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**ADVANCED
TECHNOLOGY
LABORATORIES**

Field Survey Trip Logs
India, Pakistan, Egypt and Italy
Peru, Chile, Colombia and Barbados

FIELD SURVEY TRIP LOGS

INDIA, PAKISTAN, EGYPT and ITALY

PERU, CHILE, COLOMBIA and BARBADOS

APRIL - MAY - JUNE 1962

FEBRUARY 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.

Prime Contractor General Electric Company,
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Massachusetts Institute of Technology
Cambridge, Massachusetts

International Development Center
Stanford Research Institute
Menlo Park, California

CARE, INC.
New York, New York

FIELD SURVEY TRIP LOGS

ITINERARIES AND ACTIVITIES OF FIELD SURVEY TEAMS IN
INDIA, PAKISTAN, EGYPT AND ITALY
PERU, CHILE, COLOMBIA AND BARBADOS
DURING APRIL, MAY AND JUNE 1962

SUBMITTED TO

R. E. P. A. S., AGENCY FOR INTERNATIONAL DEVELOPMENT
U. S. DEPARTMENT OF STATE

BY THE

GENERAL ELECTRIC COMPANY

UNDER

GENERAL ELECTRIC CONTRACT - AID REPAS-1

FEBRUARY 1963

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INTRODUCTION

This report records the itineraries and activities of two Field Survey Teams which visited selected sites in Asia and South America in connection with a study of the generation and utilization of power in rural areas of developing countries.

Between April 6 and May 30, 1962, India, Pakistan, Egypt, and Italy were visited by a team which included Dale J. Hekhuis, Economist - General Electric Company; Paul Rosenstein-Rodan, Economist - Center for International Studies, Massachusetts Institute of Technology (India only); Stanton Smith, Engineer - Stanford Research Institute, and Kailash Singh, Social Psychologist - University of Lucknow (India only). Between May 3 and June 11, Colombia, Peru, Chile, and Barbados were visited by a survey team which included George Street, Jr., Engineer - General Electric Company; Thomas O. Paine, Physicist - General Electric Company (Chile, Colombia and Barbados only); E. Gordon Alderfer, Program Officer - CARE, Inc.; Christopher Ahrens, Engineer - CARE Peace Corps, Bogota (Colombia only); Henry F. Dobyns, Anthropologist - Cornell Peru Project (Peru only), and Frank L. Turner, Economist - Stanford Research Institute.

The findings and conclusions of the survey teams are included in other reports of this series.

FIELD SURVEY TEAM LOG
ITINERARY AND ACTIVITIES IN INDIA, APRIL 6 - MAY 15, 1962

- Friday, April 6 Dale J. Hekhuis, General Electric Company, and Stanton Smith, Stanford Research Institute left Albany, N. Y. at 5:30 P. M. for New Delhi.
- Saturday, April 7 En route.
- Sunday, April 8 Arrived New Delhi.
- Monday, April 9 Meetings and discussions with:
1. Dr. Paul Rosenstein-Rodan, Center for International Studies, M. I. T.
 2. Indian Planning Commission.
 3. Mr. S. L. Razdan, International General Electric Company.
 4. Mr. Tarlok Singh, Additional Secretary, Indian Planning Commission.
- Tuesday, April 10 Meetings and discussions with:
1. Dr. C. P. Battacharjee, Program Evaluation, Planning Commission.
 2. Mr. John McComb, Chief, Industry Division, USOM, AID.
 3. Mr. Kenneth Levick, Industry Division, USOM, AID.
 4. Dr. Joseph Stepanek, Ford Foundation.
- Wednesday, April 11 Meetings and discussions with:
1. Mr. Gordon Manley, Industry Division, USOM, AID.
 2. Dr. E. K. G. Rao, Indian Agricultural Research Institute.
 3. Mr. Maurice LeBosquet, Sanitary Engineer, USOM, AID.
 4. Mr. B. S. Nag, Adviser (Irrigation and Power), Planning Commission.
 5. Dr. Kailash Singh, University of Lucknow.
 6. Mr. Nair, Central Water and Power Commission.

- Thursday, April 12 Meetings and discussions with:
1. Mr. M. K. Garg, Planning Research and Action Institute.
 2. Mr. A. P. Seetapathy, Planning Commission.
 3. Mr. Pitambar Pant, Planning Commission.
- Friday, April 13 Meetings and discussions with:
1. Mr. Tarlok Singh and Mr. B. S. Nag, Planning Commission.
 2. Dr. E. K. G. Rao, Indian Agricultural Research Institute.
 3. Mr. S. L. Razdan, International General Electric Company.
 4. Dr. G. W. Giles, Consultant on Agricultural Engineering, Ford Foundation.
- Saturday, April 14 Meetings and discussions with:
1. Dr. C. P. Battacharjee, Planning Commission.
 2. Dr. Joseph Stepanek, Ford Foundation.
 3. Mr. A. P. Seetapathy, Planning Commission.
- Sunday, April 15 Meetings and discussions with:
- Mr. Pitambar Pant, Planning Commission.
- Monday, April 16 Meetings and discussions with:
1. Dr. Douglas Ensminger, Ford Foundation.
 2. Dr. C. P. Battacharjee, Planning Commission.
 3. Mr. A. P. Seetapathy, Planning Commission.
 4. Prof. D. R. Gadgil, Gokhale Institute of Politics and Economics.
- Tuesday, April 17 Meetings and discussions with:
1. Mr. H. K. Bansal, Deputy Director, Rural Electrification, Central Water and Power Commission.
 2. Visit to Demonstration - Bio-Gas Plant, Indian Agricultural Research Institute.
 3. Mr. M. A. Idnani, Indian Agricultural Research Institute.

Wednesday, April 18 Meetings and discussions with:

1. Dr. Joseph Stepanek, Ford Foundation.
2. Mr. Gordon Manley, USOM, AID.
3. Mr. B. S. Nag, Planning Commission.
4. Mr. S. Pathik, All-India Mass Education Society.
5. Mr. C. Tyler Wood, Administrator, USOM, AID.

Thursday, April 19 D. J. Hekhuis, S. Smith, A. P. Seetapathy (Planning Commission), and Kailash Singh departed for Jaipur, Rajasthan; meetings and discussions with:

1. Mr. B. Mehta, Chief Secretary, Government of Rajasthan.
2. Mr. Kakar, Chairman, State Electricity Board.
3. Mr. Satsanyi, Chief Engineer, State Electricity Board.
4. Mr. N. Bhargava, Chief Forestry Officer, State of Rajasthan.

Friday, April 20 Travelled by jeep to village of Malpura.

Saturday, April 21 Travelled by jeep to village of Berat.

Sunday, April 22 Travelled by jeep to villages of Bar and Raipur.
Mr. B. Mehta, Chief Secretary, Government of Rajasthan, upon return.
Returned to New Delhi in the evening.

Monday, April 23 Meetings and discussions with:

1. Mr. A. P. Seetapathy, Planning Commission.
2. Mr. S. L. Razdan, International General Electric Company.

D. J. Hekhuis and H. R. Rao (Planning Commission) traveled by overnight train to Lucknow.

Tuesday, April 24 Arrived in Lucknow; meetings and discussions with:

1. Mr. B. B. Lal, Chairman, State Electricity Board, and Staff.
2. Mr. Som Gupta, State Electricity Board.

D. J. Hekhuis, K. Singh, and H. R. Rao travelled by overnight train to New Delhi.

Wednesday, April 25 Arrived New Delhi from Lucknow. Met with:
Mr. A. P. Seetapathy.

Thursday, April 26 D. J. Hekhuis, K. Singh, S. Smith, and H. R. Rao (Planning Commission) departed for Bombay, Maharashtra; Meetings and discussions with:
1. Mr. M. W. Desai, Industries Commissioner.
2. Mr. P. D. Kasbekar, Deputy Secretary, Industries and Labor Department.
3. Mr. J. C. Fernandez, Deputy Secretary, Industries and Labor Department.

Friday, April 27 Meetings and discussions with:
1. Mr. B. V. Deshmukh, Chief Engineer, State Electricity Board.
2. Mr. D. G. Tungare, Under Secretary of Planning.
3. Mr. B. K. Koundinyu, Research Officer, Planning.
D. J. Hekhuis, K. Singh, and S. M. Kasbekhar (Industries Department) departed for Jalgaon by overnight train.

Saturday, April 28 Travelled by jeep to villages of Jamner, Sonarhi, and Paldhi. D. J. Hekhuis and K. Singh departed for Poona by overnight train.

Sunday, April 29 Met S. Smith in Poona; conferred with:
Professor D. R. Gadgil of Gokhale Institute of Politics and Economics.
D. J. Hekhuis and K. Singh departed for Bombay;
S. Smith departed for Bangalore.

Monday, April 30 D. Hekhuis and K. Singh departed for New Delhi from Bombay. D. Hekhuis and K. Singh departed for Hardwar, Uttar Pradesh by overnight train.

Tuesday, May 1 Arrived Hardwar. Departed for Srinagar by jeep.

Wednesday, May 2 Departed for Dehradun by jeep. Departed for Lucknow from Dehradun by overnight train.

Thursday, May 3 Arrived Lucknow. Travelled by jeep to village of Chandrawal. Departed for Bridgmanganj, U.P., by overnight train. Met with officials of Planning Research and Action Institute:

1. Dr. Ram Das.
2. Mr. M. K. Garg.

Friday, May 4 Travelled by jeep to villages of Bridgmanganj and Nautanwa. Departed for Banaras by overnight train.

Saturday, May 5 Travelled by jeep to villages of Dobhi and Chandauli.

Sunday, May 6 Departed for Kathmandu, Nepal.

Monday, May 7 Kathmandu.

Tuesday, May 8 Departed for Calcutta. Departed from Calcutta by overnight train for Bubhaneswar, Orissa.

Wednesday, May 9 Arrived Bubhaneswar; meetings and discussions with:

1. Mr. D. L. Purkayastha, Secretary, Industries Department, Government of Orissa.
2. Mr. P. K. Kapila, Chairman, State Electricity Board.
3. Mr. T. C. Mahapatra, Chief Engineer, State Electricity Board.
4. Mr. G. S. Rao, Assistant Chief Engineer, State Electricity Board.

Departed for Tikabali by jeep.

Thursday, May 10 Visited village of Tikabali.

Friday, May 11 Departed for New Delhi via Calcutta.

Saturday, May 12 Arrived New Delhi.

Sunday, May 13 Worked up notes.

Monday, May 14 Meetings and discussions with:

1. Mr. B. S. Nag and Mr. A. P. Seetapathy, Planning Commission.
2. Mr. C. Tyler Wood, Administrator, USOM, AID.

Monday, May 14 (cont'd) 3. Mr. Kenneth Levick, Industries Division, USOM, AID.
4. Dr. Douglas Ensminger, Ford Foundation.
5. Dr. Joseph Stepanek, Ford Foundation.

Tuesday, May 15 Departed for Pakistan.

A detailed account of activities in India, with conclusions and recommendations, will be found in the Country report on India.

Summary of Persons Contacted in India

Bansal, H. K., Deputy Director, Rural Electrification, Central Water and Power Commission.
Battacharjee, C. P., Program Evaluation Planning Commission.
Bhargava, N., Chief Forestry Officer, State of Rajasthan.
Das, Ram, Director, Planning Research and Action Institute, Lucknow, U. P.
Desai, M. W., Industries Commissioner, Maharashtra.
Deshmukh, B. V., Chief Engineer, State Electricity Board, Maharashtra.
Ensminger, Douglas, Ford Foundation.
Fernandez, J. C., Deputy Secretary, Industries and Labor Department, Maharashtra.
Gadgil, D. R., Gokhale Institute of Politics and Economics, Poona.
Garg, M. K., Planning Research and Action Institute, Lucknow, U. P.
Giles, G. W., Consultant on Agricultural Engineering, Ford Foundation.
Gupta, Som, State Electricity Board, Lucknow, U. P.
Idnani, M. A., Indian Agricultural Research Institute.
Kakar, Mr., Chairman, State Electricity Board, Rajasthan.
Kapila, P. K., Chairman, State Electricity Board, Orissa.
Kasbekar, P. D., Deputy Secretary, Industries and Labor Department, Maharashtra.
Kasbekhar, S. M., Industries Department, Maharashtra.
Koundinyu, B. K., Research Officer, Planning, Maharashtra.
Lal, B. B., Chairman, State Electricity Board, Lucknow, U. P.
LeBosquet, Maurice, Sanitary Engineer, USOM, AID.
Levick, Kenneth, Industry Division, USOM, AID.
Mahapatra, T. C., Chief Engineer, State Electricity Board, Orissa.
Manley, Gordon, Industry Division, USOM, AID.
McComb, John, Chief, Industry Division, USOM, AID.
Mehta, B., Chief Secretary, Government of Rajasthan.
Nag, B. S., Adviser, Irrigation and Power, Planning Commission.
Nair, Mr., Central Water and Power Commission.
Pant, Pitambar, Planning Commission.
Pathik, S., All-India Mass Education Society.
Purkayastha, D. L., Secretary, Industries Department, Government of Orissa.
Rao, E. K. G., Indian Agricultural Research Institute.
Rao, G. S., Assistant Chief Engineer, State Electricity Board, Orissa.
Rao, H. R., Planning Commission.
Razdan, S. L., International General Electric Company.

Satsanyi, Mr. , Chief Engineer, State Electricity Board, Rajasthan.
Seetapathy, A. P. , Planning Commission.
Singh, Tarlok, Additional Secretary, Planning Commission.
Stepanek, Joseph, Ford Foundation.
Tungare, D. G. , Under Secretary of Planning, Maharashtra.
Wood, C. Tyler, Administrator, USOM, AID.

FIELD SURVEY TEAM LOG

ITINERARY AND ACTIVITIES IN PAKISTAN

May 15-22, 1962

Pakistan

- Tuesday, May 15 Dale J. Hekhuis, General Electric Company, and Stanton Smith, Stanford Research Institute arrived Lahore from New Delhi.
- Wednesday, May 16 National Religious Holiday; worked up notes and plans.
- Thursday, May 17 Meetings and discussions with:
(1) International General Electric Company officials to arrange itinerary.

(2) Mr. Harry Coorsh, Harza Engineering Company, International, General Consultants to West Pakistan Water and Power Development Authority (WAPDA).

(3) Mr. John Warner (and staff), Assistant Projects Manager, Miner and Miner International, Consultants to WAPDA on Secondary Transmission and Distribution Schemes and Village Electrification.
- Friday, May 18 Met with Mr. I. A. S. Bokhari (and staff), Director, Planning and Design, WAPDA.
Departed for Peshawar.
- Saturday, May 19 Met with Ray Kelley, Pakistan Rural Industrial Service.
- Sunday, May 20 No activities scheduled.
- Monday, May 21 Departed for Karachi.
Met with John Hageman, Commercial Counselor, U.S. Embassy.
- Tuesday, May 22 Meetings and discussions with:
(1) Mr. John Walker, Power Engineer, USOM, AID.

(2) Mr. Ralph Clark, Adviser, Pakistan Planning Commission.

Departed for Cairo.

These activities and discussions are recorded in greater detail in the pages that follow.

P A K I S T A N

May 16-22

1. Mr. Harry Coorsh, Harza Engineering Company International, General Consultants to West Pakistan Water and Power Development Authority, Lahore, May 17, 1962.

Discussion on Electric Distribution Problems

Coorsh noted that, on the whole, electric distribution systems in Pakistan are antiquated and costly. He stated that it costs about 10,000 rupees to wire an average urban residence or more than in the United States. Antiquated codes are a major barrier to improving distribution. In this connection some demonstrations of modern distribution technology are needed. The following specific points were made:

- a. Guardwires and baskets need to be eliminated from distribution lines.
 - b. Czechoslovakian watt-hour meters which have been purchased in quantity by Pakistan are of very poor quality.
 - c. A low-cost socket-mounted watt-hour meter is needed.
 - d. There are several 11000 volt, single phase distribution lines in North Pakistan. From the power utilization standpoint integral single-phase motors are needed.
2. Mr. John M. Warner, Assistant Projects Manager, Miner and Miner International, Inc., Consultants to WAPDA on Secondary Transmission and Distribution Schemes and Village Electrification, Lahore, May 17, 1962.

Discussion of Proposed Village Electrification Project

Miner and Miner have prepared a feasibility study of village electrification for WAPDA. Mr. Warner outlined the basic characteristics of the proposed project as follows:

- a. Total Cost of the Project. The project is estimated to cost \$69 million with a foreign exchange component of \$55 million. These costs are principally for power distribution facilities for 5000 villages. The project will tie into transmission and substation facilities already under construction in connection with WAPDA's Tubewell Electrification Project and Secondary Transmission and Distribution Project.

- b. Equipment Costs and Requirements. For purposes of electrifying 5000 villages, the following will be required: 10,000 miles of 11-Kv primary distribution line, 5000 miles of 400 volt secondary distribution line; 6000 3-phase distribution transformers averaging 50 Kva each.

Average equipment costs per individual village are estimated as follows:

Primary Line	\$ 4,160
Secondary Line	2,645
Meters and Services	4,363
Transformers	2,500
Sectionalizing Equipment and Regul.	100
Construction Vehicles	40
Communication Equipment	20
TOTAL	\$13,828

5000 villages x \$13,828 approximates \$69 million.

- c. Village Selection Criteria

- (1) Larger than average village so as to insure an adequate return on the investment cost.
- (2) Located near to existing lines so that no new or long feeders would be required.
- (3) To be fed from existing substations so that they could be served immediately.
- (4) Located in several districts so that in general existing WAPDA construction forces could build the lines without additional construction circles being required.

- d. Power Utilization. Anticipated kilowatt demand per individual village is as follows:

1st year	10 watts per capita
5th year	30 watts per capita
10th year	45 watts per capita

It is assumed that the minimum demand per individual village will be 20 Kw, involving one tubewell and one village industrial center. It is estimated that the average number of kilowatt hours consumed per village will increase by a factor of 4.5 from the first year to the 10th year.

- e. Commercial Organization. WAPDA is considering the creation of a special commercial organization for the purpose of visiting

towns and villages as a team to promote the use of electricity, solicit applications for service, survey the village and prepare maps showing locations of 400 volt lines, meters and services. From these surveys, they will then prepare Work Orders which are to be approved by the Engineers and draw the materials for construction against each Work Order. The use of this organization will assure sufficient initial load to justify the construction and also assure that project materials for services and meters will be utilized within the Project scheduled time.

3. Mr. I. A. S. Bokhari, Director, Planning and Design, WAPDA, Lahore, May 18, 1962.

Discussion of Rural Electrification in Pakistan

Mr. Bokhari indicated that Pakistan has had an unhappy experience with local generation of power for rural areas. In this connection he made the following points:

- a. Diesel engines-generators have been unsatisfactory with respect to reliability of service, difficulty of obtaining replacement parts, and the high cost of fuel.
- b. Power consumers serviced by these units have continually requested that they be supplied with grid power.
- c. The few private companies generating power on a small-scale, 50 to 5000 Kw, that are still in operation are finding it difficult to survive. Rural electrification is not a paying proposition for private entrepreneurs because of low load, small-scale generation and fixed rates.
- d. WAPDA wishes to concentrate its efforts on large scale generation of power and grid extension.
- e. Diesel pump sets were evaluated for Pakistan's village electrification program and rejected because of high capital and operating costs and the need for trained operators.
- f. If it were not for the country's extensive Tubewell Program rural electrification would be a doubtful proposition in most cases.

Some additional discussion was devoted to small-scale hydro-electric opportunities in Pakistan. For purposes of making the discussion concrete a proposal for a hydroelectric plant (Baltit Hydroelectric Project) on the Hasanabad River in Hunza State -Gilgit Agency was reviewed with Mr. Bokhari and his staff. This project would be undertaken specifically for providing power to rural communities in the Baltit area including the villages of Murtazabad, Hasanabad, Alliabad, Haiderabad and Baltit comprising a total population of 15,000. The

principal characteristics of this proposed project are as follows:

Area Characteristics. The Baltit area is about 8000 feet above sea level and is located in the Karakoram Mountain range. Agriculture is the principal economic activity and is carried out on terraced fields. The principal crops include wheat, barley, millet, buckwheat, vegetables and fruits. The latter which include apples, apricots, pears, and grapes provide an export for the area. There is a shortage of irrigation water in the spring prior to snow melt and rain.

Currently there is no electricity available to the area with the exception of a small diesel plant in the Amir's Palace at Baltit. Furthermore wood and kerosene are scarce and expensive. It is estimated that fuel costs for a family of five using 4 kerosene lanterns and a wood fire for cooking and heating are about Rs. 80 per month.

Generating Capacity and Equipment. Initially a 200 Kw unit would be installed with provision for 2 additional 200 Kw units. The type of turbine-generator installed would be similar to those manufactured by Drees and Company, G. M. B. H. Werl, Germany. This is a compact, standardized, completely assembled unit requiring a minimum of maintenance. The turbine is a vertical shaft Francis type with a 200 Kva, 400 volt, three phase, 50 cycle generator. The hydroelectric sets and penstocks can be disassembled into pieces weighing 1000 pounds or less to facilitate transport.

Cost Estimates. Comparative capital and operating costs for 200 Kw hydro and diesel units are estimated as follows:

	<u>Hydro</u>	<u>Diesel</u>
First Cost (000 Rs)	1,594,000	301,000
Fixed Charges (Rs) (Interest at 4%)	76,000	19,460
Annual Operating Costs (Rs) (assuming 50% L. F.)	20,000	728,000
Total Annual Costs	96,000	747,460
Annual Generation (Kwh)	876,000	876,000
Unit Cost of Generation	0.11	0.85

Economic Justification.

- (1) The first cost of a hydro plant for an initial 200 Kw unit is more than 5 times that for a comparable diesel electric installation.
- (2) Power generating costs for the 200 Kw hydro plant would be about 13% of the costs of diesel produced power. For 400 and 600 Kw plants this ratio would be 9% and 7% respectively.

- (3) A hydro plant would require no costly fuel shipments from the outside.
- (4) A hydro plant permits operating savings in foreign exchange that would otherwise be required.
- (5) With a hydro plant, future load expansion up to 600 Kw can be met with practically no increase in operating costs and would result in a substantial lowering of the overall unit cost of power.

Power Utilization.

Residential-Commercial. The Baltit area comprises a population of about 15,000 and approximately 3000 houses. It is estimated that each family can pay a minimum of 5 rupees per month. The probable initial demand for power based on average energy charges and load factors for electrified villages in West Pakistan, is about 250 Kw.

Agricultural-Industrial. The principal agricultural power load would be for pump lifting water from the Hunza River. This water would be for irrigation purposes and would overcome the water shortage experienced during the early part of the growing season, as well as to permit increased agricultural production in general. Additional loads may derive from food processing installations.

4. Mr. John Walker, Power Engineer, USOM, AID, Karachi, May 22, 1962.

Discussion on Rural Electrification Programs in Pakistan

a. In contrast to India, West Pakistan is currently overpowered, i.e., it generates more power than it can effectively use, and will probably continue to be over powered through 1965. The 130 Kw addition to the Multan Thermal Power Station will be completed by the end of 1963, giving a total of 400 Mw of capacity for West Pakistan. In 1967, 267 Mw of firm, continuous capacity will be available from the Mangla Dam now under construction. This capacity provides a strong base for rural electrification programs in West Pakistan. In East Pakistan, however, due to a general shortage of power, very little rural electrification will be accomplished in the near future.

b. The principal uses that Walker sees for power in rural communities are for drinking water supply and lighting. The principal difficulty in supplying power to villages will be in the distribution area. Pakistan already has in place an extensive 132 Kv transmission system.

c. Effective demonstration programs are needed to show how agricultural productivity can be increased through irrigation by tubewells. An effort along these lines is being made through an I.C.A. sponsored program in the Mona sector which involves 100 tubewells.

- d. There is a need for development programs tailored to local needs. Too frequently attempts have been made to force programs, on a wholesale basis, which have been successful in other areas, but which are often unsuitable because of local peculiarities.
- e. The most outstanding contribution of power to rural development will be in irrigation and drainage. Other applications will be marginal by comparison.
5. Mr. Ralph Clark, Adviser, Pakistan Planning Commission, Harvard University Advisory Group, Karachi, May 22, 1962.

Discussion on Agricultural Development

Clark stressed the organizational problems of agricultural development. It is his conclusion that crops offer the best opportunity for organizing agricultural production and distribution activities. He cited the Yugoslav experience with coops as an outstanding example of what can be accomplished given good organization. The Yugoslav approach has been to bring agricultural expertise to the rural areas by appointing trained agronomists as managers of rural coops. These agronomists are responsible for the introduction of improved crop varieties, fertilizers, machinery and equipment, etc. In this connection Yugoslavia has an extensive agronomist training program.

Summary of Persons Contacted In Pakistan

Bokhari, I. A. S., Director, Planning and Design, WAPDA

Coorsh, Harry, Harza Engineering Company International. General
Consultants to West Pakistan Water and Power
Development

Clark, Ralph, Adviser, Pakistan Planning Commission, Harvard
University Advisory Group

Walker, John, Power Engineer, USOM, AID

Warner, John M., Assistant Projects Manager, Miner and Miner
International, Inc., Consultants to WAPDA

FIELD SURVEY TEAM LOG

ITINERARY IN EGYPT AND ITALY

May 23-30, 1962

Egypt

Team Members -

Dale Hekhuis, General Electric Company

Stanton Smith, Stanford Research Institute

- Wednesday, May 23 Meetings with:
- (1) Mr. John Kean, Program Officer, USOM, AID, Cairo.
 - (2) Mr. William Kailus, USOM, AID.
 - (3) Dr. Alvin Lackey, USOM, AID.
 - (4) Mr. Ali Othman, Arab States Fundamental Education Center.
- Thursday, May 24 Visited ABIS Resettlement and Reclamation Project.
- Friday, May 25 Visited South Tahrir Resettlement and Reclamation Project.
- Saturday, May 26 Departed for Rome, Italy.

Italy

Team Member -

Dale Hekhuis, General Electric Company

- Sunday, May 27 Met with Prof. Paul Rosenstein-Rodan. Rodan to arrange appointments with FAO personnel.
- Monday, May 28 Meetings with:
- (1) Dr. F. W. Parker, Assistant Director General, Technical Department, Food and Agriculture Organization.
 - (2) Mr. Albert Aten, Agricultural Technology Specialist, FAO.
 - (3) Dr. R. Schickele, Director, Land and Water Development Division, FAO.
- Tuesday, May 29 Meetings with:
- (1) Mr. A. D. Faunce, Chief, Agricultural Engineering Branch, Land and Water Development Division, FAO.
 - (2) Mr. Mohammed Abbas, Economist, FAO.
- Wednesday, May 30 Departed for New York.

E G Y P T
May 23-26

1. Mr. John Kean, Program Officer, USOM, AID, Cairo, May 23, 1962.

Upon arrival in Cairo Mr. Kean was contacted relative to arrangements for field trips, persons to be contacted, etc. Kean arranged for talks with Dr. Alvin Lackey and William Kailus of the AID Mission. Kean was also most helpful in providing us with transportation during our stay in Egypt.

2. Mr. William Kailus, USOM, AID, May 23, 1962.

Our discussion with Mr. Kailus, who is a mechanical equipment specialist, was concerned with equipment maintenance problems. Mr. Kailus has responsibility for the development of maintenance programs for mechanical workshops in the Abis, Koota and Kom Oshim areas. Each of these areas has a mechanical workshop and each has a master mechanic. Mr. Kailus summarized the principal maintenance problems encountered as follows:

- a. Lack of Trained Personnel. Equipment maintenance personnel have to be trained from scratch. Moreover upon completion of an extensive training program, many personnel move elsewhere to take advantage of higher wages.
- b. Difficulties in Acquiring Parts and Materials. Average delivery time for new parts ranges from 18 months to two years.
- c. Lack of Work Organization. It is extremely difficult to bring about an awareness of the need for work scheduling, and record keeping.

With respect to worker training Mr. Kailus made the following points:

- a. Lack of Comprehension of Trainees. Most trainees have rural, agricultural backgrounds which make it difficult to adopt to a confined workshop environment.
- b. Difficulty of Grasping Team Approach. Trainees continually demonstrate an inability to work as a team. Apparently most trainees have worked mostly as individual farmers and have not previously participated in team efforts requiring a diversity of skills.
- c. Inability to follow instructions.

Mr. Kailus summed up his experience in the equipment maintenance area over the last three years by observing that he would currently

rate the equipment maintenance effort with which he has been associated as "poor."

3. Dr. Alvin Lackey, Community Development Specialist, USOM, AID, Cairo, May 23, 1962.

Our talk with Mr. Lackey centered on ways and means for rural development. The gist of our discussion was as follows:

- a. Rural development in Egypt is now at a point where a large part of the rural population has acquired a "psychological set" with respect to government programs, i. e., the rural population now simply assumes that it is up to the government to provide a host of services and benefits for the rural areas. Under these circumstances it is difficult to foster individual initiative in agriculture and small industry.
- b. The Egyptian government is relying heavily on the coop as a means for providing managerial and technical skills for rural communities. In many cases the distribution of land is actually contingent on taking out membership in a coop.
- c. In South Tahrir the Egyptian government has undertaken a 25,000 acre land reclamation and resettlement project. This is a comprehensive development project, starting from scratch, of a desert area. It is one of the most ambitious rural development projects undertaken by the Egyptian government and is particularly interesting because the government is able to start with a clean slate, as against trying to modify or improve an existing community. Thus it can be selective with respect to settlers, a careful selection of which will go a long way in determining the success of the project.

Lackey recommended that we visit the S. Tahrir project. He also suggested that we visit the ABIS Project which is under the auspices of EARIS-Egyptian American Rural Improvement Service. The latter is a joint U.S. Egyptian effort in contrast to the former which is strictly Egyptian.

4. Mr. Ali Othman, Arab States Fundamental Education Center.

The discussion with Mr. Othman, who is a community development expert, centered on the question of technical support for village development. Mr. Othman made the following principal points:

- a. Most village communities in the Arab states are not ready for electricity. By this he meant that the income level was so low that electricity could not be afforded and that there was much that could and should be accomplished in the technical assistance area, particularly with respect to agriculture, which was not dependent on the provision of electricity.

- b. One of the first steps that needs to be taken at the village level is the establishment of health centers. Until the abysmally low level of health and physical well-being is improved, the implementation of economic development programs is academic. Othman is currently associated with a program for setting up village health centers.
 - c. In parallel with a village health program, there needs to be a large scale, mass media dissemination program. The latter is required in order to bring about an awareness of government programs and efforts for achieving national economic, political and social development.
 - d. It is necessary that the government finance the health and mass media programs.
 - e. The individual Egyptian farmer is now at a point where he is seeking new techniques and practices for improving his agricultural productivity.
5. Visit to ABIS Project, May 24, 1962.

This project is a combination land reclamation, resettlement and community development effort located 12 miles south of Alexandria. It involves the reclamation of 32,000 acres of salt marsh and the eventual resettlement of 6400 families in 8 villages. To date 14,000 people have been resettled and 4 villages constructed. The project is under the auspices of EARIS - Egyptian American Service for Rural Improvement.

- a. Agriculture. Agriculture is the principal occupation and the primary crops are barley, cotton, clove, maize, rice and vegetables. Each settler has 5 acres of land and at least one buffalo.
- b. Small industry. There is no program of small industry development associated with the project. Various types of vocational training are provided, however.
- c. Electric Power. Power is supplied to the project by a diesel power station (1-75 Kw unit, 2-60 Kw units) and by transmission line. Diesel power is used principally for lighting public buildings - residences are not electrified - and for the mechanical workshop. Grid power is used for pumping for land reclamation and irrigation purposes.
- d. Mechanical Workshop. The workshop employs 150 individuals and maintains the heavy equipment - draglines, tractors, etc. - used in the reclamation work. The shop services some 300 machines including 80 different models from every manufacturing company

in the world. Twenty different types of diesel engines are maintained; 20 percent of the equipment is continually under repair and 11 tractors are currently idle because of a lack of spare parts. The master mechanic indicated that a year previous only 30 percent of the equipment was in working order.

6. Visit to South Tahrir, May 25, 1962.

This multi-purpose -economic, political, social- development project is under the direction of the General Company for Research and Ground Water, an Egyptian government concern. The construction work has been contracted to Italconsult, an Italian Engineering firm. At present approximately 25,000 acres are under cultivation and an additional 25,000 acres are to be brought under cultivation in the future. The land is irrigated by means of an extensive canal systems. Water is pumped from 6-12 meters below the surface of the ground.

Of the land under cultivation 40 percent of the acreage is in citrus fruits; 20 percent in clover and animal feed; 20 percent in grains; and 20 percent in vegetables.

The following is a brief description of the outlines of the project.

a. Village Construction and Development

A total of 4 villages of 450 families each has been completed to date. Each village is a complete unit with school, mosque, health unit, shopping center, coop store and social center. Individual residences are supplied with electricity and water. Each family has 5 acres of land which it cultivates.

b. Animal Breeding Center

This is a facility for breeding mixed types of cows and sheep. Currently experimentation is underway on a cross between Egyptian and European cows. Herefords are bred for meat production.

c. Cannery

A new cannery which is the third largest in Egypt has been constructed. It employs 250 people, has deep freeze and cold storage facilities, and turns out an average of 50,000 cans per day. Fruits and vegetables which are being cultivated in the area include apricots, oranges, strawberries, string beans, tomatoes, and beans. Currently produce is shipped in from distances of 200 Km for canning.

d. Dairy.

A new, modern dairy facility has been constructed. The principal

consumer of local milk output is a biscuit company. The total cow population in the project is approximately 6000.

e. Poultry, Sheep and Pig Raising.

Central poultry, sheep and pig raising facilities have been established. The eventual objective is to establish, in conjunction with the raising of beef cattle, a substantial meat producing and processing facility. At present wool is not processed in the area. Non-processed wool is exported overseas however. The current sheep population approximates 3000.

f. Other Industry

In addition to the canning, dairying and meat raising activities, other attempts are being made to establish local industries including a machine shop, furniture and woodworking shop and production of concrete materials.

g. Electric Power Supply and Utilization

All electric energy for the project is supplied by high voltage transmission line. From the standpoint of energy utilization, several observations are pertinent:

- (1) The project could not function or grow without the availability of power.
- (2) Particular emphasis has been placed upon diversified productive uses of power in irrigation pumping, canning, dairying, poultry and pig raising, and various other industrial activities. It should be noted that the principal impact of electric power on the development of the project is in the foregoing areas and that power for amenities, although desirable, is of secondary importance.
- (3) The emphasis on power for productive purposes is in sharp contrast to many of the situations encountered in Latin America and India where the principal use of power was for evening illumination.

R O M E, I T A L Y

May 27-29

1. Dr. F.W. Parker, Assistant Director-General, Technical Department, Food and Agriculture Organization, Rome, May 28, 1962.

General Discussion on Energy Requirements for Rural Areas

- a. Bullock power cannot cope effectively with the heavy black soils of Central India. Tractors would permit more timely plowing and cultivating operations. Tractors would also make double-cropping feasible.
 - b. Liquid fuels and mechanization of agriculture should receive a higher priority than rural electrification.
 - c. In the last 10 years the Japanese have progressed from a negligible number of garden tractors to 500,000-600,000.
 - d. Considerable gas is currently being flared in the Persian Gulf. Could this gas be put to some useful application?
 - e. Fertilizer use in Asia and the Far East by 1980 will have to approximate half of total current world consumption in order to keep pace with world population growth and bring about a per capita daily consumption of 2400-2500 calories.
2. Mr. Albert Aten, Rural Industries Specialist, Agricultural Engineering Branch, FAO, May 28, 1962.

Discussion of Opportunities for Adaptive Engineering and New Technology in Agriculture

- a. Need for locating small-scale agricultural processing facilities in the plant growing area itself.
- b. Japan is the only country seriously pursuing the development of small-scale agricultural processing and manufacturing processes.
- c. Many time-honored agricultural processing facilities are quite adequate except for scale. Most require a scale of operation which is too large for many applications.
- d. A systematic inventory of technical needs in agriculture is required.
- e. Examples of areas which require technical improvements are fiber extraction, oil extraction and date processing.

- f. Considerable improvement in olive oil extraction and processing in Syria has been made by bringing in small-scale olive oil machinery from Italy. The resulting improvement in the quality of the olive oil was sufficient to bring a price five times that of the original product.
 - g. One cannot generalize about the need for small-scale processes. For example, in British Guiana, hundreds of small rice mills have been replaced by larger, modern installations, In Antigua; St. Kitts, two modern sugar factories have replaced about 80 smaller factories.
3. Mr. A. D. Faunce, Chief, Agricultural Engineering Branch, Land and Water Development Division, FAO, May 29, 1962.

Faunce stated that he has long been interested in the application of power for rural development and that during the past two years the following three informal working bulletins had been issued by the Agricultural Engineering Branch:

- a. Possibilities for the Utilization of Solar Energy in Underdeveloped Rural Areas
- b. Windmills for Water Lifting and the Generation of Electricity on the Farm.
- c. The Potentialities for Rural Electrification in Asia and the Far East

The last two bulletins were prepared by Mr. E. W. Golding, Assistant Director and Head, Rural Electrification and Wind Power Department of the Electrical Research Association, London, United Kingdom. Faunce also referred me to FAO's studies and publications on rural industry of which the following were acquired:

- a. Flaying and Curing of Hides and Skins as a Rural Industry, FAO Development Paper No. 49.
- b. Rural Tanning Techniques, FAO Development Paper No. 68.
- c. Considerations and Procedures for the Successful Introduction of Farm Mechanization, FAO Development Paper No. 44.
- d. Agricultural Machinery Workshops: Design, Equipment and Management, FAO Development Paper No. 66.
- e. Copra Processing in Rural Industries, FAO Development Paper No. 63.
- f. Equipment for the Processing of Rice, FAO Development Paper No. 27.
- g. Olive Oil Processing in Rural Mills, FAO Development Paper No. 58.

- h. Equipment for the Processing of Long Vegetable Fibers, FAO Development Paper No. 26.
- i. Meat Handling in Underdeveloped Countries, FAO Development Paper No. 70.

Summary of Persons Contacted in Egypt and Italy

Abbas, Mohammed, Economist, FAO

Aten, Albert, Agricultural Technology Specialist, FAO

Faunce, A. D., Chief, Agricultural Engineering Branch, Land and Water Development Division, FAO

Kailus, William, USOM, AID

Kean, John, Program Officer, USOM, AID, Cairo

Lackey, Alvin, USOM, AID

Othman, Ali, Arab States Fundamental Education Center

Parker, F. W., Assistant Director General, Technical Department, Food and Agriculture Organization

Rosenstein-Rodan, -Prof. Paul, Economist, CIS, MIT

Schickele, R., Director, Land and Water Development Division, FAO.

FIELD SURVEY TEAM LOG

ITINERARY AND ACTIVITIES IN COLOMBIA
May 3-7 and May 26-June 8, 1962

Team Members May 3-7

George Street, Jr., Engineer, General Electric Company
E. Gordon Alderfer, Program Officer, CARE, Inc.
Frank L. Turner, Economist, Stanford Research Institute

Additional Team Members May 26-June 8

Dr. Thomas O. Paine, Physicist, General Electric Company
Christopher Ahrens, Engineer, CARE-Peace Corps, Bogota

Section I of this report is a log containing a detailed record of the itinerary and activities of the field survey team in Colombia.

Section II is an alphabetized summary of the persons contacted.

Section III is a bibliography tabulating the reference material obtained there.

I. LOG OF TRIP TO COLOMBIA

May 3 - Thursday (Bogota)

Aldefer, Turner and Street arrived in Bogota 6:00 PM and met by Mary C. Lowrie, Chief of Mission CARE Colombia, and Chris Ahrens, Assistant Director, CARE-Peace Corps Project in Colombia. Transportation arranged to the Hotel Tequendama.

7:30 PM to 8:30 PM - Discussed plans for week end with Lowrie and Ahrens and arranged visits to CARE and AID Mission offices for conferences.

8:30 PM to 12:30 PM - Dinner and conference with Dr. and Mrs. Eugene Staley of Stanford Research Institute. Discussed REPAS program for project team in Colombia and obtained suggested contacts. Staley recommended meetings with:

- Dr. Olivera Phillips, Director Institute de Investigaciones Technologicas, Calle 13, No. 15-61, Phone 414636.
- Charles Ketun, assistant to Henry Hopp, Agricultural Attache, American Embassy.
- Rector Low, Unversidad de Santander, Bucaramanga (some distance from Bogota) can provide team with information on social and economic situation in Colombia.
- Wallace Atherton, Center for Studies on Economic Development, Universidad de los Andes, Phone 430295.
- Lauchlin Currie, especially knowledgeable on Colombian resources, Phone 573484.
- Place to arrange hiring of local engineers and consultants ISOTEX. Director is an economics graduate from Syracuse University. Named Dr. Gerardo Eusse-Heyes, Carrera 7, No. 14-28, P. 7, Phone 340200.

May 4 - Friday (Bogota)

8:30 AM to 10:30 AM - Met with David R. Howie, Asesor Planes y Servicios de Inversion. Discussed national TV coverage and need for cheap, simple TV receivers and transmitters. Howie is an American in business for himself, a long standing associate of Aldefer, and very knowledgeable of conditions in Colombia.

11:00 AM to 2:00 PM - Meeting and lunch with Howard Velgenau, Industry Officer, AID/Colombia, and Carlton Adams, Deputy Director, AID/Colombia, Lowrie and Ahrens of CARE.

- Adams described the AID plan for installing fifteen Fairbanks Morse generators in Colombian sites. We obtained a listing of the site where the FM generators are to be installed. Street asked if we could have copies of the Ten Year Development Plan for Colombia, prepared by the Government. Adams promised to provide Lowrie with copy for transmittal to the team. (Three copies of the English summary of the plan plus one copy of the original plan in Spanish.) He also promised a brochure entitled, "Mineral Resources of Colombia."
- Volgenau agreed to serve as liaison officer of AID for the REPAS Program. He suggested consideration be given to a colonization site known as CHICORODO where AID is implementing a project.

4:00 PM to 4:45 PM - Meeting with Gerardo Tomayo-Pena, Director of Training, Socio-Economic Division, National Federation of Coffee Growers. Discussed REPAS Program. Tomayo-Pena pointed out that experiments had taken place at the coffee experiment station in CHINCHINA using coffee hulls. He may accompany the team for a visit to the Chinchina station and several adjacent potential sites in the same area.

4:45 PM - Discussed REPAS Program with Charles P. Fossum, Director AID Mission to Colombia. Fossum offered the full cooperation of the AID Mission.

6:30 PM to 9:00 PM - Reception at home of Lowrie

- Street discussed REPAS Program with local IGE representatives, Peterson and Fieselman, General Electric Colombia, S/A, and IGE's recent market studies made of apparatus used in the extension of power grids in Colombia. Plans were made to discuss this study when the team returned to Colombia about May 26. Turner learned that prices of gasoline were about \$.17 per gallon and that labor pressures were so great that prices would probably remain low indefinitely.

9:45 to 11:00 PM - Alderfer met with A. Helffrich, Regional Director, ARMCO, regarding political considerations which could affect the program.

May 5 - Saturday (Bogota)

8:00 AM to 1:00 PM - Street and Turner prepared questionnaire and field program objectives in preparation for afternoon meeting with Peace Corps representatives. It was expected and later materialized that the Peace Corps would be willing to suggest sites and follow up on reporting.

10:00 AM to 12:00 Noon - Alderfer, Ahrens and Lowrie met with Dr. Alfonso Mejia, Ministry of Public Health. Discussed the relevance of the REPAS Program to the regional health center program of the Ministry. Dr. Mejia agreed to facilitate field visits in health center areas. Also discussed the Ministry's program of water supply with participation of CARE.

1:00 PM to 3:30 PM - Luncheon and meeting with five Peace Corps volunteers for the purpose of discussing collection of data on village power needs, and related information. Attending for the Peace Corps were:

T. H. Kenworthy, Tenza, Boyaca, PCV
J. T. Mullins, Fuquene, Cundinamarca, PCV
J. F. Luema, Tinza, Boyaca, PCV
Lyle Smith, Minca, Magdalena, PCV
M. DeForest, Bogota, PCV
Bruce Lane, Manaure, Magdalena, PCV
Leon Lane, Bogota, Assistant Director, CARE-Peace Corps
Alderfer, Turner, Street, Ahrens

- Discussed site questionnaire and arrived at agreement whereby PCV's would collect preliminary field data and channel it through Ahrens. Ahrens agreed to systematize data collected for return of project team on about May 26, and will help to organize field trips to sites where PCV's are stationed.
- Mullins pointed out that a power grid line bisected his Vereda and plans were being made to tap 50 kilowatts for 22 centavos per KWH. He will attempt to obtain more information.

7:30 PM to 9:00 PM - Reception at home of Charles P. Fessum, AID Mission Director. Discussed REPAS Program with Mrs. Freeman, wife of the Ambassador, AID officials and representatives of Rockefeller Foundation and Colombian Ministry Officials.

10:00 PM to 12:00 PM - Viewed television interview of Ambassador Freeman regarding the Alliance for Progress Program, and later met Ambassador Freeman when he returned to his residence.

Discussion with Ambassador covered review of REPAS Program objectives and concepts and the Ambassador's ideas regarding the newly elected Government and of Lauchlin Currie's plan (submitted to the Colombia Government two years ago) for moving rural population to urban centers. Ambassador indicated US had taken no official position with regard to the Currie plan.

May 6 - Sunday (Bogota)

Owing to national elections, project team remained in hotel.

Alderfer met Howie for breakfast to discuss private American business interests in regard to rural programs.

Team worked all day on developing field questionnaire and itinerary for return visit to Colombia on May 26. Reached final understandings with Ahrens regarding the collection of data based on the questionnaire.

May 7 - Monday (In transit Bogota to Lima)

Enplaned for Lima, Peru.

May 7 to May 19

Survey team in Peru.

May 19 to May 26

Survey team in Chile.

May 26 - Saturday (Santiago - Bogota)

Enplaned for Bogota. Met at airport by F. Merton Cregger, Director, CARE-Peace Corps in Colombia. Proceeded to Hotel Tequendama.

May 27 - Sunday (Bogota)

In morning prepared tentative schedule for activities in Colombia during the next weeks. In the afternoon, met with James Whitely, Assistant Mission Chief, CARE, Colombia, and in the evening with Cregger to finalize programs for interviews, data collection, and rural site studies in Colombia. Discussed project goals and plans with Professor Richard Poston, Community Development Consultant, CARE, New York, and David Howie, Former Community Development Consultant, CARE, Colombia. The decision

was made to spend one day in Bogota, then to carry out field work, returning to Bogota for final data collection and analysis.

May 28 - Monday (Bogota)

Morning activities included a meeting at the CARE-Peace Corps Office to schedule appointments, personal contacts, and travel reservations necessary for data collection, interviews and rural site visits starting the next day. Paine, Street and Ahrens met with the Colombia II Peace Corps Unit at the Universidad de los Andes to brief them on the AID Research and Development project. Turner reported to Ambassador Freeman and to AID Mission Director Charles Fossum regarding the proposed project activities in Colombia.

In the afternoon the project group met with Robert Kerchen, AID Mission Program Officer, and Charles B. Seckinger, Acting Director, STACA, to obtain assistance in data collection.

In the evening final confirmations were made with Cregger for the field site travel arrangements and air tickets were obtained.

May 29 - Tuesday (Field Trips)

In the morning the group separated into two teams for the field trips. Team A, consisting of Street and Alderfer, flew to Northern Colombia, proceeding first to Barranquilla. They were met by James Lebedeff, Field Representative, CARE, Atlantico and Bolivar Departments; Martin Taylor, Field Representative, CARE, Magdalena Department; and Thomas Bentley, Peace Corps Leader, North Coastal Region. Plans and arrangements were made for visits to selected rural community sites in the Barranquilla area.

In the afternoon, Street and Alderfer visited the twin municipios of SANTO TOMAS and PALMAR de VARELA, 30 kilometers south of Barranquilla. Discussions on electrification were held with Padre Agudelo, Santo Tomas parish priest.

The small village of CARACOLI, 15 kilometers south of Barranquilla, was next inspected and data obtained from Alfonso Donado, President-Community Action Junta, and Julio del Portello, Inspector.

A second field trip was initiated by Team B, consisting of Paine, Turner and Ahrens. They departed in the morning for the town of CHOACHI, located 32 kilometers east of Bogota, in the Cordillera Oriental. An obsolete hydroelectric plant was inspected,

and data on village electrification experience obtained through consultation with the Mayor and other citizens. In the afternoon, the municipio of COGUA, 60 kilometers north of Bogota, was inspected and a possible site in the vereda of La Plazuela discussed in detail with Howard T. Adcock, Cogua Peace Corps Volunteer.

May 30 - Wednesday (Field Trip)

Team A, operating in Northern Colombia, spent the day accompanied by Bentley inspecting the fishing community of LA MARENA, located between Barranquilla and Cartagena. In the afternoon, field site data submitted by Peace Corps volunteers in the area were analyzed. Alderfer returned to Bogota to make connections for a New York flight.

In the evening the existing and future electric power grids of Northern Colombia were discussed with Barranquilla Power Company engineering personnel.

Team B flew northwest to Medellin in the morning, and met with Juan Villa and Senor Lopez, representatives of the Federacion Racional de Cafeteros, Medellin Office, to discuss promising sites for rural electrification studies in Antioquia Department. A meeting was also held with Byron Hopewell, Peace Corps Leader, Antioquia, and Richard Fiedler, Peace Corps Volunteer, Ebejico, to arrange details for the field trips. In the afternoon, accompanied by Richard Fiedler, drove west over the mountains for 55 kilometers to the municipio of EBEJICO, and the team inspected the pueblo and the vereda of LA GRAMALA. In the pueblo they met with the Cafeteros Promotor Albeirro Marin and with the operator of the small municipio hydroelectric plant. The plant and system were inspected and operating data and experience obtained.

In the evening, Team B made arrangements for visits to the municipios of JARDIN, ANDES and VENECIA, in the mountains to the south, and set up a meeting with Cafeteros representatives and Dr. Gregorio Mejia, Head, Antioquia Electrica, for Friday night.

May 31 - Thursday (Field Trip)

Team A, consisting of Street and Taylor, proceeded to Santa Marta and from there to the corregimiento of MINCA, 25 kilometers eastward in the mountains. Data were obtained from local citizens concerning plans for the installation of a small hydro plant.

During the afternoon an inspection trip was made to the fishing village of TAGANGA, 3 kilometers over a ridge northeast of

Santa Marta. Data were obtained from Estiban Marcos Vasquez, secretary to the village police officer, relative to the impact of a diesel generator recently installed there.

Team B in the morning travelled south from Medellin, accompanied by John Lewis, Peace Corps Volunteer, Jardin, 55 kilometers to the Municipio of VENECIA. The Cafeteros Granja there was inspected and data obtained on coffee processing, extension services and agricultural equipment. Village electrification data and experience were then discussed with First Sergeant Fabio Arenas-B., Acting Mayor, Military Government; Sergeant Oscar Beltran Balbin, Second in Command; and Dr. German Guarra Moreno, District Travelling Judge.

In the afternoon, Team B drove south 65 kilometers further to the Municipio of ANDES and discussed agricultural extension work with a Cafeteros agronomist. They then proceeded south another 30 kilometers to the Municipio of JARDIN and arranged for an evening meeting with the local Consejo. At the meeting, considerable information was obtained regarding the electrification experience of Jardin from members of the Consejo, the town treasurer, the town doctor, and Senor Carlos Franco, a retired Colombian Army Captain. A general discussion of opportunities for productive applications of electricity in the pueblo proved very fruitful.

June 1 - Friday (Field Trip)

In the morning, Team A flew down the coast from Santa Marta to Cartagena and met with Lebedeff; Alfonso Escobar, Secretary to Lebedeff for the Cartagena Area; Jazid Velasquez, Promotor, Accion Comunal, Bolivar Department; and J. Gonzalez Manrique, Gerento, Electrificadora de Bolivar S.A. to discuss Bolivar power grids and suitable sites to inspect in the Cartagena area. The rural Municipio of SAN ONOFRE was selected for a subsequent site survey.

In the evening met with Howard Volgenau, Industry Officer, AID Mission, Bogota, who was vacationing in Cartagena to arrange for his participation in the San Onofre field trip.

Early in the morning, Team B returned to Andes and obtained information on municipio electrification from the manager of the local plant and from the town treasurer. Proceeded north to Venecia and interviewed the operator of the diesel plant there to obtain actual costs of village generation, including maintenance.

In the afternoon, Team B returned to Medellin, visited the Industrial Exposition to inspect local industrial activity and purchased books and maps of Antioquia.

In the evening met with Dr. Gregorio Mejia and Senores Lopez and Villa to discuss Antioquia electrification plans, Cafeteros community development programs, and their interrelationship with each other and with our program.

June 2 - Saturday (Field Trips)

Team A, consisting of Street, Escobar and accompanied by Volgonau, proceeded south to San Onofre, 120 kilometers from Cartagena. They met there with Sr. Amaury Cavalier, owner of a large hacienda including the municipio of San Onofre and environs. Obtained data on the municipio of SAN ONOFRE.

Team B flew south to Cali in the morning and met with John Burdick, Head, CARE Office, Valle, to arrange Cauca Valley field trips. In the afternoon the team toured Cali and rural environs, being extensively developed under the management of Cauca Valley Corporation, accompanied by Dr. Bernardo Garces-C., Director, Cauca Valley Corporation. The new CVC steam plant and distribution lines were inspected and a new, small marble-cutting industry. Visited in the vereda of VIJES, 20 kilometers north of Cali.

In the evening, the roles of large electrification and river basin programs in economic development were further discussed with Dr. Garces.

June 3 - Sunday (Field Trips - Return to Bogota)

Team A in northern Colombia met with Anthony Jay, American Consul, Barranquilla, and described the project and the site inspection activities. Street returned by air to Bogota in the afternoon. While on air flight to Bogota, met with Antonio C. Brazer, Regional Director of Sales, in Venezuela and Colombia, Fairbanks Morse & Co., Inc. He knew of the FM-Z engines recently purchased by Colombia AID Mission, but very little of their intended application.

Team B in the Cali area, accompanied by Burdick, visited the vereda of LA TUPIA in the municipio of Candelaria, 30 kilometers east of Cali. Met with Roland Yaeger, Peace Corps Volunteer, La Tupia, and discussed village electrification results under CVC. Visited a sugar cane processing plant, and inspected a 1000 KW steam turbine generating plant there, fueled by cane waste. Visited the village of LA GORGONA and examined the loom recently designed by Peace Corps volunteers for weaving bamboo lattice work for reinforcing plaster or concrete walls; the operation of the loom was demonstrated by Charles Perry, Peace Corps Volunteer, La Gorgona.

In the later afternoon, Paine, Turner and Ahrens flew back to Bogota.

In the evening, the project team assembled to exchange experience and to plan activities for the final week in Colombia.

June 4 - Monday (Bogota)

In the morning met in the CARE-Peace Corps Office, Bogota, to schedule appointments. Called on Charles B. Beckinger, STACA, and Howard Volgenau, AID Mission, to discuss the field trips and to review preliminary results.

In the afternoon conferred with Dr. George Espinel, STACA Economist, to obtain needed background data on Colombian plans and resources.

In the evening completed plans for the interview schedule and data collection activities for the period June 5 through June 8.

June 5 - Tuesday (Bogota)

In the morning met with Dr. Rene Van Meerbeke-R., Chief, Department of Administration, Colombian Civil Aviation Agency, to obtain maps and meteorological data, accompanied by Dr. Espinel. Proceeded to Universidad Nacional, where Dr. Espinel obtained detailed information on fuels and minerals from the Institute Geologico.

In the afternoon visited the Institute de Aprovechamiento de Aguas y Fomento Electrico, accompanied by Dr. Espinel, and met with Dr. Mariane Estrada and Agustin Saffon-B., Electrificadora del Atlantico, to obtain long-range planning data for the various Colombian electrification systems and departments.

Visited Dr. Vicente Pizano, Director Accion Comunal, and discussed selection of sites for rural electrification.

In the evening met with Dr. Richard Poston and David R. Howie to review tentative conclusions reached during field trips.

June 6 - Wednesday (Bogota)

In the morning the team members met to finalize plans.

In the afternoon met with Dr. Gerardo Tamayo-Pena to review project findings in Antioquia and to discuss possibilities for developing small scale industry in rural coffee-growing areas.

June 7 - Thursday (Bogota)

In the morning Turner departed for the U.S.A. Paine and Street, accompanied by Dr. Espinel, visited the Universidad Nacional to discuss the program with Dr. Orlando Fals-Borda, Head of the Department of Sociology, and with Dr. Antonio Maria Gomez, Rector of the School of Engineering. Possibilities for cooperative action were reviewed.

In the afternoon met with Dr. Olivera Phillips, Director, Institute de Investigaciones Technologicas, to discuss the project and related Colombian research and development programs.

Remaining Activities in Latin America

Final meetings were planned with Carlton Adams, Deputy Director - AID Mission, and with CARE/Peace Corps personnel on Friday, June 8th, after which Street and Paine would depart for Barbados, B.N.I., to inspect McGill University's Brace Experimental Station programs on wind and solar energy, returning then to New York.

June 8 - Friday (Bogota to Barbados and USA)

Enplaned for Barbados and return to New York.

II. Personnel Met in Colombia

Adams, Carlton - Deputy Director, AID Mission, Colombia
Adcock, H. T. - PCV, Coqua, Colombia
Agudela, Padre - Parish Priest, Santo Tomas, Colombia
Arenas-B, First Sgt. Fabio - Venicia, Colombia
Balbin, Sgt. Oscar Beltran - Venicia, Colombia
Bentley, T. - PCV Leader, Barranquilla, Colombia
Brazer, A. C. - Regional Director of Sales, Venezuela and Colombia,
Fairbanks, Morse & Co., Inc.
Burdick, John - Head, CARE, Valle, Colombia
Cavelier, Amaury - Hacienda Owner, San Onofre, Colombia
Cregar, Mert - Assistant Director, CARE-Peace Corps, Colombia
DeForest, M. - PCV, Colombia
Donado, Alfonso - President of Junta, Caracoli, Colombia
Escobar, Alfonso - Secretary to CARE, Cartagena, Colombia
Espinell, Dr. George - STACA Economist, AID Mission, Colombia
Estrade, Dr. Mariane - Instituto de Aprovechamiento de Aguas y
Fomento Electrico, Bogota, Colombia
Fals-Borda, Dr. Orlando - Head, Dept. of Sociology, Universidad
Nacional, Bogota, Colombia
Fiedler, R. - PCV, Ebijico, Colombia
Fossum, Charles P. - Director, AID Mission, Colombia
Franco, Carlos - Jardin, Colombia
Freeman, U. S. Ambassador to Colombia and Mrs. Fulton
Garces-C, Dr. Bernardo - Director, Cauca Valley Corp., Cali, Colombia
Gomez, Dr. Antonio Maria - Rector of the School of Engineering,
Universidad Nacional, Bogota, Colombia
Helffrich, A. - Regional Director, ARMCO
Hopewell, B. - PCV, Ebijico, Colombia
Howie, David R. - Asesor planes y Servicios de Inversion, Bogota, Colombia
Jay, A. - U.S. Consul, Barranquilla, Colombia
Kenworthy, T. H. - PCV, Colombia
Lane, B. - PCV, Colombia
Lane, Leon - Ass't. Director, CARE-Peace Corps, Colombia
Lebedef, J. - CARE Field Representative, Bolivar and Atlantico
Deptos, Colombia
Lopez, Sr. - Representative of Federation Nacional de Cafeteros,
Medellin Office, Colombia
Lowrie, Mrs. Mary G. - Chief of Mission, CARE, Colombia
Luoma, J. F. - PCV, Colombia
Manrique, J. Gonzales - Gerente de Electrificador de Bolivar,
S. A. Colombia
Marin, Albeirro - Promotor - Ebijico, Colombia
Mejia, Dr. Alfonso - Ministry of Public Health, Colombia
Moreno, Dr. German Guarro, Venicia, Colombia
Muellens, J. T. - PCV, Colombia

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FIELD SURVEY TEAM LOG

ITINERARY AND ACTIVITIES IN PERU
May 7-19, 1962

Team Members

George Street, Jr., Engineer, General Electric Company

E. Gordon Alderfer, Program Officer, CARE, Inc.

Frank L. Turner, Economist, Stanford Research Institute

Dr. Henry F. Dobyns, Anthropologist, Cornell Peru Project

Section I of this report is a log containing a detailed record of the itinerary and activities of the field survey team in Peru.

Section II is an alphabetized summary of the persons contacted.

Section III is a bibliography tabulating the reference material obtained there.

I. LOG OF TRIP TO PERU

May 7 - Monday (In transit Bogota to Lima)

Arrived at Lima in mid-afternoon. Made phone arrangements for Tuesday meetings with Dr. H. F. Dobyms, of the Cornell-Peru Project, and Mr. R. E. Culbertson, Director of the AID Mission, Peru. In the evening, the city of Lima experienced a total power failure, lasting four hours, due to a shorted transmission transformer outside the city.

May 8 - Tuesday (Lima)

11:00 AM - Meeting with the AID Mission Director, R. E. Culbertson; his Deputy, James Bourne; and Dr. Henry F. Dobyms, Coordinator of the Peru-Cornell Project.

The principal purpose was to acquaint the AID people with the activities planned during the period May 8 - May 18 and to describe the objectives of the project.

Since no communication had been received from AID in Washington, Culbertson and his staff were unaware of the REPAS Program and Street reviewed the historical development of the project, and the current objectives.

Culbertson and Bourne were keenly interested and offered the following suggestions:

- The AID Mission Industry Officer, Dr. Zontag, should be approached to obtain basic resource information and data on the anticipated extent of regional power grids being planned for Peru.
- There was some research in solar energy being conducted by the Institute for Andean Research.
- Appointments should be scheduled with George ("Judd") V. Bowers, AID Mission Agriculture Officer.
- Culbertson felt quite strongly that the team should visit the southern part of Peru near the Alto Plano where four development corporations had each initiated a development program at: Cuzco, Arequipo, Tacna and Puno. He felt the Cuzco program was particularly important and that the University of Cuzco could help in providing economic and social data.

Culbertson thought the problem of communications was critical in Peru, and cited the work being done by the Maryknoll Fathers to improve radio communications. He thought that power was needed for radio and TV communications as a means of improving education and bringing remote communities into contact with urban areas. He hoped that research could be undertaken to develop a low-cost portable TV since the Sony portable TV was far too costly for rural Peru.

Culbertson concluded by saying that the concept of bringing power to villages was so important that it warranted consideration of the creation of a special authority within the Government. Such an authority could be empowered to receive loans, train personnel and execute programs of rural power development.

3:00 PM - Office of Dr. Henry F. Dobyns, Coordinator, Peru-Cornell Project, Los Menzanos 109, San Isidro, Lima, Peru. Alderfer, Street and Turner attending.

In response to Street's letter and subsequent telephone conversations in Lima, Dobyns had given thought to a possible itinerary for the survey team. He had conferred with Douglas Henderson, Counselor of Embassy for Economic Affairs (currently in charge in the Ambassador's absence), and invited Henderson to attend the meeting.

Dobyns and Henderson felt very strongly that the survey should include sites in central Peru in the province of Junin near Cerro de Pasco and in the province of Pasco. The reasons for selecting sites in this area to be visited are as follows:

- An American firm, the Cerro Corporation, has gradually expanded its land holdings. Indian groups in the vicinity have resented this expansion and, at one time, refused to leave the Cerro Corporation lands. Government attempts at eviction resulted in bloodshed and the death of some eight Indian squatters. The bitterness resulting will probably smoulder unless measures are taken to improve the living conditions of the Indians.
- There are good access roads to area for the first time so that industry can now develop.
- The local people have extraordinary receptivity to new ideas and are eager for industrial development and power.
- There are numerous hydroelectric possibilities.

- The Mantaro River Project is four years from seeing the completion of the feasibility study and the Project itself will take another five years. Meanwhile, there is no power in the area.

Henderson and Dobyms also recommended sites in Northern Peru near Vicos in Callejon de Huaylas. These sites would show the after effects of power, and would show conditions prior to the installation of power. Also, the emmigration from the area has contributed to the rapid growth of coastal cities such as Chimbote, to cite an extreme case, where population rose from 5,000 in 1940 to 100,000 in 1960. The area is eager for power as shown by one case where a village erected its own poles and wiring and finally persuaded the Chimbote smelting company to extend the line into the village at an agreed price for electricity.

A final reason for selecting sites in the above two areas was that the Peru-Cornell Project can furnish information on conditions through their own field investigations which are continuing in the two areas.

It was agreed that the field trips would begin on Thursday, May 10, and consist of a three-day visit to the Pasco area and a three- or four-day visit in the Callejon de Huaylas area.

Dobyms thought that the UN Meteorological Mission would have information on solar possibilities.

5:00 PM - Meeting with George V. Bowers, AID Agricultural Officer. Alderfer, Street and Turner attending.

Bower suggested seeing the following:

- Dr. Juan Bazo or Ing. Atilio Gonzales, OCEP, Ministerio de Hacienda, Piso 90 -- to discuss Peruvian plans for extending grids.
- Ing. Carlos Vidalon, Decano Facultad de Ingenieria Agricola, Universidad Agraria.
- Ing. Enrique Olivares, Supervisor General de Sierra, Servicio de Investigacion y Promocion Agraria (SIPA) -- to discuss villages in the Alto Plano.
- W. Drewes, Geographic Attache at the Embassy -- to discuss fuel resources.

7:00 PM - Meeting with ILO -- Alderfer, Street, Turner and Dobyns attending. Participating were: Dr. Carlos d'Urgard, Regional Director, Andean Indian Program; W. J. V. Taylor, Deputy Director and Chief of Mission, FAO; William C. Blanchard, International Advisor to the National Integration Plan.

The meeting resulted in suggestions to visit the ILO centers in Puno, Cuzco and Junin, to call on the Banco Fomento Agropecuario, Dr. Emilio Folley to discuss wind generation in southern Peru, to see: Dr. Hernan Santa Cruz, Assistant Director General, FAO and Regional FAO Director for Latin America, FAO Regional Office, Cano y Aponte, 995, Casilla 10095, Santiago de Chile, and Miss McKinan who are familiar with solar energy planning in Chile and elsewhere in Latin America.

The ILO and FAO representatives agreed to cooperate with the project team through Dobyns.

May 9 - Wednesday (Lima)

9:00 AM - Meeting with Drewes, Geographic Attache, American Embassy, Lima. Participating: Street and Turner.

Drewes has been recommended to the team by George V. Bower as being a person especially well grounded in Peruvian resources. This proved to be the case, since Drewes had lived in Peru since 1955 when he came as a graduate student to write on economic geography studies. Drewes expects to be transferred soon to India.

Publications or sources of information recommended by Drewes:

- Elements of the Plan del Sur dealing with electrification in southern Peru from Edwary Coy, AID Mission Program Officer. Also maps of Peru.
- From Auguste Martinelli-Tixon, Sub-Director, Ministry of Fomento, has a French study of electric power and data on installed capacity.
- From Peruvian Times, Mr. Griffis should get Population Map of Peru.
- Same source Arthur D. Little Report on industrialization of Peru.
- A Peruvian agency known as "Hygro Agro Met Instituto" (concerned with meteorology) has cooperated with a United Nations group to check wind conditions and have issued several wind studies based on reports of 50 weather stations. These stations report three times daily. 700 stations will be installed.

Drewes said that a general problem in Peru was that power was not sold during daylight hours. Power was barely sufficient to meet the evening peaks, but little was used for industry in the day time. As a result, he thought that 70% of the capacity was idle. If industries could be brought in to use the capacity during daylight hours, the newer capacity would be effectively used. Arequipa in Southern Peru was a prime example.

Drewes mentioned the discovery of "one of the largest natural gas deposits" in the world at Aguaytia, about 200 Km north of Cerro de Pasco near Tingo Maria. He thought this source would provide a great deal of energy. In addition to the Montaro Project, Peru would have ample energy supplies for years. The problem, however, would be to find the capital to distribute the power. Hence, the rural areas would not benefit for many years.

The following information was obtained at the next interview with John Burgess, Minerals Attache, but is included here for convenience.

The Mobil Oil/Peruvian Oil Companies have sunk one well (wild-cat Aguaytia No. 1) near Pucallpa with an absolute open flow for the one well of 41 million cubic feet per day at a depth of 9104 feet. The field is estimated to be 6 kilometers x 20 kilometers (120 sq. kms.) having an estimated reserve of 1.5 trillion cubic feet.

With regard to future hydro development, Drewes mentioned that the US Air Force was flying complete photographic coverage of Peru. Drewes did not say when the coverage would be completed.

Cost of Petroleum Fuels

In discussing the probability of continued low cost fuels, Drewes said the labor movement and popular pressures were keeping costs down. At present, gasoline costs were as follows:

<u>Locality</u>	<u>Price for Premium Gas</u>
Lima	5.2 (19.4 cents)
Cuzco	7.0 (26.1 cents)
Meldenado	14.0 (52.2 cents)

Drewes thought that the price of diesel and heavy fuel oil was likely to fluctuate and would rise because the principal consumers were industries. The labor pressure from such groups as the Sidicados de Chofers would tend to keep the price of motor gasoline constant.

Drewes thought that there was a good solar potential because there was eight months of solar exposure in the Sierra.

Petroleum Reserves

Burgess said that additional reserves existed in the north, where private companies had concessions from the Government, and in the south, where the Government planned to exploit reserves. In both areas, however, the costs were high. In the northern part, the jungles and the alluvium deposits were major obstacles. However, the wild-cat ratio was 1 to 6, much higher than in the U.S., according to experience in Loreto Department (NE Peru).

Gas Reserves

Burgess' comments are included in the earlier interview with Drewes.

Mantaro Project & Other Power Sources & Petroleum Refining

Burgess was pessimistic about the completion date of the Mantaro Project and said it would take "ten years" to complete, and even then the power would be distributed in a fan extending from the small town of Marcona on the south to Lima in the north. He thought the rural areas would not benefit because of the high cost of stepping down the power by transformers.

Regarding coal deposits, Burgess said coal outcroppings consisting of anthracite were known in Ancash Department along the Santa River.

In Cerro de Pasco, steam plants have been installed in connection with copper smelting. The capacity consists of one thermal plant of 7500 KW, and five hydro plants totalling 168,250 KW. This power will probably not be made available to rural areas because the Cerro Corporation does not intend to supply power to the public. This is because the Government would classify the plants as public utilities, control rates, and require the extension of power to areas requesting it. Once power was furnished to one community, then it would have to be supplied to others. This would deplete the supply for the smelter.

Burgess said there were four refineries in Peru, two were cracking plants and two were only topping units: Tulara, run by the International Petroleum Co., Ltd., a subsidiary of Standard Oil of New Jersey (ESSO), on the northwest coast; a new refinery at Cochán, financed by the Standard Oil Company of California;

and two topping plants, one at Iquitos in the interior on the Amazon headquarters, and the other at Pucalpa on the Ucayali River, also in the interior of Loreto Province.

The chain of lakes in the south extending northwest of Lake Titicaca was a good source of hydro power potential, Burgess said, because of high head.

We asked the question: What sections of Peru have large populations and which are unlikely to have access to a central grid? Burgess said that the Sierra area (west side of the Andes chain, about 2000 meters in altitude and above), also in the southern part of Peru. The Callejon de Huaylas area is typical Sierra country.

Luncheon Meeting with Juan Bazo, Ministerio de Hacienda - Dr. Bazo was invited to the Crillon Hotel for a luncheon meeting through the cooperation of George V. Bowers. He is noted for being a "doer" in the planning department of the Ministry of Finance. He has been educated in the United States and speaks fluent English; he seemed most interested in the Project and would be cooperative.

Conflicting opinions had been heard by the Project Team regarding the completion date of the noted Mantaro Project in central Peru. Bazo thought that contracts would be signed in June with the European firms which would supply the equipment. The Government was committed to the project and financing would be found, Dr. Bazo was certain. Once started in 1962, the project would take "three to four years" to complete. However, the purpose of the project was to supply the industrialized urban areas of the coast around Lima and, hence, very little power would be available for rural communities; only about 5%, Dr. Bazo thought.

The Mantaro Project would be constructed in stages; the first stage would provide about 1/2 million KW. In the subsequent stages, the project could yield a total of 2.5 million KW. Because of the high head, volume of stream flow, etc., it was generally believed that the Mantaro Project was one of the most efficient hydro projects in the world. By tunnelling 20 to 30 kilometers, a drop of 3000 feet could be achieved. The consumers of power are located in areas as far as 300 km away, but the initial cost was so low that distribution would still be economical. A recent TVA engineer had described Mantaro as "the cheapest source of power in the world."

Bazo thought that the prospect for oil discoveries along the coast was not promising and hence Mantaro would probably be the main power source for central Peru.

In commenting on the possibility of using Mantaro power for villages, Bazo said he thought the power would be used almost entirely for industry because industry was willing to pay a favorable rate. Village communities, on the other hand, would not want to pay as much. Bazo cited an example in Tingo Maria in Huanuco Department where the Ministry of Agriculture had installed a power plant for its own purposes but later began to sell power to the village. Little by little, the demand grew but the village was unwilling to pay more for power. The Ministry of Agriculture soon tired of losing money and decided to dispose of the generator. It took six years to give the generator away to the local government agency in Tingo Maria.

Bazo said that the rural electrification plan was contained in a document called "Fondo Desarrollo Economico Plan." This was published by the Ministry of Fomento and Public Works under the direction of George Grieve. Other people in the Ministry who were informed and could furnish a copy were Mr. Lamas or Mr. De La Flor. Over these two men is Alfonso Serpa. The best man is Lamas, Bazo said.

Bazo felt that virtually all the villages in Peru wanted power. The people want irons, sewing machines, lights. They will save money and "will do anything" to get power. The natives are quick to learn, he said, could readily learn to operate machinery and were good imitators.

Bazo felt that wind reliability was low in the Sierra but that it was strong enough to be harnessed for providing irrigation power where some interruptions in generation would not be serious.

3:00 PM - Turner got from the International Petroleum Corporation (Standard Oil of New Jersey affiliate) oil product prices for the following localities f.o.b. bulk plant: Callao Terminal, Juliaca, Huancayo, Cerro de Pasco, Cuzco.

4:00 PM - Street visited with Auguste Martinelli-Tixson, Sub-Director de Electricidad, Ministerio de Fomento y Obras Publicas with Mario Reggero, Rural Development Division, AID Mission to Peru (as interpreter).

Described REPAS Program much to the interest of Martinelli. He commented that in his 21 years in power plant work, this was the first project by U. S. Government agencies to appraise the use of electricity in local communities.

In 1956, Electricite de France completed a national electrification plan for Peru. The consultants recommended a plan of action including a system capacity growth of 10% per year. The Peruvian Government accepted the recommendation and established a series of laws required to implement the plan and negotiated contracts with several European power plant manufacturers. Principal contractors did not include any U. S. firms nor do they now.

Since 1956 new capacity has been added and, as of 1962, is found to have increased at an annual rate in excess of 10% per year and has been as high as 14% in some Departments of the country.

Total Installed Capacity in Peru
(Public and Private) - Figures denote KW

<u>Year</u>	<u>Capacity</u>
1956	400,000
1960	840,000
1964	1,600,000 (estimated)

Capacity for Metropolitan Lima

<u>Date</u>	<u>Plant Location</u>	<u>Plant Capacity</u>	<u>Total Capacity</u>
1962 (current)			204,000 KW
Oct. 1964	Lima	240,000	444,000
?	Sayan	165,000)	
?	Churin	140,000) -	1,014,000
?	Matucana	65,000)	
1967	Mantaro	300,000)	

Planned Montaro River Hydro-Electric Plant

First Phase: first loop tunnel, 3000 foot drop, by 1967 will produce 300,000 KW all for Lima and Pisco area. Total developed capacity 1,800,000. By 1970 some power may be available to large industries in the Montaro-Junin-Cerro de Pasco, but no plans exist for tapping the power by small villages.

Second phase: Construction of dam and second loop tunnel, 3,000 foot drop; ultimate capacity of second loop: 1,800,000 KW. Total ultimate capacity - 3,500,000 KW.

The French consultant group has prepared new plans for the ten year period 1962-1972.

Street was given a four-volume French consultant's report (in Spanish).

Martinelli suggested return visit after site surveys for discussion on new data which he will have on low power diesel generator equipments from 100 KW and above for villages.

5:00 PM - Street visited Mr. Donald I. Griffis, Peruvian Times Publications, Inc. Obtained population map about 1955 compiled by W. E. Drewes, Geographic Attache of Embassy, plus Year Book.

May 10 - Thursday (Lima - Vicos)

Street, Dobyms, Alderfer and Turner drove from Lima to Vicos. Used pick-up truck, drove north on Pan American Highway to Paramonga, turned off, drove on dirt road through Huaras to Vicos. Driving time about eleven hours. Bunked up at Vicos in the Cornell-Peru project, former hacienda building.

Price of gasoline at Huaras, 4.90 soles per gallon, regular; 5.90 soles per gallon, high test. Price of diesel fuel 4.30 soles per gallon.

May 11 - Friday (Vicos)

Met personnel working at Vicos project, Dr. Mario C. Vasquez, Director de Campo del Proyecto Peru-Cornell en Vicos. Two assistants to Dr. Dobyms, an Englishman named "Nicholas", and "Kurt", an American graduate student from Yale University. Obtained field data on site.

May 12 - Saturday (Vicos)

Planned to visit Huaylas but found bridge across Rio Santa was washed out. Was able, however, to view the installation of steel poles for grid, an extension into the market town of Huaras. This line is supposed to be completed by December, 1962, but may not be available to small towns along its right of way.

Gasoline costs in the Caras-Yungay area were: 4.9 soles per gallon, regular; 5.9 soles per gallon, high test.

Dobyns outlined his understanding of the composition of the population of Peru. The population, totaling 12.0 million, is broken down as follows:

- A. Population of the metropolitan area of Callao-Lima - 2.0 million
- B. Population of other cities in Peru such as Sullana, Preura, Chiclaye, Trujille, Chimbote, Arequipa, Cuzco. (The above groups A and B, totaling 3.0 million or 25% of the total population, live under fairly modern conditions, market the bulk of Peru's exports, purchase the bulk of the imports. The group is Criollo on the coast (white) and is largely Mestizo (mixed Indian and white) in the mountains. 1.0 million
- C. Population in semi-modern small towns, pueblos, such as Ayachucho, Huaras, Carhauz; this group is part of the market economy but not strongly oriented to world markets. Socially, the group are Mestizo. 3.0 million
- D. Population of "free Indian" communities. These people are independent, self-governing. Of this group, 1.3 million live in recognized communities numbering 1600. The remaining 1.7 million Indians live in unrecognized communities, or clan-type groupings known as "ayus". 3.0 million
- E. The remaining persons are literally serfs, usually Indians living on large haciendas. They are share croppers required to pay a portion of their crops to the Hacienda or owner of the land. 3.0 million

Quite different in mores, economic and social status are jungle Indians residing in the jungle and organized in tribes. For statistical convenience, this latter group is included in Group E.

Total Population 12.0 million

May 13 - Sunday (Vicos - Lima)

Return trip to Lima via Huaras and Casma. Trip took 15 hours.

May 14 - Monday (Lima)

No activities scheduled. Members of the project team worked on reports and read background information.

May 15 - Tuesday (Lima)

9:00 AM - 4:00 PM - Continued to work on reports of prior meetings and revised field questionnaire for typing by public stenographer in hotel.

Street made arrangements to hire car with chauffeur for field trip to Junin-Tarma region.

Turner made call to Culbertson to ask two questions: First, would it be best to arrange Cuzco trip with George Bowers? Answer affirmative. Second, could we look at country program book classified Confidential? Answer affirmative. Purpose of call was also to keep AID Director informed of activities and of our decision to visit Cuzco which AID Director had suggested we include in our itinerary.

Turner made arrangements to visit Cuzco.

4:00 PM - In order to keep Peruvian Government informed of activities, Dobyms of the Cornell-Peru Project arranged a meeting with the Ministry of Labor, Bureau of Indian Affairs. Present were Dr. Charles Monge-M. and his Deputy, Dr. Pelegrin Roman-U., Executive Head for Integrating the Indigenous Population.

Dobyms described the project, its financing, its independence from local AID Mission, direct channel to AID in Washington, field trips to select sites, and expressed the hope that the Peruvian Government could help provide the administrative machinery for possible field experiments in later phases of the program.

Dr. Monge said he and his people would gladly cooperate, but cautioned that the country was underdeveloped, that the Government services were imperfect, and that we should not expect too much. Also, the problems of bringing the Indian population up to modern levels were very formidable and would require a long term solution.

Dr. Monge urged Turner to meet Dr. Vargas of the University of Cuzco who was a botanist who had worked with Dr. Goodspeed of UC in Berkeley. He would be excellent in telling us what kind of crops would yield biogas.

12:20 PM - Drewes reported on feedback from August Martinelli-Tixen, Sub-Director de Electricidad, Ministerie de Fomentey O.P. Martinelli is also a Senator for the Apurimac Department in Southern Peru SW of Cuzco. He is very interested in a possible site selection for later program phases. Communities he has in mind are quite remote.

It is possible his operation would be extremely helpful in administering and implementing a subsequent test program.

Other comments by Drewes were as follows: In Cuzco Drewes suggested that we consult with Dr. Montecinos, Director of CRIF (Cerperacion de Reconstruccion, Industria y Fomente). The CRIF group is sponsoring work with the Indian communities is Machu Picchu, about 75 kilometers WNW of Cuzco. He said that the AID-SIPA Director, Dr. Vivacencia, was also an excellent contact, but that Montecinos was more directly concerned with the Indian communities and has stream flow data. To obtain wind and insolation data, Drewes is arranging a 10:00 AM, May 16, meeting with Direccion General de Meteorolgia and possibly with Hydre-Agre-Met Servicie under Dr. Cayatano. The latter agency is working with the UN team.

Alderfer tried unsuccessfully to get in touch with David Thornburg, Director of International Development Services, who is doing special studies of the migration of rural people from Callejon de Huaylas to the coast. He is currently in Bolivia.

Alderfer discussed low-cost housing programs in Peru with Howard Wenzel, World Homes, Inc.; he will arrange to send a copy of the first architecture dissertation on low-cost housing in Peru to Alderfer in New York.

Street obtained Arthur D. Little's report, "A Program for the Industrial and Regional Development of Peru" from the Peruvian Times.

Additional Vicos Data

- Altitude of Vicos, Cornell-Peru Project site: 3008 meters
- Altitude of Upper Pasture above Cornell-Peru Site. The Puno: 3350
- The high pasture is located at a point where agriculture stops and grass pastures begin. This point is called the Puno and is usually 11,000 feet high. Grass extends to about 13,000 feet.

- The two avalanches in recent times in the Callejon de Huaylas area occurred in 1941, Huaras, when 5000 people were killed.
- The second avalanche occurred in January, 1962, and wiped out 3000 persons in and around the village of Ronrhicco.
- The January, 1962, avalanche travelled at an estimated 40 miles per hour. A 7-minute warning was given by the telephone operator in a nearby town, but the Ronrhicco operator thought it was a joke and there was no time to alert the villagers.

May 16 - Wednesday (Lima - Tarma)

Commenced trip to Tarma, Junin Department. Rented car and hired chauffeur from Changamaya. Vasquez, Dobyms, Dolores Aguala (assistant to Dobyms), Alderfer and Street made trip.

A two-lane paved road into Tarma with the exception of new road construction at the top of pass, 15,800 feet altitude. The entire trip to Tarma took seven hours.

Visited village of Acobamba, population 2000 persons. Including surrounding farm areas, the total population is 9000. The village already has 15 KW capacity tapped from the power grid installed forty years ago, which is now completely inadequate for the needs of the village. There appears to be no opportunity to increase the capacity in a practical sense in the future.

Field project team was warmly welcomed in the village of Acobamba as a brass band played for the group on arrival. A meeting was then held in the Community Hall with officials of the village council and attended by approximately 150 citizens of the area.

Information was obtained during the meeting with the council to complete the questionnaire forms, and a possible hydro-electric site was inspected with a capability up to 300 KW.

The brass band ended the meeting and the project team was taken to dinner at a local "restaurant". After dinner, the team returned to the Tourist Hotel in Tarma.

Turner in Lima

Turner, accompanied by Drewes, visited the Ministerio de Aeronautica, Direccion General de Meteorologia, an agency of the

Peruvian Air Force (F.A.P.) under the command of Major General Raul Ravines Benvenidas. Discussions were held with members of the staff, and especially with Dr. Santiago Vallejo about wind and solar conditions in Peru. The agency also maintains precipitation data. However, in view of the limited time available, the discussions stressed solar and wind information in the belief that precipitation data could be obtained later if needed and in the belief that glacial run-off in the Sierra is more significant from the point of view of future hydro-electric installations.

The Meteorological group maintains sixty weather stations plus seven stations where high altitude wind readings are recorded.

The principal results of the meetings were:

- The team has a tabulation of insolation at 19 localities for the period January through December, 1959. This table shows areas where insolation is likely to be highest among the various weather stations.
- Obtained annual report for period 1947 through 1951 of 67 stations, showing wind, temperature, insolation, precipitation, etc.
- In the event that special studies of wind or insolation are needed, we can communicate with the Director General and ask that specific areas be surveyed.

Turner, at the AID program office, reviewed the "Country Book" and took notes of unclassified portions regarding the social, demographic and economic situation of the country. Obtained copies of Tables "C-1" through "C-4" which can be used for describing total situation of Peru. The same tables will be requested in Colombia and Chile. Special help was obtained from Miss Golda Stander, Assistant Program Officer, after a preliminary conversation with Culbertson, AID Mission Director.

May 17 - Thursday (Tarma)

(Same persons participated as on May 16.)

Visited Palcomaya, 24 kilometers from Tarma. Dirt road was in such bad condition that the trip required two hours. The team interviewed the Alcalde of Palcomaya and completed a questionnaire. Visited potential hydro-electric. Luncheon guests of Alcalde.

Arrived at the village of Palca and interviewed Personnero and the village council. Approximately thirty citizens attended the meeting. Obtained information for questionnaire and then inspected a potential hydro-electric site. Were then treated to "cafecinto" at the home of the mayor. Returned to Tarma at 7:00 PM.

Turner in Cuzco

As the result of suggestions by Culbertson and Bowers, the team decided that a visit to southern Peru to the Cuzco region should be scheduled.

Turner arranged through Bowers to be met in Cuzco by the local SIPA (Servicio de Investigaciones y Promocion Agraria) and to obtain information on local sites.

Principal conclusions of the visit to Cuzco were:

- The machu Picchu hydro-electric project, amounting to 120,000 KW after four stages are completed, would not provide power to villages in the area but rather would concentrate on industries and the metropolitan area of Cuzco. CRIF (Corporacion de Reconstruccion y Fomento del Cuzco) supplied this information.
- Questionnaires were completed containing partial information on two village sites which the local SIPA group felt were most desirable. The Cuzco SIPA Director, Ing. Mauro Villavicencio, was certain that the town of CUYO CHICO, would be a good site because: (a) SIPA could provide administrative control and could obtain good reports through the University of Cuzco which is conducting an anthropological experiment similar to the Vicos project; (b) the village population of 1873 persons had displayed a high degree of community responsibility in the construction of a bridge, a school, housing repair, a community center; (c) the local river has a 300 meter drop, about 30 cubic meters/second continuous stream flow in dry season; (d) eager for industry to improve already established plaster, tile, and timber industry; (e) Cuyo Chico is 35 kilometers from Cuzco via a dirt road and is readily accessible; (f) the Indians in the area have shown a tendency to squat on land -- not in Cuyo Chico -- and this means an eroding of legal and political institutions. A project at Cuyo Chico, by demonstration, could help arrest the local unrest; and (g) the farmers own only one-half hectare per family and unless industry comes in, hardship will result.

A questionnaire was filled out by SIPA for ANDAHUAILLAS.

May 18 - Friday (Tarma - Lima)

Left Tarma for trip to village of SAN PEDRO DE CAJAS. En route, had brake failure on mountain grade. Stopped at La Oroya, a mining town, for repairs. Lost much time and had to cancel visit to San Pedro de Cajas. Arrangements were made, however, to have Miss Dolores Aquala, assistant to Dobyms, take a Spanish version of the field questionnaire for interviewing persons in San Pedro de Cajas over the week-end. This particular village had recently installed a hydro-electric generator.

Remaining members of the team proceeded to Lima. Driving time from Tarma to Lima was approximately nine hours.

Turner in Lima

Reported to Bowers on favorable impression of SIPA organization and interest.

Dobyms will return to Ithaca, Cornell University, about June 15 and will plan to integrate with the team sometime thereafter.

May 19 - Saturday (In transit Lima to Santiago)

Enplaned for Santiago.

II. Personnel Met in Peru

Bazo, Dr. Juan - Ministerio de Hacienda, Peru
Benvenidos, Maj. Gen. Raul Ravines - Ministerio de Aeronautica,
Direccion General de Meteorologia
(FAP), Peru
Blanchard, Wm. O. - International Advisor to the National Integration Plan,
Peru
Bourne, James - Deputy Director, AID Mission, Peru
Bowers, George V - Agricultural Office, AID Mission, Peru
Bravo, Mauricio Perez - Alcalde de Palcamayo, Peru
Burgess, J. Jr. - Minerals Attache, U.S. Embassy, Peru
Cairu, Marcalo Castro - Village de Palcamayo, Peru
Culbertson, R. E. - Director, AID Mission, Peru
Drewes, W. E. - Geographic Attache, U.S. Embassy, Peru
d'Urgard, Dr. Carlos - Regional Director, Andean-Indian Program, Peru
Griffis, D. I. - Peruvian Times Publications, Inc., Peru
Henderson, Douglas - Counselor of U.S. Embassy for Economics, Peru
Martinelli-Tixon, Auguste - Fomento y Obras Publicas, Peru
Monge-M, Dr. Carlos - Ministry of Labor, Bur. of Indian Affairs, Peru
Rogerro, Mario - Rural Development Div., AID Mission, Peru
Roman-U, Dr. Pelegrin - Executive Head for Integrating the Indigenous
Population, Peru
Standar, Miss Golda - Ass't. Program Officer, AID Mission, Peru
Taylor, W. J. V. - Deputy Director and Chief of Mission, F. A. O., Peru
Vallejo, Dr. Santiago - Ministerio de Aeronautica, Direccion General
de Meteorologia (FAP), Peru
Vasquez, Lr. Mario C. - Director de Campo del Proyecto Peru-Cornell
en Vicos, Peru
Vicuna, Luis Macasi - Ex Alcalde de Palcamayo, Peru
Villavicencio, Ing. Mauro - Dir. Servicio de Investigaciones y Promocion
Agraria (SIPA) Cuzco, Peru
Wanzel, Howard - World Homes, Inc.

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5. Edicion Especial Agricultura Mecanizada; La Hacienda, Hacienda Co., Inc., 20 Vesey Street, Nueva York, N.Y., March 1962, 70 pages.
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9. Iowa State University, Peruvian Agrarian Reform Problems and Possible Solutions, Ames and Iowa City, Iowa, December 29, 1961, 65 pages.
10. Kennedy, E., Callejon de Huaylas, Lima, 1961, 11 pages.
11. Little, Arthur D., Inc., A Program for the Industrial and Regional Development of Peru, Cambridge, Mass., 1960.
12. Ministerio De Agricultura 1959, Memoria del Ministerio de Agricultura al Congreso Nacional - 1959, Imprenta Nacional, 1959, 312 pages.
13. Ministerio de Aeronautica, Boletin Anual Meteorologico, Lima, 1948, 88 pages.
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16. Ministerio de Aeronautica, Boletin Climatologico Anual, Lima, 1951, 144 pages.
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22. Peruvian Times, Light and Power in the Cordillera Negra, 1961, 28 pages.
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23. Servicio Cooperativo Interamericano del Plan del Sur, Mapa Hidrogeologico del Sur del Peru.

FIELD SURVEY TEAM LOG

ITINERARY AND ACTIVITIES IN CHILE

May 19-25, 1962

Team Members

George Street, Jr., Engineer, General Electric Company

Dr. Thomas O. Paine, Physicist, General Electric Company

E. Gordon Alderfer, Program Officer, CARE, Inc.

Frank L. Turner, Economist, Stanford Research Institute

Section I of this report is a log containing a detailed record of the itinerary and activities of the field survey team in Chile.

Section II is an alphabetized summary of the persons contacted.

Section III is a bibliography tabulating the reference material obtained there.

I. LOG OF TRIP TO CHILE

May 19 - Saturday (Lima - Santiago)

En route from Lima to Santiago via Canadian Pacific Airlines. Met on arrival by William Salas, Acting CARE Director in Chile. Reservations had been made at Hotel Lido. Dinner with Mr. and Mrs. Salas.

May 20 - Sunday (Santiago)

Spend day writing reports of Lima activities. Met CARE Director, convalescing from hepatitis, John Edmonston at his home for reception. Other guests included Winfield W. McIlroy, Project Coordinator of AID, Mr. Benjamin Maluenda of Instituto de Educacion Rural whom we would meet next Tuesday.

May 21 - Monday (Santiago)

Holiday in Chile to celebrate anniversary of Naval engagement with Peru. Worked on letters and reports of Peru trip until noon. Visited Vina del Mar and Valpariso with Mr. and Mrs. Salas.

May 22 - Tuesday (Santiago)

9:00 AM - T. O. Paine from General Electric Company arrived to join team. Met with Sala of CARE to plan activities for day.

11:00 AM - Met U.S. Ambassador to Chile, Charles W. Cole (former President of Amherst College). Points mentioned by Cole:

- Chile, next to Argentina, has the highest production of power per capita in Latin America. However, many rural areas are still outside the reach of grids.
- South of the Bio Bio River, Chile is blessed with petroleum and coal resources and with major forests of pine. The latter is not well managed.
- Cole suggested seeing the CHILECTRA staff (subsidiary of American Foreign Power) which is planning a \$105.0 million expansion program; UN Special Fund representatives; Instituto de Educacion Rural; Joseph Bowman Tisinger, First Secretary of Embassy; Paul Oechsli, AID Program Officer; Madison Monroe Adams, Jr., Second Secretary.

12:00 N - Met Instituto de Educacion Rural at latter's offices, Cienfuegos 47, Casilla 10397, Santiago. Paine, et al, briefed following persons on program objectives and discussed sites to be visited:

Sr. Juan de Dios Carmona, Director Coordinator
Sr. Benjamin Maluenda, Chief, Department of
Community Development
Monsenor Rafael Larrain (priest familiar with rural
communities in southern Chile)

3:00 PM - Continued discussion with Maluenda plus other participants: Dr. Walter Langford, Peace Corps Director; Dr. George E. Smith, Assistant Director, Peace Corps, and other Peace Corps volunteers. Decision reached that Alderfer would visit sites in Valpariso-Santiago area (Collinguay, Rancagua, and Curico-Curepto) to note impact of power on rural communities. Street and Paine would visit Cholchol, Loncoche and other localities travelling by train May 22 PM and returning Friday, May 25, by Lineas A Nacional, Chile (local air service). Turner would remain in Santiago for visitations to goverment agencies. Paine, Street and Martin Ronan, PCV, Santiago, entrained for Temuco in southern Chile.

May 23 - Wednesday

Turner arranged appointment with McIlroy and AID Director, Charles H. Lee, for PM.

Met with Joseph Bowman Tisinger, First Secretary of Embassy, in charge of economic reporting. Gather three major problems in Chile are: uncurbed appetite of urban population for imported goods, inability of government to police capital flight, orientation of goverment toward pressures of urban groups and consequent inattention to rural problems.

Arranged for Friday night dinner for Peace Corps, IER, AID and CARE people; invited: Maluenda, Langford, McIlroy, Smith, Salas and wife, Griffis and wife, and Ronan, at El Parron Restaurant, 9:30 PM Friday, May 25.

Met Daniel Alexander, 2nd Secretary, and Madison Monroe Adams, Jr., to discuss economic situation and obtain documents relative to power.

3:30 PM - Met with Charles H. Lee, AID Director; Oechsli, and McIlroy. Lee offered help in appointment with ENTESA (Chilean

power agency). McIlroy spent two hours lining up appointments and helped greatly. Arrangements made to obtain information or contacts on: meteorological data, fuels, ENDESA, rural economic situation, power system, demographic maps, fuel costs, water run-off, solar experiments, university contact, trade and investment.

5:30 PM - Met William Douglas Carter, Geologist, US Geological Survey, Agustinas Street, No. 785, Santiago, to learn about fuel resources and obtain Geological Maps of Chile and make further appointments. Carter suggested contacting CORFO to obtain data on steam. Italian team had made report on possible power application.

Alderfer visited and obtained data at village site of COLLIQUAY.

Temuco, Cholchol, Loncoche

Paine, Street and Ronan arrived Temuco 8:30 AM on train. Hired taxi to visit CHOLCHOL, 27 km distance. Road to Cholchol one and two lane gravel, badly rutted. This road is occasionally impassable during winter. Became stuck in one mud hole at edge of village and had to be pulled out.

Called on Father Ward Munday and two Peace Corpsmen. Jim Fitzgerald and Jim Dungan assigned to Cholchol. Father O'Brien also participated. Had lunch at their invitation -- described program which interested them and extended their thinking in regard to village development as affected by electrification.

Later met with village elders. Completed questionnaire. Left to catch train for Loncoche.

Arrived Loncoche, registered at Alamane Hotel; entertained PCV's including Martin Ronan, Jacque Seigler, Peggy Ahern (PCV nurse), and Smith (PCV Leader).

May 24 - Thursday (Santiago)

Met Charles R. Myers, Aviation Operation Specialist (FAA) technician, advising Chilean Government. Discussed Chile weather characteristics and arranged to obtain meteorological data following day.

Lunch meeting with Japanese seismologist, J. Kazuo Minami, UNESCO, to discuss Japanese seismic and anti-seismic architecture literature.

Met Robert J. Dingman, USGS, to discuss glacial run-off.

Met J. E. Glover, Gerente de Marketing, ESSO Standard Oil Company (Chile) SAC, to obtain fuel, diesel, gasoline prices at some 15 localities (statistics being compiled May 25 and converted to US dollars, and gallons from pesos and liters). Address: 1170 Alameda O'Higgins.

Met McIlroy and others at AID mission, particularly Louis G. Sleeper, Education Officer, to arrange meeting at University of Chile with Enrique d'Etigny. Sleeper urged we contract with University of Chile since latter is prestige university, has solid science and electrical engineering departments and is willing to work with U.S. groups; is now operating tracking stations for NASA.

Sleeper also agreed to obtain pamphlets and material on solar energy experiments in Chile by three university groups in north Chile and mail to Turner.

Alderfer visited and obtained data for site of CUREPTO.

Loncoche, Villarica, Temuco

Entrained for Villarica with Paine, Street, Ronan and Sr. Alfonso Pedrosa, Instituto de Educacion Rural, Casilla 170, Loncoche, Chile.

In Villarica met with Padre Juan but failed to identify promising sites to visit. The trianjulo area will shortly be electrified from power grid.

Took bus from Villarica to Temuco. Bad road and flat tire were only incidents.

Registered at Frontier Hotel in Temuco.

May 25 - Friday (Santiago)

Turner had appointments for 9:00 to read AID Country Program Book; 11:00 to meet Carlos Croxatto of ENDESA; 12:45 for lunch with geologist, Robert Dingman; Chilean Air Force for weather at 2:15; 4:00 at University of Chile.

Temuco

Visited several agencies in town to obtain prices of electric generation and load equipments. See tabulation. At Temuco airport

met Gerrald Riddley and some of his group working as Baptist missionaries. Flew to Santiago via Concepcion.

On arrival in Santiago, entertained AID and Peace Corps personnel at a wrap-up dinner.

EQUIPMENT PRICES AT TEMUCO, CHILE

2.5 KW Petter gasoline engine generator, AC Morrison Eng. -
Southampton, England, 220 V - 50 cycles, 1 phase, 1500 RPM.
Eo 1940.00
\$518/KW

8 KW Petter gasoline engine generator, Eo 1160.00
\$968/KW

2.0 KW Gasoline engine generator, S. A. Bernard Moteures,
12 Rue Mederia, Paris, France, 220 V, 50 cycle, 1 phase, RPM
Eo 2200.00 for engine generator
300.00 for tankage \$833/KW
Sell 5 per year of 0.6 KW in country
1 per year of 2.0 KW
5 per month of 0.6 KW in city
1 per month of 2.0 KW

1.85 KW Gasoline engine generator, Seimans, 220 volt, 50 cycle,
1 phase, 3000 RPM, Eo 835.00
\$301/KW

4.5 KW Diesel engine generator - Seimans, 220 V, 50 cycle,
3 phase, 1500 RPM, Eo 3800.00
\$563/KW

15 KVA Alternator - Servina, 400 V, 50 cycle, 3 phase,
1500 RPM incl. controls, Eo 2000.00
\$89/KW

American made milker and vacuum pump not including
1-1/2 HP engine, Eo 750.00
\$500

Grain mill - SKJOLD, Denmark, 250 kilos/hr, requires 8 HP
engine, Eo 400.00
\$267

10 HP Clinton gasoline engine, Eo 360.00
\$24/HP

Combination bench/hand power saw, Eo 300.00
\$200

U.S. Dollars = 1.50 Escudados

II. Personnel Met in Chile:

Adams, M. M. Jr. - U.S. Embassy, Chile
Ahern, P. - PCV Nurse, Chile
Alexander, D. - Second Secretary, U.S. Embassy, Chile
Carmorra, Juan de Dios - Director Coordinator, Inst. Rural Education,
Santiago, Chile
Carter, W. D. - Geologist, U.S. Geological Survey
Cole, C. W. - U.S. Ambassador
Croxatto, Carlos - ENDESA
d'Etigny, Enrique - University of Chile, Santiago, Chile
Dingman, R. J. - U.S.G.S.
Dungan, J. - PCV, Cholchol, Chile
Edmonston, John - Director, CARE, Chile
Fitzgerald, J. - PCV, Cholchol, Chile
Glover, J. E. - Gerente de Marketing, Esso Standard Oil Co.,
Santiago, Chile
Juan, Padre - Parish in Villarico, Chile
Langford, Dr. Walter - Director, Peace Corps, Chile
Larrain, Monsenor Rafael - Inst. Rural Education, Santiago, Chile
Lee, C. H. - Director, AID Mission, Chile
Maluenda, Benj. - Chief Dept. of Community Development, Inst. Rural
Education, Santiago, Chile
McIllroy, W. W. - Project Coordinator, AID Mission, Chile
Minami, J. Kazuo - Seismologist, UNESCO
Mundey, Father Ward - Maryknoll Missionary, Cholchol, Chile
Myers, C. R. - Aviation Operations Specialist, FAA
O'Brien, Father - Maryknoll Missionary, Cautin Depto, Chile
Oechsli, P. - Program Director, AID Mission, Chile
Pedrosa, Alfonso - Inst. Rural Education, Cautin Depto, Chile
Riddley, G. - Baptist Missionary, Temuco, Chile
Ronan, Marlin - PCV, Santiago, Chile
Salas, William - Acting Director, CARE, Chile
Seigler, J. - PCV, Cautin Depto, Chile
Sleeper, L. G. - Education Officer, AID Mission, Chile
Smith, Dr. G. E. - Assistant Director, Peace Corps, Chile
Smith - PCV Leader, Chile
Tisinger, J. B. - First Secretary in Charge of Economic Reporting,
U. S. Embassy, Chile

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FIELD SURVEY TEAM LOG
ACTIVITIES AT BARBADOS, JUNE 9 - 11, 1962

Team Members

George Street, Jr., Engineer - General Electric Company.
Dr. Thomas O. Paine, Physicist - General Electric Company.

At the suggestion of Dr. F. M. Gulick of R. E. P. A. S., A. I. D., a stopover was made at Barbados during the return trip from Bogota to New York. The facilities and programs of the Brace Experiment Station of McGill University relating to wind and solar power were reviewed there with the staff and resident director, Dr. Austin H. Whillier. Professor Gerald T. Ward is Director of the Brace Research Institute, and Dr. Whillier is Deputy Director and Head of the Brace Experiment Station.

This Institute is establishing an advanced engineering education and research program directed toward identifying, evaluating, and solving the problems involved in the more effective application of water desalination and wind and solar energy to meet the needs of the developing nations. The facilities of the Experiment Station include laboratory, library, shop, and field test locations for wind-powered pumping and electrical generation equipment, and for solar-powered sea water distillation, water pumping and generating equipment.

At the time of the visit, a curriculum on "Engineering Aspects of Arid Land Development" was being established for graduate work in the fall semester leading to a graduate diploma. This program will be repeated annually, and the fall program will include courses by Professor Ward on saline water conversion and heat and mass transfer, and a course by Professor Whillier on solar energy applications. It is hoped that Professor E. W. Golding of the Electrical Research Association will serve as a visiting professor from England to present a course on wind-powered electrical generators and their utilization.

The Brace Research Institute was founded by McGill University with a bequest of two million dollars from Major James H. Brace, to be devoted to research on the economic conversion of saline water to fresh, with particular reference to the conversion of arid regions into fertile agricultural country. It was specified that the results of the work should be made freely available to all nations. The Brace Experiment Station was built at St. James, Barbados in 1961 adjacent to McGill's Bellairs Research Institute, where programs are being carried out in marine biology (including fisheries development), tropical meteorology, and climatology.

The endowment furnishes an income to the Brace Institute of about \$100,000 per year, so supplemental R&D funding will be required to mount an adequate research program. It is hoped that in the future cooperative research programs can be formulated with governments and research centers concerned with arid regions, and support obtained from the UN, FAO, Colombo Plan or other source. These programs will initially emphasize the engineering rather than the agricultural aspects of the problem of arid land development, and will concentrate on the evaluation of solar distillation and pumping, and small-scale wind and solar power devices. Later, it is planned to carry out adaptive modifications of such devices and to demonstrate their application in arid regions around the world. The educational program which will bring in students from many lands will also help to accomplish this. Applied agricultural studies aimed at the more efficient utilization of fresh water by plants will also be undertaken in the future. In general, basic research will be carried out at Montreal, and applied research at Barbados.

The Brace Experiment Station at St. James has 2700 square feet of laboratory space, including a library, a small general-purpose workshop, and an electronics repair facility. Instrumentation for recording meteorological and solar radiation data is in operation. A small wind-power test station has been erected on top of the ruins of an old stone sugar windmill on a high, windy hill in the middle of the Island. A commercial one kilowatt, 32 volt d-c wind generator manufactured by Quirk's Victory Light Company of Australia was installed there, but it was not in operation during our visit, and test data were not available. It is hoped to secure larger wind generators (5-30 kw) from England and France for future testing.

The teaching program envisions a one-year course, which will include two terms of specialized lectures and laboratory work over a seven-month period at McGill in Montreal, followed by five months' practical work at the Experiment Station on Barbados, during which a graduate project relevant to problems of the student's native land will be undertaken.

Since this is one of the few attempts to provide such training in the world today, the proposed course of study may be worth recording here. Candidates for admission to the course are expected to have a college technical degree and two years' experience in scientific R&D. The program is divided into two parts: Theoretical Training and Practical Training, as described in the following excerpt from a descriptive pamphlet:

"A. THEORETICAL TRAINING - McGill University, Montreal, Seven Months

The student will be required to take a minimum of four courses each comprising approximately fifty hours lectures and seminars. At least two of the courses will be obligatory and will be chosen from the following:

1. The Utilization of Wind Energy

History of windmills; wind characteristics and distribution; wind power sites, wind surveys; wind flow over hills; the measurement of wind velocity; wind structure and its determination; wind data and energy estimation; wind driven machines; propeller type windmills; the generation of electricity by wind power; the use of wind power for water pumping; the economic aspects of wind power generation; the relationship of wind power to other power sources; the role of wind energy in underdeveloped areas.

2. The Utilization of Solar Energy

History of solar devices; the nature of radiant energy; the radiant properties of opaque and diathermanous materials; the solar constant; the sun as an energy source; atmospheric depletion of beam radiation; calculation of the beam radiation at the ground; determination of the sun's position; calculation of the diffuse radiation at the ground; the modification of clear sky radiation by clouds; the measurement of solar radiation; a survey of solar radiation records; solar energy and architecture; solar water heaters; domestic space heating; solar stills; the use of solar energy in the drying and processing of agricultural produce; solar cookers; solar furnaces; solar refrigerators; the storage of solar heat; solar heat engines; solar water pumps; the direct conversion of solar energy into electricity; the economic aspects of solar energy utilization; the role of solar energy in underdeveloped areas.

3. The Principles and Practice of Salt Water Conversion

The occurrence, physical and chemical properties of sea water and brackish waters; the minimum energy requirements for salt water conversion processes; the design and operation of vapor compression distillation units, single and multiple effect evaporators and combination units; the freezing process; reverse osmosis; ion exchange; electrolysis; electro dialysis; the production of power and fresh water from low temperature difference plants; the simultaneous recovery of minerals and fresh water from sea water; solar distillation methods and equipment; the incidence, treatment and prevention of corrosion and scaling; the economic aspects of saline water conversion; the role of salt water conversion in underdeveloped areas.

4. Engineering Hydrology

Precipitation; snow and snow-melt; analysis of precipitation data; occurrence of groundwater; groundwater movement; groundwater and well hydraulics; water wells and equipment; groundwater levels and fluctuations; quality of groundwater; groundwater development; groundwater surveys; sea

water intrusion in coastal aquifers; model studies and numerical analysis of groundwater; stream-flow data; analysis of run-off data; land evaporation and transpiration; moisture in irrigated soils, irrigation water requirements; losses and waste of irrigation water; quality of irrigation water; irrigation of saline and alkaline soils; the hydrology of the arid zones.

5. Elective Courses

The remaining courses may be chosen from the following McGill courses:

- G 505 Applied Mathematics
- G 506 Applications of advanced Mathematics to Engineering Design
- G 510 Advanced Mechanical Design
- G 520 Heat Transfer
- G 524 Process Heat Transfer
- G 530 Aerodynamics: Ideal Fluid Theory
- G 531 Aerodynamics: Viscous Flow and Boundary-Layer Theory
- G 532 High Speed Aerodynamics
 - 61 Advanced Chemical Engineering
 - 62 Fluid Mechanics and Particle Dynamics
 - 63 Chemical Engineering Rate Operations
 - 64 Heat and Mass Transfer in Dispersed Systems

B. PRACTICAL TRAINING - Brace Experiment Station, Barbados, Five Months

1. Instrumentation

The student will be able to familiarize himself with the operation and maintenance of recorders of solar and wind energy and with the techniques of energy surveys.

2. Demonstration Equipment

A representative selection of solar and wind driven equipment for water pumping, salt water conversion, heating and power supply will be available and the student will be encouraged to assess their relative merits in terms of his home environment.

3. Special Project

Each student will be given a special development project which will be related to possible future application in his home country. He will work under the supervision of a Faculty member and will be required to submit a written report on his findings. "

The over-all impression gained by the field survey team members who visited Barbados was that the development efforts there are minimal, and possibly even sub-critical in view of the magnitude of the problems to be solved. On the other hand, the personnel are extremely competent engineers with a good understanding of the technical problems involved. If present plans can be carried out so that increased support is made available and closer ties established with environmental problems in underdeveloped arid regions, this Institute can undoubtedly make significant contributions. McGill University is to be congratulated on the quality of its pioneering efforts in this significant new field.

Further information on this activity is available from:

Dr. Austin H. Whillier, Deputy Director and Head - Brace Experiment Station, McGill University, St. James, Barbados, B. W. I.

Dr. G. T. Ward, Director - The Brace Research Institute of McGill University, Montreal 2, P. Q., Canada.