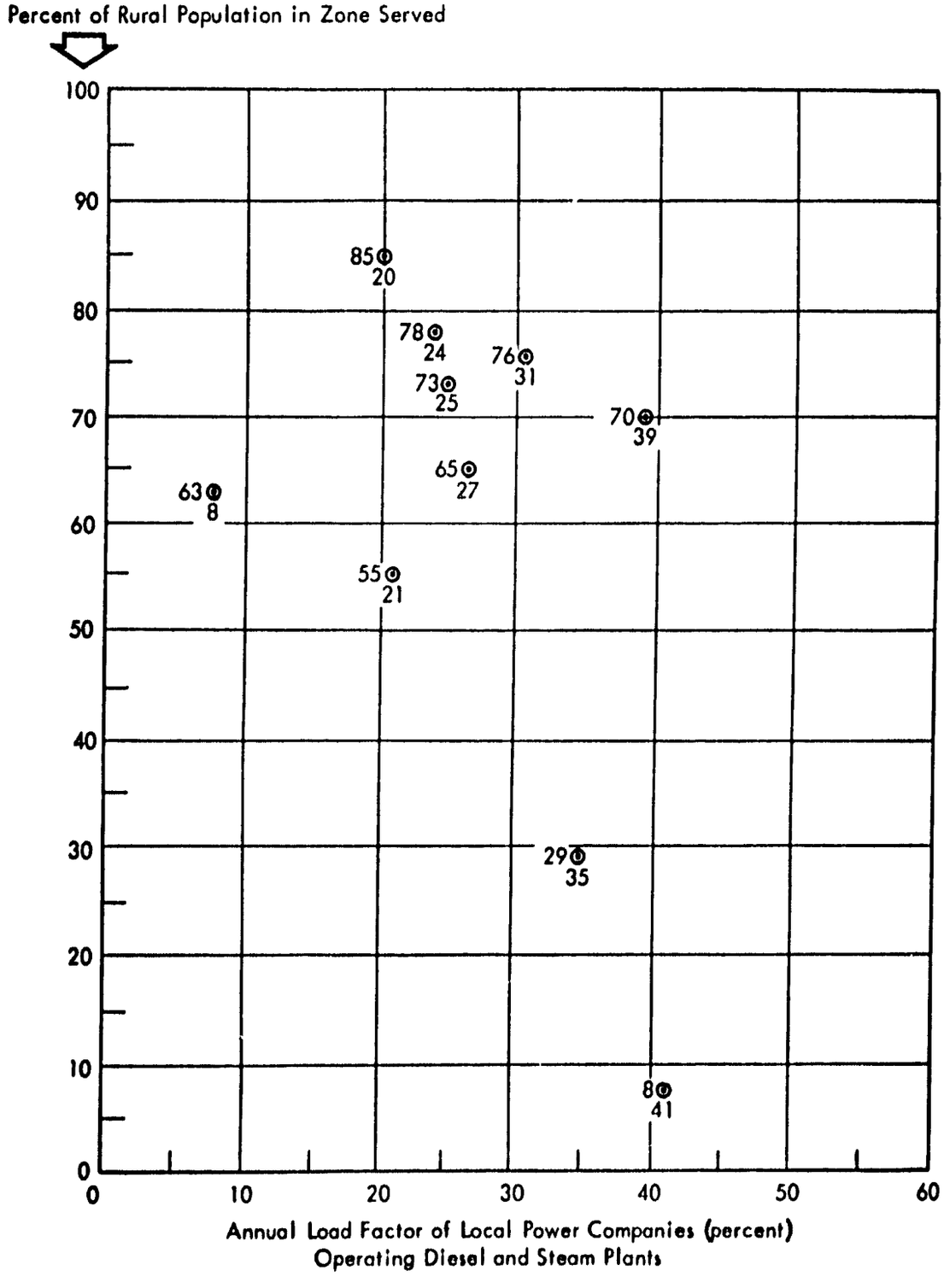


Table 10

ANNUAL LOAD FACTORS AND RURAL POPULATION SERVED FOR COLOMBIAN POWER COMPANIES SUPPLYING POWER FROM HYDROGENERATORS ONLY
1960

Name of Company	Location	Department	Generating Capacity (kw)	Annual Potential Generation (kwh)	Actual Generation (kwh)	Population in Zone Served (Rural Population)	Percent of Rural Population in Zone Served	Annual Load Factor (percent)
Empresa de Energia El de Puerto Berrio	Puerto Berrio	Antioquia	1,760	15,417,600	8,516,450	14,830 (6,585)	44.4%	55.2%
Empresa de Energia Electrica de Tamesis	Tamesis	Antioquia	1,004	8,795,040	2,995,865	17,580 (14,064)	80.0	34.0
Energia Electrica de Riosucio y Supia	Riosucia	Caldas	650	5,694,000	2,310,738	63,390 (50,823)	80.2	40.6
Central Hidroelectrica de la Florida	La Florida[a]	Valle	2,100	18,396,000	10,789,018	n.a.[b]	n.a.[b]	58.6
Central Electrica "La Cascada" San Gil	San Gil	Santander	2,141	18,755,160	7,690,488	54,910 (36,839)	67.1	41.0
Empresa de Energia Electrica de Chiquinquira	Chiquinquira	Boyaca	960	8,409,600	1,373,360	55,070 (41,871)	76.0	16.3
Total			8,615	75,467,400	33,675,919	205,780[b] (150,182)	73.0%	44.6%

a. The town of La Florida is located in Valle, but for power administration, the 2,100 kw plant at La Florida is included in the grouping of power companies called Centrales Electricas del Cauca S.A. located in the neighboring Department of Cauca.
b. Excludes population of La Florida of about 20,550 persons according to different source.

Table 11

ANNUAL LOAD FACTORS AND RURAL POPULATION SERVED FOR POWER COMPANIES IN COLOMBIA GENERATING POWER FROM BOTH DIESEL AND HYDRO PLANTS
1960

Name of Company	Location	Department	Total Capacity (kw)	Hydro Capacity (kw)	Diesel Capacity (kw)	Total Potential Annual Generation (kwh)	Actual Generation (kwh)	Population in Zone Served (Rural Population)	Percent of Rural Population in Zone Served	Annual Load Factor (percent)
Empresa de Energia Electrica de Rionegro	Rionegro	Antioquia	1,290	1,090	200	11,300,400	7,512,315	25,160 (17,009)	67.6%	66.5%[a]
Empresa de Energia Electrica de Ocana	Ocana	Norte de Santander	747	180	567	6,543,720	2,022,494	28,790 (11,689)	40.6	30.9
Energia Electrica del Socorro	Socorro[b]	Santander	780	280	500	6,832,800	325,709 (sic)	34,550 (18,322)	53.0	4.8
Total			2,817	1,550	1,267	24,676,920	9,860,518	88,500 (47,020)	53.1%	40.0%

a. The unusually high load factor for Rionegro may be explained by the existence of farms established by Medellin interests where irrigation is needed for pasture land. A further reason could be small industry, such as a shoe manufacturing plant, visited by an SRI staff member. The vicinity of Rionegro is also a resort area, about 38 km southeast of Medellin on a paved road.

b. The 280 kw hydroplant at Socorro produced 161,460 kwh during 1960, the 500 kw diesel plant produced 164,249 kwh. The combined total was 325,709 kwh.

available on (a) capacity in 1960 and (b) output in the same year.

The load factors for companies providing power from hydro facilities are much better than for the diesel generating group. For the limited sample available the average factor was 45 percent. The higher factor is attributable to lower rates, which are about one third of the rates charged by diesel-based companies (see Table 12). In only three cases were 1960 data available on companies with mixed capacity, that is both hydro and diesel. Of the three companies, two had 1960 load factors below 30 percent. One company, however, that located in the town of Rionegro, 38 kilometers from Medellin, recorded an unusually high load factor of 67 percent in 1960. This may be explained by the fact that the vicinity of Rionegro contains pasture land where Medellin interests have begun to irrigate alfalfa crops for cattle. The three cases where both capacity and generation data are available are shown in Table 11.

Power Rates

Characterized by scattered, independent local generating companies, Colombia's power system has widely differing power rates and various methods for computing charges to customers. In the small towns, such as Jardin (urban population 5000), in Antioquia, a 350 Kw hydro generator serves the community, and rates for residential users are 2 centavos per month per installed watt of lighting. Assuming that a typical household has 120 watts with a daily use of 300 watt hours, the monthly charge would be 2.40 pesos equal to 27.6¢ U.S. currency. The monthly use might be 9 kw/hours indicating that the charge

Table 12

AVERAGE SALES PRICE PER KWH FOR COMPANIES
ACCORDING TO TYPE OF GENERATING CAPACITY, COLOMBIA
1960
(Sales Prices Expressed in U.S. Cents)

Type of Company	Average Sales Price for Companies Sampled	Index Number (For Comparison)
Companies with hydro capacity only	0.860¢/kwh	100
Companies with both hydro and diesel capacity	1.501¢/kwh	175
Companies with diesel capacity only	2.648¢/kwh	308

would be equivalent to 27 centavos per kw/hour or 3.1¢ per kw/hour in U.S. currency.

Contrasting with the rate in Jardin, is the residential rate in the city of Cerete (population 16,740) in Cordoba Department. Power in Cerete is provided by a 2520 Kw diesel generator and the rate charged to residential consumers is 44.8 centavos, the equivalent of 5.2 U.S. cents per kw/hour and the highest rate reported to the Survey Team in Colombia. (The average rate for power charged to all consumers in Cerete is somewhat lower as shown in Table 13).

In the town of Andes (urban population about 7000) in Antioquia Department, the rate per kw/hour was the equivalent of 0.5¢ for residential, 0.7¢ for industrial, and 0.9¢ for commercial consumers, irrespective of the amount consumed.

One of the principal functions of Electroaguas is to study rates and rate structures and to gradually raise rates to economic levels throughout Colombia. Each upward revision presents formidable problems, according to Electroaguas and its affiliated companies. Once a rate is established, an upward adjustment can be achieved only after prolonged studies, hearings and negotiations. Except for urban areas where commercial and industrial consumption is high, the adjustment of Colombia's rates will be a protracted process.

In order to analyze the level of rates in Colombia for this report, Electroaguas rate data covering 47 companies was reviewed. From this data, the average sales price per kw/hour sold was identified for three classes of companies: (a) companies producing power from

diesel generators only, (b) from hydro-electric generators only and (c) from companies with mixed, hydro and diesel capacity.

The rates charged by 20 companies or groups of companies were obtained for the sample. The results showed that rates for companies with hydroelectric power were lowest, for mixed-generating capacity companies were the next lowest, while the rates for companies operating diesel plants only were the highest as shown in Table 12. The rates for diesel companies were three times as high as the rates charged by the companies using hydro generating capacity.

The following three tables show actual sales prices for companies in the three groups, diesel, hydro and mixed generating capacity companies (see Tables 13, 14, and 15.)

Power Costs in Rural Communities and Relationship to Rates

During field visits to power companies in rural areas, company officials informed the Survey Team that they kept records on fuel and lubricant costs, personnel costs, spare parts and maintenance. However, fixed costs derived from capital charges and depreciation were not taken into account because the municipio (probably Electroaguas through the Electrificadora) provided the initial capital and no interest or amortization was payable by the Company. When the generator was fully depreciated, the plant manager in Venecia, Antioquia said, the municipio would purchase a new one.

Table 13

AVERAGE SALES PRICE PER KWH OF COLOMBIAN POWER COMPANIES
WITH DIESEL GENERATING CAPACITY ONLY
1960

Locality	Department	Capacity (kw)	Average Sales Price Converted to U.S. Cents (11.5¢ = 1 peso)
Sincelejo	Bolivar	1,500	2.667¢
Cerete	Cordoba	842	3.521
Lorica	Cordoba	494	2.360
Sahagun	Cordoba	300	2.734
Quibido	Choco	700	1.157
Cauca Valley	Valle	1,500	3.450[a]
Average sales price			2.648

a. The Cauca Valley Corporation has sold power from diesel plants at 30 centavos per kwh but will reportedly discontinue the practice in the future.

Source: Electroaguas, Bogota except for Cauca Valley.

Table 14

AVERAGE SALES PRICE PER KWH OF COLOMBIAN POWER COMPANIES
WITH HYDROELECTRIC CAPACITY ONLY
1960

Locality	Department	Capacity (kw)	Average Sales Price Converted to U.S. Cents (11.5¢ = 1 peso)
Puerto Berrio	Antioquia	1,760	0.874¢
Tamesis	Antioquia	1,004	0.762
Chiquinquira	Boyaca	960	0.941
5 localities in Caldas	Caldas	26,440	0.828
Riosucio y Supia	Caldas	650	0.869
La Florida	Cauca	2,100	0.576
Lebrija	Santander	9,000	1.142
San Gil	Santander	2,141	0.889
Average sales price			0.860

Source: Electroaguas, Bogota.

Table 15

AVERAGE SALES PRICE PER KWH OF COLOMBIAN POWER COMPANIES
WITH MIXED HYDRO AND THERMAL CAPACITY
1960

Case No.	Locality	Department	Combined Capacity (kw)	% Hydro	Average Sales Price Converted to U.S. Cents (11.5¢ = 1 peso)
1	6 towns	Huila	6,065	68%	1.281¢
2	5 towns	Narino	6,041	92	0.930
3	3 towns	N. de Santander	8,229	13	1.673
4	Pamplona	N. de Santander	816	10	1.909
5	Ocana	N. de Santander	747	24	2.283
6	Socorro	Santander	780	36	1.389
Average sales price					1.501

Source: Electroaguas, Bogota.

In response to a written inquiry, Electroaguas said, "it is impossible to determine the operating costs of diesel plants in the 200 to 500 Kw capacity range, except for the cost of fuel per kwh which is known."

One element in the cost picture is known, however, namely fuel costs per Kw/hour and these are shown in Table 16, Column 1. Additional data on fuel costs per gallon are presented in Table 18. The capital costs are not known but can be assumed on the basis of a rule of thumb cited by the Electrificadora, namely that the equivalent of $230 dollars per installed kw of diesel capacity covers capital costs for generation, transmission and distribution equipment. Other estimates used by the UN suggest a lower figure of $193 per installed Kw. For estimate purposes, the $230 figure is used below.

The generating capacity, kw/hours generated and hence load factors are known for certain companies shown in Table 9. Line losses are not known but since transmission is local, they would presumably be small.

Various interest rates and amortization schedules were reported to the Survey Team in Colombia, but 15 years amortization and depreciation (assuming low use factors) plus 6 percent interest in unpaid balances seems reasonable.

Operating costs consisting of personnel, maintenance and spare parts actually checked in Colombia varied from the equivalent of 1.35¢ per kw/hour in a small 90 kw plant to 0.624¢ per kw/hour in a 1760 kw plant.

Using the known data plus the foregoing assumptions, estimates of actual costs have been constructed as shown in Table 16. The critical element is fixed charges for capital and depreciation shown in columns G and J of Table 16. These costs are critical because they are typically disregarded by the smaller companies in rural areas. If they were taken into account, the costs at current load factors would usually exceed the rates charged.

Using the same data, the charges in costs per kw/hour have been calculated on the assumption that the load factors were raised from actual 1960 levels to 30 percent. The results of this calculation are shown in Table 17.

Summarizing the conclusions in Table 16 and Table 17, the 842 kw diesel plant at Cerete, in Cordoba Department, operating with an 8.2 percent load factor in 1960 produced power at a cost of 6.9¢ per kw/hour, as compared to its selling rate of 3.5¢. If the load factor had been raised from the 1960 level of 8.2 percent to 30 percent, the costs would have fallen from about 6.9¢ to 3.7¢ and the selling rates would have nearly covered costs.

The 300 kw diesel plant at Sahagun in Cordoba, operating with a load factor of 19.7 percent in 1960 produced power at a cost of about 4.5¢ per kw/hour and sold power at 2.7¢. If this same plant had raised its load factor to 30 percent from the 1960 figure of 19.7, its cost would have fallen from 4.5¢ to about 3.9¢.

Table 16

ESTIMATED 1960 COSTS PER KWH COMPARED WITH 1960 RATES FOR EIGHT COMPANIES
OPERATING DIESEL GENERATORS ONLY
(Cost Units: U.S. Cents)

(A) Company	(B) Location by Municipio and Department	(C) Generating Capacity[a] (kw)	(D) Estimated Capital Cost[b] (U.S. $)	(E) Actual 1960 Output[a] (kwh)	(F) Annual Load Factor[a] 1960 (%)	(G) Estimated Fixed Costs per Kwh Based on (D) and (E)[c]	(H) Estimated Operating Costs per Kwh[d]	(I) Actual Fuel Cost[a] 1960 per Kwh (in centavos)	(J) Depreciation Cost Based on 15-Year Life per Kwh and (D) and (E)	(K) Total Estimated Costs per Kwh 1960	(L) Actual 1960 Rates, Averages for All Power Sold
Electrificadora de Cordoba	Cerete, Cordoba	842	$ 194,000	601,453	8.2%	2.2¢	1.0¢	1.5¢ (13.05)	2.2¢	6.9¢	3.5¢
Electrificadora de Cordoba	Sahagun, Cordoba	300	69,000	518,624	19.7	0.9	1.1	1.6 (13.5)	0.9	4.5	2.7
Electrificadora de Bolivar	Magangue, Bolivar	1,568	360,640	2,824,138	20.6	0.9	0.6	1.2 (10.21)	0.9	3.6	n.a.
Electrificadora de Cundinamarca	Villeta, Cundinamarca	209	48,070	456,427	24.9	0.7	1.3	1.3 (11.59)	0.7	4.0	1.2
Electrificadora de Cordoba	Lorica, Cordoba	494	114,000	1,027,590	23.7	0.8	1.1	0.9 (8.1)	0.7	3.5	2.4
Central Termoelectrico de Calamar	Calamar, Bolivar	380	87,400	892,960	26.8	0.7	1.1	1.0 (8.42)	0.7	3.5	1.8
Electrificadora del Choco	Quibido, Choco	700	161,000	1,878,983	30.6	0.6	1.0	1.6 (14.07)	0.6	3.2	1.2
Cia. Colombiana de Electricidad	Giradot, Cundinamarca	5,512	1,267,760	19,633,990	40.7	0.4	0.5	0.8 (6.81)	0.4	2.1	1.5

Note: The actual data shown in this table are for companies operating diesel generators only. Data for 12 companies was found showing 1960 capacity and output. Although computations could have been made for all 12 companies, this table selects 8 companies, ranging from the lowest capacity and load factor companies to the highest to illustrate the costs in relation to rates.

a. Electroaguas, Bogota, 1962 cost study.
b. Estimated by Electrificadora de Antioquia at $230 per kw of installed capacity including transmission and distribution. Compares with UN estimates of $193 for small diesels. Assumes 15-year, 6% interest amortization.
c. Because power company costs for collection, meter reading, and operating are borne by local government budgets, costs are difficult to estimate. Actual cases measured by the survey group range from 1.35¢ per kwh to 0.624.
d. All conversions made at U.S. 11.5¢ = 1 peso.

Table 17

PROBABLE CHANGES IN COSTS PER KWH RESULTING FROM AN INCREASE IN 1960 LOAD FACTORS TO 30 PERCENT

(A) Company	(B) Location by Municipio and Department	(C) Generating Capacity (Kw)	(D) Estimated Capital Cost	(E) Output at 30% Load Factor (actual 1960 output and load factor in kwh)	(F) Estimated Fixed Costs per Kwh (1960 est.)	(G) Estimated Operating Costs per Kwh (1960 est.)	(H) 1960 Fuel Costs per Kwh (1960 est.)	(I) Depreciation Cost per Kwh (1960 est.)	(J) Total Estimated Cost at 30% Load Factor per Kwh (1960 est.)	(K) Difference between 1960 Cost and Costs at 30% Load Factor
Electrificadora de Cordoba	Cerete, Cordoba	842	$194,000	2,212,776 (601,453 8.2%)	0.6¢ (2.2)	1.0¢ (1.0)	1.5¢ (1.5)	0.6¢ (2.2)	3.7¢ (6.9)	-3.2¢
Electrificadora de Cordoba	Sahagun, Cordoba	300	69,000	788,400 (518,624 19.7%)	0.6 (0.9)	1.1 (1.1)	1.6 (1.6)	0.6 (0.9)	3.9 (4.5)	-0.6
Electrificadora de Bolivar	Magangue, Bolivar	1,568	360,640	4,120,704 (2,824,138 20.6%)	0.6 (0.9)	0.6 (0.6)	1.2 (1.2)	0.6 (0.9)	3.0 (3.6)	-0.6

Note: The three diesel generating companies shown were those with the lowest load factors shown in Table 16.

Table 18

CONSUMPTION OF DIESEL OIL, PRICE PAID FOR DIESEL OIL, COST PER KW-HOUR OF DIESEL OIL AND OTHER MATERIALS CONSUMED BY SELECTED DIESEL POWER PLANTS IN COLOMBIA - 1960

(A) Name of Company	(B) Location (municipio)	(C) Department	(D) Gen. Capacity (kw)	(E) Act. Generation (kwh)	(F) Diesel Oil Consumed in 1960 (US gallons)	(G) Price Paid in 1960 per US gal. of diesel oil (US ¢)	(H) Total cost of matls consumed in 1960 (diesel, oil grease, etc. in US ¢)	(I) Cost of diesel oil and grease etc. in 1960 per Kw/hour (Column J/G)
Electrificadora de Cordoba	Cerete	Cordoba	842	601,453	63,715	10.12¢	9029	1.5¢
Electrificadora de Cordoba	Lorica	Cordoba	494	1,027,590	80,339	9.43	9576	0.9
Electrificadora de Cordoba	Sahagun	Cordoba	300	518,624	60,207	10.57	8032	1.6
Electrificadora del Choco	Quibido	Choco	700	1,878,933	181,091	12.31	30,408	1.6
Central Termo-electrico de Calamar	Calamar	Bolivar	380	892,960	77,813	8.86	8647	1.0
Elect. de Cundinamarca	Villeta	Cundinamarca	209	456,427	45,098	9.55	6086	1.3
Empresa de En. Elec. de Magangue	Magangue	Bolivar	1 568	2,824,138	328,032	8.74	33,172	1.2
Empresas Munic. de Monteria	Monteria	Cordoba	2 520	8,513,180	691,787	10.00	110,401	1.3
Cia. Colombiana de Electricidad	Giradot	Cundinamarca	5 512	19,633,990	1,554,756	8.74	153,787	0.8
Empresas Publicas de Barrancabermeja	Barrancabermeja	Santander	3 940	12,093,840	801,287	7.13	65,644	0.5
Empresa de Energia Elec. de Sincelejo	Sincelejo	Bolivar	1 500	3,759,810	366,666	8.63	61,864	1.6

a. Includes municipios of Quibido and Bagado.

Source: Electroaguas, Bogota, 1961, Section for Tariffs and Statistics)

NOTE: Companies selected for the above table are those which operated diesel plants only in 1960. The average cost of diesel oil for the above plants was 9.45 U.S. ¢ per U.S. gallon. A study by Electroaguas covering 34 companies (including the above 11) shows an average price of 9.1¢ US gallon paid by all 34 companies. The highest price paid by any one of the 34 companies was 1.10 pesos equal to 12.65 US¢ and the lowest price was 0.62 pesos equal to 7.3 US¢.

The 1568 kw diesel plant at Magangue operated with a factor of 20.6 percent in 1960 and produced power at about 3.6¢ per kw/hour. By raising the load factor to 30 percent, the costs would have declined from 3.6¢ to about 3.0¢ per kw/hour.

Table 16 brings out the point that of the eight cases listed, the rates in all cases were below what would have been actual costs if fixed charges had been taken into account.

A further indication of the cost situation was brought to the attention of the Survey Team by the Cauca Valley Corporation. This Corporation operating in cooperation with the Central de Anchicaya, Ltd. is one of the four class "A" power companies in Colombia operating generators with a capacity in excess of 25,000 kw. A part of the system consists of a 1500 kw diesel generator of recent model, and judging by the system's reputation is probably as efficiently run as any in Colom bia. Cost experience with the diesel generator taking into account capital charges and depreciation is as follows:

Costs per kw/hour delivered to residential consumers in rural communities near Cali:	4.0¢ (35 centavos)
Sales price per kw/hour to same consumer:	3.5¢ (30 centavos)
Financial loss sustained per kw/hour:	about 0.5¢

The Cauca Valley Corporation stated that this experience was so unsatisfactory that they had recently adopted a policy of denying diesel generated power to rural communities in the vicinity of Cali because

the financial losses were considered excessive. Judging by the Cauca Valley Corporation experience,none of the rates shown in Table 16 for diesel generation companies would appear to cover actual costs.

The Significance of Power Costs in Rural Areas

Despite the anticipated annual growth in installed capacity of 13.5 percent to 1970, major elements of the rural population, some 7.0 million persons will still be without grid power in that year. This means that pressures will mount for local, unconnected generating capacity with its attendant load factors problems and costs. While hydro power in Colombia is generally economical, diesel power, given the present rate structure and load factors, is uneconomical.

Where hydro potential does not exist, the diesel plant, despite its higher costs, offers a solution for bringing electricity to rural areas, and Electroaguas plans to raise small diesel capacity, although at a much slower pace than in the past. The outlook for and some of the effects of diesel electrification appears as follows: In 1960, installed capacity of diesel generators in classes D, E, F, and G (those with 5000 Kw capacity or below) was 63,109 Kw or about one tenth of the total national capacity. (This figure may include some actual plans of Electroaguas for an increase in this kind of capacity by another 8000kw by 1965, to a total of 71,000 kw). With its load factor typically in a range of 20 percent, these small generators could cost the Colombian economy some 1.9¢ per Kw/hour produced, or nearly $3.0 million annually in the form of a subsidy for rural electrification.

Summary Observations on Power Utilization in Colombia

The most striking observation with respect to the use of power in rural areas in Colombia is that it is almost wholly confined to illumination -street lighting and households. This is particularly true of Class G plants (less than 100 kw capacity), where 80-90 percent of the total power consumed goes for illumination. In the case of plants in Classes D, E, and F (101-5000 kw capacity) at least two thirds of the total power consumption is for lighting.

Furthermore, it was not at all unusual to discover in the course of the field investigations, that in several instances where power had been available for as long as 30-40 years, there was a singular lack of application of power for purposes other than illumination.

This indicates that the mere availability of power is insufficient for purposes of bringing about productive applications. It also suggests, and this was brought out in on-site discussions with local representatives, that there has been very little comprehension of alternative uses for power.

PERU FIELD SURVEY REPORT

APPENDIX C

FIELD DATA FROM SELECTED RURAL COMMUNITIES IN PERU

Between May 7 and May 19, 1962, the field survey team that visited selected rural communities in Peru obtained local data relevant to the generation and utilization of power in these areas, with particular regard to the relation between the provision of power and resulting rural social-economic development. Communities with and without power were included in the survey. An effort was made to secure a representative cross section of villages. Sufficient site data were desired to permit the later preliminary selection of promising villages for possible future village electrification-community development pilot project experiments.

This Appendix contains the community data collected in the course of this program arranged by village name. In general, more information is available for those communities of the greatest interest for possible future field programs. In some cases, photographs are included to better portray village conditions. It is hoped that the raw data contained in this Appendix may be of use to workers interested in rural communities in Peru in connection with other programs.

Additional information on the gathering of these data is included in the accompanying project report: Field Survey Trip Logs. The Summary Project Report presents the over-all conclusions and recommendations of the project. Comparable information for villages in Colombia, Chile, and India are presented in the accompanying Field Survey Reports on those Countries.

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SITE: ACOBAMBA

PROGRAM FOR ADVANCED TECHNICAL SUPPORT
FOR VILLAGE DEVELOPMENT

CHECK LIST OF FIELD INFORMATION

Version No. 3 - October 17, 1962

SURVEY DATE: May 16, 1962

FIELD TEAM MEMBERS: (incl. association)
E. G. Alderfer - CARE, Inc.
G. Street - G. E. Co.
Dr. H. F. Dobyns - Cornell - Peru Project
2 Assistants - " " "

INFORMANTS: (incl. titles, etc.)
City Council

I. VITAL STATISTICS

Village: Acobamba Province: Tarma
Department: Junin Country: Peru
Type of Government: Junta
Population: Urban: 1961 Rural: 7531 Total: 9492
Urban families: ~280
Birth rate: Net increase Death rate: ----
Population growth rate: 30% Increase 1940-1961
Net emigration: Some Why: Seek work in LaOroya, C.de P. Lima - but return due to unavailable work.
Literacy level: 15%

II. ENVIRONMENTAL CHARACTERISTICS

Name and distance of nearest town: Tarma - 8kms.
Name and distance of nearest market: Tarma - 8 kms
Geographical classification: Mountain valley
Type of access road: 2 lane all weather asphalt
Other access routes: Dirt Roads

Sewage facilities: Latrines disposing into Tarma River
Drinking water sources: Spring with pipes to convenient outlets - Reported pure.

Stream and river sources: Tarma River 96 cu. ft./sec. - 35 meter drop in 2 kms.

Fuel cost and availability:

Regular Gasoline	4.10 soles/gal.
High Test Gasoline	5.60 soles/gal.
Kerosene	2.20 soles/gal.
Diesel Fuel	4.10 soles/gal. -not locally available
Bottled Gas	2 families use for cooking
Crude Oil	None
Coal	None

Fuel trucked from Callao in 55 gallon drums.

Available indigenous fuels: Wood available for cooking - not enough for power.
Agricultural waste - used for cattle food.

Wind and its utilization: Daily easterly winds - gentle - noticeable on mountain ridges.

Sunshine and its utilization: Rare to have day without sun.

Availability of medical skills:

Resident doctors	----
Itinerant doctors	1 from Tarma
Dentists	----
Nurses	----
Midwifes	----
Pharmacists	----
Herbalists	Yes

Clinic: None

Schools: Primary School (11 rooms - 2 work shops) with water, sewage and wired for electricity but unconnected.
Girls school - adobe and tiles
23 teachers - preoccupational and primary
43 teachers in total Acobamba district.

Community Center:
Cement 2 story building built by Odria

Cooperatives: None

III. ECONOMIC CHARACTERISTICS

Work force pattern - percent of total population: Males work; females stay home

Section	Percent	Avg. Income
Agriculture	About 100%(full or part time)	6000 soles/year
Industries	negligible	18000 soles/year
Services	5 small shops	
Mining	70% of males once worked for Cerro de Pasco	
Fishing		
Others Transport	40% males	
Unemployed	Negligible	
Non productive	Negligible	
% Self employed	Most % Employed	≈10%

Income fluctuation: Yes - 2 Harvests each year.

Typical Debt: To some extent Why: Loans to buy trucks, Funerals, Illness
Typical Savings: ---- Form: ----

Subsistence level: Yes

Types of farm crops: Potatoes, corn, barley, carrots, cabbage, artichokes, spinach, lettuce, beans, alfalfa, peaches, garden crops.
(Indicate major cash crops)

Types of farm animals raised: 200 Cattle
(include numbers) ~ 1200 Small stock
Poultry
Guinea pigs for local consumption
Horses
Donkeys

Typical size of farm plots: 1/2 Hectare
Smallest would be 1/20 hectare
Largest would be 50 hectares

% Farmers owning land 90% % Renting 10% peons or share croppers

Latifundia Minifundia X

Composting practiced Yes

Types of industries: Saw Mill (gasoline engine)
(Including size) Pottery making
Blacksmith

Handicrafts:

Types of services: 15 Retail stores (use electricity)
8 - Gas Stations (each with 1Kw generator)
(one has 3Kw generator)
Shoemaker, Tailor, Bakeries, Hairdressers

Available Tech. Skills: Soldering, Mechanics, Electricians, Chauffers, Truck Drivers, Carpentry

Cooperative community works: Stadium, school, plaza, public market

IV. PRESENT ELECTRIFICATION

Year of installation: About 1922
Type of electric power: Grid tap - 15Kw capacity
Distance to and cost of electric grid power: ----
Nearest town with grid accessibility: ----

Power plant rating: 15 Kw capacity
Phases: 3 Volts: 220V. A.C. Freq.: 60~

Power plant ownership: Servicio Electrico de Tarma
operator: ditto

Use of electricity and connected loads:
Household illumination 176 Households each with 40W bulb - 7.04Kw
Radios Outlets
Street lighting Estimate of 1 watt per capita installed - 2.0Kw
Industries - None

Irrigation - None

It appears that a greater load is connected than legally permitted - estimate 20 to 30 Kw bulbs glow like candles at 8:00 P.M. - Voltage is 180 at 9:00 A.M.

Others - 15 Retail Stores

Operational time: 96 Homes with 24 hr. available. 804 with 12 hour available
Type rate, price and source of fuel: ----

Rate, price and source of lube oil:

Fuel transport:
Power plant maintenance:

Availability of spare parts:

Maintenance problems:

Are power plant records kept? How?

Installation cost of power plant:

Operation costs:

Maintenance costs:

Fuel and oil costs:

Tariff schedules: 30 soles/mo. for 40W. bulb - 24 hr. availability per day
15 soles/mo. for 40W. bulb - 12 hrs. availability per day
8 soles/mo. for radio

Yearly revenue: Approximates 60,000 soles/year

V. PROBLEM, NEEDS, OPPORTUNITIES

What are major problems: Inadequate reliable electric power - Adult education during evening hours.

What are felt needs: Weaving Industry - Movie Theater
Extended Household Electrification
Electrification of saw mill
Radio Station - Mechanics Work Shops
Carpentry Shops - Irrigation of mountain side farms

What are obvious opportunities: Solution to their electrification problem by connection to overhead grid - use of Diesel generator or hydroelectric plant.

Does village desire electrification: Yes

VI. REMARKS

- Acobamba has ideal climate. People emigrate for climate but leave because of no work opportunity. Electricity installed 40 years ago - 3- 15 Kw transformers. About 20 years ago this was reduced to 3- 6Kw units. Houses are not heated. Kerosene used for cooking and for several refrigerators. Present grid tap is inadequate, the power company will not increase it. Village has been considering alternates.

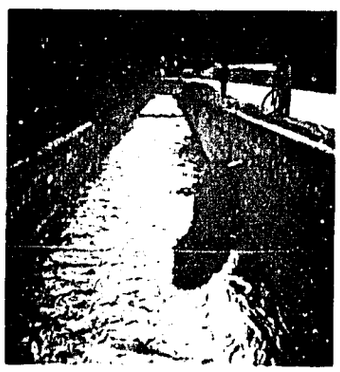
1- Tap into Cemento Andina grid passing directly overhead. This Company proposes selling 200Kw @ 60 ctvs/kw-hr. The power would be available at 44000 volts at Tarma substation 8 kms away. They would have to procure and install a 44000/2300 volt transformer, 2300 volt transmission line (10kms) and distribution transformers for 220V. village use. Equipment cost would be S/1,200,000.

2- Install hydro electric plant on Tarma River, passing through village. Team checked flow rate (est.) at end of dry season 96ft.^{3} /sec. Reported head, 35 meters in 2 kms. Acobamba has discussed purchase of 40 year old 100 Kw unit from Cerro de Pasco - designed for 80 meter head. Have submitted request to Ministerio de Fimenta for water rights but it was rejected because sketches were of improper size. They are planning to set up a corporation to raise capital. An initial effort has already yielded S/120,000. There is optimism that all families will invest S/500 to S/3000. In addition they are prepared to sell land to raise another S/600,000.

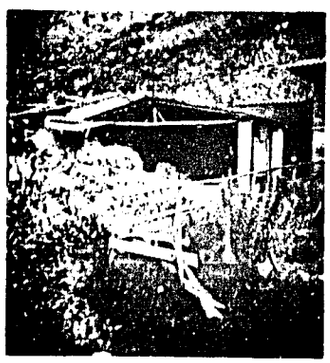
3- Possibility of a diesel generator - but they are not keen because they feel the costs would be too high.

Most villages use gasoline mantle lanterns. They cost S/400 and last 3 years before worn out. 3/4 Litre of gasoline burns 12 hours. They use them each night for 3 to 4 hours.

Village stated their greatest difficulty was in obtaining technical advice in regards to course of action to follow.



Tarma River by-pass for irrigation flowing through Acobamba.



Sawmill operated by gasoline engine, Acobamba.

SITE: PALCA

PROGRAM FOR ADVANCED TECHNICAL SUPPORT
FOR VILLAGE DEVELOPMENT

CHECK LIST OF FIELD INFORMATION

Version No. 3 - October 17, 1962

SURVEY DATE: May 17, 1962

FIELD TEAM MEMBERS: (incl. association)
G. Street - G. E. Co.
Dr. H. F. Dobyns - Cornell - Peru Project
2 Assistants - " " "

INFORMANTS: (incl. titles, etc.)

I. VITAL STATISTICS

Village Palca Province: Tarma
Department: Junin Country: Peru
Type of Government: ----
Population: Urban: 1200 Rural: 2600 Total: 3800
Urban families: ----
Birth rate: ---- Death rate: ----
Population growth rate: Increased over 10 years
Net emigration: To Lima Why: Education and work
Literacy level: 150 Illiterate Little emigration in last few years

II. ENVIRONMENTAL CHARACTERISTICS

Name and distance of nearest town: Acobamba - 11kms.
Name and distance of nearest market: Tarma - 20kms
Geographical classification: Mountain valley
Type of access road: 2 Lane all weather asphalt
Other access routes: Dirt roads

Sewage facilities: None - Use fields
Drinking water sources: Spring piped to faucets in streets

Stream and river sources: Tarma River and tributaries

Fuel cost and availability: Gasoline in Acobamba
Kerosene - 2.40 soles/gal.

Available indigenous fuels: Wood - Available for cooking.

Wind and its utilization: Daytime constant light wind up valley.

Sunshine and its utilization: Mostly sunny except rainy season.

Availability of medical skills:

Resident doctors	No
Itinerant doctors	From Tarma
Dentists	No
Nurses	No
Midwifes	No
Pharmacists	No
Herbalists	Yes

Clinic: None

Schools: 6 Room adobe plus rented 3 room adobe.
In process of building new girls school

Community Center: Plastered adobe - offices and meeting hall.

Cooperatives: In formation - financial quota for co-op is 30,000 to S/40,000.

III. ECONOMIC CHARACTERISTICS

Work force pattern - percent of total population: 98%

Section	Percent	Avg. Income
Agriculture	95%	?
Industries	Part Time	S/18000
Services	1%-2%	
Mining		
Fishing		
Others Government		S/20,000
Unemployed		
Non productive		
% Self employed	100%	% Employed Part Time

Income fluctuation: Yes - 2 potato harvests per year.

Typical Debt: ---- Why: Loans for trucks

Typical Savings: ---- Form: Impossible to get estimate

Subsistence level: Subsistence

Types of farm crops: Potatoes, Corn, Wheat, Barley, Carrots, Broad Beans,
(Indicate major cash crops) Peas, Ollucllu, Garden Vegetables.

Types of farm animals raised:
(include numbers)

Typical size of farm plots: 20 to 30 Tongos
Must own more than 2 hectares
No real large holdings

% Farmers owning land 100% % Renting

Latifundia Minifundia X

Composting practiced

Types of industries:
(Including size)

Handicrafts: Carpentry, blacksmithing, shoemakers, dressmakers.

Types of services: Tailor, Bakeries

Available Tech. Skills: 100 Drivers and helpers, 7 store operators,
25 (including teachers) school system,
50 with administrative skills,
10 Auto repair

Cooperative community works: Built mountain road to Potay, community council building, 8 schools for Palca and neighborhood (no state aid)

IV. PRESENT ELECTRIFICATION

Year of installation: 1925
Type of electric power: Hydroelectric - Swiss "ASEA"
Distance to and cost of electric grid power: Cemento Andina Grid lines overhead.
Nearest town with grid accessibility: Acobamba - 11kms.

Power plant rating: ~10KW
Phases: 3 Volts: 220 Freq.: 60 Cycles

Power plant ownership: Village Corporation - 400 original shareholders -
operator: Hired empirico - paid monthly.

Use of electricity and connected loads:
Household illumination 40 to 50 homes - 200 - 40W. bulbs 8.0KW
Radios Outlets available
Street lighting Plaza only
Industries - None

Total connected load ~10.0KW

Irrigation None

Others None

Operational time: 6 P.M. to 12 P.M. each day

Type rate, price and source of fuel: ----

Rate, price and source of lube oil: ----

Fuel transport: ----
Power plant maintenance: No readily available mechanic

Availability of spare parts: Difficult - must send away to Switzerland

Maintenance problems: Equipment worn out - inoperative at present - dam and ditches constantly being repaired.
Are power plant records kept? No How?

Installation cost of power plant: S/24,000 in 1925

Operation costs: ----

Maintenance costs: ----

Fuel and oil costs: ----

Tariff schedules: S/2.00 per month per 40W. bulb + additional assessments as needed.

Yearly revenue: On bulbs alone = ~4800 soles/year.
Each new consumer puts up quota of S/3500 for each bulb installed.

V. PROBLEM, NEEDS, OPPORTUNITIES

What are major problems: Antiquated, unreliable power plant.

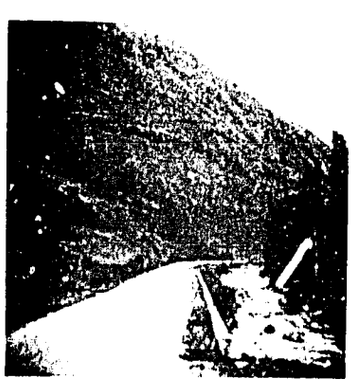
What are felt needs:
- Extended household electrification
- Saw Mill
- Carpentry shops
- Movie theater
- Grain mills
- Blacksmith shop
- Irrigation

What are obvious opportunities:
- Installation of hydroelectric plant.
- Extension of irrigated farm lands.
- Exploitation of wood product manufacture.

Does village desire electrification: Yes

VI. REMARKS

2 km Out of town is a tributary to the Tarma River. Its estimated flow is less than 100 Ft.^{3}/sec. It is tapped for irrigation and due to the fortunate ridge formation, it is possible to have a head drop of 100 meters or more at a possible hydroelectric site. This stream is glacier fed and fairly constant flow all year.



Proposed site for high head hydroelectric plant using water from irrigation ditch half-way up mountain and discharging to river in foreground, Palca.

SITE: PALCAMAYO

PROGRAM FOR ADVANCED TECHNICAL SUPPORT
FOR VILLAGE DEVELOPMENT

CHECK LIST OF FIELD INFORMATION

Version No. 3 - October 17, 1962

SURVEY DATE: May 17, 1962

FIELD TEAM MEMBERS: (incl. association)
E. G. Alderfer - CARE, Inc.
G. Street - G. E. Co.
Dr. H. F. Dobyns - Cornell - Peru Project
2 Assistants " " "

INFORMANTS: (incl. titles, etc.)
Mauricio Perez Bravo - Alcalde
Luis Macosi Vicuna - ex-Alcalde
Marcelo Castro Cairu

I. VITAL STATISTICS

Village Palcamayo (3400 meters altitude) Province: Tarma
Department: Junin Country: Peru
Type of Government: Junta
Population: Urban: 2300 Rural: ~4200 Total: ~6500
Urban families: 800 to 1000 (total)
Birth rate: ---- Death rate: ----
Population growth rate: Slight increase in 10 years.
Net emigration: Seasonal Why: 800 Men work for several months at mines or Industrial Centers but return during slack period.
Literacy level: 30%

II. ENVIRONMENTAL CHARACTERISTICS

Name and distance of nearest town: Acobamba - 15km.
Name and distance of nearest market: Tarma - 24km.
Geographical classification: Mountain valley
Type of access road: Unimproved dirt road
Other access routes: Mountain trails

Sewage facilities: None
Drinking water sources: Streams and one spring

Stream and river sources: Rio Palcamayo - 80 meter drop in 2kms. 2-3 meters wide -- Rio Shaco and Rio Chuelo-50 cm. deep.

Fuel cost and availability:

Regular Gasoline	4.80 soles/gal.
Kerosene	2.40 to 2.50 soles/gal.
Diesel Fuel	Available in Callao
Coal	Scarce - imported for blacksmith

Available indigenous fuels: Wood - Available for cooking

Wind and its utilization: Daytime up-valley breeze, especially on ridges.

Sunshine and its utilization: Sunny most of year - rainy season during winter - ice at night.

Availability of medical skills:

Resident doctors	No
Itinerant doctors	Sometimes from Tarma
Dentists	No
Nurses	1
Midwifes	No
Pharmacists	No
Herbalists	Yes

Clinic: 1 Room Posta Medica - obstetrical nurse in charge.

Schools: 12 Room adobe boys school with 2 agricultural workshops.
4 rented rooms for girls --- 250 girls - 380 boys.
9 teachers

Community Center: 1 Room Consejo Municipal adobe (plastered front)
Attached to Posta Medica

Cooperatives: None
Telegraph and Post Offices

III. ECONOMIC CHARACTERISTICS

Work force pattern - percent of total population: All

Section	Percent	Avg. Income
Agriculture	90 to 95%	S/800 to S/1000
Industries	Negl.	S/12000 to S/15000
Services	Few	
Mining	5%	S/12000 to S/15000
Fishing		
Others Transport	Few	
Unemployed		
Non productive	Few retired	
% Self employed	Most	% Employed Part time work outside village.

Income fluctuation: Seasonal - 2 harvests

Typical Debt: Frequent Why: Trucks, sewing machines, stoves, etc.
Typical Savings: 5 to 50 soles Form: At home in the sock

Subsistence level: Below subsistence

Types of farm crops: See Acobamba
(Indicate major cash crops)

Types of farm animals raised: 10,000 Head - cattle and sheep
(include numbers)

Typical size of farm plots: 5-6 Tongos, 1 to 2 are irrigated
60 Tongo farm is maximum
Alcalde's family has 40 plus

% Farmers owning land Most % Renting Few

Latifundia Minifundia X

Composting practiced By a few - generally stake animals in fields.

Types of industries: None
(Including size)

Handicrafts: Carpentry, shoemaking, sombrero repairing, weaving, blacksmithing.

Types of services: 1- Auto repair shop

Available Tech. Skills: 22 Truckers, 7 carpenters, 4 shoemakers, 1 Tailor, 2 seamstresses, 25 storekeepers, 22 (incl. 9 teachers) school system.

Cooperative community works: Church tower, Council building, Boys school - bridges.

IV. PRESENT ELECTRIFICATION

Year of installation: None
Type of electric power: _____
Distance to and cost of electric grid power: 15km.
Nearest town with grid accessibility: Acobamba

Power plant rating: _____
Phases: _____ Volts: _____ Freq.: _____

Power plant ownership: _____
operator: _____

Use of electricity and connected loads:
Household illumination _____
Radios _____
Street lighting _____
Industries

Irrigation

Others

Operational time: _____

Type rate, price and source of fuel: _____

Rate, price and source of lube oil: _____

Fuel transport: _____
Power plant maintenance: _____

Availability of spare parts: _____

Maintenance problems: _____

Are power plant records kept? _____ How? _____

Installation cost of power plant: _____

Operation costs: _____

Maintenance costs: _____

Fuel and oil costs: _____

Tariff schedules: _____

Yearly revenue: _____

V. PROBLEM, NEEDS, OPPORTUNITIES

What are major problems: Resolution of present electrification problem.
Increase irrigation supplies to save crops.
Alleviate subsistence living.

What are felt needs: Extended mountainside irrigation
Electrification of auto shop
Ice cream factory
Electrify schools
Movie theater
Electric stoves

What are obvious opportunities: Installation of hydroelectric plant on plant on Palcamayo River. Instituting irrigation pumping 100 meters higher than present, village electrification, school vocational workshops.

Does village desire electrification: Yes

VI. REMARKS

a) Flu epidemic 10 years ago caused many deaths, major population increase has occurred during last 2 years.

In 1950 (approx.) a 40KW diesel generator plant owned by a Sr. Lean was demonstrated to village by lighting Plaza. Subsequently, Sr. Lean organized a village corporation and collected S/55000 along with bank loans, to buy this equipment for the community. Money was used by Lean for other purposes. Equipment was never installed - it is supposed to be in Lean's house. Village has obtained order from Lima for Lean to turn equipment over - but so far it has not been able to implement a resolution.

Some 15 years ago a group of leading citizens organized a cooperative effort for the eventual installation of a hydroelectric plant on the Palcamayo River. A concrete dam with spillway and 1-1/2 kms of preliminary ditching were dug. A foundation for the proposed plant was located and excavated as was an underground tiled tail race to the river, some 500 feet away. With the exception of the dam, this work would all have to be redone and the team found a more promising site only 1/2 km from the dam. Why this work was discontinued was not reported. No equipment had been ordered and apparently there were no engineering designs or specifications made.

Concrete dam, Palcamayo.
Men washing produce.

Diversion ditch leading from dam, for irrigation, Palcamayo.

Irrigation ditch extension with tunneling for proposed hydro-electric plant, Palcamayo.

Hydroelectric site from edge of ditch. River flowing through village, Palcamayo.

Abandoned excavation at site for hydroelectric equipment with underground tail race (not visible), Palcamayo.

SITE: SAN PEDRO DE CAJAS

PROGRAM FOR ADVANCED TECHNICAL SUPPORT
FOR VILLAGE DEVELOPMENT

CHECK LIST OF FIELD INFORMATION

Version No. 3 - October 17, 1962

SURVEY DATE: May 19, 1962

FIELD TEAM MEMBERS: Senorita Teresa Egoavil E.
(incl. association) (Assistant to Dr. H. F. Dobyn - Cornell-Peru Project)

INFORMANTS: Junta representatives
(incl. titles, etc.)

I. VITAL STATISTICS (3700 meters altitude)

Village San Pedro de Cajas Province: Tarma
Department: Junin Country: Peru
Type of Government: Junta (600 inscribed members out of 4800)
Population: Urban: 4800 Rural: ---- Total: ----
Urban families: ----
Birth rate: 200 Death rate: 120 to 150
Population growth rate: Increasing
Net emigration: 5% per 2 years Why: Work and education
Literacy level: 80%

II. ENVIRONMENTAL CHARACTERISTICS

Name and distance of nearest town: Palcamaya - Junin (30km.)
Name and distance of nearest market: La Oroya - 35km.
Geographical classification: Mountain valley
Type of access road: Unimproved dirt road
Other access routes:

Sewage facilities: None - Use fields
Drinking water sources: River - (impotable). There is an unused spring some distance away.
Stream and river sources: Power stream - 300 liters/sec.

Fuel cost and availability: Regular gasoline 4.20 soles/gal.
Kerosene 2.20 soles/gal.

Available indigenous fuels: There is no wood
Straw for cooking S/3.00 a load
Champa (peat blocks) S/25.00 per 1000
Annual dung also burned

Wind and its utilization: Day and night constant wind.

Sunshine and its utilization: Sunny except for rainy season.

Availability of medical skills:

Resident doctors	No
Itinerant doctors	No
Dentists	No
Nurses	No
Midwifes	Yes
Pharmacists	No
Herbalists	Yes

Clinic: New one inaugurated in April 1962, but not staffed as yet - expect to be in operation in several months.

Schools: Boys pre-vocational - 450 students -
2nd category girls school - 230 students

Community Center: Use Municipal Building

Cooperatives: Cattle co-op - successful - has 2200 sheep
Transport co-op - 2 buses - experiencing poor management.

III. ECONOMIC CHARACTERISTICS

Work force pattern - percent of total population: Most all

Section	Percent	* Avg. Income
Agriculture	95%	S/12.00 per day
Industries	few	------
Services	few	------
Mining		
Fishing		
Others Govt.	Negl.	S/1300
Unemployed		
Non productive		
% Self employed	50%	% Employed 50% (of these 80% are in ~~industry~~)

Income fluctuation: Seasonal - Major income May-June.

*Estimate of total village yearly income is S/500,000.

Typical Debt: Exist Why: Farming, Illnes,, Religious Festivals

Typical Savings: 1% of Income Form: In Bank Accounts

Subsistence level: Bare subsistence

Types of farm crops: Potatoes, Olluco, Barley, Quinua
(Indicate major cash crops)

Types of farm animals raised: 1000 Cattle
(include numbers) 200 Horses
200 Llamas
30,000 Small stock

Typical size of farm plots: 4 to 10 Hectares (80%)
No one has less than 1 hectare.

% Farmers owning land 100% % Renting Some 20% of grazing land

Latifundia Minifundia X

Composting practiced No - Dung is used as field fertilizer

Types of industries: Textiles (blankets - mantas)
(Including size) Ceramic roof tiles

Handicrafts: Weaving, blacksmithing

Types of services: 32 Stores

Available Tech. Skills: 2- Auto repair, 70 drivers
20 School systems, 100% agricultural
10% Administrative

Cooperative community works: Local girls school

IV. PRESENT ELECTRIFICATION

Year of installation: 1957 (to replace older equipment)
Type of electric power: Hydro-electric - ASEA (Swiss)
Distance to and cost of electric grid power: 3kms.
Nearest town with grid accessibility: Pacchapata
Power plant rating: ----- (There is expectation they will be eventually tapped into the grid.)
Phases: ----- Volts: 220V, AC Freq.: 60 Cycles

Power plant ownership: Village corporation
operator: Above - hires an operator at S/750/month

Use of electricity and connected loads:
Household illumination Yes (incl. sewing machines) 2500 bulbs
Radios Yes - 500 Radios
Street lighting Yes
Industries - No

Irrigation - No

Others - Clinics
Schools

Operational time: 16 Hours per day

Type rate, price and source of fuel: -----

Rate, price and source of lube oil: -----

Fuel transport: -----
Power plant maintenance: No mechanic available - must rely on major supplies in big city.
Availability of spare parts: None on hand

Maintenance problems: Lack of automatic regulator and incidental problems.

Are power plant records kept? How?

Installation cost of power plant: S/273,000 , S/200,000 down payment - balance in 4 years.

Operation costs: S/9000 per year

* Maintenance costs: S/1750 per year (?)

Fuel and oil costs: -----

Tariff schedules: 60 ctvs/kw-hr. for share owners
80 ctvs/kw-hr. for non share owners

Yearly revenue:

* Transmission lines are being repaired now at a cost of S/18000

V. PROBLEM, NEEDS, OPPORTUNITIES

What are major problems:

What are felt needs:

What are obvious opportunities:

Does village desire electrification: _____

VI. REMARKS

The team was unable to visit this site due to transportation breakdown.

SITE: VICOS

PROGRAM FOR ADVANCED TECHNICAL SUPPORT
FOR VILLAGE DEVELOPMENT

CHECK LIST OF FIELD INFORMATION

Version No. 3 - October 17, 1962

SURVEY DATE: May 11, 1962

FIELD TEAM MEMBERS: (incl. association)
E. G. Alderfer - CARE, Inc.
F. L. Turner - S.R.I.
G. Street - G. E. Co.
Dr. H. F. Dobyns - Cornell - Peru Project

INFORMANTS: (incl. titles, etc.)
Dr. H. F. Dobyns
Dr. M. Vasquaz - Director de Campa - Peru Cornell Project

I. VITAL STATISTICS

Village Vicos(12 sq. miles) Province: Carhaus
Department: Ancash Country: Peru
Type of Government: Community Council (Junta)
Population: Urban: Negl. Rural: 2080 Total: 2080(56% women)
Urban families: 466
Birth rate: 350-400 Death rate: 300
Population growth rate: 1780(in 1951) to 2080 (in 1961)
Net emigration: Into Vicos Why: Increased economic opportunity - Emigration in past years was due to escaping reprisals on hacienda and rebellious adolescence.
Literacy level:

II. ENVIRONMENTAL CHARACTERISTICS

Name and distance of nearest town: Marcara - 6kms.
Name and distance of nearest market: Huaraz - 35kms.
Geographical classification: Mountain Valley
Type of access road: Unimproved dirt road
Other access routes: Mountain trails

Sewage facilities: None - Use fields
Drinking water sources: From irrigation ditches - not potable

Stream and river sources: 5 Large and 200 small irrigation ditches - small river (continuous flow)

Fuel cost and availability:

In Huaraz	
Reg. Gasoline	5.00 soles/gal.(+1.00 for transportation)
Diesel Fuel	4.30 soles/gal.(+1.00 for transportation)
Kerosene	2.80 soles/gal.(3.20 in Vicos)

Available indigenous fuels: Wood - scarce
Poor quality coal - on private land
Agricultural wastes - fed to cattle-not available
Dung used as field fertilizer

Wind and its utilization: Daytime - up valley - light wind
Consider top of UTUSH PAMPA ridge

Sunshine and its utilization: 100 days complete cloud cover -
265 days brilliant - some clouds

Availability of medical skills:

Resident doctors	----
Itinerant doctors	----
Dentists	----
Nurses	----
Midwifes	Untrained
Pharmacists	----
Herbalists	Yes

Clinic:

Schools:

Community Center:

Cooperatives:

III. ECONOMIC CHARACTERISTICS

Work force pattern - percent of total population: Total

Section	Percent	Avg. Income
Agriculture	100%	
Industries		
Services		
Mining		
Fishing		
Others		
Unemployed		
Non productive		
% Self employed	All	% Employed Some at part time work

Income fluctuation: Seasonal with crop harvest.

Typical Debt: _____ Why: _____
Typical Savings: _____ Form: _____

Subsistence level: Bare subsistence

Types of farm crops: Potatoes
(Indicate major cash crops) _____

Types of farm animals raised: (include numbers)

2500 Cattle
2500 Sheep
400 Goats
800 Horses
400 Donkeys
--- Guinea Pigs
--- Poultry

Typical size of farm plots:

% Farmers owning land _____ % Renting _____

Latifundia _____ Minifundia X

Composting practiced No

Types of industries:
(Including size)

Handicrafts:

Types of services:

Available Tech. Skills:

1 Automotive Operation
1/2 to 1% Administrative Skills
100% Agricultural Skills

Cooperative community works:

IV. PRESENT ELECTRIFICATION

Year of installation: 1954

Type of electric power: Onan gasoline engine generator

Distance to and cost of electric grid power: 110 kms. 30 ctvs/kw-hr.

Nearest town with grid accessibility: Huallanca - Team witnessed grid extension being set up into Huaraz to pass 6 kms. from Vicos, operable Dec. 1962.

Power plant rating: - 3.5 KVA

Phases: 1 Volts: 230 A.C. Freq.: 60 Cycle(1800 RPM)

Power plant ownership: Cornell: Peru Project

operator: Project employee

Use of electricity and connected loads: (For Project purposes only)

Household illumination 2650 W.

Radios

Street lighting 60W.

Industries -- None

Irrigation -- None

Others -- Community Center - 400W.
Total connected load - 3.11KW.

Operational time: 4 Hours daily -- 6 P.M. to 10 P.M.

Type rate, price and source of fuel: Gasoline - 2 gals/day
5.00 soles/gal. plus 1.00 soles/gal. for delivery from Huaraz

Rate, price and source of lube oil: 75 soles/month for lube oil change

Fuel transport: In 55 gal. drums trucked from Huaraz

Power plant maintenance: Mechanic from Huaraz - 250 soles/ per visit

Availability of spare parts: In Lima - Major overhauls - 2 since installation in Tolima - cost 3000 to 4000 soles.

Maintenance problems: Overload spark plugs - control

Are power plant records kept? No How? Included in general project.

Installation cost of power plant: S/16,000 in 1952 - Estimated cost of replacement in 1962 S/36,000

Operation costs: ----

Maintenance costs: S/250 - minor overhaul S/3000 to S/4000 major

Fuel and oil costs:

Tariff schedules: None

Yearly revenue: None

V. PROBLEM, NEEDS, OPPORTUNITIES

What are major problems: (By Project)

What are felt needs:

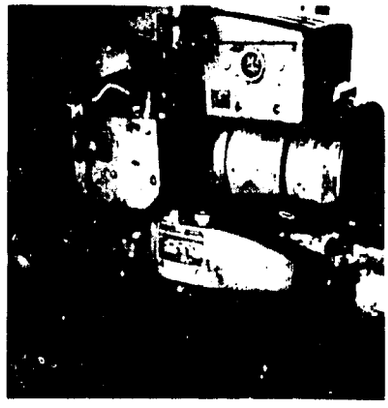
Household illumination
Weaving
Milling
Fiber and Rope Processing

What are obvious opportunities:

Does village desire electrification: Project feels it does.

VI. REMARKS

Vicos is an extended community covering 12 square miles. There are only family clusters of houses. There is some beginning of pueblo construction around hacienda - some 5 families have built. Question -- will electrification provide an incentive for forming a village? Otherwise, survey team felt stringing wire all over Vicos for household use is impractical. Electricity for community centered education and small industry activities is possibility.



3.5-kw Onan electric power supply, Vicos.

School and compound, Vicos.

SITE REPORT FOR VICOS, ANCASH DEPARTMENT, PERU

Site Name and Location: Vicos Village, Ancash Department

Population: 2080

Date Investigated: May 10-13, 1962

Field Investigation Team: Gordon Aldefer, CARE; George Street, Jr., GE; Frank L. Turner, SRI; Henry F. Dobyns, Cornell-Peru Project; Mario C. Vasques, Cornell-Peru Project

The Environment of Vicos

Vicos is located about 175 miles NNW of Lima, but driving distances over the mountains are about twice that figure. The community of 2080 persons spreads out for six miles along the steeply sloping sides of a valley at an altitude of 9869 feet just west of the costal Cordillera. Reachable after 12 to 15 hours of driving, access is difficult but has improved greatly in recent years, thanks to one-lane roads now extending inland from the Pan-American coastal highway.

The valley region where Vicos is located, called the "Callejon de Huaylas", is noted for its massive nearby glaciers rising to the east. Particularly famous is the 22,400-foot glaciated peak, Huascaran, from which two avalanches have fallen in recent years, one in 1941 killing over 5000 persons in the town of Huaras. Another avalanche in January 1962 demolished the town of Ron Ranrahirca, killing some 3000 inhabitants less than ten minutes after heavy ice formations broke away from the walls of the glacier.

The Impact on Vicos of the Cornell-Peru Project

The inhabitants of Vicos are Quechua speaking Indians typical of Peruvian mountain areas; the village, however, is not typical for reasons outlined below, and is the center of an anthropological experiment to modernize what in 1951 was a community of half-starved serfs, according to Dr. Henry F. Dobyns, coordinator of the project. Widely acclaimed as being successful, the experiment was initiated in 1951 by Dr. Allan R. Holmberg of Cornell University and Dr. Carlos Monge M., Director of the Bureau of Indian Affairs, Ministry of Labor. The experimental

program, known as the Cornell-Peru Project, virtually rescued the Indian population, now 2080 persons, from starvation after the war and has since raised local levels of living to a degree appreciably higher than levels prevailing in other nearby mountain communities. Attesting to this success are indicators of improved health and welfare, and most important, a transfer of land from absentee landlords to the cultivators.

When the Cornell-Peru Project began, a stranger was often greeted with hostility and even a shower of rocks; today, members of the Cornell-Peru Project team are welcomed, and visiting scientists freely come each year to study such subjects as the living habits, nutrition, and customs of the Indians with a minimum of friction.

As mentioned, one of the major achievements has been the transfer of some 18,940 acres of farm land and pasture from the absentee owner (Beneficencia Publica de Huaras). Gradually the improving financial strength of the inhabitants reached the point where the land was purchased (although not yet fully paid for) by the Indian residents themselves. Such a transfer of title and departure from the traditional peonage system was financed by community savings since 1956 of $19,230. This amount and further savings of $5,769 to purchase a truck were made possible by improved agricultural yields and the sale of livestock, eggs, potatoes, and other products.

This experience has served as a model, many features of which are now being followed in other communities under the auspices of the Ministry of Labor, Bureau of Indian Affairs.

Economic Characteristics

The farm plots and huts of the Vicos community are widely dispersed on sloping terrain over an area some six miles long and two miles wide along the Marcara River. This dispersed type of community, known as a rancheria, creates problems of marketing and transportation, and would add to transmission costs in the event that a community power plant were ever to be installed. The wide separation of individual huts or small groupings of huts is evidence of the subsistence and frontier-like living conditions of the community. The farmers traditionally sought to locate their houses near the plot rather than in a compact cluster, but have begun to move into a compact cluster of new houses around the community square.

The population of Vicos in mid-1962 was estimated at 2080 persons composing 466 farm households. In addition, some 22 households or individual adults are engaged in occupations other than farming, namely six in storekeeping, four are employed by the Cornell-Peru Project, eleven persons are teachers or teaching assistants, and one is a potter.

The population has grown from 1780 to 2080 persons in ten years, an annual average growth of 1.6 per cent, as compared with the recent Peruvian national annual average growth of 2.5 per cent. As economic and health improvements gather momentum, however, the population growth in Vicos may well accelerate, as indicated by the "reverse migration" described by Dr. Henry F. Dobyns as the tendency of persons to return to Vicos from the larger coastal communities to which they had migrated in earlier and harder times. Thirty-two persons have returned to Vicos in the last seven years, according to Dr. Dobyns.

The 466 farmers in Vicos cultivate or use for pasture a total of 4257 hectares of varying degrees of fertility. This land in turn is divided between community-operated and privately-operated land, as shown in the tabulation below:

Type of Land	Community Hectares	Private Hectares	Total Hectares
All lands	2,853	1,404	4,257
Irrigated farm plots	50	82	132
Non-irrigated farm plots	100	1,322	1,422
Pasture (above 11,000 feet in altitude)	2,703	0	2,703

The above tabulation shows a total of 1,554 hectares of farm land and thus indicates an average holding of 3.3 hectares per farm household (1554 hectares divided by 466 households). Since one-third of the land lies fallow, however, the annual farm income is derived from 87 hectares of irrigated and 939 non-irrigated hectares, or an average of 2.2 hectares per year per household (1,026 hectares divided by 466 households).

Although the average hectarage cultivated is about 3.3 per farm household, the amount of land cultivated by individual households varies widely according to estimates of staff members of the Cornall-Peru Project. Six households cultivate only one-half hectare each, another six operate about seven hectares each, while the remainder of the farm households operate from three to six hectares (7.4 to 14.8 acres). The principal crops grown in order of importance are: potatoes, corn, wheat, oca (a tuber), olluca (a tuber), rye, and barley.

Other crops grown include beans, chick-peas, squash, peppers, cabbage, mashua (a tuber), tauri (lupine), edible flax, pig weed (amaranth), and quinoa (chenepodium).

The major cash crop is potatoes, but even more farm cash income is derived from the sale of livestock, poultry, cheese, eggs, and guinea pigs (see Table I below). Roughly, the cattle population of the Vicos rancheria is as follows:

Animal	Head
Cows	2,500
Horses and mules	800
Donkeys	400
Sheep	2,500
Goats	400

The growth in the number of horses and donkeys used as pack animals has been remarkably rapid considering that these animals were barely known at Vicos prior to 1958. Under the former Hacienda system when the Indians were literally serfs, the human being in Vicos was the beast of burden. (Vicunas, llamas, and alpacas have been in use in southern Peru as pack animals, but not in the Vicos area.)

Vicos has no industry except for a pottery. Grain and corn milling, threshing, decorticating of fibers, and wood cutting are accomplished by primitive manual means, or not at all. This suggests some limited industrial potential for future years in the event power were to become feasible. Some possible future industries that might be usefully explored include: weaving of the agave fiber for sacks, rope making, decorticating of agave, grain and corn milling, cold storage of meat, poultry, eggs, cheese, possibly smoking of hams if pork sales were introduced, fruit growing and processing if fruits were introduced,

Table I

Estimated Annual Cash Income of the village of Vicos, Ancash Department, Peru, 1962

Products or Service	Value (soles)	Value (US$)
A. Products Sold		
1) Potatoes sold to urban markets, chiefly Lima	70,000	2692
2) Potatoes sold to local markets	10,000	385
3) Beef cattle sold, about 100 head annually @ 2000 sales/head	200,000	7692
4) Sheep sold, about 150 head annually @ 200 sales/head	30,000	1154
5) Eggs sold (72 eggs/hen, 6 hens/family, 466 families, .70 per egg)	141,000	5423
6) Chickens sold, about 500 annually @ 30 sales	15,000	577
7) Guinea pigs sold, 2/family about 1000 sold annually @ 10 sales/head	10,000	385
8) Cheese, 300 cows, 6 cheeses/week @ 2 sales	43,200	1661
9) Ice, 104 trips to glacier per year, 12 sales per trip, 5 ice collectors	6,240	240
Sub-total for products	525,440	20,208
B. Services Sold		
1) Muleteer services, 4 families, 7 mules each, 25 sales/muletrip, 4 trips/year	2,800	108
2) Day labor for hire at 10 sales/day (3000 man-days per year of such labor)	30,000	1,154
3) Store Keepers (6), Cornell-Peru local employees (4), Teachers (7), Teaching assistants (4), Potter (1)	249,600	9,600[a]
Sub-total for services	282,400	10,862
C. TOTAL PRODUCTS AND SERVICES	807,840	31,070

[a] Assumes $350 for 6 storeskeepers, $500 for 4 Cornell-Peru employees, $600 for 7 teachers, $300 for 4 teaching assistants, $100 for one potter.

wool spinning and weaving, saw milling from the locally grown eucalyptus trees, furniture making, stone dressing for construction, and making of work clothes with industrial sewing machines. (Sewing machines, nine in all, were already being used in Vicos in May, 1962.)

As mentioned, Vicos probably enjoys a better standard of living and produces more goods and services than other Sierra non-urban communities. Even by Peruvian national averages, Vicos appears to have a high level of gross product. The national 1962 average gross national product per capita according to US/AID is about $178. The per capita product in Vicos appears to be a higher $246, as discussed below.

During the survey team's visit to Vicos, an attempt was made to determine measurements of cash income as well as gross product in Vicos. The measurements arrived at were by no means precise and were developed in part on the basis of estimates by the Cornell-Peru staff and in part on specific data.

While the measurements arrived at may be seriously in error, a useful purpose will be served in recording them at least as bench marks for later refinement and correction. Once such measurements are refined, they will be helpful in gaging the progress or lack of progress in Indian communities, both at Vicos and elsewhere.

To arrive at economic measurements, an attempt was first made to determine the cash income of the Vicosino, as the inhabitants are called. Cash income is, of course, only a small part of the total value of goods and services produced by a Vicosino family. It is, however, largely from this cash income that the remarkable savings of the community have been derived. As mentioned, these savings totalled $19,230 for land purchases and $5,769 toward the purchase of a truck as of May, 1962. In the last two years, the community has saved about $6,345 per year. These cash savings come from the sale of cattle, eggs, potatoes, cheese, and other products as shown in Table I.

Table II (derived from data in Table I) shows the average cash income per farm household as being the equivalent of about $46, or $11 per capita on the assumption that farm families average 4.4 persons. The non-farm households in Vicos consist of teachers, teaching assistants, the employees of the Cornell-Peru Project, retail store keepers, and a potter. Households in this latter group collectively fare much

better in terms of cash income than the farm households because they usually are paid in cash, whereas the farmer still deals to some extent, outside the money economy, mortgaging and bartering his crops to obtain needed fertilizers, pesticides, seeds, new livestock, etc. On a per capita cash income basis, the non-farm group are likewise much better off because many of the "households" consist actually of unmarried persons with no dependents, such as teachers or teaching assistants. The economic difference between the farm and non-farm groups is narrower, however, when viewed in terms of the value of products and services which they supply. (This is brought out later in Table IV.)

Table II

Estimated Cash Income Per Household in Vicos -- 1962
(Unit U.S. $)

Cash Income		Estimated No. of Households (No. of Individuals)	Cash Income Per Household (per capita)
Farm Households,	$21,470[a]	466 (2050)	$46 ($11)
Non-farm[b] Households,	$9,600	22[b] (30)	$436 ($320)
TOTAL	$31,070	488 (2080)	$64 ($16)

[a] Includes muleteers and day laborers' income.

[b] Includes: 6 storekeepers, 4 Cornell-Peru local employees, 7 teachers, 4 teaching assistants, 1 potter. Excludes muleteers.

Table III shows the estimated gross product for Vicos in 1962. The total gross product for Vicos is estimated as being the equivalent $511,088 (13,288,840 soles) of $246 per capita. Of this gross product, crops account for the preponderant amount, 94.5 per cent, services come next with only 2.1 per cent, followed by livestock amounting to 2.0 per cent, and other products (eggs, cheese, and ice), 1.4 per cent. Some assumptions made in developing Table III follow. The calculation assumes that one third of the land is allowed to lie fallow each year. This assumption is valid for the unirrigated land, but may be only partially true for irrigated land.

The value of farm crops was based on a rule-of-thumb method of estimating the value per hectare in Vicos rather than on prices received by farmers for specific crops. Since the value of potatoes sold is included as a part of the per hectare farm product, the amount for potato sales in Table I is not repeated in Part A of Table III.

In the case of livestock and other products, Parts B and C in Table III, the sales proceeds received per year (as shown in Table I) are assumed to be the annual value added to herds of cattle, sheep, and holdings of chickens and guinea pigs. Similarly, the sales proceeds received per year of other products, eggs, cheese, and ice, are assumed to be the amount produced. These latter two assumptions probably reduce the gross product figure below what it actually is because Vicosinos eat some of their own livestock, cheese, and eggs. However, the extent of error cannot be determined on the basis of data collected, and hopefully an adjustment can be made later when a more careful study is possible.

Table IV indicates that the per capita gross product for the entire Vicos community is $246, as compared with the national figure cited above of $178. The two figures may not be comparable, and the basis for computing the latter is not known. It would hardly seem possible that the Vicos figure could be so much higher than the national figure since the latter includes the higher gross product in urban areas. Possibly, however, the urban area product for Peru would be more than offset on an average basis by the very low level of product prevailing in other parts of the country, especially southern Peru. Irrespective of statistical measures, it is known that the Vicosino is better off than his non-urban neighbors, produces higher yields, raises more livestock, and is saving more money.

Table III

Estimated Gross Product of Village of Vicos,
Ancash Department, Peru -- 1962

		Soles	$
A. Crops Raised Annually			
a) Crops from 132 irrigated hectares (132-$\frac{1}{3}$ times 132 fallow land times 15,000 soles = 87 hectares times 15,000)		1,305,000	$50,190
b) Crops from 1422 unirrigated hectares (1422 - $\frac{1}{3}$ times 1422 fallow land times 12,000 soles = 939 hectares times 12,000 soles)		11,256,000	432,906
Sub-total	12,561,000		$483,096
B. Livestock Raised Annually			
a) beef cattle		200,000	7,692
b) sheep		30,000	1,154
c) chickens		15,000	577
d) guinea pigs		10,000	385
Sub-total	255,000		9,808
C. Other Products Sold			
a) eggs		141,000	5,420
b) cheese		43,200	1,662
c) ice		6,240	240
Sub-total	190,440		7,322
D. Services			
a) Muleteer services		2,800	108
b) Day labor		30,000	1,154
c) Store keepers (6), Cornell-Peru Project local employees (4), Teachers (7), teaching assts. (4), Potter (1)		249,600	9,600
Sub-total	282,400		$10,862
E. TOTAL		13,288,840	$511,088

Despite this local superiority, it is doubtful that Vicos crop yields would compare favorably with those in other countries. The survey group gained the impression that farm yields in the Andes were generally poor due possibly to such factors as cold weather, erosion, low fertilizer applications, and rocky soil. International comparisons are outside the scope of this report, but within the writer's own experience, the Vicos yields look worse than yields in Colombian highlands and worse than yields in the upland (i. e., non-irrigated) farms of the Ryuku Islands. In a recent study, the writer found that upland yields in the Ryuku Islands resulted in a gross product per hectare of $707 in Ishigaki Island, and $500 to $700 in Irimore Island, as compared with the estimated per hectare product in Vicos of $468 (the gross product per farm household of $1076 divided by the average Vicos land holding of 2. 3 hectares).

Table IV

Estimated Gross Product Per Household and Per Capita in Vicos -- 1962

	Est. Gross Product	Est. No. of Households (individuals)	Gross Product per Household (per capita)
Farm Households	$501, 488	466 (2050)	$1076 (245)
Non-farm Households	9, 600[a]	22[a] (30)	436[a] (320)
TOTAL	$511, 088	488 (2080)	$1050 (246)

[a] Same figure as in Table I, Item B(3), salaries or earnings of 22 non-farm residents.

Table V attempts to estimate the disposition of the annual gross product of a farm household in Vicos. The calculation is a crude one. Particularly inadequate is the absence of data on Item e regarding household expenses and expenses arising from livestock holdings. Except for Item e, the other figures were reported to the survey team as being typical of Vicos.

Table V

Disposition of Farm Household Annual Gross Product

	Soles		$
Total Gross Product[a]	27,976	(100%)	1076
a) Potato or corn seed	3,600	(13%)	139
b) Fertilizer	1,800	(6%)	69
c) Farm tools and tool maintenance	50	(-)	2
d) Pesticides	250	(1%)	10
e) Household expenses, wool, food, livestock, education fees, interest, fiestas, funerals, church[b]	18,142	(65%)	697
f) Community savings	364	(1%)	14[c]
g) Discretionary income	3,770	(14%)	145[d]

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a/ Assumes 445 farmers, 1026 non-fallow hectares, 2.3 hectares average per farm household.

b/ No breakdown available.

c/ Community has saved $6345 (165,000 soles) per year over last two years. This figure divided by 466 farmers is $14.

d/ Highest figure reported was $250; low was $40; $145 is average.

The Table does show, however, that the average Vicos farmer has advanced beyond the subsistence stage and does enjoy some discretionary income. This is also indicated by the capital formation which has taken place as a matter of record and has made it possible for the community to purchase their land and buy a truck. Although wide variations in product exist between farms because of different land holdings, it was reported by staff of the Cornell-Peru Project that some farm families enjoyed a surplus in goods or cash of as much as $250 annually. On the average, the surplus amounts to 14 per cent of the estimated gross product of a farm household.

If a thorough study of economic bench marks were to be made for Vicos or similar communities, it might be useful to supplement conventional measures of income and product value by certain other indicators of economic conditions. For example, many of the huts inhabited by Vicosinos are made of mud blocks. A few miles away in the semi-urban outskirts of towns such as Huaras where standards of living are higher than in Vicos, most of the adobe houses are surfaced with white plaster. This is viewed by the local citizens as a status symbol and a mark of progress. Thus growth in the number of plastered houses might be an indicator to gage future economic gains. Similarly, the number of floored houses, square footage of residential housing, bus and truck departures and arrivals, rates of growth in savings, per capita holdings of cattle, sheep, goats, guinea pigs, might be helpful bench marks to gage rates of economic progress in Indian communities. Once certain measures were standardized, norms could also be determined to measure the economic status of a given community.

ELECTRIFICATION OF VICOS PROJECT

The Cornell-Peru Project at Vicos is headquartered at the site of the old hacienda. Closely integrated in a physical sense are the quarters for the Project administration staff, the guest house, church, school, teachers' quarters, and the community center. The Project owns and operates a gasoline engine-generator to supply electricity for illumination purposes to this complex.

In this instance, the installation of electricity was for the direct benefit of the Project, although the Vicos community has felt its impact in several ways, particularly through:

Community center illumination

Community square illumination

Weekly educational movies

2 Vicos houses adjacent to Project headquarters are electrified, each with a 25-watt bulb.

Power Plant

The power plant consists of a 3.5 kva, 1800 rpm Onan gasoline engine-generator. Its output is single-phase, 60 cycle, 230 volts. It was installed in 1954. The purchase price of the equipment at that time was 16,000 soles. It is estimated that its replacement cost today would be 36,000 soles. This cost does not include the small brick building and distribution system which were constructed by the Vicosinos.

Maintenance

Since the installation of the plant, there has been need for occasional minor maintenance--particularly in the case of fouled spark plugs and adjustments to the engine controls due to overloaded operation. A mechanic from the town of Hauraz (35 km away) is on call at 250 soles per visit for this maintenance.

There have been two major overhauls, for which the engine-generator equipment must be shipped either to Lima or Tolima for rework. The cost of major overhauls approximates 3,000 to 4,000 soles.

Normally, the plant is operated four hours each night, or about 1,360 hours per year, allowing 25 days per year for outages. Assuming three major overhauls in eight years, this indicates an overhaul every 3,600 hours. This is typical of gasoline engine maintenance practice.

For purposes of estimating power plant maintenance costs, the following are assumed:

Major overhaul occurs each 3,600 hours of running time, or each 2.67 years.

Cost of overhaul is 4,000 soles, or 1,500 soles on an annual basis.

Two minor maintenance visits are required each year at 250 soles each.

Connected Load

The total connected load was estimated as including:

2 Vicos family houses at 25 watts each	50 w
Community center	400 w
Community square illumination	60 w
Project and school buildings	2,600 w
Radios and minor appliances	Negl.
Movie projector	700 w
Total connected load	3,110 w

In all, a total of 70 bulbs is installed of 25-watt to 100-watt capacity. The distribution wiring is of small gage copper wire BWG #14) and several long runs are made, the resistance of which must add considerably to the load. For estimating purposes, assume this loss to approximate 390 watts. The total connected load would then be 3,500 watts, which explains the overload situation they are experiencing.

Load Use

The power plant is operated four hours each night, from 6:00 P.M. to 10:00 P.M. It is assumed that 25 days will experience outages for maintenance on other situations. The load use is estimated below on the basis of observation and statements made by the Project staff:

Square illumination and two houses:--

$$\frac{4 \text{ hours} \times 340 \text{ days} \times 110 \text{ watts}}{1,000} = 150 \text{ kw-hrs/yr.}$$

Community center - assume a use factor of 75 per cent:--

$$\frac{4 \text{ hours} \times 340 \text{ days} \times 0.75 \times 400 \text{ watts}}{1,000} = 408 \text{ kw-hrs/yr.}$$

Movie projector - operated one hour, two nights per week:--

$$\frac{1 \text{ hour} \times 2 \text{ nights} \times 52 \text{ weeks} \times 700 \text{ watts}}{1,000} = 73 \text{ kw-hrs/yr.}$$

Project buildings - assume a use factor of 50 per cent:--

$$\frac{4 \text{ hours} \times 340 \text{ days} \times 0.50 \times 2,600 \text{ watts}}{1,000} = 1,770 \text{ kw/hrs/yr.}$$

Distribution line loss - assuming 50 per cent use factor:--

$$\frac{4 \text{ hours} \times 340 \text{ days} \times 0.50 \times 390 \text{ watts}}{1,000} = 265 \text{ kw-hrs/yr.}$$

Total power used = 2,666 kw-hrs/yr.

Useful power delivered (less line losses) = 2,401 kw-hrs/yr.

Load Factor

The resulting power plant load factor, assuming a lagging power factor of 0.9, is 8.7 per cent.

Yearly Costs

Fixed costs are determined on the basis of an interest rate of 14 per cent per year (present rate in Peruvian banks) and an equipment life of ten years. Further, the fixed costs are based on replacement cost of the equipment (36,000 soles).

Capitalization (at 14 per cent)	=	5,050 soles
Depreciation (10 years)	=	3,600 soles
Fixed Costs		8,650 soles per year

Operating costs include fuel and maintenance. The power plant operator is a member of the Project staff and receives no wage for this specific activity.

Two gallons of gasoline are used for each four hours of operation--or 680 gallons per year. The fuel is delivered via truck in 55-gallon drums from Hauraz, 35 km away at a price of five soles per gallon, plus one sole per gallon for transportation.

Cost of lubricating oil amounts to 75 soles per month.

Fuel costs	4,080 soles per year
Lube oil	900 " " "
Pro-rated major overhauls	1,500 " " "
Minor overhauls	500 " " "
Total Variable Costs	6,980 soles per year
Total Yearly Costs	17,630 soles per year

Unit Cost of Electricity

The effective cost of generating electricity is 7.35 soles per kw-hr., or 27.4 cents per kw-hr. (U.S.A.).

SITE REPORT FOR CUYO CHICO, CUZCO DEPARTMENT, PERU

Site Name and Location	Cuyo Chico Village, Cuzco Department, Peru
Population:	1873
Date Investigated	May 17, 1962
Field Investigation Team	Oscar Aragon, Agronomist and Ing. Mauro Villavicencio, Director of Cuzco Office of Servicio de Investigaciones y Promocion Agraria (SIPA) Frank Turner, Stanford Research Institute (NOTE: Turner did not visit this site because of meetings with CRIF and SIPA during the one working day in Cuzco. Other investigators did visit the site and presented a written report and questionnaire reply.)

Characteristics of Cuyo Chico

The village of Cuyo Chico is located about 22 miles (35 kilometers) from the city of Cuzco, Department of Cuzco, in Southern Peru. The village is at an altitude of 10,500 feet and temperatures fall at night to near freezing at times and rise to about 60 degrees during the day.

The 1873 inhabitants consist of 289 households indicating an average per household of 6.5 persons. The number of births is about 75 each year and the number of deaths is about 38. The village population has grown over the last ten years from 1503 persons in 1952 to the present figure of 1873, an annual average growth of 2.2 percent. Some emigration has taken place because of poor harvests, the lack of employment opportunities, and separation from family members who have previously left the village.

Landholdings per family average about 1/2 hectare and virtually all land cultivated is owned by the cultivator himself. There is no completely level farm land. The hillside plots yield sub-standard crops (for Peru) of corn, potatoes, a kind of lima bean, wheat and barley. Livestock raised includes pigs, guinea pigs, a few vicuna and beef cattle. The average family cash incomes per year is probably not more than 1040 to 1300 soles, or U.S. $40 to $50. The village is regarded as one of the poorest in the Cuzco area.

Inhabitants of Cuyo Chico earn cash income from the sale of barley to a brewery in Cuzco and from the sale of rough timber from a community-owned stand of about 2000 pine and 9000 eucalyptus trees.

Some cash income is derived from the sale of tiles baked in Cuyo Chico, and from the sale of plaster considered to be of exceptional quality and hence in demand as a finishing layer for adobe walls.

A rough, narrow, hair-pin curve dirt road connects Cuyo Chico with the nearby town of Pisac, which in turn is connected by road with Cuzco.

The level of literacy is quite high, about 80 percent of all inhabitants being able to read. This is attributed to the presence of three schools in Cuyo Chico accommodating 300 pupils from the neighboring communities of Mask'a and Quotobamba.

Cooperatives in Cuyo Chico

The community has distinguished itself for cooperative projects which have included: (a) construction of a canal to make water more readily accessible to all parts of the village, (b) continuous construction and repair of houses under the ayuda mutual (mutual aid) procedure followed in Cuyo Chico, (c) expansion and care of 11,000 trees grown for timber purposes, (d) the organization of two buying cooperatives and one producing and marketing cooperative.

Encouraging the above type of activity has been the University of Cuzco. This national university operates programs of community improvement and conducts anthropological and economic research at Cuyo Chico. This work is carried out under an agreement, dated March 17, 1959, with the Ministry of Labor and Indian Affairs in Lima. The Cuyo Chico program is quite similar to the Cornell-Peru Project at Vicos in central Peru, also under the sponsorship of the Ministry of Labor and Indian Affairs.

Agricultural extension work at Cuyo Chico is undertaken by the Servicio de Investigaciones y Promocion Agraria (SIPA) which works closely with the US AID Mission in Lima.

Possibilities for Small Scale Industry

Site investigators from SIPA stated that the enterprising nature of the Cuyo Chico community provided a good foundation for small scale industry. The inhabitants already make tiles, plaster for adobe walls, and cut wood manually from the community-owned stand of timber.

The SIPA representatives felt that additional industries which might be established in Cuyo Chico were: a saw mill, woodworking shop, sewing machines for the fabrication of work clothes from Cuzco made textiles materials, a corn mill, a power-driven batching plant for plaster, and eventually the manufacture of leather goods. None of these industries could be justified without prior study of markets, prices, raw material availability, and competition in the

area. The inhabitants would "enthusiastically welcome" electrification to provide a base for industry according to SIPA representatives.

Means for Electrifying Cuyo Chico

The village of Cuyo Chico is located only 13 miles from a 138 kv transmission line running from the Machupicchu Hydroelectric Plant (see map at end of this Appendix). However the cost of transformers and transmission lines would be too great to use grid power from Machupicchu according to officers of the Corporacion de Reconstruccion y Fomento del Cuzco (hereafter CRIF). Also there is idle manufacturing capacity in Cuzco waiting for the increased allocation of power soon to be expected from the Machupicchu project with an eventual capacity of 120,000 kw. Any diversion of power to rural communities is out of the question, according to local authorities in Cuzco.

The power distribution map for the Machupicchu hydroelectric project shows a series of circles drawn around various load centers. These circles, about 10 miles in diameter, show the theoretical limits of areas to be served by sub-stations at the load centers. According to CRIF, it is unlikely that transmission lines will be extended even as far as the circles indicate and definitely not beyond the circles to Cuyo Chico and other communities similarly situated.

The principal hope for bringing electricity to Cuyo Chico lies in local hydroelectric generation. This appears especially promising for Cuyo Chico because of the head and volume of water flowing along the outskirts of the village. The flow volume, according to SIPA engineers, is as follows:

Stream Flow Estimates for Cuyo Chico

February through April	90 liters per second
May through November	50 liters per second
Minimum flow	45 liters per second

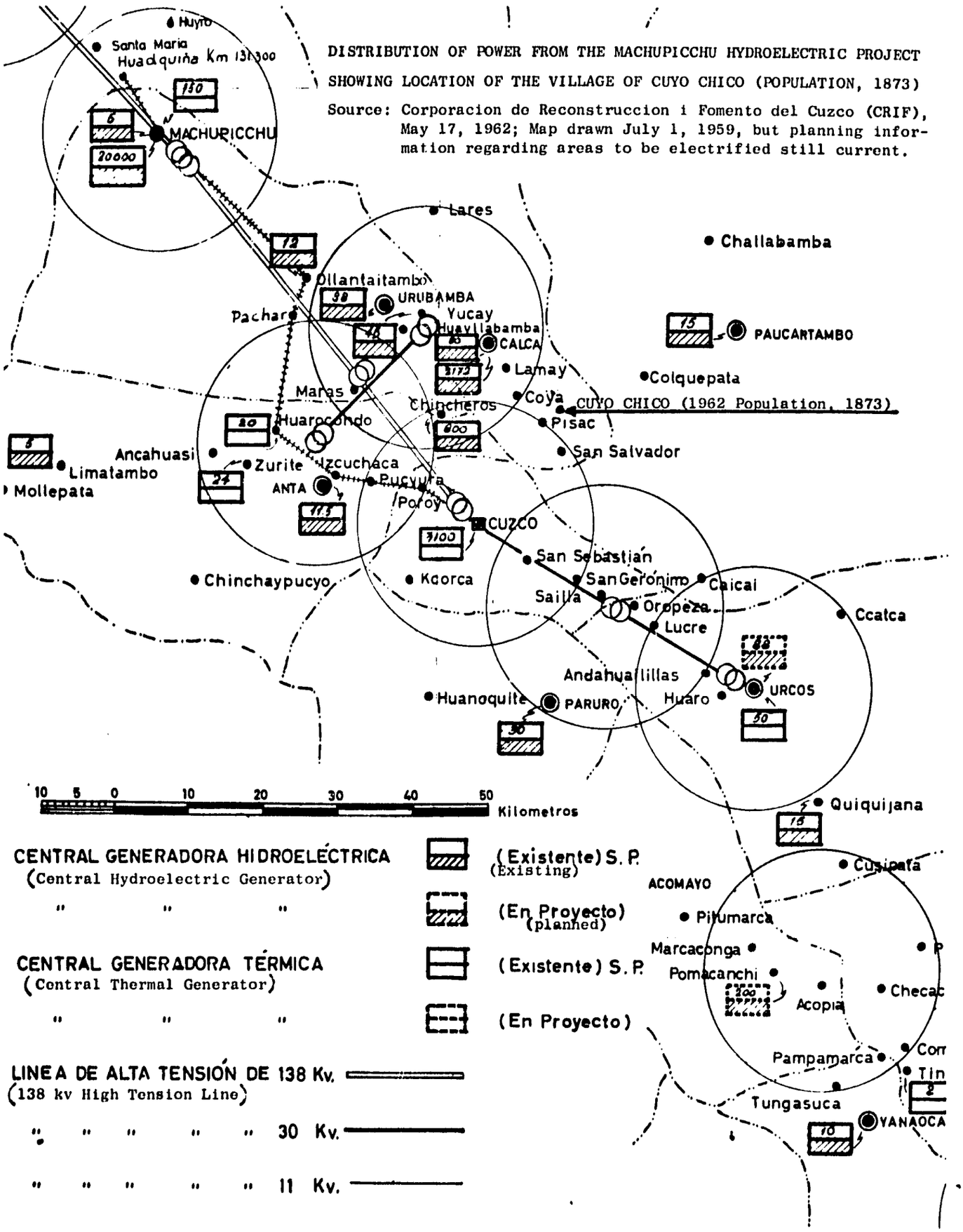
The stream at Cuyo Chico falls off sharply near the village, dropping 300 meters over a horizontal distance of only 156 meters. This suggests that a hydroelectric plant of more than 100 kw capacity might be installed.

Conclusion

The village of Cuyo Chico offers an excellent opportunity to conduct a pilot project to demonstrate the productive application of power to raise rural living standards using an integrated systems approach to the development problem.

DISTRIBUTION OF POWER FROM THE MACHUPICCHU HYDROELECTRIC PROJECT SHOWING LOCATION OF THE VILLAGE OF CUYO CHICO (POPULATION, 1873)

Source: Corporacion de Reconstruccion i Fomento del Cuzco (CRIF), May 17, 1962; Map drawn July 1, 1959, but planning information regarding areas to be electrified still current.



APPENDIX D

OBSERVATIONS ON RURAL ELECTRIFICATION IN PERU

National Capacity and Growth Trends

Installed capacity in Peru has risen at an average annual rate of 12.8 percent from 1952 to 1960. Hydro generating capacity has risen at about 12.3 percent from 1952 to 1958, but is likely to move ahead much more rapidly with the completion of the Mantaro Project to serve the Lima area and the Machupicchu project to serve Cuzco in southern Peru. The growth of installed capacity in recent years and the future outlook is indicated below.

GROWTH OF INSTALLED CAPACITY

Calendar Year	Total Installed Public Service plus Privately Owned and Used Capacity	Hydro Capacity (MW)	Percent of Total	Thermal and Diesel (MW)	Percent of Total
1952	321	197	61	124	39
1953	332	221	67	111	33
1954	391	218	56	173	44
1955	391 (sic)	218	56	173	44
1956	430	231	54	199	46
1957	648	382	59	266	41
1958	660	395	60	265	40
1959	718	n.a.		n.a.	
1960	840	n.a.		n.a.	
1964	1,600	n.a.		n.a.	

Source: 1952 - 1960 data from United Nationa Statistical Yearbook and from Ministerio de Fomento y Obras Publicas; 1964 figure from latter source.

About half of the installed capacity shown above is privately owned and operated for the benefit of mining properties and manufacturing concerns. The remaining capacity is principally for the benefit of urban areas where power shortages already exist because of rising residential and industrial

requirements.

The rural communities inhabited by some 6.0 million Indians are unlikely to benefit for many years from the above capacity. This is because transmission costs to outlying areas are too great and because the urban areas as the major load centers command first priority in current planning. This suggests local generation based on hydropower offers the most promise for Peruvian rural electrification.

To judge the magnitude of Peru's rural electrification problem, the following population breakdown is helpful.

Population Group	Description of Group	Number of Persons
A	Population of the metropolitan area of Lima-Callao	2.0 million
B	Population of other urban centers such as Sullana, Piura, Chiclayo, Trujillo, Arequipa, Cuzco, Huancayo Ica, Ayacucho (This group plus Group A is composed largely of criollo inhabitants near the coast becoming predominantly mestizo toward the interior. This group plus Group A totals 3.0 million persons and accounts for the bulk of Peru's imports and exports.	1.0 million
C	Composed of the population of semi-modernized smaller towns or pueblos such as Huaras, Huanuco, Carhuas. This group is part of Peru's market economy but not strongly oriented toward world markets. Persons in the group are mestizo.	3.0 million
D	Composed of population of "free Indian" communities, not engaged in farming property of absentee owners. Usually cultivate own property. Of persons in this group, 1.3 million live in recognized communities numbering 1600. The remaining 1.7 million persons, all Indian, live in unrecognized communities or clan-type village groupings	3.0 million
E	Share cropping Indians living on hacienda plus jungle Indians.	3.0 million
	TOTAL POPULATION	12.0 million

Groups A through C are being supplied with power either from large public service systems or from local generation. The 6.0 million persons in Groups D and E are likely to be last groups to benefit from rural electrification. Within Group D are about 1.3 million persons residing in some 1600 recognized village communities, indicating an average of 814 persons per community. If a program of rural electrification were to be initiated, these 1600 villages would probably be given first consideration.

During field visits to these small villages, the Survey Group found that there was invariably keen interest on the part of the local inhabitants in having electrification. In several villages, the junta had accumulated capital and were prepared to pay for electrification. The principal impediment in some cases was a lack of engineering knowledge and in another case, the village Vicos, the purchase of land and a truck were considered more important. In Vicos, the 2080 inhabitants had saved the equivalent of $24,614 (640,000 soles) toward the land and truck purchases. Because Vicos is an unusal community having benefitted from the guidance of the Cornell-Peru Project, the capital accumulation may not be typical of other villages.

At least an eagerness to have power exists in the Peruvian villages, and thus consideration of the organizational framework to meet such eagerness might be a first step in formulating a program of rural electrification. A rural electrification authority, similar to Electroaguas in Bogota, with regional sub-divisions might be needed to perform the following functions: (a) Assist the Indian communities in solving engineering problems associated with the introduction of power, (b) arrange for the procurement of small generators where financial and technical requirements could be met, (c) provide rural communities with information on the costs and feasibility of power and thereby stimulate savings for that purpose, (d) if capital were available for lending, power loans could be extended with appropriate safeguards, (e) once generators were installed, a load building program based largely on small industry would be initiated to reduce power costs,

There are many variables which enter into an estimate of what an electrification program might cost. With the assumptions stated below, a rough cost magnitude might be arrived at as follows. An initial effort would be made to introduce electrification in the 1600 communities cited above as being inhabited by 1.3 million persons in Group D. Other communities in Group E might also be considered especially where hydro power potential and a physical concentration of houses in a compact area were found to be characteristic. (In some Andean communities, the homes of Indian farmers are dispersed widely along a valley or slope so that transmission lines would have to be extended several miles; because of the transmission costs in these rancheria communities, they should be considered at a later stage.)

Possibly some 2000 communities inhabited by persons in Groups D and E might be considered for selection in the above manner. Of this 2000, those having a hydro power potential might be selected. Without a series of surveys, it would be impossible to say how many communities would have the necessary year-round stream flow to support hydro stations. Assuming that 30 percent of the communities could support hydro power, 600 candidate villages would remain. Assuming these villages would need 150 watts of installed capacity per household of five persons, some 15,000 kw of installed capacity would be needed(600 villages x 814 persons each = 488,400 divided by 5 persons per household = 97,680 households x 150 watts each of connected load = 14,652 kw of installed capacity.) If such capacity were to cost from $200 to $300 per kw including transmission and distribution, the total capital required would be in a range of 3 to 4.5 million dollars. Such a program would cover something less than 500,000 persons or about 8 percent of the population in Groups D and E above.

If it were assumed that residential subscribers were able to buy hydro power at 2¢ per kwh and consumed 137 kwh per year (5 hours use per day x 50 percent utilization x 365 days x 150 watts), then costs per subscriber annually would be $2.74. This amount annually might be within the financial reach of Indians residing in rural communities.

In rural communities where hydro plants were not feasible, diesel electrification would pose greater difficulties from the standpoint of the subscribers' ability to pay. Given Peru's fuel costs (4.80 soles per U.S. gallon at the bulk plant in Cuzco and 3.92 soles at the bulk plant in Cerro de Pasco), diesel electrification would be expensive. The Cuzco and Cerro de Pasco bulk plant costs converted at a rate of 26 soles per U.S. dollar would mean diesel fuel costs of U.S. 18.5¢ and 15.1¢ respectively. Prices for diesel oil in remote areas would be 30 to 50 percent higher depending on the distances from bulk plants. This suggests that a diesel plant in a remote community would possibly have to pay as much as 29¢ per gallon. Judging by experience in Colombia, the cost of diesel power per kwh from small generators in Peru might range as high as 8 or 9¢. In Colombia, diesel plants generally pay about 10¢ per gallon and costs of power per kwh ranged from 4 to 7¢ in the cases sampled where load factors were 21 percent or less. Presumably load factors in rural Peruvian communities would also be in the range of 20 percent or less. Assuming that the Peruvian rural subscriber had to pay 9¢ per kwh for diesel power and further assuming that his consumption would be 137 kwh per year, costs per year to the subscriber would be $12.33, a major portion of the Indian's yearly income. In Vicos, the Survey Group estimated the Indian farmer received something like $45 per year. Rather than pay as much as $12.33, consumption would probably fall as it does in Colombian communities, leaving the users with very little consumption.

While certainly not an ideal solution, small hydrogenerators commend themselves in Peru because of the comparatively abundant water near glaciated areas and the low costs.

APPENDIX E

CHILE FIELD SURVEY REPORT

FIELD DATA FROM SELECTED RURAL COMMUNITIES IN CHILE

During the period May 19-25, the field survey team visited Santiago and selected rural communities in Chile. This appendix contains the village data gathered in the course of this study. Additional information on the gathering of these data is included in the accompanying project report: Field Survey Trip Logs; the Summary Project Report presents the over-all conclusions and recommendations of the project.

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SITE: CHOLCHOL

PROGRAM FOR ADVANCED TECHNICAL SUPPORT
FOR VILLAGE DEVELOPMENT

CHECK LIST OF FIELD INFORMATION

Version No. 3 - October 17, 1962

SURVEY DATE: May 23, 1962

FIELD TEAM MEMBERS: (incl. association)
T. O. Paine - G. E. Co.
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INFORMANTS: (incl. titles, etc.)
Father Ward Munday - Cholchol-Maryknoll Missionary
Father O'Brien - Regional Maryknoll Missionary
Jim Fitzgerald - PCV - Chile - Cholchol
Jim Dungan - PCV - Chile - Cholchol
(See attachment)

I. VITAL STATISTICS

Village: Cholchol Province: Temuco
Department: Cautin Country: Chile
Type of Government: Junta
Population: Urban: 1200 Rural: ~ 8800 Total: ~10000
Urban families: ~ 180
Birth rate: 600 per year Death rate: ~150 per year
Population growth rate: Yes - due to birth rate
Net emigration: Out of village Why: Poverty - big city attractions
Literacy level: 70% urban; 20% rural

II. ENVIRONMENTAL CHARACTERISTICS

Name and distance of nearest town: Nueva Imperial - 25 kms.
Name and distance of nearest market: Temuco - 27 kms.
Geographical classification: Flat Valley Plains
Type of access road: Single lane gravel roads through village
Other access routes: Occasionally impassable in rainy season
Trails - river - field for landing planes(seldom)
Sewage facilities: Latrines
Drinking water sources: Half urban population have wells in summer - additional water obtained from river.
Stream and river sources: 1 continuous flow river (Cholchol) several streams - There is 8 ft. wide waterfall, 5 ft. deep, plus other falls some distance away.
Fuel cost and availability:

Regular gasoline	86.6 pesos/ltr.(Temuco)
Kerosene	70 pesos/ltr.(Temuco) 100 pesos/ltr.(Cholchol)
Diesel oil	80 pesos/ltr.(Temuco)+ 5 pesos/ltr. freight
Charcoal	imported from mountains

Available indigenous fuels: Wood - getting scarce- cooking, heating.

Wind and its utilization: afternoon winds - very strong in summer, possibly used for water pumping.

Sunshine and its utilization: Heavy overcast March to August - Balance is sunny

Availability of medical skills:

Resident doctors	1
Itinerant doctors	----
Dentists	----
Nurses	1
Midwifes	1
Pharmacists	0
Herbalists	1

Clinic: Prefab House - 3 rooms - waiting room, office, pharmacy dark room, 14 to 16 beds. Has some electrical equipment, but no effective electricity.

Schools: 6 Grades, primary and 3 grades high school (Catholic) 300 students.
Ditto for Anglicans - about 300 students
The above have own electric plants.
The 4 grade public school - 60 students, is not electrified

Community Center: None - Parish hall used for public functions

Cooperatives: None

III. ECONOMIC CHARACTERISTICS

Work force pattern - percent of total population: _____

Section	Percent	Avg. Income
Agriculture	~100%	200 Eo./year/family
Industries	Very few	
Services	Very few	
Mining		
Fishing		
Others		
Unemployed		
Non productive		
% Self employed	Majority	% Employed Few

Income fluctuation: Seasonal - 1 crop per year

Typical Debt: ---- Why: ----

Typical Savings: ---- Form: ----

Subsistence level: Bare subsistence

Types of farm crops: Wheat, oats, few garden crops.
(Indicate major cash crops)

Types of farm animals raised: Cattle - sold on hoof at conception
(include numbers) Sheep
Poultry

Typical size of farm plots: 5 - 10 hectares

% Farmers owning land None % Renting None
(This is an Indian reservation on gov't. land. Indians are permitted to farm plots without rentals)

Latifundia ---- Minifundia ----

Composting practiced ----

Types of industries: ----
(Including size)

Handicrafts:

Types of services: Private electric power company

Available Tech. Skills: 1- auto repair - 5 to 10 auto operators
5 to 10 administrative

Cooperative community works: -----

IV. PRESENT ELECTRIFICATION

Year of installation: 1921
Type of electric power: Diesel engine generator
Distance to and cost of electric grid power: 25 km. (tariff unknown)
Nearest town with grid accessibility: Nueva Imperial

Power plant rating: 15 Kw.
Phases: _____ Volts: 220 V. - D.C. Freq.: _____

Power plant ownership: Private entrepreneur
operator: Hired mechanic

Use of electricity and connected loads:
Household illumination 300 - 40W. bulbs - 12 Kw.
Radios Yes
Street lighting Yes, but presently needs repair
Industries None

Irrigation None

Others None

Operational time: 3 hours per day in evening

Type rate, price and source of fuel: Diesel fuel @ 85 pesos/litre
18 litres per 3 hours operation

Rate, price and source of lube oil: ----

Fuel transport: By truck, 27 Kms. from Temuco
Power plant maintenance: Hired mechanic

Availability of spare parts: In Temuco

Maintenance problems: Worn engine - poor fuel consumption - many outages
Plant was inoperative during visit.
Are power plant records kept? No How? ----

Installation cost of power plant: ----

Operation costs: 200 E.o./year - based on average wage

Maintenance costs: Not obtainable

* Fuel and oil costs: 520 Eo./year not including oil.

Tariff schedules: 600 pesos per bulb per month
58 Eo./month - from municipal subsidy

Yearly revenue: 2856 Eo./year

* Based on 3 hrs./day - 340 days/year.

V. PROBLEM, NEEDS, OPPORTUNITIES

What are major problems: Poverty
Adequate food

What are felt needs: Irrigation for garden plots - later for crops
Reliable and adequate electrification
Flour mill
Weaving
Adult education - Shoe making
Ceramics - Food preservation

What are obvious opportunities: Irrigation would increase crop yield - expand cattle raising - perhaps launch into dairy operation and butchering. Possibility of tourist activities - fishing

Does village desire electrification: Yes

VI. REMARKS

- The present electric system is obsolete and inoperable most of the time. Villages still pay tariffs and at a high percentage of yearly income (~7%). For the revenue and subsidy being paid, this village can well afford new and adequate equipment. The missionaries and city council members are enthusiastic and want to get started on significant improvements. Cholchol is on the Indian reservation and many of its neighboring villages are being infiltrated by so-called "Communist" elements.

Village Council Members Met in Cholchol

Sta Nimia Rivas Núñez

Jose Amador Matamala Millapán

Marcelo Sandoval Mella

Juan Alberto Reina Sandoval

Ernesto Troncoso Sánchez - Power Plant Owner

Diego Narváez Sepúlveda - Technician

Ramón Castillo del Pino

Nelson Trombert de la Harpe

Manuel Quesada Hermández

Ezequiel Neiro Arriagada

ELECTRIFICATION IN CHOLCHOL

Cholchol is presently electrified by a 15 KW diesel engine generator installed in 1921 by a private individual, Sr. Diego Narvaez Sepulveda. This equipment was installed with a distribution system for household and street lighting and as a source of income for its owner. Sr. Ernesto Troncoso Sanchez is the full-time technico hired to maintain and operate the equipment. No information was available relating to original equipment and installation costs.

Present Situation

The equipment is now forty years old and is obviously worn out. The plant has been inoperative for several months awaiting replacement parts from the European manufacturer. Parts are no longer carried locally. It was stated this outage would continue for many more months. The street lighting circuit is also inoperative and will require replacement of light fixtures and connections that have failed. When the engine is operating, the fuel rate is excessive because of worn engine cylinders.

Apparently, the village has experienced this quality of service for the last five to ten years. They implied that a major repair involving an extended delay for parts was a common occurrence.

Plant Rating

The equipment is a diesel engine generator of Swiss make. It is rated at 15 KW - 220 Volts - D. C.

Connected Load and Power Use

It was reported that 300 forty-watt bulbs are installed in a major portion of the village households. Outlets were also available for radios. A street lighting system is also installed, but currently requires considerable repair to put it back in operating condition.

Household connections	- 12 KW
Street lighting	- 2 KW (estimated)
Total connected load	- 14 KW

The plant is operated three hours each day in the evening. It can be assumed that normal plant operation would permit 340 electrified days per year, the remaining 25 days set aside for equipment maintenance. In addition, it can be assumed that a use factor of 75% for household illumination and 100% for street lighting prevails during the three-hour daily operating period.

Total power generated under these assumptions is 11,210 KW Hrs./yr.

The resulting load factor is 8.54%.

Under actual conditions, however, the equipment is reportedly inoperative more than half this time, and the street lighting circuits are wholly inoperative. Under these circumstances, the power generated becomes 4590 KW Hrs./yr. with a load factor of 3.49%.

Yearly Revenue

The tariff charged consumers is on a per bulb basis, being 600 pesos per 40-watt bulb per month, regardless of availability of electricity. In addition, the plant owner receives a municipal subsidy of 58,000 pesos per month.

Tariffs on 300 bulbs	- 2160 Eo/year
Subsidy	- 696 Eo/year
Total revenue	- 2856 Eo/year

Operating Costs

Fuel rate is 18 liters of diesel fuel for 3-hour operation.

Fuel costs are 85 pesos/liter.

Lube oil costs are assumed to be one-fifth of fuel costs.

	Normal Operation	Actual Operation
Fuel Costs	520 Eo/year	260 Eo/year
Lube oil costs	104	52
*Technician wages	200	200
Total	824 Eo/year	512 Eo/year
Net balance (revenue less above expense) available for capitalization, major repairs, profit, etc.	2032 Eo/year	2344 Eo/year

*Assumed equivalent to reported average income of village.

Unit Cost of Electricity

Costs are shown for normal and actual situations in local and U.S. currencies. A conversion rate of 1.50 Escuedoes per $1.00 U.S. is assumed. This rate prevailed at the time of the visitation. The current rate is far less -- approximation 1.05 Eo per $1.00 U.S.

	Normal	Actual
Gross Income to Plant Operator	254 pesos/KW Hr. (16.9¢/KW Hr.)	622 pesos/KW Hr. (41.5¢/Kw Hr.)
Price to Consumer	192 pesos/KW Hr. (12.8¢/KW Hr.)	470 pesos/KW Hr. (31.4¢/KW Hr.)

Electricity Costs/Income

There are approximately 180 families in the village, each with an average income of 200 Eo/year. (Neglecting the few who are much better off.) Total population is 1200, resulting in a per capita income of 30 Eo/year ($20.00 US/year).

Per capita use of power, based on 100% village connection (the number of consumers was not reported) is

Normal = 9.35 KW Hr./year

Actual = 3.82 KW Hr./year

The ratio of electricity costs to average income is then 5.98%.

Remarks

The system is antiquated and should be scrapped and replaced with new equipment.

The present owner is now quite elderly, is undoubtedly deriving a good income from the present situation, and apparently is not interested in modernizing the plant. At the interview he remarked that he had no plan other than to repair the present system.

The village desires adequate electricity and is willing to pay a premium price for it. The solution lies in organizing a new electric power supply operation for local generation (there is no possibility for grid extension) on the basis of a corporation, a cooperative or Junta ownership.

Estimated Costs of a New Plant

With reference to the prices of several European diesel engine generator sets on sale in Temuco, Chile, and comparing them to factory list prices in the United States, it appears that a 15 KW diesel generator may be obtained by a village such as Cholchol for 350 to 400 $/KW. Assuming the higher value, this is equivalent to 6000 Escuedoes.

If we replace the old equipment with one of the same rating and reproduce the identical use requirements, what would be the resulting unit cost for generating electricity and how would this compare to the price the consumers now pay?

Installation Costs

New 15 KW diesel generator = Eo 6000

Purchase of present distribution system = Eo 500 (assessed)

Modernizing distribution system to 3 phase 220V A.C. = Eo 2000(assessed)

Structures and labor = Donated

Total Installation = Eo 8500

Power Use and Load Factor

Normal power use and load factor have been determined previously as

11,210 KW Hrs./year

8.54%

Equipment Maintenance

Assume the life of the total installation is 20 years, and that the equipment operates 3 hours per day, 340 days of the year.

Total operating time is 1020 hours/year.

The net maintenance rate for this operating requirement approximates 12.8% of the original generator cost on a per year basis.

Yearly Costs

Capitalization (at 6%) = Eo 510

Depreciation (20 year life) = Eo 425

Fixed yearly costs = Eo 935

Fuel rate assumed to be 0.75#/KW Hr.

HHV = 19750 Btu/lb.

Sp. Wt. = 6.879 lbs./gal.

1 liter = .264 gallons = 1.818 lbs.

Total fuel used per year = 8420 lbs./year
= 4630 liters/year

Price of diesel fuel = 85 pesos per liter

Cost of diesel fuel = Eo 394/year

Lube oil costs (1/5 of fuel) = 79

Maintenance = 12.8 x 6000 = 768

Technician = 200

Load dependent costs = Eo 1441/year

Total plant yearly costs = Eo 2376/year

Unit cost to generate electricity = 211 pesos/KW Hr.
(14.1¢/KW Hr.)

The unit electricity price would have to be somewhat greater to produce operating profits, funds for taxes and future expansion, but it is obviously comparable to the 470 pesos/KW Hr. the consumers now pay for poor quality power. This exercise implies that the village should not continue with their present system, but should take immediate steps to organize and install modern equipment.

CHOLCHOL, CHILE

FIG. 1

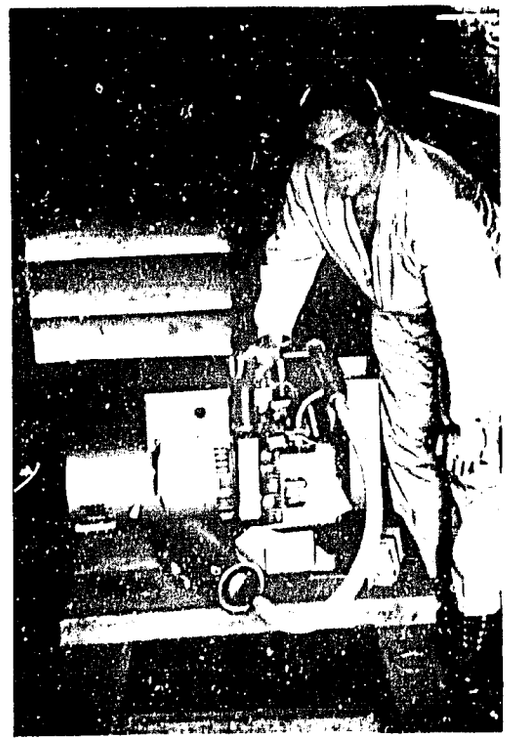

FIG. 2

FIGS. 1 and 2 -- Exterior and interior of Peace Corps Generator Building

FIG. 3
Power poles of old system -- out of operation for many months

SITE: COLLIQUAY

PROGRAM FOR ADVANCED TECHNICAL SUPPORT
FOR VILLAGE DEVELOPMENT

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Version No. 3 - October 17, 1962

SURVEY DATE: May 23, 1962

FIELD TEAM MEMBERS: (incl. association) E. G. Alderfer - CARE Inc.
M. Curtin - PCV - Chile

INFORMANTS: (incl. titles, etc.)

I. VITAL STATISTICS

Village: Colliquay Province: Quilpue
Department: Valparaiso Country: Chile
Type of Government: ----
Population: Urban: ---- Rural: 3000 Total: 3000
Urban families: 450 (Dispersed in 3 groups)
Birth rate: ---- Death rate:
Population growth rate: Much reduced
Net emigration: Out Why: Leave for big cities
Literacy level: 50%

II. ENVIRONMENTAL CHARACTERISTICS

Name and distance of nearest town: Quilpue - 60 km.
Name and distance of nearest market: Valparaiso - 80 km.
Geographical classification: Mountain Valley
Type of access road: Unimproved dirt road
Other access routes:

Sewage facilities: Outhouses
Drinking water sources: A well for each house - 4 to 15 meters deep

Stream and river sources: Intermittent stream - dries up in summer
(there is a water shortage)

Fuel cost and availability: Gasoline, kerosene, diesel fuel is available in Quilpue, 60 km. away.

Available indigenous fuels: Poor grade coal outcroppings - very little wood

Wind and its utilization: Variable but may be used for water pumping

Sunshine and its utilization:

Availability of medical skills:

Resident doctors	No
Itinerant doctors	No
Dentists	No
Nurses	No
Midwifes	No
Pharmacists	No
Herbalists	No

They have a "Practicante" (low scale doctor)

Clinic: Clinic with resident "Practicante" - supported by Social Security System.

Schools: 3 schools (1-4 grades)

Community Center: Use Church

Cooperatives: None

III. ECONOMIC CHARACTERISTICS

Work force pattern - percent of total population: All start at 12-13 years

Section	Percent	Avg. Income
Agriculture	100%	Eo./300
Industries		
Services	few	Eo./1000
Mining		
Fishing		
Others Fundos.		700 pesos/day
Unemployed		
Non productive		
% Self employed	% Employed	

Income fluctuation: Seasonal - during harvest

Typical Debt: _____ Why: _____
Typical Savings: _____ Form: _____

Subsistence level: _____

Types of farm crops: Potatoes, fruits, wheat, beans, corn
(Indicate major cash crops) _____

Types of farm animals raised: Cattle
(include numbers)

Typical size of farm plots: 50% have 10 hectares or larger
20% have no land

% Farmers owning land 80% % Renting _____

Latifundia _____ Minifundia X

Composting practiced _____

Types of industries:
(Including size)

Handicrafts:

Types of services:

Available Tech. Skills: 1% Auto repair, 2% auto operation, 7 in education, 100% agricultural, 20 to 30 administrative

Cooperative community works:

IV. PRESENT ELECTRIFICATION

Year of installation: _____

Type of electric power: _____

Distance to and cost of electric grid power: _____

Nearest town with grid accessibility: _____

Power plant rating: _____

Phases: _____ Volts: _____ Freq.: _____

Power plant ownership: _____

operator: _____

Use of electricity and connected loads:

Household illumination _____

Radios _____

Street lighting _____

Industries

Irrigation

Others

Operational time: _____

Type rate, price and source of fuel: _____

Rate, price and source of lube oil: _____

Fuel transport: _____

Power plant maintenance: _____

Availability of spare parts: _____

Maintenance problems: _____

Are power plant records kept? _____ How? _____

Installation cost of power plant: _____

Operation costs: _____

Maintenance costs: _____

Fuel and oil costs: _____

Tariff schedules: _____

Yearly revenue: _____

V. PROBLEM, NEEDS, OPPORTUNITIES

What are major problems:

What are felt needs: Domestic Lighting, Vocational work shops, irrigation, clinic, flour mill, bakery, small industries

What are obvious opportunities:

Does village desire electrification: Not greatly enthusiastic

VI. REMARKS

SITE: CUREPTO

PROGRAM FOR ADVANCED TECHNICAL SUPPORT
FOR VILLAGE DEVELOPMENT

CHECK LIST OF FIELD INFORMATION

Version No. 3 - October 17, 1962

SURVEY DATE: May 24, 1962

FIELD TEAM MEMBERS: E. G. Alderfer - CARE, Inc.
(incl. association)

INFORMANTS:
(incl. titles, etc.)

I. VITAL STATISTICS

Village Curepto Province: ____
Department: Talca Country: Chile
Type of Government: ----
Population: Urban: 2000 Rural: ---- Total: ----
Urban families: 400
Birth rate: high Death rate: High (infant mortality)
Population growth rate: Steady
Net emigration: Out of village Why: Lack of opportunity
Literacy level: ____

II. ENVIRONMENTAL CHARACTERISTICS

Name and distance of nearest town: ----
Name and distance of nearest market: Talca - 104 km.;Curico - 114 km.
Geographical classification: Valley
Type of access road: All weather dirt road
Other access routes: ____

Sewage facilities: ----
Drinking water sources: ----

Stream and river sources: ----

Fuel cost and availability:

Reg. Gasoline	86.80 pesos/liter
Kerosene	80 pesos/liter
Diesel fuel	Available
Charcoal	35 pesos per kilo

Available indigenous fuels:

Wind and its utilization:

Sunshine and its utilization:

Availability of medical skills: Resident doctors _____
Itinerant doctors _____
Dentists _____
Nurses _____
Midwifes _____
Pharmacists _____
Herbalists _____

Clinic: Small hospital with 1 full time doctor with limited equipment.

Schools: 1 Parrochia (Mary Knoll)
1 State School

Community Center: None

Cooperatives: Savings Coop. - Credit Union

III. ECONOMIC CHARACTERISTICS

Work force pattern - percent of total population: _____

Section	Percent	Avg. Income
Agriculture		
Industries		
Services		
Mining		
Fishing		
Others _____		
_____		
Unemployed		
Non productive		
% Self employed		

_____ % Employed _____

Income fluctuation: _____

Typical Debt: _____ Why: _____

Typical Savings: _____ Form: _____

Subsistence level: _____

Types of farm crops: _____
(Indicate major cash crops) _____

Types of farm animals raised:
(include numbers)

Typical size of farm plots:

% Farmers owning land _____ % Renting _____

Latifundia _____ Minifundia _____

Composting practiced _____

Types of industries:
(Including size)

Bamboo Chairs
Jam Preserves

Handicrafts:

Types of services:

Available Tech. Skills:

Cooperative community works:

IV. PRESENT ELECTRIFICATION

Year of installation: About 10 years ago
Type of electric power: Grid tap
Distance to and cost of electric grid power: ----
Nearest town with grid accessibility: Substation at Curicó

Power plant rating: ----
Phases: _____ Volts: 220V AC Freq.: 50 Cycles

Power plant ownership: Endesa
operator: _____

Use of electricity and connected loads:

Household illumination Yes
Radios Yes
Street lighting Yes
Industries Saw Mill
Auto Garage
Carpenter Shop
Irrigation ---------- 1 Inoperative irrigation project.

Others Clinic, Schools, Movie theater

Operational time: _____

Type rate, price and source of fuel: _____

Rate, price and source of lube oil: _____

Fuel transport: _____
Power plant maintenance: _____

Availability of spare parts: _____

Maintenance problems: _____

Are power plant records kept? _____ How? _____

Installation cost of power plant: _____

Operation costs: _____

Maintenance costs: _____

Fuel and oil costs: _____

* Tariff schedules: 1040 pesos/2 mos. inside lamp) for less than 80 kw-hr.
1140 pesos/2 mos. outside lamp)

Yearly revenue: ----

* Approximates 6¢/kw-hr.

V. PROBLEM, NEEDS, OPPORTUNITIES

What are major problems:

What are felt needs:

What are obvious opportunities:

Does village desire electrification: _____

VI. REMARKS - Information very sketchy