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PRODUCTIVE USES OF ELECTRICITY IN RURAL AREAS

Workshop Proceedings

November 15-19, 1982
Dhaka, Bangladesh

Sponsored by: *The National Rural Electric Cooperative Association*
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WORKSHOP PROCEEDINGS

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The National Rural Electric Cooperative Association (NRECA) organized this workshop, "Productive Uses of Electricity in Rural Areas," in collaboration with the U.S. Agency of International Development (USAID), the Rural Electrification Board of Bangladesh (REB), the World Bank and the Asian Development Bank. In this effort, recognition is due, above all, to several key individuals for their assistance in making this workshop a success: Air Vice Marshall Sultan Mahmud, Deputy Chief Martial Law Administrator and Minister for Energy and Mineral Resources, GOB; Brigadier Sabihuddin Ahmed, Chairman, Rural Electrification Board; Mr. James Norris, Director, USAID/Bangladesh, and Mr. William Joslin, Deputy Director, USAID/Bangladesh; and U.S. Ambassador Jane A. Coon.

Although many had a hand in developing the workshop, special thanks must go to the following individuals for their support and guidance during the many months of planning: from USAID/Washington--Hasan Hasan, Chief, Engineering Division, Office of Project Development, Asia Bureau, and Jacob LeMair, Assistant Chief, Engineering Division, Office of Project Development, Asia Bureau; James Heifner, NRECA/CAI Team Leader in Bangladesh and his staff; the Directors and staff of REB and the USAID Mission Staff in Bangladesh; Mr. James Fish, Power Advisor, Energy and Industry Staff, the World Bank; and Dr. Shyam Rungta, Asian Development Bank.

Thanks must go to several others, in addition to those mentioned above, who helped the workshop run smoothly: from REB--Syed Yusuf Hossain, Director, Finance, and M.A. Wadud, Director, Rural Electric Society Management Operations; John Corr, Public Information Officer, U.S. Embassy; and from USAID/Bangladesh--Graham Thompson, Claude Reece, and Thomas Tift.

A special thanks must be given to the REB Liaison personnel who provided personal and unstinting assistance to each of the visiting country groups.

These proceedings were developed by the NRECA Staff with assistance from Paul Swanson and Irene Fischer, editors; Marlene Kaletta, Marie Lang, Jessica Putnam, Micki Kasow, and Kitty Anderson, word processors; and the NRECA Art Department.

OVERVIEW

Summary

Workshop Program

Participants and Observers

Workshop Evaluation Results

SUMMARY

James D. Lay

Economic growth, whether urban or rural, whether in the developing or developed countries of the world, is largely dependent on the availability of steadily increasing supplies of energy in one form or another. In many parts of the rural areas of the developing world, newer forms of energy supply systems are just beginning to be developed. However, in terms of scarce resources, the investment required to bring these systems into areas where none existed before can be substantial. It is essential, therefore, that every effort be made to ensure that maximum overall benefit be derived from these newly available energy supply systems.

While electric energy by itself may bring some minimal social and economic benefits to a given rural area, to justify the investment in developing the delivery system it, too, must be consciously channeled into those kinds of economic and social activities that will bring the biggest gains to the people it is serving.

With this in mind, the National Rural Electric Cooperative Association (NRECA), in cooperation with the U.S. Agency for International Development (USAID), has programmed a series of Seminars/Workshops entitled "Productive Uses of Electricity in Rural Areas," to be carried out over the next several years in the developing regions of the world. The first such Workshop was held in Dhaka, Bangladesh, from November 15-19, 1982, with representatives from nine Southeast Asian countries and the United States participating. The participating countries were Bangladesh, India, Indonesia, Malaysia, Nepal, Pakistan, The Philippines, Sri Lanka, Thailand, and the United States. In all, nearly 100 persons participated in the Workshop, with average attendance at the working sessions being approximately 50.

It was gratifying to the planners of the Workshop that there was full-time participation from four of seven USAID Missions, with thirteen staff present and sharing their experiences and learning with the country participants.

The purpose of the Workshop was to improve the understanding of the productive uses of energy as a tool for the promotion of economic development and to ensure viable rural electric systems. As one reads the proceedings presented here, one is convinced that the purpose of the Workshop was achieved.

The Workshop in Dhaka was hosted by the Rural Electrification Board of Bangladesh (REB) in cooperation with the NRECA Team in Bangladesh and the USAID Mission in Bangladesh.

Participants also included Representatives from the following agencies or groups:

Rural Electrification Corporation Limited, India

National Power Authority (PLN), Indonesia

Rural Electrification Project Development Office, Directorate General of Cooperatives, Indonesia

National Electricity Board, Malaysia

Nepal Electricity Board, Nepal

Small Hydro Development Board, Nepal

Water and Power Development Authority, Pakistan

National Electrification Administration, The Philippines

Miasmis Oriental Electric Cooperative, The Philippines

Ceylon Electricity Board, Sri Lanka

Provincial Electricity Authority, Thailand

Rural Electrification Board, Bangladesh

Power Development Board, Bangladesh

Ministry of Energy, Bangladesh

Planning Commission, Bangladesh

Secretariat, Chief Martial Law Administrator, Bangladesh

Ministry of Finance, Bangladesh

Bangladesh Small and Cottage Industries Corporation

Bangladesh Agricultural Development Corporation

Bangladesh Agricultural University

Bangladesh University of Engineering and Technology

Bangladesh Krishi Bank

University of Sidney, Australia

The Workshop was formally opened on Monday, November 15, by the Chairman of the REB. A welcome address was given by the Minister of Energy and Mineral Resources who outlined the importance of productive uses of energy in rural areas and spoke of the need for all participants to take advantage of the Workshop to increase their knowledge of the subject matter. This was followed by an outline of the objectives and agenda for the Workshop by the Chairman of the REB.

To lay the groundwork for sessions to follow a paper was presented on the importance of an effective productive uses program. The participants then heard from representatives of the Asian Development Bank, the World Bank, and USAID on the importance of productive uses programs as an integral part of planning for and carrying out rural electrification programs. It was also pointed out that there is a great need for exchange of information among and between countries on the successful uses of electricity for productive purposes.

One of the most interesting sessions of the Workshop was when the participants reported on the status and structure of productive uses programs in their countries. From these discussions it was learned that such activities ranged from very elaborate and well-organized programs, in the case of Bangladesh and India, to nonexistent programs, in Nepal. All participants indicated a need for much more work in this very important area.

The session on productive uses of electricity by the private voluntary sector pointed out the need for coordination and cooperation between end-users of electricity and the providers of electricity. Many of the voluntary agencies' staffs were working, often in isolated areas, on programs which depended on the provision of electric services to their project areas, but had no formal contact with the rural electrification agency. The reader will find very useful information on innovative uses for productive purposes in the materials contained in this section, but will also find out that those responsible for the provision of electricity to rural areas must coordinate their activities with all of the agencies or groups involved in rural development.

Financing of productive uses of electricity was one of the critical elements of successful programs, and as pointed out by the economist addressing this issue, respondents from both the international funding institutions and the participants, this issue must be injected into the planning process. Channels for credit and financing must be opened up to allow the ultimate consumer to undertake productive activities with electric energy.

The session on end uses of electric energy produces much food for thought for the reader of these proceedings. Cases are presented for agriculture, smal rural industries, home/cottage industries, and special applications which reflect a range of potential for the development of economically viable uses which in turn can lead to real growth in the rural areas.

The field trip to the Districts of Dhaka and Tangail to view the productive uses of electricity in Bangladesh was a high point of the Workshop. To be able to see with one's own eyes the productive uses already underway in the countryside after what is a relatively short life of the rural electrification program in Bangladesh was truly impressive; the large jute rug factory, the shallow and deep tubewells for rice irrigation and fresh drinking water, the soft drink processing factory (located in the rural area because of the availability of reliable electric energy), the rice mills, the lighted classrooms, clinics, and health facilities, and the return to the city of Dhaka at night through well-lighted villages and towns.

On the fourth day of the Workshop the participants were able to learn about how women can effectively use electric energy as well as the role electricity plays in the development of small cottage industries in Bangladesh. This session also pointed up the need for greater coordination between the providers of electricity and the development agencies in any given country where there is a significant rural electrification program.

On this day the participants heard from speakers who presented papers on the productive uses of electricity from small decentralized systems and a productive uses program as a part of a consumer services department. The specialists indicated: (1) that it is important to have well-defined plans for both isolated as well as grid-connected electric systems to enable these systems to be economically viable; and (2) conscious thought must be given to providing a framework from which to develop and operate a productive uses of electricity program.

A key session of the Workshop was devoted to the participants meeting by country groups to design, or improve, productive uses programs for use upon return to their countries of origin. The breadth and effectiveness of the information presented during the first 3 1/2 days of the Workshop were clearly reflected in the reports of these groups.

In this, the critical phase of the work done during the week, not only did it become apparent that the Workshop had succeeded in leading the participants to new perspectives on the productive uses of electricity

and, perhaps for some, confirming the importance of existing plans and direction, but also the critical first step in developing a deliberate, comprehensive productive uses program was taken.

Together, the ten country groups established over 20 separate categories of productive uses goals, ranging from the very general to the very specific. Not surprisingly, the leading category among these was the increase of the production and processing of agricultural goods. Also frequently cited was the development of rural and cottage industries. Among the other goals prominently mentioned were:

- The reduction of transmigration to urban areas
- The development of national standards for equipment
- The encouragement of village entrepreneurship
- The improvement of essential public services
- The maximization of the electrification of rural homes.

The groups were able to identify many constraints on achieving the goals that they had set, among which were: inadequate information, less than fully experienced manpower, lack of refined overall institutional capacity to develop and promote the productive uses of electricity, a clear lack of authority to carry out an effective program, the absence of interagency coordination, and the lack of funding and credit facilities to provide the necessary resources for the growth of productive electric energy uses. Also quoted as constraints were the lack of adequate and reliable sources of power, and the unwillingness of suppliers and consumers alike to take risks. These are all serious obstacles requiring the concerted attention of key groups of individuals or entities, if they are to be overcome.

It is felt that the Workshop helped the participants move measurably closer to their objectives. They were able to establish specific target areas by country group on which to take action in the coming months and years--concrete steps were identified to help carry out a comprehensive plan of action spanning a wide range of institutional and technical activities. The responsibility for taking these actions were assigned to specific groups and agencies, and sources of funding were proposed. Equally important, time schedules were established by some groups in which to carry out and complete these activities.

The final day of the Workshop included a review of the week's activities and some very interesting observations by representatives of the USAID Missions, the participants, and the conference chairmen on the followup necessary for the development of sound and effective programs for the productive use of electricity in each of the participating countries.

The Workshop was formally closed with an address from the U.S. Ambassador to Bangladesh, in which she shared her deep commitment to rural electrification, her pleasure with the success of the Bangladesh rural electrification program to date, and her pride in the success of the Productive Uses Workshop and its having taken place in Dhaka. She gave special thanks to the REB for having so successfully sponsored and supported the Workshop.

WORKSHOP PROGRAM

Sunday, November 14	
2:00 p.m.-6:00 p.m.	Registration--Sonargoan Hotel, Dhaka
Monday, November 15	
8:00 a.m.-9:00 a.m.	Registration for local participants and late arrivals, Hotel
9:00 a.m.-10:30 a.m.	WORKSHOP INAUGURATION
9:00 a.m.	Call to Order--Chairman of the Rural Electrification Board, Peoples Republic of Bangladesh
9:10 a.m.	Opening--Minister in Charge, Ministry of Energy, Peoples Republic of Bangladesh
9:25 a.m.	Bangladesh--Total Commitment to Area Coverage for Rural Electrification, Edward Gaither, Regional Administrator, Asia and the Pacific, National Rural Electric Cooperative Association, Washington, D.C.
9:55 a.m.	Objectives and Agenda of Workshop--Brig. Sabihuddin Ahmed, Chairman of the Rural Electrification Board, Peoples Republic of Bangladesh
10:10 a.m.	Audio-visual Presentation on Productive Uses, Samuel Bunker, Administrator, International Programs Division, National Rural Electric Cooperative Association, Washington, D.C.
10:30 a.m.	Tea/Coffee Break
11:00 a.m.-12:30 p.m.	FIRST SESSION
11:00 a.m.	Call to Order, Samuel Bunker
11:05 a.m.	Importance of an Effective Productive Uses Program, Thomas Niblock, International Consultant
11:30 a.m.	Asian Development Bank Definition of Productive Uses of Electricity, Dr. Shyam Rungta, Project Economist, Asian Development Bank, Manila
12:00 noon	World Bank Definition of Productive Uses of Electricity, John Schwartz, Chief, World Bank Resident Mission, Bangladesh
12:30 p.m.-2:00 p.m.	Lunch Break
2:00 p.m.-5:15 p.m.	SECOND SESSION
2:00 p.m.	Call to Order, Yusuf Hossain, Member, Rural Electrification Board

2:05 p.m.	PANEL DISCUSSION #1--Status and Structure of Productive Uses Program in Each Participating Country, chaired by the Chairman, Rural Electrification Board
	Recorder, Edward Kelly, National Rural Electric Cooperative Association, Bangladesh
	One participant from each country. Each participant to give ten-minute summary and then a series of key questions directed toward panelists by Chairman, and open discussion.
3:45 p.m.	Tea/Coffee Break
4:15 p.m.	Productive Use Assessments, An Integral Part of Rural Electrification Planning and Project Feasibility Studies, Philip Costas, Assistant Administrator, Economic Analysis and Evaluation, National Rural Electric Cooperative Association, Washington, D.C.
4:45 p.m.	Productive Uses: The Effect on Load Growth, Dr. Frank Denton, Consultant, NEA/Philippines
	Commentators--Selected Country Representatives
5:15 p.m.	Adjourn
6:30 p.m.-7:30 p.m.	Reception at Sonargoan Hotel, Hosted by National Rural Electric Cooperative Association
Tuesday, November 16	
8:00 a.m.-12:00 noon	THIRD SESSION
8:00 a.m.	Call to Order, James Heifner, Team Leader, National Rural Electric Cooperative Association, Bangladesh
8:05 a.m.	PANEL DISCUSSION #2--Productive Uses of Electricity's Importance to the Private Voluntary Sector, Chaired by James Norris, Director, USAID/Bangladesh
	Recorder, Raymond Shoff, National Rural Electric Cooperative Association Team Leader, Indonesia
	Participants--CARE, HEED, CARITAS, CONCERN, World Council of Churches (WCC)
9:45 a.m.	Tea/Coffee Break
10:15 a.m.	PANEL DISCUSSION #3--Financing Productive Use Activities and Programs, Chaired by Philip Costas
	Recorder, Kenneth Cureton, National Rural Electric Cooperative Association, Bangladesh
	Participants--UNDP, World Bank, Asian Development Bank, Finance Ministry, Local Bank, Rural Electrification Board Representative
12:00 noon-1:30 p.m.	Lunch Break
1:30 p.m.-5:15 p.m.	FOURTH SESSION
1:30 p.m.	Call to Order, Yusuf Hossain, Member, Rural Electrification Board

1:35 p.m.	Productive End Uses of Electricity--Case Studies of Innovative Programs to be presented by the participants. Chaired by Azhar Ali, Additional Secretary in Charge, Energy Division, Ministry of Energy, Peoples Republic of Bangladesh. Recorder, Paul Clark, Information and Training Specialist, National Rural Electric Cooperative Association, Washington, D.C. Introductory Statements
2:00 p.m.	Agricultural End Uses Case Studies Presenters: Bangladesh Participant India Participant Pakistan Participant
2:30 p.m.	Small Rural Industries End Use Case Studies Presenters: Indonesia Participant Malaysia Participant
3:00 p.m.	Home/Cottage Industries End Uses Case Studies Presenters: India Participant Philippines Participant Thailand Participant
3:30 p.m.	Tea/Coffee Break
4:00 p.m.	Special Application End Uses of Electricity (Secondary Energy Production, Public Productive Uses, etc.) Presenters: Nepal Participant Sri Lanka Participant NRECA Participant
4:30 p.m.	Preparations for Action Planning Workshops scheduled for Thursday, Chaired by Edward Gaither, National Rural Electric Cooperative Association, Washington, D.C. (Explanation of Worksheets) Explanation of what is expected from workshops Group election of chairman, recorder, and reporter
5:00 p.m.	Briefing on Field Trip, Edward Kelly
8:00 p.m.	Dinner aboard the "Mary Anderson," courtesy Rural Electrification Board

Wednesday, November 17

8:00 a.m.-5:30 p.m.	FIELD TRIP TO VIEW PRODUCTIVE USES OF ELECTRICITY IN DHAKA AND TANGAIL RURAL ELECTRIC SOCIETIES
12:30 p.m.	Box Lunches
4:30 p.m.	Depart for Dhaka
5:30 p.m.	Arrive Dhaka
Evening	Free--transport available for groups, courtesy of Rural Electrification Board. Sightseeing/visits at the discretion of guests.

Thursday, November 18

8:00 a.m.-12:00 noon	FIFTH SESSION
8:00 a.m.	Call to Order, Yusuf Hossain, Member, Rural Electrification Board
	Announcements
8:05 a.m.	Women's Role in the Productive Uses of Electricity, Akhtari Begum, Project Director, Planning, Bangladesh Small Cottage Industries Corporation
8:30 a.m.	Productive Uses of Small Renewable Energy Systems Paul Clark, National Rural Electric Cooperative Association, Washington, D.C.
9:00 a.m.	Productive Uses Program As Part of a Consumer Services Department, James Lay, Regional Administrator for Latin America and the Caribbean, National Rural Electric Cooperative Association, Washington, D.C.
	Commentators--Selected Country Representatives
9:45 a.m.	Tea/Coffee Break
10:15 a.m.	WORKSHOPS--Meet by country groups to design, or if program is in existence, to improve productive uses program for use upon return home using worksheet as guide
12:00 noon-1:30 p.m.	Lunch Break
1:30 p.m.-5:00 p.m.	SIXTH SESSION
1:30 p.m.	Continue Workshops by country groups
2:30 p.m.	Group to prepare brief action report on Productive Uses Program designed in Workshops for presentation at Panel Session
3:30 p.m.	PANEL SESSION--Reports on Productive Uses Actions Plans, moderated by Ivan Holler, National Rural Electric Cooperative Association, Bangladesh
	Recorder, Paul Clark
5:00 p.m.	Adjourn
7:30 p.m.	Dinner followed by cultural show at Sonargoan Hotel, hosted by Minister of Energy, Peoples Republic of Bangladesh

Friday, November 19

9:00 a.m.-11:15 a.m.	SEVENTH SESSION
9:00 a.m.	Call or Order, Yusuf Hossain, Member, Rural Electrification Board
	Announcements
9:15 a.m.	AID Mission Directors or Designees--Look toward the future of productive uses of electricity and rural electrification programs in Southeast Asia and the Pacific
	PANEL DISCUSSION by Mission Directors or designees, chaired by Samuel Bunker
	Recorder, Paul Clark
10:15 a.m.	Summary and Conclusions of Productive Uses Workshop, presented by Edward Gaither
	Recorder, Raymond Shoff
10:45 a.m.	Workshop Closing--Remarks by U.S. Ambassador Jane A. Coon, and the Chairman of the Rural Electrification Board, Brig. Sabihuddin Ahmed
11:15 a.m.	Adjourn
	Recorder, Paul Clark

PARTICIPANTS AND OBSERVERS

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Shahiduddin Ahmed, Deputy Director (F.S.)
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Thailand	Gandhi Kumar Roy
United States	Golan Rabbani

WORKSHOP EVALUATION RESULTS

Workshop participants were requested to evaluate each session and/or activity at the end of each day. The results are presented here for the reader to share.

Based on the point scale devised to evaluate the Workshop, 79% of the participants completing the evaluation forms considered the Workshop good or excellent from a content standpoint; 21% of the participants ranked the Workshop satisfactory; and 0% ranked the Workshop either poor or unsatisfactory.

Based also on this point scale, this is how all the individual workshop sessions were evaluated by the 30-plus participants filling out the evaluation forms:

%	Session
84	Field trip
82	Denton's presentation
82	Lay's presentation
76	Panel discussion--finance
75	Niblock's presentation
69	Workshop exercise
62	Slide presentation
60	Panel discussion--PVOs
60	Begum's presentation
60	Clark's presentation
55	Case studies--cottage industries
49	Panel discussion--country programs
46	Case studies--rural industries
44	Case studies--agriculture
40	ADB and IBRD presentations
32	Case studies--special applications

The respondents thought these major items should have been covered in more detail during the workshop:

- o Rural development theory
- o Workshop exercise
- o Equipment benefit/cost analysis and manufacturing development
- o Case studies
- o Funding mechanisms and constraints
- o Productive uses program as part of consumer services department.

Moreover, the respondent thought that these major additional topics should have been included in the workshop:

- o Promotion of manufacturing productive uses equipment and appliances
- o Pros/cons of rural electrification agencies getting into productive uses programs versus other development agencies
- o Productive uses training programs
- o Productive uses evaluation programs
- o Pricing methods for encouraging productive use activities.

INTRODUCTION

Welcome Speech at the Inaugural Ceremony of the International Ceremony Workshop on "Productive Uses of Rural Electricity"
Air Vice Marshal Sultan Mahmud

Total Commitment to Area Coverage Rural Electrification
Edward Gaither

Objectives and Agenda
Brig. Sabihuddin Ahmed

WELCOME SPEECH AT THE INAUGURAL CEREMONY OF THE INTERNATIONAL WORKSHOP ON "PRODUCTIVE USES OF RURAL ELECTRICITY"

Air Vice Marshal Sultan Mahmud
DCMLA and Minister for Energy and Mineral Resources
Bangladesh

I consider it to be a matter of great pleasure and privilege for me to welcome you all this morning at the Inaugural Session of the International Workshop on Productive Uses of Rural Electricity.

It is indeed gratifying for us that, as a case study for the developing nations, Bangladesh has been chosen to host this international workshop as a model Asian country where a rural electrification program has made a significant mark and is fast gaining momentum.

Against this backdrop, the timely organization of the workshop with the cooperation of USAID and the sponsorship of the National Rural Electric Cooperative Association of the United States deserves unqualified appreciation.

In the present-day modern economy, electricity is considered to be the basic input--the prime mover of the wheels of production. And, in developing countries like ours, it has a far-reaching and multidimensional impact on various sectors of the economy. In pragmatic terms, it is the fulcrum of development programs.

The Area Coverage Rural Electrification program has been a total commitment of the Bangladesh Government.

In Bangladesh, the rural electrification program has gained commendable grounds. In fact, it is a matter of great satisfaction to all of us that, in spite of the rural electrification program still being in its early stage in Bangladesh, productive use performance has far exceeded our expectations.

I firmly believe that this international workshop, which is the first of its kind in this region, will generate deliberations on many important and unresolved issues related to the relevant fields of study. The exchange of views of the learned experts on productive use of rural electricity will definitely bring to light solutions to outstanding problems common to most of our developing countries.

I would like to take this opportunity to thank USAID and the NRECA for their assistance in making this workshop possible. I hope the distinguished visitors to our country will find their short stay comfortable and pleasant.

I wish the workshop its well-deserved success.

Thank you, ladies and gentlemen.

TOTAL COMMITMENT TO AREA COVERAGE RURAL ELECTRIFICATION

Edward Gaither
Regional Administrator for Asia and the Pacific
International Programs Division, NRECA,
Washington, D.C.

BACKGROUND

Many countries have been making various types of assistance programs available to Bangladesh since it established its independence in 1971.

Bangladesh is one of the least developed countries in the world, and over 80% of its gross domestic product is derived from agriculture. Bangladesh is not self-sufficient in food production and has one of the highest population growth rates in the world.

The United States has consistently been one of the largest donors contributing to Bangladesh's program of development through its Agency for International Development and has assisted Bangladesh in many projects.

Since 1961, USAID has made soft loans and grants to many developing countries for rural electrification projects. They have all been successful when rural electrification has been a national priority and has had the strong support of the central government.

FEASIBILITY

Early in 1976, USAID made a project studies grant to the Government of Bangladesh to conduct a rural electrification feasibility study. Two U.S. firms, the National Rural Electric Cooperative Association and Commonwealth Associates, Inc., were selected to combine their efforts and carry out the study. The purpose of the study was to ascertain whether area coverage rural electrification could be financially viable in a poor country, to determine if it was affordable by the rural poor, and to determine what contribution it could make toward improving the economic and social well-being of the country. The study was divided into two phases: Phase I, Economic, Financial and Social Feasibility; and Phase II, a detailed planning and design study to determine the magnitude and cost of the necessary physical facilities.

Perhaps we should pause here to clarify what we mean by area coverage rural electrification. It is a concept developed by the U.S. Rural Electrification Administration (REA) as an agency of the Federal Government. The Administration's mandate is to develop rural electric utilities to provide central station electric service to the rural areas of the U.S. Additionally, it provides the necessary technical assistance to design, construct, manage, operate, and maintain these rural electric utility systems. The Act establishing the Administration further provided that REA would make loans to its borrowers at 1/2 of 1% above the cost of borrowing by the U.S. Treasury. In the initial years, the REA adopted a policy that a borrower must be able to demonstrate a density of two connections per mile of line. In the sparsely populated western U.S., this density was impossible to achieve.

As a result of pressure from the grassroots, Congress amended the Rural Electrification Act in 1940 to provide 35-year loans at 2% interest for all REA borrowers who agreed to provide connections to anyone in their service area who can afford to pay for electric service. That, then, is the area coverage rural electrification concept.

In order to make this approach economically viable, it was necessary to develop lower-cost components and more economical construction methods to effect savings wherever possible. REA engineers introduced single-phase rural distribution lines and, in cooperation with industry, developed high strength conductors which reduced the number of poles required per mile of line by over 25%; single-bushing, single-phase transformers, which reduced transformer costs considerably; and uniform construction assembly standards, which enabled contractors to utilize "assembly line"-type construction practices and thereby reduce construction labor costs by as much as 50%. These and other innovations reduced investment per mile of rural distribution line to approximately one-half of what was previously considered acceptable and area coverage rural electrification was on its way. From 1936 to 1960, the number of farms and rural establishments receiving central station electric service grew from 10% to over 99%.

The results of the Bangladesh feasibility study indicated financial viability within 5-10 years of energization, providing a strong productive uses program was planned and developed with emphasis on electric-powered irrigation, which would permit multiple cropping (three crops annually, rather than one); development of agro-based small industry, and utilization of electric power in cottage industries and the home.

The socioeconomic study indicated 75% of the rural households could achieve immediate financial benefit by substituting electricity for kerosene for lighting; and

that rural health clinics, mosques, and schools could provide increased and improved services to the community.

Based on the objective of making electric service affordable to the rural poor (which was verified as possible by the findings of the socioeconomic study), it was recommended that Bangladesh adapt the U.S. system of the area coverage concept to Bangladeshi conditions and customs.

The study concluded that rural electrification would have a high probability of success, provided the Bangladesh Government would establish a separate organization with the sole responsibility of developing and administering the rural electrification program.

IMPLEMENTATION

The Phase I study was completed and distributed by July 1, 1977. Many weeks of discussion and clarification ensued, after which the Bangladesh Government elected to accept and implement the study recommendations. Rural electrification was designated as one of the top priorities of the government's development programs. In October 1978, the Bangladesh Government adopted a Rural Electrification Act creating a Rural Electrification Board (REB) to develop and administer the program. USAID made $50 million available to enable the REB to establish 13 Rural Electric Societies (RES) in the areas covered by the feasibility study. The REB was formed June 1, 1978, with the appointment of a Chairman. A Technical Assistance Agreement was signed in March 1978 with NRECA/CAI; the first bid opening for commodities was held in September 1978; construction of distribution facilities began in December 1979; and the first system was energized in June 1980.

During this period, NRECA/CAI was advising and assisting the REB in the organization and development of the RESs and the staffing and training of their leaders and employees. An Institutional Training Institute and a Technical Training Institute were established, and to date over 6,000 leaders and employees have received specialized training courses in the various aspects of the planning, design, construction, management, operation and maintenance of rural electric distribution systems.

A typical organogram was developed for the RESs which included a well-staffed Productive Uses Department. The Productive Uses Department begins by training village electricians; supervising the wiring of homes, shops, cottage industries, small industry, and irrigation installations; demonstrating the application and use of single-phase motors; assisting in obtaining sources of credit; and advising in the safe and wise use of electric service. As the departments gain experience, they continue to broaden their activities in assisting their consumers to maximize their use of electric service for economic and social gain.

NRECA has two expatriate Productive Uses Advisors working with the REB agricultural engineers and they are, in turn, working with the productive uses personnel of the RESs and their members. The REB has established a strong and active productive uses program and the results, in just a little over 2 years. are impressive by any standard.

That was one of the determining factors in deciding what organization should co-host the first of a series of workshops on the Productive Uses of Rural Electricity. We believe that a strong productive uses program is going to make the Bangladesh rural electrification program one of the most successful in the world.

CONCLUSION

The Bangladesh rural electrification program is uniquely Bangladeshi. It is not a U.S. program transplanted to Bangladesh but rather a U.S. concept that has been adapted to fit the conditions that exist in Bangladesh. The program has been so successful to date that arrangements were completed earlier this year with a consortium of donors/lenders to develop another 20 RESs. REB has developed a master plan which indicates that 80-90 RESs must be developed to extend area coverage rural electrification to all of rural Bangladesh, and we anticipate no problems in securing continued foreign exchange funding as long as the program continues to be successful and we feel productive uses is the KEY. That is why we invited you to Dhaka to share with you the Bangladesh story and have you share with the rest of us the creative and innovate things you have developed in the maximization of the use of electricity for economic and social gain in your country.

OBJECTIVES AND AGENDA

Brig. Sabihuddin Ahmed
Chairman
Rural Electrification Board
Bangladesh

Ladies and gentlemen, I will briefly cover for you, for the information of the guests who are participating in the inaugural session only, the objectives and agenda of this Workshop.

The purpose is to improve the understanding of productive uses of rural electricity as a tool to foster economic development and ensure viable rural electric systems. The objectives have been divided into six groups:

1. To discuss institutional approaches to a productive uses of electricity program. Here we would like to establish which institutional approach has worked best for each type of program you have established. I repeat, to discuss the institutional approach or approaches to a productive uses of electricity program, we are going to find out what institutional approach has worked best for each type of program you have established in your country.

2. To present speakers on key topics related to productive uses of electricity. Here we would like to establish or find out and explore all of the many facets of productive uses of electricity.

3. To share experiences of productive uses among participants. Here we would like to learn and share the successes and failures in the programs of the projects you have tried.

4. To identify the constraints against optimum productive uses of electricity. Here we would like to learn what problems you have encountered and how they can be overcome.

5. To observe a productive uses of electricity program in Bangladesh. We have arranged a field trip on Wednesday to enable you to see our achievements in this regard. We will also tell you about the ones which haven't worked satisfactorily and our assessment of why they have not.

6. To draw conclusions and then make recommendations. We will try to draw certain conclusions on the causes of both success and failure. By sharing experiences and exchanging ideas, together we should be able to improve our overall approach to establishing the best possible productive uses program.

The agenda has been developed with these criteria in mind, and we hope that it is all inclusive. I will not review it in detail now since it is included in your program. However, if we have overlooked any important points, you will have an opportunity during the course of the Workshop to bring them up for discussion.

We will now have an audio-visual program presented by Mr. Samuel Bunker, he Administrator of the International Programs Division of NRECA in Washington, D.C.

BACKGROUND PAPERS ON PRODUCTIVE USES

Importance of an Effective Productive Uses Program
Thomas Niblock

Comments on Productive Uses
Ralph Bird

A Productive Uses of Electric Energy Program Within a Consumer Services Department of an Electric Utility Organization: A Model
James D. Lay

A Note on the Productive Uses of Electricity in Rural Areas
Shyam Rungta

World Bank Definition of Productive Uses of Electricity
John Schwartz

Participant Discussion and Comments on Overview Papers

IMPORTANCE OF AN EFFECTIVE PRODUCTIVE USES PROGRAM

Thomas Niblock
International Consultant
Washington, D.C.

Few of us would be here if we did not already believe rural electrification to be one of the keys to economic and social progress. We don't need to persuade each other that rural electrification is a good thing. Furthermore, people pretty much everywhere agree it is a good thing. Why, therefore, do our colleagues in the development ministries and in the aid agencies hesitate to give priority funding to rural electrification?

There are, no doubt, a variety of reasons for this reluctance, and certainly reasons will differ from place to place. This morning I want to deal with one special reason standing in the way of a broader consensus that rural electrification should receive a larger share of scarce development resources. And that reason is the difficulty of establishing a direct and predictable link between investment in extending electric power to rural communities and use of that power for productive purposes. Put another way, is it safe to assume money spent for rural electrification will lead to increased employment and higher incomes? To increased food production?

A challenge this group should be willing to accept is the challenge to present solid evidence that an important part of the stated goals of rural development can be achieved by bringing electric power to rural areas. There is growing evidence that rural electrification, by expanding irrigation, has had a major role to play in the rise of food production in India. Perhaps the influence from electrification has rivaled the impact of high yielding seed varieties. If so, this impact of electrification has not been documented. Hopefully, it will be documented here in Bangladesh. In other countries where pump irrigation is less important, such as Indonesia, the largest impact from electrification will likely be in the agro-industry and small enterprise sector. In both cases, village electrification may be one of the most effective ways to mobilize the private sector of the economy and local initiatives. Again, if this is true, then advocates of rural electrification need to present a better documented case.

With such evidence, development planners will find it hard to refuse funds for expanding rural electrification. Successful rural development projects command attention. The task is to identify successful projects and what they have accomplished to people who have been disappointed enough times to be skeptical of any project proposal and to want to see the evidence. Rhetoric is not the answer. A convincing case is the answer.

Arguments in support of rural electrification invariably cite the need for expanding rural employment opportunities and raising rural incomes. It is asserted that agro-industries and rural enterprises are stimulated by rural electrification--as is higher crop production from expanded use of irrigation pumps. Cottage industries are generally listed as beneficiaries of electrification.

The difficulty arises in measuring the impact of rural electrification on employment, production, and incomes. There should be little reluctance by development planners to placing high priority on rural electrification if they have uncontestable data verifying a rise in these economic indicators within a reasonable time after electric power is turned on, and if a genuinely plausible case can be made that rural electrification played an important role.

There is some documentation which seems to establish strong casual linkage between rural electrification and higher employment, production, and incomes. I have in mind the study of the Sircilla Rural Electric Cooperative in India by the Indian Council of Social Research and the Madigan study of the Moresco Electric Cooperative in the southern Philippines. AID evaluations of rural electrification in Costa Rica and Ecuador found very positive linkage between rural electrification and growth of local enterprises and incomes. Early reports from Klaten in Central Java suggest such a linkage also. At the same time, there are other evaluations of rural electrification which did not establish such linkages. We may believe these negative evaluations to be faulty. Some of them, no doubt, are. But they call for more than a wringing of hands.

To provide the evidence needed by planning ministries and funding organizations, there will be a need for additional and highly professional program appraisals. There needs to be a more thorough system for data collection and, in some cases, changes in design of projects to reflect what has been learned from early projects and from evaluation findings. A frequent criticism of rural electrification projects is that they are not coordinated with other rural development and agricultural programs.

In an effort to provide more definitive data, and deal

with critical evaluations, project planners are not devoting special attention to the design of rural electrification projects to build in assurances that increased employment, production, and incomes would follow from investment in rural electrification. This seminar and workshop reflects the interest by both the Government of Bangladesh and the larger development community in assuring that investments in rural electrification will be used for productive purposes as well as for consumption.

To provide such assurances should not be viewed as an impossible task. A recent data-based study of rural electrification in the Philippines found there to be much greater use of electric power for productive purposes than was evident from early observation. Once the Philippine electrification program was in place, with a strong institutional base and a few years of operations to analyze, the National Electrification Administration was able to satisfy the World Bank and the Asian Development Bank of the soundness of its rural electrification program. Both banks are continuing sizeable lending for the Philippine program. The process promises to be repeated here in Bangladesh.

But there will be special problems facing new electrification programs that seek external funds where there is no record of accomplishment for lending agencies to rely upon. These new programs will be called upon to present evidence that the planning and design of projects have built-in provision for productive uses of electric power.

The fact that this week we are paying special attention to the productive uses of electricity should not be viewed as lack of interest in other aspects of rural electrification which designers of projects need to take into account. I have in mind such factors as the organization and management structure for rural electrification; timing in relation to other rural development programs; financial and economic feasibility analysis, including the subsidy issue; and the mixed economic, political, and social character of rural electrification.

I wish we had time to talk about the special problems of dealing with a program which is administered on the one hand as a business which aims for financial payout and viability and, on the other hand, as a social service with important noneconomic benefits which are hard to quantify, such as improved security of home and business and better opportunities for children to study after dark. But that is for another time.

For this week, as we focus on productive uses of electricity, we will, no doubt, discover there are things we can identify pretty easily, such as the importance of an effective consumer services department in the electric utility organization itself. And we will deal with things which go well beyond the usual functions of rural electrification programs, such as promotion of small industry and related credit and marketing programs. Just what the relationship should be between these and other productive users of electricity as one party, and the rural electrification distribution system itself as the other party, is not so clear. Nor is there agreement as to how rural electrification comes to be used for productive purposes, and how village and farm electrification fit into the broader pattern of rural national development.

Some appraisals have concluded that future rural electrification projects themselves should incorporate additional resources needed to ensure the utilization of electricity for productive uses. Other appraisals have stressed the importance of rural electrification being undertaken within the framework of integrated rural development (i.e., coordinated with other programs even though the programs are funded and administered separately). Still other studies have documented a positive impact from rural electrification on employment and production when electrification was the major new intervention in a rural community.

Growing out of these and related studies is a body of data which is beginning to shed light on the subject of productive uses and which can be useful in placing the matter in perspective and in formulating future courses of action.

In the balance of my remarks, I will draw upon reports of experience with rural electrification programs from several countries, including early years of rural electrification in the United States. There is time to comment on only a few aspects of this experience which seem to me to be especially pertinent to this seminar and workshop. They are:

- The record of growth,
- Evidence of increased employment and income,
- Rural credit and marketing, and
- The impact on irrigation and general agriculture.

The field trips and case studies which have been built into this week's program will, no doubt, shed further light on each of these topics and more. And before concluding I will have a few remarks which attempt to relate this background to the future of rural electrification.

LOAD GROWTH AND POWER CONSUMPTION

Data generated within the past year by a carefully structured survey on seven rural distribution systems in the Philippines reveal that 60% of the electric power was sold for commercial and industrial purposes. Security and institutional lighting accounted for some 10%. Power used in the home for directly productive purposes accounted for 20-25% of total sales to households. Household consumption as a personal convenience was revealed to be under 20% of total power use.

In this connection, it may be useful to contrast use of power in so-called Third World rural electrification

schemes with the use of power in the early years of rural electrification in the United States. Customers per mile of line in the United States averaged just under three per mile--sometimes many more. I understand there are 120 customers per mile of line in some areas of Bangladesh.

Kilowatt hour sales per mile of line--revenues--are consequently higher than was the case in early years in the United States. Average kWh sales per mile of line from NRECA member cooperatives in the United States were 6,588 kWh in 1980--after 40 years of service. In The Philippines, for example, sales had reached 4,604 kWh per mile of line during the first seven years of service--a level not reached in the United States until 1973. This level was reached in The Philippines even though one-third of the customers used only 10 kWh or less per month. Sales per mile of line and per customer in the new electrification programs in Bangladesh and Indonesia are, I understand, generally in line with projections contained in project feasibility studies.

While such comparisons should be used cautiously in view of widely different conditions between countries, it is interesting that per family use of electricity grew slowly in the United States and that high rates of farm consumption in the United States did not occur until after the Second World War. As of September 1941, power use per customer in the 800 rural electric cooperatives formed by the time averaged just 71 kWh per month. By comparison, per customer usage in the rural Philippines in 1980 was approximately 80 kWh per month. At a comparable stage in Costa Rica, power use was even higher.

One of the important differences between the United States' experience and that in many developing countries today is the restriction placed on the cooperatives in the United States. They could only serve towns of under 1,500 people. Private utilities were already serving rural load centers and local industry. In any event, there does seem to be a sizeable potential for load growth in many, if not most, developing countries. As the only source of electric power in the area, the entire potential load is available to the new rural system. This is due to the relatively high number of customers per mile of line, even if per customer use is quite low, and to the still untapped potential to connect irrigation pumps, market towns, and local enterprises, to say nothing of the stimulative effect of bringing reliable electric power to an area for the first time.

INCOME AND EMPLOYMENT FOR FARMS AND RURAL ENTERPRISES

Rural electrification programs can add workers to employment rolls both directly and indirectly. One of the important motivations for launching the REA program in the United States in 1935 was to put people to work. The original program required that a minimum of 20% of construction workers come directly from the public relief rolls. This was not a very good way to get construction done, but it says something about the conditions under which the rural electrification program was launched in the United States. Soon, tens of thousands of people were employed directly throughout the United States in building power lines and operating the new distribution systems. The indirect employment and economic and social impact from this new nationwide rural development program can only be guessed at, but it is widely recognized to have been substantial.

Curiously, very little research has been done on the impact of this major social and economic innovation in the United States. Perhaps this is because virtually everyone took the benefits of electric lighting and power for granted in America in 1935 and never really doubted the value of electric power provided to the rural community. Futhermore, it was good politics to be identified with responding to such a strong felt need. The rural community in America had come to feel it was unfair for city people to have electricity and for them not to have it. The question dealt with how to get it--and such things as the role of public versus private power--not if it would benefit the rural populace or be used in any particular way or for any special purpose.

It is not surprising that in the Third World today the main focus of attention is the same as it was in the United States a generation ago--how to get electricity to the countryside and respond to a rising chorus of demand.

In many countries, development planners are busy with designs for major new generating plants and high voltage transmission grids, and plotting the spread of distribution lines to additional thousands of villages per year. A number of these plans will be translated into project proposals to international lending agencies. This, in turn, may require lending agencies to review their own plans and guidelines for assisting rural electrification. Hopefully, the information exchanged and ideas considered at the seminar and the workshops will benefit lending agencies and developing countries alike. Aware of the rising interest in rural electrification and the necessity of choosing among alternative investment possibilities, development planners have raised questions never really dealt with adequately, and which did not receive priority attention in either the United States or in early electrification programs undertaken in developing countries. You know the questions: how does electrification increase rural employment and incomes; how will agriculture be affected; what will be the social impact on the family, the community and, particularly, the poor; and how does rural electrification fit into the bigger picture?

There is, of course, some data on the impact of rural electrification in the United States. Use of labor saving electric appliances and various electrified convenience facilities affecting the quality of rural life expanded dramatically in the years immediately following electrification and can be directly linked to the rural

electrification program. Every electric cooperative was encouraged to have a member services and power use department, and to allocate an annual budget to help customers know how to use electricity most productively in home and farm applications. Most frequent applications were radio, refrigeration, electric pumps, flat irons, fans, sewing machines, poultry equipment, and automatic milking machines. Special financing was provided to facilitate purchase of such equipment. Rural commerce and industry were encouraged through other government programs.

It was not until 1962 that a serious effort was made to gather data on the contribution of electrification to rural employment and income in the United Sates. Beginning in that year and in each succeeding year, the REA asked all its borrowers to report on community development activities assisted by the borrower. Useful as this is in getting a picture of the role of electric cooperatives in encouraging economic growth and community activities, it does not tell much about the contribution of electrification to employment and income in early years, nor does it segregate the impact of electrification from other development programs. It is, nevertheless, significant that the rural electric cooperatives across America were able to play a very constructive role as community leaders in many local projects.

The REA reports indicate that about 50,000 jobs are helped to come about each year through assistance from rural electric cooperatives. The electric cooperatives have done this by acting in many cases as catalysts to bring parties together on projects such as water and sewer systems, hospitals, and recreational [illegible] agriculturally related service and manufac[illegible]ing facilities. The REA estimates its borrowers have created a market for electrical appliances and household equipment of more than $1 billion a year.

Yet, as noted earlier, lending agencies and social scientists anxious to forecast the benefits which could come from rural electrification in developing countries today have raised questions for which firm answers are either not documented or discernable from earlier experience in the United States. AID has taken the lead among donor agencies in funding research aimed at helping development planners get a better fix on the impact of extending electrification in rural areas.

For the past two years, Resources for the Future of Washington, D. C., has been examining rural electrification in three countries: Colombia, India, and Indonesia. The results are expected to be published early next year. A preliminary report from the principal investigator of the study, Douglas Barnes, concludes that ". . . electrification projects properly coordinated with complementary programs appear to have substantial potential for improving productivity and the quality of rural life."

Some of the most useful data compiled to date dealing with the employment and income effect of rural electrification are Francis Madigan's study of electrification in The Philippines. The Madigan study is a serious attempt to construct a before and after analysis of rural electrification.

There are, no doubt, a number of studies undertaken within developing countries by local researchers with which I am not familiar. And, certainly, there are excellent opportunities for further targeting of research on the impact of electrification. I hope that participants in this seminar will follow up on such opportunities in your own countries.

RURAL CREDIT AND MARKET

A study BY Janice Brodman of three villages energized through a demonstration rural electrification project in Central Java, Indonesia, found that consumption by business customErs accounted for 57% of total kWh consumption, with businesses providing services using more power than manufacturing and agricultural processing operations. She found that most businesses in the area were benefitting from electric service and were highly satisfied with it, even though relatively little electric equipment had yet been put in service. She concluded that most studies of rural electrification underestimated the likely use of power for services and gave too much emphasis to manufacturing. She made two very significant observations concerning productive uses: one was that some 35% of businesses in the survey area had made productive use of electricity to extend working hours and/or add small motors and appliances; the other was that a much larger potential exists for productive uses if improved credit and marketing services were made available to the village entrepreneur. The Brodman study went beyond ascertaining the use of electricity to inquire whether or not electricity use resulted in development of businesses. She found that "development," i.e., progress of business, depended to a large extent on access to capital (credit) and reliable market outlets. Her data found that from one use of electricity--electric sewing machines--output increased 58% per standardized day. And she found that 80% of businesses which "developed" reported an increase in profits due to electricity. Profits were increased for the very small business as well as for the larger. The Brodman study found a tendency for entrepreneurs to extend work hours in preference to hiring new employees, although she could detect no evidence of job loss due to use of electrical equipment.

The Brodman study of three villages is cited here not as a basis for generalization but as evidence of the kind of site-specific investigations which will be necessary to determine the best ways to help villagers make most effective use of electricity. She has identified a critical link between electrification and rural credit and markets, and the ability to make full use of these interdependent activities.

IRRIGATION, GENERAL AGRICULTURE, AND RURAL DEVELOPMENT

Rural electrification has influenced agriculture in quite different ways, depending on local conditions. In South Asia, the most prominent effect has been the expansion of land under irrigation. Tube wells have tended to be the focus of rural electrification. In these countries, there have been relatively few connections per village for other productive uses or for households. In Latin America, program evaluations found very little direct impact on agriculture. On the other hand, there was considerable use of electricity for food storage and processing and for rural-based industry. As I have indicated, early reports from pilot electrification projects in Central Java, where farms are small, population dense, and cottage industries are traditional, have suggested principal uses there will be off-farm uses for services and job-creating activities. The Philippine surveys mentioned earlier indicate electricity is being used for a wide variety of activities with no single use predominating.

What this suggests is that productive uses of electricity are quite site-specific. Project designers need to become very familiar with both established agricultural practices as well as with potential and prospective innovations of various kinds, off-farm and on-farm, which could benefit from electric power.

To illustrate the problem, irrigation has been cited as a probable use of electricity in places where a better knowledge of agricultural practices would have indicated pump irrigation would be very slow to develop. Elsewhere, programs of electrification have been mounted with the sole purpose of operating tube wells without giving consideration to other productive and social uses. This latter choice is more understandable if one considers the advantages of electric pumps over either diesel pumps or even more costly public investments in canals and distribution systems, or the savings in oil from electric motors compared to diesel engines. Nevertheless, it is unfortunate the full potential from rural electrification is often missed.

Now that we have considerable experience with rural electrification in different countries and regions of the world, it should be possible in the 1980's to design better electrification projects which serve a wide spectrum of productive uses. Along with disappointments from some past projects, there are solid achievements to point to from investment in rural electrification. It is possible to present a strong case for rural electrification as a key ingredient and vehicle for rural development. The workshops and field trip later in the week will provide an opportunity to exchange views and experience on such achievements. Personally, I look forward to learning about electrification programs I have not had the opportunity to visit, such as the new and dynamic program now well underway here in Bangladesh. And I look forward to an update on the progress of the Philippine program in providing leadership and organizational support for the imaginative and ambitious effort to achieve energy self-sufficiency by substituting its own tree farms for oil tankers.

When I speak of designing better projects for the future, I am not suggesting an academic exercise or the need for additional "studies." You know the questions and concerns that development planners and lending agencies have about rural electrification. These have been spelled out in a large number of reports and evaluations in recent years. There are convincing answers to these questions. I believe the best answers lie in examination of your own experience and experience in other countries. Several countries have already shown what it takes to convince international lending agencies to make a major commitment to their program.

This group is in a good position to clarify many of the questions which have been raised about rural electrification:

- Its role in the overall development process
- Preconditions for successful rural electrification.
- The relationship between rural electrification and other rural development and agricultural programs
- Its benefits for women and the family
- Alternative forms for organization and management
- The element of subsidy for early years
- Calculation of costs and benefits
- Identification of productive uses of electric energy on farms and in village

Your focus this week on productive uses at the village level will, no doubt, result in strengthened project proposals. It is worth noting in this connection that a major expansion of rural electrification is not out of the question in financial terms. Financial requirements, while fairly large in relation to some programs, can be kept in perspective by reminding ourselves and others that a comprehensive national rural electric distribution program can be carried out with about 10% of the electric power budget of most countries. The Philippines, for example, is well on the way to total rural electrification on a budget comprising just under 10% of that country's budget for generation, transmission, and urban distribution.

Another point you may want to keep in mind is that rural electrification is a proven and readily available technology. With care in providing an efficient institutional base for electrification, this service can be delivered as planned and promised. This cannot be said of many development project alternatives. The know-how is at hand. And there are good institutional models for rural electrification. The models include both

cooperative and noncooperative modes of organization and apply to national and local administration.

Finally, while I recognize that electric power, per se, is ideologically neutral, bringing elec[illegible]ower to rural communities can help stimulate c[illegible]vity and local, private initiatives and mobilize local leadership for development.

By giving serious attention to opportunities for productive use of electric power and doing a better job of documenting performance and trends, it should be possible to relate investments in rural electrification to achievement of important national goals. These can include expanding the availability of food and food consumption, or a rise in rural employment. By establishing such linkages, you will command the attention of your national development planners and the international lending agencies alike. I believe you are very close to being able to present such evidence.

COMMENTS ON PRODUCTIVE USES

Ralph Bird
Chief Engineer
USAID/Bangladesh

Thank you very much.

I've enjoyed listening to Mr. Niblock because I followed him in The Philippines, and I lived in the Bikol area in Naga City for four years, and I was a beneficiary of rural electrification. When I first got to Naga, we didn't have electricity from 5:00 o'clock in the evening until 10:00 o'clock at night. And, by the time I left, the rural electrification project had been implemented; they had put the Tiwi geothermal plant on, and we had electricity 24 hours a day.

The development of productive uses of electricity there was sort of the coordinated and the "hands-off" variety. We had several programs that we coordinated with the rural electrification co-ops in our large- and small-scale irrigation projects, and that was sort of the coordinated one. When we were designing an irrigation project with electric pumps, we would coordinate with them, and they would make sure the lines were there when the pumps were installed, and it worked very well.

In the "hands-off" approach, it was the private businessmen. You could see that as soon as electricity came in the private businessmen would get rid of their diesel engines driving their rice mill or their compressors for their refrigeration plants and install electric motors. The little guy with the tire repair station at the corner would get rid of his little gasoline engine driving his air compressor, and he would get a small electric motor driving his air compressor. This high school in Naga started night classes for children. Up until then, they had no electricity, so they had no night school. They had probably 1,000 students who attended high school at night just because of rural electrification. When I came here, I was assigned to the implementation phase of the AID-funded rural electrification project. So, I am seeing it from two sides of the fence right now.

I agree with Mr. Niblock on the recording data. I'll bet that none of these data on the experience in the Naga City area of The Philippines has been recorded--but it certainly should have been. I think here in Bangladesh we are not making that mistake. The REB is completing their base-line surveys on their first 13 rural electrification societies, and the intention is to have periodic evaluations of that. I hope that the follow-on of the recording and documentation of these data would be the free exchange of this information among the delegates from the various countries that are involved in this conference. I think if we get a freer flow of information between the countries which are anticipating or which are doing rural electrification projects, then this conference will be well worthwhile.

A PRODUCTIVE USES OF ELECTRIC ENERGY PROGRAM WITHIN A CONSUMER SERVICES DEPARTMENT OF AN ELECTRIC UTILITY ORGANIZATION: A MODEL

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INTRODUCTORY STATEMENT

Economic growth, whether urban or rural, whether in the developing or developed countries of the world, is largely dependent on the availability of steadily increasing supplies of energy in one form or another. In many parts of the rural areas of the developing world, newer forms of energy supply systems are just beginning to be developed. However, in terms of available scarce resources, the investment required to bring these systems into areas where there were none before can be substantial. It is important, therefore, that every effort be made to ensure that maximum overall benefit be derived from these newly available energy supply systems.

While electric energy by itself may bring some elementary social and economic benefits to a given rural area, to justify the investment in developing the delivery systems it, too, must be consciously channeled into those kinds of economic and social activities that will bring the biggest gains to the people it is serving. The process of developing the type of programs that will bring this about will not be an easy one.

A productive uses program for electric energy systems will depend to a large extent on the availability of certain other "tools" of development--skilled labor, credit, raw materials, markets, supporting infrastructure, etc. But it will also depend on the ability of the responsible institutions of either government or the private sector to effectively develop and implement action programs that will encourage and assist with the use of electricity in the most economically and socially productive ways possible. The development of a program to actively promote the productive uses of electricity, therefore, requires first of all the formulation of a course of action. The model which follows is such a plan which must, of necessity, be modified and adapted to coincide with a country's stage of development at the time such a plan is introduced to further its overall development strategy.

The model as presented assumes that a productive uses program will be an integral part of a utility's comprehensive consumer services program and, once instituted, will be a permanent, ongoing part of that electric system.

OBJECTIVES

Each electric system shall have a Consumer Services Department which will conduct a productive uses of energy program as an essential part of carrying out its objectives relating to consumer services, power use, public relations, and safety. The objectives of the program are to:

- o Achieve broad-based local, regional, and national support of the program and the application of all available human and financial resources to this segment of the coordinated and integrated rural development effort
- o Ensure rational development and use of available energy
- o Enhance the financial stability of the electric system through the promotion of new and appropriate productive uses of energy
- o Ensure community and consumer understanding and support of the productive uses program
- o Ensure continuity of the productive use of electricity program in the rural electrification program itself
- o Furnish all possible services to consumers in the safe and practical uses of electricity on the farm, in rural industry, in cottage industry, in commerce, and in the home.

SPECIFIC ACTIVITIES

The Consumer Services Department will undertake the following activities to promote the productive uses of electricity in the economic development of newly electrified areas:

- o Work to achieve broad-based local, regional, and national support of the program and the application of all available human and financial resources to this segment of the rural development effort through:
  - -- Information and education programs directed toward all appropriate ministries and government agencies, national banks, and other

public or private funding agencies and development organizations at the national level

- Coordination and joint planning efforts with appropriate agencies to assure the most efficient use of limited resources

- Involvement of government agencies, funding agencies, marketing institutions, universities, and other appropriate groups in the careful analysis of the uses of electricity in the service areas for the purpose of economic development.

o Work to ensure rational development and use of available energy by:

- Review of socioeconomic factors in the areas which are electrified or to be electrified which may affect productive uses of energy

- Production and marketing surveys of the areas to be electrified to ascertain development potential for appropriate agro-industry, commerce, and cottage industry

- Formation of a plan promoting the productive uses of energy to attract to or develop appropriate industry in the newly electrified areas.

o Enhance the financial stability of the electric system through the:

- Addition of new consumers within the guidelines established by the Board of Directors and/or management of the electric system

- Promotion of new and appropriate productive uses of energy to increase power sales and improve load factor

- Promotion, based on findings from production and marketing surveys, of the economic development of the area by providing leadership and by cooperating with local, state, national, and private organizations in establishing new industry and community facilities

- Establishment of a mechanism for importation and promotion of the sale of approved electrical equipment through local merchants or directly by the electric utility, particularly that to be used in productive uses of energy.

o Seek to assure community and consumer understanding and support of the program's and organization's ideals, objectives, and activities through:

- Information and education programs conducted through existing organizations and media

- Training, education, and continuing information programs for all employees so they can respond correctly and effectively to questions and complaints

- Education and information programs for local and national leaders and others to assure their understanding, cooperation, and support of the organization's goals and objectives

- Establishment, in writing, of the organization's operating practices, policies, and procedures concerning consumer services to maximize understanding of them and thus minimize any possible negative reaction among consumers and the public.

o Work to assure continuity of the productive uses program in the rural electrification program itself by working toward the necessary expansion of service areas and expansion of the system into new areas by:

- Investigating possible sources of funding for the establishment of a revolving fund in the electric utility or at the national level. (Such a fund could be based on the REA model, which allows loans that are repaid to go into this fund so that they can be reloaned to the rural electric systems.)

- Establishing policies, practices, and procedures for lending and controlling funds which are made available for this purpose.

o Furnish all possible service to consumers by providing useful information, assistance, and training in the safe and practical uses of electricity on the farm, in rural industry, in cottage industries, in commerce, and in the home. This includes:

- Extensions of new services as quickly as time and finances permit

- Safe and adequate wiring in farms, businesses, homes, and other places where electricity is used

- Directions and guidance for safe and adequate wiring installations

- Adult/youth group/school classes on the safe use and installation of home wiring and on minor repairs to small appliances

- Convenient methods for consumers to pay for initial installation and/or connection charges, bills, and the purchase of electric appliances and equipment.

CONSTRAINTS ON POWER USE AND PRODUCTIVE USES OF ENERGY

Nearly all rural electrification programs carried to the

completion of an established system have as one of their primary purposes the development of rural areas. Historically, though, only lip service has been paid to planning for the implementation of a well-thought-out, well-supported, and well-financed power use/productive uses program which is the key ingredient in the use of electric energy as a tool for integrated rural development. The following are some of the constraints which have limited or completely restricted the implementation of such a program:

- o Consideration of the program as a social good only, focusing primarily on household and public service uses of electricity
- o Lack of capital or credit by both the utility and the potential user
- o Unwillingness (or inability) to take risks
- o Absence of entrepreneurial ability in the service area
- o Lack of understanding of electricity and its applications
- o Lack of experience in carrying out such activities
- o Unreliability of the power source
- o High cost of energy (power)
- o Lack of technical assistance in proper and productive uses of energy
- o Inappropriateness of uses (i.e., no demand for final goods)
- o Absence of market access (i.e., no roads, no transportation)
- o Lack of availability of electrical materials and supplies
- o Restrictions on supply.

This model is designed to overcome these and other limitations and restrictions.

GENERAL OBSERVATIONS AND RECOMMENDED PROCEDURES

This model assumes a new rural electrification program or a major expansion of an existing program, but the same plan may be applied, with appropriate modifications, to an existing system.

- o Any rural electrification power use/productive use of energy program should be considered as an ongoing service of the system rather than a discrete activity which terminates on completion of the construction period of the planned rural grid.
- o The Consumer Services Department of the system should adopt the staffing pattern and the activity schedules described in this model. The Department should be responsible for developing plans and conducting activities and programs relating to rural consumer services, market analysis, power use, productive uses of electricity, and consumer and public relations. Specific examples of activities to be undertaken can be found in the chronograph of activities starting on page 13 (?) and in the position descriptions of individual staff members in the attached Appendix. In essence, the plan calls for three central staff members in the headquarters city to develop the consumer services program in more depth; to carry out a production and marketing analysis of the areas to be electrified; and to prepare information releases and announcements as well as brochures, wiring diagrams, cost information, and "how to" information on various productive and safe uses of electricity. In addition, they will be responsible for developing training programs for rural electrification advisors, productive uses advisors, village leaders, and key leaders in the country. It is proposed that the rural electrification and productive uses advisors begin activities before the rural system construction and energization is completed. Once in the field, these staff members will receive constant support, guidance, and direction from the central office.
- o The Department should develop a broad-based program of local, regional, and national support to focus all feasible human and financial resources on coordinated and integrated rural development efforts. A plan for establishing close cooperation between the system and the various government agencies, funding institutions, marketing institutions, universities, research and development groups, and local consumer action groups must be drawn up and then carried out. It is incumbent on the electric utility to inform, educate, and train, if necessary, these groups in the productive uses of electricity and to elicit their assistance and cooperation.
- o Uniform and aggressive procedures need to be developed for signing up new rural consumers. The procedures should be developed by a committee composed of key staff members from the administrative and operational sections of the utility. The committee should agree on an application form for a new service which could be filled out by prospective consumers during communal meetings, or house-to-house contact, which should take place in all project areas in anticipation of system energization. The application form should provide space for indicating the anticipated uses of electric energy, including productive uses, since this information will assist the rural electrification and productive uses advisors in their future informational, educational, and developmental activities.

- A scheme must be developed to undertake socioeconomic studies as well as a thorough market analysis of the areas to be electrified to assure that factual data on development potential appropriate to the area are available. Such analysis will include projections on potential markets or outlets for products, goods, and services produced.

- A plan should be formulated to attract appropriate industry to the newly electrified areas. It is recommended that at least two field positions be established in selected regional offices entitled "Productive Uses Advisor." Since these positions will require a high degree of consumer contact as well as familiarity with the local areas and leaders, in addition to a high level of local support, it is necessary that they be field positions and that they be closely related to area (district and regional) management and operations.

- Energy substitution should be made a part of any rural electrification program. This is normally apparent from a comparison of the benefits stream calculations for such energy uses as kerosene lighting and refrigeration and diesel and gasoline engines. At the same time, these represent the bulk of potential uses of electricity. In view of this, the rural electrification and productive uses advisors must be armed with mechanisms and analytical tools to aid them in convincing rural consumers of the economic benefits of converting to electrical power. Such "tools" might include detailed cost comparisons, audio-visual materials documenting the benefits achieved by others who have converted, and/or demonstration sites. Experience gained in successfully convincing consumers to make the energy substitutions will greatly facilitate the introduction of new and productive uses.

- Specific lines of communication between the consumer services department and the operating and administrative departments of the utility is required. The head of the consumer services department must be a key member of the staff and report directly to the chief executive of the organization. All staff must be made aware of the importance of the power use/productive uses program, receive appropriate training when necessary, and become advocates in the use of electric energy as a tool for rural development.

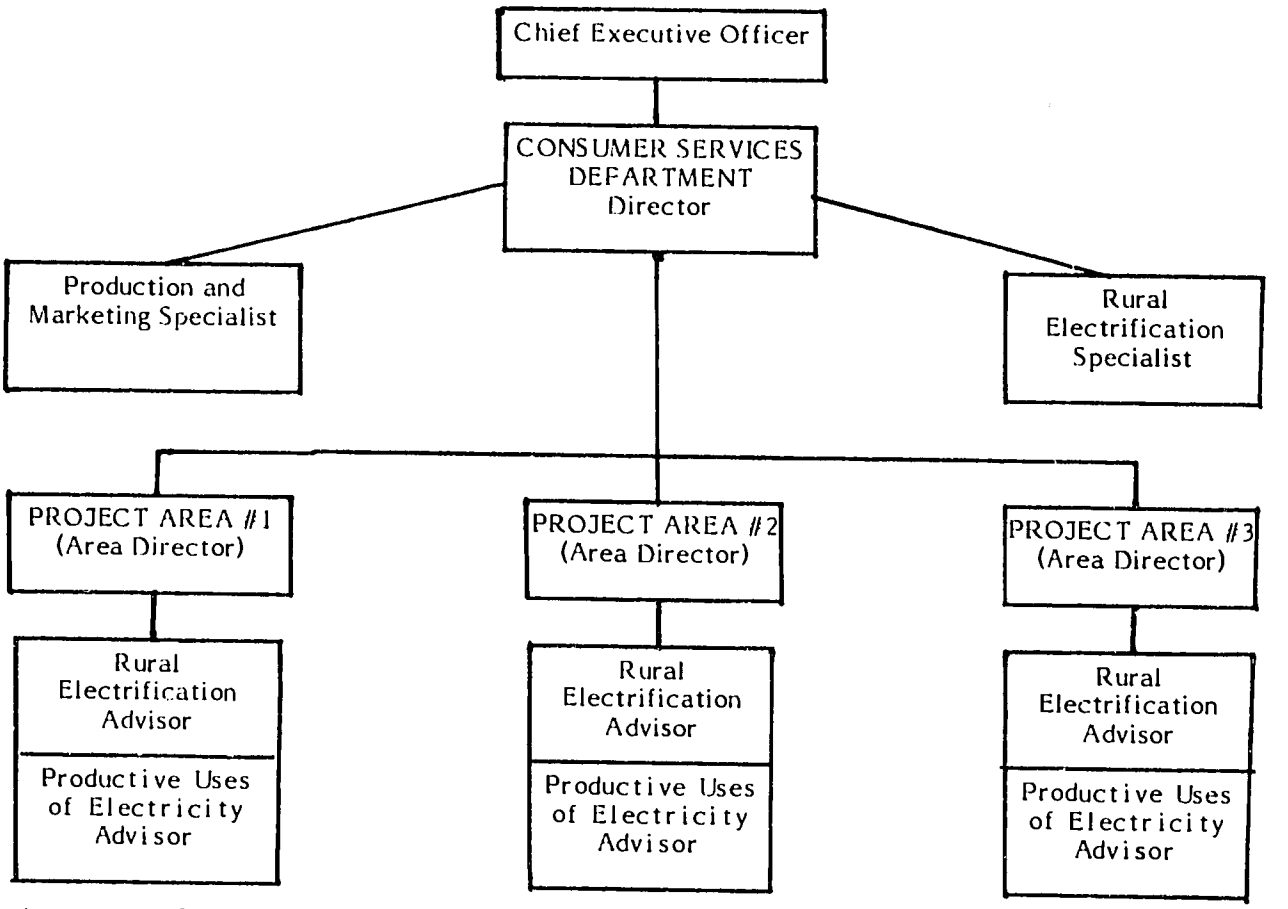
- One or more utility-operated financial plans should be established which will permit middle- and low-income consumers to purchase small electric tools and devices through the utility and make long-term, low-interest payments through their monthly electric bills. The optimum funding required by the utility should be determined and plans included for the control and use of such funds.

- Training, educational, and informational programs for all employees; consumers; and local, regional, and national leaders should be provided to assure understanding, cooperation, and support of the electric system's goals and objectives.

- The organization's policies, practices, and procedures should be formulated and promulgated in writing to assure maximum understanding of them and to ensure maximum efficiency in achieving the goals and objectives of the organization and its consumer services program while minimizing possible misunderstandings and negative reactions among consumers and the public.

- Working with the national government, the national and international banks, and other sources of financing, an adequate funding base should be developed for the utility to continue necessary expansion after initial funding and to perpetuate and further replicate the system. This should be done through the establishment of a revolving fund whereby some of the initial funding that is repaid can be recirculated.

SUGGESTED ORGANIZATIONAL PLAN (Professional Staff Only)



The above is a suggested staffing plan for a national rural electrification program. Modifications should be made for regional or local rural electrification schemes. As a general rule it is suggested that one electrification advisor and one productive uses advisor be assigned to work with each 4,000 to 5,000 new consumers. It is recommended that during the construction stage of a rural electrification program the consumer services department work as a unit, with field staff who are assigned geographic areas of responsibility reporting directly to the head of the department. After completion of construction, it is recommended that the field staff report to the local or area manager, but continue to receive functional direction and support from the central consumer services department. As other rural electrification projects are planned and constructed, it is important that allowance be made for the addition of qualified staff.

GENERAL COURSE OF ACTION

Creation of a consumer services department is the first activity to be undertaken. Responsibility for this falls under the direct responsibility of top management of the utility but requires strong support and direct input from all operating and administrative divisions (departments), especially from the public relations department, in the elaboration of materials for dissemination.

The plan should proceed in three stages which will coincide with the construction and energization schedule of a five-year rural electrification program. The first stage is a preparatory one (in the case of a new rural electrification program) lasting approximately ten months. During this phase, the central office personnel for the consumer services department are hired, receive the necessary training to perform their functions, and begin preparing detailed plans and materials for the second phase. During this phase the central staff will be reviewing the socioeconomic factors of the areas which are or will be electrified and undertaking initial production and marketing surveys to determine the appropriate power and productive uses programs which should be designed. The central staff will also be acquainting itself with local, regional, and national leaders and organizations connected to the energy field, production and marketing activities, development programs, funding institutions, and other related activities, and will begin to coordinate their activities and seek support of these leaders and institutions. During the latter part of stage one, the field staff should be hired and given appropriate training.

The second stage involves the actual undertaking of field activities which will include signing up and educating new members and local and area community leaders. This will be accomplished by the field staff in

each project area under the direction, support, and supervision of the central office staff. During this period, the productive uses advisors will review the socioeconomic data collected by the central staff; refine the data gathered by the production and marketing analyst; and begin to design a program to attract appropriate industries, businesses, and other productive activities to the service areas. This stage should begin approximately five months before line construction and a full year before construction of internal installations; it continues until construction is complete and beyond.

The third phase is merely the continuing recognition that consumer services, education and training activities, and continued focus on the productive uses of electricity should be an integral part of any electric utility. Over the long run, it is recommended that these activities be directed and supervised by local management personnel in each distribution area, with only those production and market analyses and activities that are best done on a regional or national level being handled by the central office staff.

A suggested timetable follows for the major activities to be carried out during the five-year period needed to accomplish the objectives listed above. More detailed information on program activities is included in the suggested position descriptions of key personnel.

SUGGESTED TIMETABLE FOR MAJOR ACTIVITIES

The following is a model to be adapted to the time frame of a given rural electrification program and other national and local project conditions.

Phase I—Preparation

Approximate time: initial construction date minus ten months (C-10)--Duration: two months

- o Hire consumer services department director and other central office staff
- o Familiarize staff with electric utility and plans for rural electrification program
- o Visit project areas and hold discussions with area directors
- o Conduct specialized training in power use, productive uses of electricity and consumer services, as required
- o Familiarize production and marketing specialist with all related development plans of the country that do or could have a bearing on electrified areas.

Approximate time: C-8--three months (constant activity afterwards)

- o Establish a reference library of books and articles on power use, productive uses of electricity geared toward the development of rural areas, socioeconomic evaluations of rural project areas, maps, distribution design guidelines, equipment and supplies catalogues, etc.
- o Develop guidelines for conducting production and marketing surveys of the proposed electrified areas
- o Develop a plan to seek sources of funding for consumer connections and utility financing of appliances needed by consumers
- o Develop information/educational materials to include:
  - — Potential products or activities in newly electrified areas
  - -- Potential markets for products from the newly electrified areas
  - -- Energy consumption cost comparison sheets
  - — Informational booklets on productive and other uses of electricity
  - -- Comic-book-style educational pamphlets on safety and rational use of energy
  - -- Radio announcements for eventual use in project areas
  - -- Posters and devices for demonstration purposes
  - — Typical wiring diagrams for lighting, pumps, motors, shop, and other equipment for agricultural and other rural enterprises
  - -- Catalogs of supplies and equipment
- o Make initial contacts and begin education program for leaders in government agencies, marketing institutions, universities, banking and funding institutions, and other appropriate local, regional, and national groups to elicit support for goals and objectives of the power use/productive uses program

Approximate time: C-5--(three months)

- o Develop a training program for organization staff to acquaint them with the goals, objectives, procedures, etc., of the consumer services department.
- o Develop a training/educational/information program for national leaders of public agencies (Ministry of Agriculture, agricultural and rurally related bodies, planning and development organizations, agricultural banks, etc.), and private organizations (agricultural and business, marketing groups, rurally related cooperatives, etc.)

- o Develop a training/educational/information program for regional and local public and private leaders

- o Develop a classroom plan for rural school teachers to deal especially with safety considerations in the use of electricity

- o Become familiar with parallel rural development programs and obtain commitments of cooperation in disseminating information from the Ministry of Agriculture, agricultural development banks, national funding institutions, other rurally involved ministries, etc. (This will be an ongoing constant activity.)

- o Enter into discussions with firms from the private sector for mutual promotional campaigns, including equipment discounts, information exchanges, lists of clients, etc. (constant activity)

- o Develop a plan for conducting and carrying out socioeconomic studies and production and marketing surveys.

Approximate time: C-2--(two months)

- o Begin recruitment for and hire rural electrification and productive uses advisors

- o Develop a training program for the rural electrification advisors and productive uses advisors to include complete familiarization with the utility, the five-year plan, rate structure, power use, productive uses of electricity, reference materials, technical topics necessary, reporting responsibilities, etc.

- o Begin undertaking production and market surveys of project areas and complete data on the socioeconomic backgrounds of consumers.

Phase II—Sign-up, Educational Drives, Marketing Surveys, Program Execution

This activity will begin at start-up of construction and will last until the end of construction.

Approximate time: C+1--(one month)

- o Train rural electrification and productive uses advisors and locate in project area offices.

Approximate time: C+2--(continual on an as-appropriate basis)

- o Hold meetings with local personnel of Ministry of Agriculture, national banks for development, rural development agencies, etc., on appropriate means of coordination and communication

- o Develop master schedule and plan for community and individual meetings, striving to reach as large a number of potential consumers as possible with each encounter

- o Production and marketing specialist, with assistance from field staff, completes initial production and marketing surveys. Also completes data on socioeconomic background characteristics of service areas. Completes within three months

The following activities are on a continual basis:

- o Begin broadcasting radio announcements of informational nature in project areas in accordance with construction schedule. Broadcasts should announce towns to be electrified, dates and locations of community meetings, etc.

- o Arrange community meetings with local representatives and conduct them. Advance sign-up forms should be distributed and commitments obtained.

- o Discuss energy use with prospective consumers, farmers, and industrial and commercial users

- o Schedule and conduct training program for local utility staff personnel

- o Schedule training programs for local and area leaders and hold them.

Approximate time: C+6--(three months)

This following activities will be on a continual basis:

- o Conduct classes on uses of electric energy and on safety

- o Promote productive uses of energy.

Approximate time: C+9 and onward

- o Productive uses advisors, using marketing data gathered by specialist, begin resource assessments, establishing contacts, writing and publishing brochures to attract industry to areas, answering industry inquiries or complaints, helping consumers solve technical problems, etc.

On a continuing basis:

- o Conduct sign-up drives through individual contact with potential consumers in project areas

- o Implement plan(s) for providing financing schemes for electrical appliances and continue to look for new sources of finance to promote the productive uses of electricity

- o From time to time, solicit support of local electrical

equipment and appliance dealers to run short promotional campaigns and sales of selected items

- o Seek import waivers on those materials and equipment needed for productive uses of electricity, when such equipment is not available locally or in country

- o Prepare activity reports and interim reports on a bimonthly basis

- o Meet with organizations such as agricultural groups, production and consumers cooperatives, and other businesses to help them solve electrical problems and to use electric energy more efficiently and productively

- o Production and marketing specialist begins to seek markets for locally produced products and continually feeds the information to local field staff.

Approximate time: annually--from C+10 to +12

- o Consumer services department, working with local field staff and others in the utility, prepares one-year and five-year work plans. This should be done annually and revised according to experience gained, progress of development, and resources available.

Approximate time: C+12 (and continuing for life of program)

- o Present plan for marketing of products produced at the local level through the productive uses of electricity; work with appropriate national and international marketing channels

- o Evaluate progress of consumer services program and make necessary adjustments to improve viability of program and improve viability of rural electrification system

- o Develop audio-visual materials for continuing dissemination of information on and promotion of appropriate productive uses of energy in service areas

- o In conjunction with the annual evaluation of progress, determine present and future personnel requirements.

Phase III--After Completion of Construction

- o Continue all area and central office activities. By this time the field staff should be an integral part of the local management team, receiving day-to-day supervision and direction from the area director, but continuing to receive technical assistance, support, and materials from the central office's consumer services department.

- o As stated in the beginning of the chronological narrative, it is of extreme importance to continue the functions of the consumer services department as an integral part of central office and area operations. If the number of consumers warrants it, each area office should have a consumer services department which will continue to give service, guidance, and technical assistance to consumers as outlined above.

- o Continue to schedule and conduct training programs for new regional staff as required by grid extensions

- o Continue socioeconomic evaluations of new areas as they are added to the system

- o Continue market studies and implementation of market plans as areas are added

- o Continue the program to attract new industries to already electrified areas and to new areas as they are developed

- o Continue to have informational/educational/training programs for village and area leaders, as well as those on a national level

- o Continue to promote productive uses of energy

- o Continue to promote efficient, safe, and rational use of energy.

APPENDIX

Although the following exhibits provide detailed job descriptions and suggested qualifications, it is important to note that the single most important trait of the individuals involved in this program will be an ability to identify and work with rural people. The success of this program hinges on the credibility of the field workers with the rural people. If they are not accepted as individuals, neither will their service be accepted. From this standpoint, personal qualifications will be more important than education or professional experience. Indeed, intelligent, trainable rural individuals would be preferred over well-qualified urban dwellers.

Exhibit A

Position description: Director of Rural Electrification Consumer Services Department

I. OBJECTIVE

Promote the economic development of rural areas through the productive uses of electricity while carrying out the Consumer Services Department's responsibilities relating to consumer services, information, and training in safety and power use and public relations.

II. REPORTING RELATIONSHIPS

A. Reports to: Chief Executive Officer of Utility

B. Directs: Rural Electrification Specialist
Production and Marketing Specialist
Rural Electrification Advisors
Productive Uses of Electricity Advisors

III. RESPONSIBILITIES

Within the limits of established policies, budgets and authority delegated by the Chief Executive Officer of the organization, the Director of the Consumer Services Department, in carrying out his responsibility to plan, develop, and supervise programs and activities relating to consumer services, power use, and productive uses of electricity for rural consumers, will personally:

A. Learn the organization's system plans, programs, policies, objectives, and viewpoints dealing with rural electrification projects.

B. Staff the Department by filling the positions of the Rural Electrification Specialist, the Production and Marketing Specialist, the Rural Electrification Advisors, and the Productive Uses of Electricity Advisors. Ensure adequate training and equipping of the staff.

C. Enhance the financial stability of the utility through the:

1. Promotion of new and additional uses of electricity by rural consumers to increase power sales and improve the load factor.

2. Investigation of possible sources of funding for the establishment of a revolving fund in the utility to recirculate program funds and perpetuate the program.

D. Promote the economic development of the area by providing leadership and by cooperating with other department, provincial, national and local, and private organizations to establish new industry and community facilities.

1. Formulate a plan to attract appropriate industry to newly electrified areas.

2. Approve plans and policies under which the Production and Marketing Specialist is to carry out socioeconomic evaluations and production and marketing studies of project areas.

3. Approve plans and broad policies drawn up by the Production and Marketing Specialist for assistance in farm-to-market, rural industry-to-market, and cottage industry-to-market activities and determination of markets for products and services created through the productive uses of energy.

4. Establish relations with personnel of the Ministry of Agriculture, Ministry of Industry, government planning and development agencies, development banks, etc., at the national level and in each community to assist them in their programs and seek their support and assistance in promoting rural electrification projects.

E. Explain and encourage acceptance by employees of the organization's system plans, programs, policies, objectives, and viewpoints dealing with rural electrification projects.

1. Organize, or assist in organizing, employee training programs and seminars to make them more effective in responding to consumer questions and complaints. Design and execute specific staff training programs as needed.

2. Advise department heads of programs, events, and activities that are creating (or may create) a bad public image for the utility.

F. Seek rural consumer and community understanding and support for the organization's objectives and programs.

1. Conduct information and education programs for all levels of the populace through all existing organizations and media.

2. Supply promotional information and pictures of rural consumers to rurally oriented organizations for use in their publications.

3. Establish and maintain friendly relations with all school officials in the area of rural electrification projects and arrange to conduct talks and demonstrations in appropriate classes on the safe and proper use of electricity and electric appliances.

4. Actively seek and respond to all invitations to speak and give demonstrations before area groups and organizations about electricity uses and electric service to rural consumers.

5. Keep informed on all the activities and problems of rural electrification projects and respond promptly and honestly to inquiries from the area news media and answer questions and complaints from rural consumers as necessary.

G. Provide maximum service to all rural consumers by providing reliable information, guidance,

assistance, and instruction in the safe, practical, and productive uses of electricity in the home, in commerce, and on the farm.

1. Establish, publish, and maintain a current list of electrical equipment (showing initial cost and estimated monthly operating cost) having practical and productive use in the homes, farms, and businesses of the area; promote the purchase and use of this equipment among consumers. Arrange with the farm supply cooperatives and appliance dealers in each town to stock and sell the electric appliances on the promotional list.

2. Stress safe and adequate wiring installations in all places where electricity is used, and establish and publish interior wiring standards to be used in the project area.

3. Plan convenient methods for paying bills, purchasing light bulbs and appliances, and extending circuits when desired.

4. Establish and publish forms and procedures for signing up new rural consumers and provide training, pamphlets, and other promotional material for Rural Electrification Advisors to use in visits to each rural home to explain the details of electric service and encourage acceptance and to sign up new rural consumers as quickly as possible after electric lines are built.

5. Establish a mechanism for importation and promotion of the sale of approved electrical tools, equipment, and devices through local merchants or directly by the utility, particularly those used in productive processes.

6. Attend meetings, read publications, and establish reference files to keep informed on new techniques and product developments that might be effectively used by the organization and its consumers.

H. Perform certain administrative functions.

1. Submit written monthly progress reports to the Chief Executive Officer.

2. Prepare an annual work plan and budget for the Consumer Services Department for submission to the Chief Executive Officer.

3. Authorize and recommend the purchase of equipment and material used by the Consumer Services Department.

I. Perform such other activities as may be assigned by the Chief Executive Officer.

IV. RELATIONSHIPS

The Director of the Consumer Services Department establishes and maintains the following contacts and relationships:

A. Internal

1. Chief Executive Officer--Confer on matters concerning consumer service, productive uses programs, and public relations to keep him informed on programs, plans, progress, and special problems involving the Consumer Services Department, and seek advice, information, and assistance and recommend procedures for the Department.

2. Other CSD Staff Members--Train, advise, assist, and inform them on matters pertaining to consumer services, productive uses programs, and public relations and seek advice, assistance, and information as necessary; participate in planning and accomplishing work programs that further the services of the organization.

3. Other Employees--Enlist the support and assistance of other employees, particularly in area offices, in promoting the productive use of electricity and the services of the organization.

B. External

1. Consumers and Prospective Consumers--Create and initiate action on ways of providing individual and group assistance relating to the uses of electricity and the activities of the organization.

2. Educational, Agricultural, Development and Related Agencies--Seek and stimulate cooperation and participation in programs of mutual benefit and coordinate planned programs and activities.

3. Newspapers and Radio--Provide information and advertising.

V. QUALIFICATIONS

A. Bachelor's Degree in Public Relations, Agricultural Economics, Communications, Sociology, or similar fields.

B. Training or expertise in as many as possible of the following:

Electricity	Photography
Agriculture	Salesmanship
Community Development	Public Speaking
Administration	Teaching
Marketing	Drafting
Wiring	Commercial Art
Electric Equipment	Layout and Design
News Story Writing	Audio-Visual Equipment
Advertising	

C. Personal Characteristics

1. A pleasing personality and meets people well.

2. An interest in improving the life of rural people.

3. Sufficient intelligence and desire to learn new concepts and skills.

4. Willing to work in rural areas and do limited manual work when necessary to get the job done.

5. Strong leadership characteristics.

Exhibit B

Position description: Rural Electrification Specialist

I. OBJECTIVE

Under the supervision of the Director of the Department, formulate and oversee implementation of an effective consumer services program emphasizing power use and the productive uses of electricity.

II. REPORTING RELATIONSHIPS

A. Reports to: Director, Consumer Services Department

B. Directs: None

III. RESPONSIBILITIES

Within the limits of established policies, budgets and authority delegated by the Director of the Consumer Services Department, the Rural Electrification Specialist will personally:

A. Learn the plans, programs, policies, objectives, and viewpoints of the organization and explain and encourage acceptance of them by other staff and among rural consumers. Provide power use, productive uses, and public relations information to other central office and field office employees so the staff outside the Consumer Services Department can provide assistance with the development work of the organizaton.

B. Keep informed on new methods and product developments relating to the use of electricity and provide this information to the Rural Electrification Advisors and other Consumer Services Department and organization staff through:

1. Personal contacts with professional, educational, or other organizations and groups with similar or related programs and objectives.

2. Attendance at seminars, demonstrations, exhibits, and other training meetings.

3. Newspapers, magazines, manufacturers' literature, and other publications.

4. Maintenance of reference files of catalogs and technical information.

C. Assist in the training and guidance of the Rural Electrification Advisors in the achievement of their objectives to provide maximum assistance to the rural consumer, and provide continuous support in the development of an effective consumer services program at the local level.

1. Learn interior wiring standards as necessary in order to train the Rural Electrification Advisors to assist consumers and employees in the proper installation of wiring.

2. Prepare drawings and instructions for use by Rural Electrification Advisors and others in the installation and use of wiring, including the various options available for switches, outlets, and other hardware.

3. Study operation, maintenance, initial purchase cost, monthly operating cost, and repair facilities for electric appliances and equipment.

4. Prepare guidelines for and provide assistance with the development of demonstrations of appropriate electric appliances and equipment by the Rural Electrification Advisors and Productive Uses Advisors.

5. Prepare illustrated information sheets that can be freely distributed on electric appliances and on different lighting fixtures, lamps, and controls that may have practical use on the farm, in business and industry, and in homes in rural areas.

D. Contact national and regional educational leaders to prepare the way for local staff to schedule demonstrations in technical, vocational, home economics, and other appropriate classes, and prepare guidelines under which local staff should contact leaders in community adult or youth organizations to schedule demonstrations of electric equipment available for power use and productive uses on the farm, in business and industry, and in the home.

E. Work with Rural Electrification Advisors to organize and conduct community sign-up meetings when electric service is being extended to new towns and rural areas.

F. Promote economic development in the project areas through individual leadership, by working closely with the Production and Marketing Specialist and the field staff, and through cooperation with national, regional, local, and private organizations in establishing new industries and community facilities. Counsel, on the national and regional levels, agricultural leaders, technicians, university agricultural, and agri-business teachers and other farm and industry specialists on the development of practical and productive uses of electricity by individuals, and on programs of training and instruction to assure their proper installation and use, to improve their production, processing, storage, and marketing operations. These might include, but are not limited to:

1. Electrified equipment in business and industry to improve efficiency and increase productivity.

2. Air conditioning and/or heating to provide a more comfortable work environment for employees and thus increase efficiency and productivity.

3. Electric water pumps in wells for better farm and home water supply and in wells or streams for pump irrigation.

4. Electrified fences to protect crops from livestock or contain livestock in pens.

5. Artificial hatching and brooding of large numbers of chickens.

6. Lighting to extend the apparent length of the day so that chickens will eat more and grow faster, and so that laying hens will skip fewer days.

7. Water heaters for sanitation and processing purposes.

8. Electric grind wheels for sharpening knives and tools.

9. Electric milking machines to increase by many times the number of cows which can be milked by one farmer.

10. Refrigeration equipment to cool milk quickly, improving its quality and greatly extending the length of time it can be stored without spoiling.

11. Refrigeration or freezing equipment to improve the quality and lengthen the storage time of meat and fruits.

12. The grinding and mixing of feed grains and supplements.

13. Better lighting for better sorting and grading of farm produce.

G. Counsel agricultural leaders and businessmen on the use of electric energy as an alternative to scarce fossil fuels, such as gas, oil, and kerosene, and as an alternative to wood as a fuel so as to conserve these finite and rapidly diminishing resources.

H. Encourage farm supply cooperatives, business and industry supply houses, and other appliance and equipment dealers at the national and regional levels to stock and promote the sale of items which are being promoted for effective, efficient, and productive uses of electricity at the local level.

I. Assist the Rural Electrification Advisors and the Productive Uses Advisors in working closely with any area development committee(s) to remain alert for possible community improvement projects and industrial plants which may be built in the rural areas and assist them to compete for the establishment of such a project in the system's service area.

J. Maintain contact with agricultural agencies, industrial development and assistance agencies, farm and other development banks, etc., to solicit their cooperation and assistance in fomenting the productive uses of electricity by rural consumers.

K. Undertake certain public relations responsibilities:

1. Recommend to the Director of the Consumer Services Department the purchase of suitable audio-visual equipment and learn how to operate it well and train others to operate it well.

2. Locate national and regional sources of films and determine how to rent, borrow, or

purchase films dealing with electricity, electric appliances, and productive uses of electricity. Screen films before organizations and other interested parties at the national and regional levels and make them available to the Electrification and Productive Uses Advisors at the local level.

3. Work with the Production and Marketing Specialist to develop presentations about the region's potential, the organization, and other items of interest which can be illustrated with color slides. Take the necessary pictures and be prepared to present these to national and regional audiences and make them available to local staff for wide viewing by groups and classes throughout the local project areas.

4. Prepare news articles and photographs for national and regional radio stations and newspaper offices as appropriate and assist field staff in also doing so for local areas on those events which have bona fide news value.

5. Design newspaper advertisements that effectively carry messages which the organization wishes to communicate to the rural public. The messages may deal with the promotion of electric service or uses or with the organization as a responsible, effective, efficient institution in the community.

6. Prepare radio, and, if appropriate, television advertising scripts.

L. Submit written weekly activities reports to the Director of the Consumer Services Department.

M. Prepare and submit necessary data on an annual basis for inclusion in the annual report and for preparation of annual and updated five-year work plans.

N. Perform such other activities as may be assigned by the Director of the Consumer Services Department.

IV. RELATIONSHIPS

The Specialist establishes and maintains the following contacts and relationships:

A. Internal

1. Director of the Consumer Services Department--Receive information and instruction on job responsibilities; advise, assist, and inform on matters pertaining to the planning, scheduling and performance of assigned tasks as necessary.

2. Production and Marketing Specialist--Coordinate, advise, assist, and inform on matters pertaining to production and marketing studies and marketing plans for the Department; seek advice, assistance, and information necessary to jointly and effectively participate in the planning and accomplishment of the marketing objectives of the organization.

3. Rural Electrification Advisors--Assist in the initial training of these staff members. Advise, assist, and inform on matters pertaining to planning, scheduling, and performance of assigned work in the field; seek advice, assistance, and information when necessary; jointly participate in planning and accomplishment of programs of the rural electrification project, particularly in their assigned areas, under the supervision of the Director of the Department.

4. Productive Uses Advisor--Advise, assist, and inform on matters pertaining to the efforts to increase the productive uses of energy in the project area; seek advice, assistance, and information necessary to render assistance and guidance to the Advisor in providing effective and efficient service to rural consumers.

5. Other Employees--Enlist their understanding, support, and assistance in promoting the productive uses of electricity and the services of the organization.

B. External

1. National and Regional Institutions, Including Governmental, Banking, Developmental, Educational, and Private Sector Groups--Stimulate cooperation, coordinate planned programs, and encourage participation in activities.

2. Equipment and Appliance Dealers--Provide guidance and information that will elicit support of these dealers to stock the necessary items and will support the dealers' efforts to increase sales of electric appliances. Provide guidance and information for improvements in selection of items offered.

3. Newspapers, Radio, and Television Stations--Inform and advise on news releases, advertising and electric promotion programs.

4. Consumers and Prospective Consumers--In coordination with field staff, seek out and advise on the advantages and productive and other uses of electricity and assist in the sign-up for electric service.

V. QUALIFICATIONS

A. Bachelor's Degree in Electrical Engineering, Agricultural Engineering, Agricultural Economics, Sociology, Public Relations, or similar fields of study.

B. Training or experience in as many as possible of the following areas:

Electricity	Drafting
Wiring	Commercial Art (Layout and Design)
Electric Equipment	
Audio-Visual Equipment	
News Story Writing	Community Development
Public Speaking	Agriculture
Teaching/Training	Salesmanship
Photography	

C. Personal Characteristics

1. Preferably reared in rural area.

2. An interest in improving the life of rural people.

3. Willingness to work extensively in rural areas and with farmers.

4. Sufficient intelligence and willingness to learn new concepts and skills.

5. A pleasing personality and meet people well; a motivating person.

6. Mechanical aptitude.

Exhibit C

Position description: Production and Marketing Specialist

I. OBJECTIVE

Promote economic development through the productive uses of electricity in areas to be electrified by providing leadership to and cooperating with local, state, national, and international governmental and private organizations in the establishment of new industries, businesses, farm enterprises, and community facilities.

II. REPORTING RELATIONSHIPS

A. Reports to: Director, Consumer Services Department

B. Directs: None

III. RESPONSIBILITIES

Within the limits of established policies, budgets and authority delegated by the Director of the Consumer Services Department, the Production and Marketing Specialist will personally:

A. Establish detailed plans and policies for carrying out socioeconomic studies of the regions being electrified which will be utilized in the development of a productive uses program for each region.

B. Undertake production and marketing surveys of the areas to be electrified to ascertain the development potential for appropriate agro-industry, commerce, cottage industry, and agricultural activities.

C. Develop and foster implementation of a production and marketing program that will attract industry and stimulate the production of appropriate goods and services in the region being newly electrified, making productive use of energy and assure, through the formulation of detailed plans and programs, that there are available markets for them, whether such markets are local or more remote. Coordinate such a plan with all private marketing agencies and groups and governmental bodies having related oversight responsibilities.

D. Establish and maintain relations with government personnel of the Ministries of Agriculture and Industry and government planning and development agencies, as well as public and private marketing agencies, etc., at all levels to seek their support and assistance in establishing industry and promoting markets for the products and services of the newly electrified rural areas.

E. Represent the utility before national, regional, and local groups, making presentations about the organization's current power picture and future projections, and promoting interest in the productive uses of electricity and its relationship to the marketplace.

F. Assist in the preparation of information bulletins on the uses of electric energy in production, and in food, grain and product processing, preservation and storage.

G. Work with electric equipment suppliers to develop plans for the sale and financing of appropriate electric equipment through local merchants or directly through the utility, particularly equipment for productive uses of electric energy.

H. Perform such other duties as may be assigned by the Director of the Consumer Services Department.

IV. RELATIONSHIPS

The Production and Marketing Specialist establishes and maintains the following contacts and relationships:

A. Internal

1. Director of the Consumer Services Department--Receive information and instruction on job responsibilities; advise, assist, and inform on matters pertaining to the planning, scheduling, and performance of tasks assigned to the Department; seek advice, assistance, and information as necessary.

2. Rural Electrification Specialist--Coordinate, advise, assist, and inform on matters pertaining to planning, scheduling, and performance of work assigned to the Department; seek advice, assistance, and information as necessary; jointly participate in planning and accomplishment of activities of the Department under the supervision of the Director.

3. Rural Electrification Advisors--Assist in the initial training of these staff members. Advise, assist, and inform on matters pertaining to planning, scheduling, and performance of assigned work in the field; seek advice, assistance, and information necessary to jointly participate in the planning and accomplishment of programs of the rural electrification project, particularly in their assigned areas, under the supervision of the Director of the Department.

4. Productive Uses Advisors--Advise, assist, and inform on matters pertaining to the efforts to increase the productive uses of energy in the project area; seek advice, assistance, and information necessary to render assistance and guidance to the Advisor in providing effective and efficient service to rural consumers.

5. Other Employees--Enlist their understanding, support, and assistance in promoting the productive uses of electricity and the services of the organization.

B. External

1. National and Regional Institutions, Including Governmental, Banking, Developmental, Educational and Private Sector Groups--Stimulate cooperation, coordinate planned programs, and encourage participation in activities.

2. Production and Marketing Agencies and Groups--Develop joint planning and execution of schemes with a bearing on market development. Stimulate cooperation among these groups and consumers and potential consumers in electrified or soon-to-be electrified areas.

3. Local Industrial, Agro-Industrial, Business and Agri-Business Groups, Financial and Banking Institutions and Related Groups and Agencies--Create and initiate ways of providing individual and group assistance in the promotion of appropriate new agro-industrial/business ventures and/or expanding existing operations. Seek out and stimulate cooperation and participation in programming effective use of electric energy for the mutual benefit of all.

V. QUALIFICATIONS

A. Bachelor's Degree in Business Administration, Business Management, Marketing, Industrial Relations, Economics, or related fields.

B. Training and experience in:

1. Production and marketing surveys

2. Utility management

3. Business management

4. Analytical research and analysis and/or related training and experience.

C. Personal Characteristics

1. A highly motivated self-starter.
2. An interest in rural development.
3. Preferably a rural background.
4. A desire to learn new concepts and skills.
5. Strong leadership characteristics.

Exhibit D

Position description: Rural Electrification Advisor

I. OBJECTIVE

Promote the economic development of the system's service area through good public relations and individual leadership and through cooperation with national, provincial, local, and private organizations in establishing new industry and community facilities making productive use of electric energy.

II. REPORTING RELATIONSHIPS

A. Reports to: Director, Consumer Services Department

B. Directs: None

III. RESPONSIBILITIES

Within the limits of established policies, budgets, and authority delegated by the Director of the Consumer Services Department, the Rural Electrification Advisor will personally:

A. Learn plans, programs, policies, objectives, and viewpoints of the organization and explain and encourage acceptance of them among rural consumers and employees.

B. Keep informed on methods and product development relating to the use of electricity through information received from the Rural Electrification Specialist as well as through:

1. Personal contacts with professional, educational or other organizations and groups with similar or related programs and objectives.

2. Attendance at seminars, demonstrations, exhibits, and other training meetings.

3. Newspapers, magazines, manufacturers' literature, and other publications.

4. Maintenance of reference files of catalogs and technical information.

C. Provide power use information and instruction to other employees so they can provide assistance in the promotion and development work of the organization.

D. Provide maximum assistance to consumers.

1. Learn interior wiring standards as necessary, with assistance from the Rural Electrification Specialist, so as to advise consumers and employees in the proper installation of wiring.

2. Prepare drawings and instructions, based on those received from the Rural Electrification Specialist, for use by employees and rural consumers in the installation and use of wiring, including the various options available for switches, outlets, and other hardware.

3. Study operation, maintenance, initial purchase cost, monthly operating cost, and repair facilities for electric appliances and equipment.

4. Prepare, with the assistance of the Rural Electrification Specialist, demonstrations of electric appliances and equipment which have been selected for promotion. The demonstration would include the actual equipment, and it will be made to perform one or more of its normal functions. The demonstration would cover all costs associated with the appliance and include the proper use of the equipment for best performance. Demonstration aids might include charts, pamphlets, motion pictures, and slides in addition to the equipment.

5. Prepare illustrated information sheets to be freely distributed to consumers on all electric appliances and on different lighting fixtures, lamps, and controls that may have practical use in homes in rural areas.

6. Locate sources of money which may be borrowed for the purchase of appliances, and publicize the terms and procedures.

7. Answer questions and complaints from rural consumers as necessary.

E. Contact individual school principals and teachers to schedule demonstrations in home economics, vocational, and other appropriate classes, and contact leaders in community adult and youth organizations to schedule demonstrations of electric equipment available for use in the home and on the farm.

F. Organize and conduct community sign-up meetings, working through the advisors when electric service is being extended to new towns.

G. Counsel local agriculturalists and businessmen on the use of electric energy as an alternative to scarce fossil fuels, such as gas, oil, and kerosene, and as an alternative to wood as a fuel so as to conserve these finite and rapidly

7. Maintain personal contacts at the local radio stations and newspaper offices, know their rates and deadlines, and deliver news and advertising material as required.

K. Submit written weekly activities reports to the Director of the Consumer Services Department.

L. Drive and maintain assigned vehicle.

M. Perform such other activities as may be assigned by the Director of the Consumer Services Department.

IV. RELATIONSHIPS

The Rural Electrification Advisor establishes and maintains the following contacts and relationships:

A. Internal

1. Director of the Consumer Services Department--Receive information and instruction on job responsibilities; advise, assist, and inform on matters pertaining to the planning, scheduling, and performance of

assigned duties; seek advice, assistance, and information as necessary.

2. Rural Electrification Specialist--Receive guidance, information and support in carrying out job responsibilities; advise, assist, and inform on matters pertaining to planning, scheduling, and performance of assigned duties; seek guidance, advice, and assistance as necessary.

3. Production and Marketing Specialist--Coordinate, advise, assist, and inform on matters pertaining to production and marketing studies and marketing plans for the Department; seek advice, assistance, and information necessary to jointly and effectively participate in the planning and accomplishment of the marketing objectives of the organization.

4. Productive Uses Advisor--Advise, assist, and inform on matters pertaining to the efforts to increase the productive uses of energy in the project area; seek advice, assistance, and diminishing resources.

H. Encourage farm supply cooperatives and other appliance dealers to stock and promote the sale of appliances which are being promoted.

I. Work closely with the Rural Electrification Specialist and Productive Uses Advisor and any area development committees(s) in order to remain alert to possible community improvement projects and industrial plants which may be built in the rural areas and assist them to compete for the establishment of such a project in the system's service area.

J. Undertake certain public relations activities:

1. Recommend to the Rural Electrification Specialist and the Director of the Consumer Services Department the purchase of suitable audio-visual equipment and learn how to operate it well.

2. Locate a source of movie films and determine how to rent, borrow, or purchase films dealing with electricity and electric appliances and screen them before organizations and classes in the area (check agricultural agencies, university library).

3. Work with the Marketing Specialist to develop presentations about the region's potential, electricity in general, and particular appliances which can be illustrated with color slides. Take the necessary pictures, rehearse the presentations, and show them widely to groups and classes throughout the area.

4. Prepare news articles and photographs for newspapers and radio stations in the area on those events that have bona fide news value.

5. Design newspaper advertisements that effectively carry messages which the organization wishes to communicate to the rural public. The messages may deal with the promotion of electric service or use or with the organization as a responsible, effective, efficient institution in the community.

6. Prepare radio advertising scripts. information necessary to render assistance and guidance to the Advisor in providing effective and efficient service to rural consumers.

5. Other Employees--Enlist their understanding, support, and assistance in promoting the productive uses of electricity and the services of the organization.

B. External

1. Consumer and Prospective Consumers--Seek out, sell to, and advise on the advantages and uses of electricity and sign up for electric service.

2. Agricultural Institutions, Financial Institutions, Teachers, and Community Leaders--Stimulate cooperation, coordinate planned programs, and encourage participation in activities.

3. Appliance Dealers--Provide guidance and information that will support the dealers' efforts to increase sales of electric appliances and suggest improvements.

4. Newspaper and Radio Stations--Provide copy for and advise on news releases, advertising, and electric promotion plans.

V. QUALIFICATIONS

A. Bachelor's Degree in Agricultural Engineering, Electrical Engineering, Agricultural Economics, Sociology, Public Relations, or similar fields of study.

B. Training or experience in as many as possible of the following areas:

Electricity	Drafting
Wiring	Commercial Art (Layout and Design)
Electric Equipment	Audio-Visual Equipment
Electric Equipment	Community Development
News Story Writing	Agriculture
Public Speaking	Salesmanship
Teaching/Training	
Photography	

C. Personal Characteristics

1. Preferably reared in a rural area.

2. An interest in improving the life of rural people.

3. Willing to work extensively in rural areas and with farmers.

4. Sufficient intelligence and willingness to learn new concepts and skills.

5. A pleasing personality and meet people well; a motivating person.

6. Mechanical aptitude.

Exhibit E

Position description: Productive Uses of Electricity Advisor

I. OBJECTIVES

A. Foster the more effective use of electric energy for increased agricultural production, the development of cottage industries and other rural industries and businesses, and the promotion of other rurally oriented economic activities.

B. Maximize the benefits to be derived from electric energy once it is introduced into a rural area.

II. REPORTING RELATIONSHIPS

A. Reports to: Director, Consumer Services Department

B. Directs: None

III. RESPONSIBILITIES

Within the limits of established policies, budgets, and authority delegated by the Director of the Consumer Services Department, the Productive Uses Advisor will personally:

A. Supervise project area surveys along with the Production and Marketing Specialist to determine the nature of new economic enterprises that would be most suitable for development. These would include:

1. Socio-economic surveys.
2. Production surveys.
3. Marketing surveys.

B. Analyze adequacy of project area infrastructure essential to the development of business and industry such as roads, water, and electric power availability, with particular reference to the movement of raw materials and finished products.

C. Provide individual services to those local business entrepreneurs, industrialists, and farmers who may want to develop new enterprises based on electric energy. This would include:

1. Making available appropriate survey information.

2. Assisting in obtaining financial resources.

3. Assisting in obtaining other resources--technical and managerial.

4. Advising on the type of electrical machinery and equipment most suitable for the purpose of the enterprise.

5. Maintaining continuing contact with the consumer after the start up of the new activity.

D. Conduct periodic programs designed to inform the general public of potential productive uses of electricity in the project area. This would include:

1. Organizing demonstration activities.

2. Conducting and participating in seminars and discussion groups.

3. Organizing and carrying out training programs.

4. Assisting in the preparation of bulletins, news articles, and radio and television programs.

E. Maintain contact with local college and university officials; appropriate area, regional, and national agencies; trade and marketing groups; and suppliers and representatives of industry in order to mobilize and utilize professional support for new enterprises.

F. Counsel agricultural leaders, technicians, university agricultural teachers, and other farm, business, and industry specialists on the development of productive uses of electricity by individuals, and on programs of training and instruction to assure their proper installation and use, to improve their production, processing, storage, and marketing operations. These might include, but not be limited to:

1. Electrified equipment in business and industry to improve efficiency and increase productivity.

2. Air conditioning and/or heating to provide a more comfortable working environment for employees and thus increase efficiency and productivity.

3. Electric water pumps in wells for better farm and home water supply and in wells or streams for pump irrigation.

4. Electrified fences to protect crops from livestock or contain livestock in pens.

5. Artificial hatching and brooding of large numbers of chickens.

6. Lighting to extend the apparent length of the day so that chickens will eat more and grow faster and so that laying hens will skip fewer days.

7. Water heaters for sanitation and processing purposes.

8. Electric grind wheels for sharpening knives and tools.

9. Electric milking machines to increase by many times the number of cows which can be milked by one farmer.

10. Refrigeration or freezing equipment to cool milk quickly, improving its quality and greatly extending the length of time it can be stored without spoiling.

11. Refrigeration or freezing equipment to improve the quality and lengthen the storage time of meat and fruit.

12. The grinding and mixing of feed grains and supplements.

13. Better lighting for better sorting and grading of farm produce.

G. Provide information and assist in the preparation of informative bulletins, news articles, and radio and television spots with reference to the productive uses of electricity on the farm, in business, in agro-industry, industry and in the home.

H. Prepare monthly reports of work accomplished for the Director of the Consumer Services Department.

I. Prepare input for annual work plans when and as requested.

J. Perform other duties as assigned by the Director of the Consumer Services Department.

IV. RELATIONSHIPS

The Productive Uses of Electricity Advisor maintains the following contacts and relationships:

A. Internal

1. Director of the Consumer Services Department--Receive information and instruction on job responsibilities; advise, assist, and inform on matters pertaining to the planning, scheduling, and performance of duties assigned to the Department; seek advice, assistance, and information as necessary.

2. Rural Electrification Specialist--Receive guidance, information, and support in carrying out job responsibilities; advise, assist, and inform on matters pertaining to planning, scheduling, and performance of duties assigned to the Department; seek guidance, advice, and assistance as necessary.

3. Production and Marketing Specialist--Coordinate, advise, assist, and inform on matters pertaining to production and marketing studies and marketing plans for the Department; seek advice, assistance, and information necessary to jointly and effectively participate in planning and accomplishment of the marketing objectives of the organization.

4. Rural Electrification Advisor--Advise, assist, and inform on matters pertaining to the planning, scheduling, and performance of work assigned in the area; seek advice, assistance, and information as necessary; jointly participate in the planning and accomplishment of tasks of the Consumer Services Department under the supervision of the Director.

5. Other Employees--Advise on the advantages and potential of the productive uses of electricity; enlist their understanding, support, and assistance in the promotion of the productive uses of electricity and other services of the organization.

B. External

1. Actual and Prospective Consumers--Seek out, sell to, and advise on the advantages of productive uses of electricity and, in cooperation with the Rural Electrification Advisor, sign up for electric service.

2. Agricultural, Business, Industrial, Financial and Government Institutions, and Educational and Community Leaders--Stimulate

cooperation, coordinate planned programs, and encourage participation.

3. Appliance and Electric Equipment and Supplies Dealers--Provide guidance and information that will encourage the availability of the appropriate electric appliances, equipment, and supplies and support the dealers' efforts to increase sales of equipment to be used for productive purposes. Suggest improvements in these items to improve their efficiency.

4. Newspaper, Radio, and Television Stations and Other Local Media--Provide copy for and advise on news releases, advertising, and promotion plans for the productive uses of electricity.

V. QUALIFICATIONS

A. Bachelor's Degree in Agricultural Engineering, Business Management, Economics, Engineering, Agriculture, Public Relations, or similar field of study.

B. Training or experience in as many as possible of the following areas:

Electricity	Public Speaking
Electric Utility Operations	Photograhy
Wiring & Electric Equipment	Community Development
Teaching/Training	News Story Writing
Agriculture	
Salesmanship	
Audio-visual Equipment	

C. Personal Characteristics

1. Preferably reared in a rural area.

2. An interest in improving the life of rural people.

3. Willing to live and work in rural areas and with rural people.

4. Mechanical aptitude.

5. Able to motivate people.

A NOTE ON THE PRODUCTIVE USES OF ELECTRICITY IN RURAL AREAS

Shyam Rungta
Project Economist
Asian Development Bank
Manila, The Philippines

(The views expressed in this paper are those of the author and not necessarily of the Asian Development Bank, its management, or staff.)

Many developing member countries (DMCs) of the Bank are planning significant expansion of their rural electrification networks. It is envisaged that the future growth of rural electrification would be at an annual rate of about 20% compared with 10-12% for the power sector as a whole.

The Asian Development Bank (ADB) has given four rural electrification loans and technical assistance to four countries. The first of these was technical assistance in 1977 to Sri Lanka. Other recipients were The Philippines, Pakistan, and the Laos People's Democratic Republic. The first loan was in 1979 and the latest in 1981. Bank assistance in this area amounts fo $138.7 million compared with some $1 billion provided to DMCs by the World Bank and USAID.

Rural development and the improvement of the conditions of the poor are always very important considerations, but the Bank must also be conscious that capital is not only scarce but very costly and should be used as productively as possible.

ADB, therefore, attaches great importance to productive uses of electricity in considering loan applications for rural electrification. But the productive use is not the only or even the most important reason for approving loan requests. Other socioeconomic considerations, economic rate of return on investment, whether or not any subsidy is involved and the reasons and magnitude of any such subsidy are also important factors in decisions of the Bank. In general, one could say the Bank favors "productive uses" and disfavors subsidies. The Bank does not have any crisp academic definition of the phrase "productive uses," but its meaning can be gleaned from the way the concept has been used in practice in appraising the several loans approved by the Bank.

In the case of the Sri Lanka rural electrification loan in 1979, use of electricity in the following areas was considered to constitute productive load:

- o Agriculture: Pump irrigation from ground water resources
- o Industrial:
  - -- Agro-based: tea, rubber, coconut, paddy, sugarcane
  - -- Marine based: fisheries, ice plants
  - -- Forestry: sawmills
  - -- Building materials: brick and tile manufacture
  - -- Others: small-scale and village industries, textiles.

The technical assistance study there had identified over 10,000 industrial-commercial consumers for connection in the initial five years of the project. This assessment was based on the survey of existing activities and the potential for converting and/or developing rice mills, chile mills, coconut fiber mills, sawmills, rubber collection centers, cane crushers, ice plants, marketing centers, etc. The area also offered potential for connecting 800 irrigation pumps.

The opening of opportunities for productivity growth and improvement in rural agro-based small-scale industries, handicrafts, irrigation pumping and commercial activities thus provided the major economic justification for the project.

In Laos, the Vientiane Plain is the most important economic area of the country and, in providing a loan for the development of the area, the Bank considered the value of electricity in meeting the substantial need for pump irrigation and flood control for increased food production and establishment of agro-based industries. In addition, it was estimated that up to two hours of extra work time would become available in the evening to the rural population, enabling them to prolong farm work during the peak season and undertake other useful tasks such as cloth weaving and repair of household equipment.

In the case of Pakistan, the combined load for commercial, industrial, and tubewells for irrigation for 2,000 villages for the year 1985-86 was estimated to be 56.4% of the total energy requirement for that year.

Similarly, for The Philippines, the irrigation, commercial and industrial energy needed was estimated

at 40% of the total for 1985.

In Bank parlance, productive use thus normally means use of electricity for motive power and refrigeration, and its value is relatively easily quantified. But there is no reason why watching educational programs on television or improvement of medical facilities through use of electrification and such other uses cannot be considered a productive use of electricity. These uses would, in time, increase productivity and output of goods and services through increase of knowledge and less absenteeism, for instance. It would seem the reason these aspects are not emphasized as "productive" in project evaluation is that it is very difficult to quantify the value of any such indirect productive use of electricity.

It is clear from the preceding paragraphs that quite often the main element in justification of rural electrification programs is the expectation that the availability of electricity would contribute to productivity increases and, therefore, to economic growth. Load promotion and monitoring activities should, therefore, play a leading role in promoting the use of electricity for productive purposes. It is suggested that proper recording of village data, consumer data, and load growth be developed to help in the formulation of initial schemes and prioritizing of rural electrification projects and the monitoring of the success of rural electrification programs. Analysis of the end use of electricity and identification of productive pursuits encouraged by such use are also important for determining complementary conditions and measures required to enhance the contributions of rural electrification programs to rural development. Successful implementation of rural electrification programs requires small industry promotion and development work and coordination with the various government departments concerned with rural development.

PROPOSED REGIONAL RURAL ELECTRIFICATION SURVEY, ASIAN DEVELOPMENT BANK

Need for the survey

Although a large number of rural electrification programs have been implemented in many DMCs and there is considerable information on related experience, comprehensive analysis and evaluation of the programs have not been undertaken. A few surveys and studies that are available relate mainly to the cost-benefit evaluation of programs; these studies attest to the strong social impact of rural electrification programs and also provide evidence of linkages between the availability of electricity in rural areas and increases in the productivity of these areas. However, the findings are often inferential and relate to specific situations. Therefore, they do not form an adequate basis for making judgments on rural electrification programs in general. A comprehensive review and evaluation of programs comprising not only the cost-benefit analysis but also other aspects relevant to the operations such as the quality of service, standards of design, institutional arrangements, and tariff policies need to be carried out. Such a broad-based examination of rural electrification programs in the DMCs would help in formulating guidelines for the selection, preparation, and implementation of more effective programs and also assist in the development of a framework of criteria

In fact, rural electrification should be considered essentially as part of an integrated rural development plan, and the scheme for rural electrification should be developed together with the provision for the supply or availability of other cooperant factors essential for economic growth.

Electric utilities are not particularly well suited to providing development services or consumer advisory or assistance services in industrial, commercial, or agricultural areas. The primary responsibility for identifying areas for rural electrification should be with the rural development departments of the governments. The responsibility of the electric utilities should be limited to providing electricity at cost in the most efficient, least costly manner to these areas.

Electricity is a powerful agent of economic and social growth. Very little is actually known, however, about its dynamics or how these dynamics are affected by the availability of other cooperant factors. Although a few available surveys and studies provide evidence of linkages between the availability of electricity in rural areas and increases in the productivity of these areas, their findings are often inferential and relate to a specific situation. They do not, therefore, form an adequate basis for making judgments on rural electrification programs in general. Because of this, a comprehensive review and evaluation of a rural electrification program in the region is necessary. Such a survey would be undertaken under technical assistance approved by the Bank in September 1982.

Objectives

The main objective of the proposed survey is to obtain and review information on the various aspects of rural electrification programs in the DMCs. It is considered that this task could best be carried out within the framework of comparative analysis for a proper evaluation of the various aspects of such programs. The findings of the survey would, therefore, contribute to a deeper understanding of the constraints and considerations relevant to the efficient operations of rural electrification programs, which, in turn, would permit a better assessment of the contribution to the socioeconomic well-being of the community. Based on the findings of the survey, guidelines will be formulated for the preparation and implementation of more effective rural electrification programs and also a framework of criteria prepared for the evaluation of such programs.

Scope

Although efforts will be made to cover all the DMCs in the scope of the survey, the focus will be on DMCs in which relatively greater attention has been given to rural electrification and for which data and information on related operations are available. In carrying out the survey, special attention will be given to the aspects and issues discussed in paragraphs 10-16 below.

Implementation arrangements and schedule

The survey will be carried out by a team of three consultant experts in close coordination with Bank staff and the national agencies concerned with rural electrification programs. The expertise would be in requisite fields such as electrical engineering, project evaluation, rural development, and appropriate technology. The experts will have extensive experience in planning, implementing, and evaluating rural electrification programs.

For the purpose of expeditious collection of data and the analysis of experiences of relevant programs of the individual DMC, national support teams (NST) will be established in the individual DMCs where feasible. NSTs will include knowledgeable persons from the agencies responsible for rural electrification and experienced groups of researchers and/or research and training institutions engaged in relevant activities in the DMCs concerned. The support to be provided by NSTs will vary according to their capabilities. It is intended that, in addition to the collection and processing of data and information, NSTs will also undertake analysis and evaluation of the experiences and policies related to rural electrification programs. The NSTs will be assisted in these tasks by the survey consultants who will maintain close liaison with NSTs, monitor their work, and provide guidance as needed.

It is expected that the establishment of NSTs will facilitate the availability of data and information in an efficient manner. Moreover, it is considered that NSTs will contribute substantially to the survey through the analysis and evaluation of their experiences in rural electrification. However, the overall responsibility for the analysis and findings on the programs of DMCs, both in individual DMCs and also as a group, will be that of the survey consultants.

The survey is scheduled to start in December 1982 and will be carried out over a period of ten months. At suitable stages during the conduct of the survey, review meetings will be held to provide outside assessment of the progress and the direction of the survey work. The review meetings will be attended by prominent researchers, policymakers, and senior officials concerned with rural electrification programs in DMCs.

Terms of reference of the Rural Electrictrification Survey

The main objective of the survey is to obtain and review information on the experience of rural electrification programs in the DMCs of the Bank and to: (1) prepare guidelines for the formulation and operation of rural electrification programs in the future; and (2) develop a framework of criteria for the evaluation of such programs. The work will be carried out in the framework of comparative analysis and, while developing prescriptions for wider application, relevant intercountry differences will be kept in view. The main activities under the survey will consist of:

1. Review of the available material and studies on the experience of rural electrification programs in DMCs and identification of further information that needs to be obtained from DMCs

2. Prepare a detailed framework for gathering and processing data and information from DMCs with the involvement of NSTs to be established for the survey

3. Review of major objectives and considerations underlying the policies and programs of rural electrification programs with the view to determining their consistency with the major socioeconomic objectives of the economy

4. Study and evaluate the approaches and selection criteria used in the formulation of rural electrification programs with the view to determining their consistency with the major socioeconomic objectives of the economy

5. Assess rural electrification programs as an option for improving the energy situation in rural areas. This will be done with respect to the suitability of electric energy vis-a-vis competing energy supplies to meet rural energy needs in terms of relative costs, resource endowments, and benefits

6. Examine the standards adopted for the quality (reliability, voltage regulation) of the power supply made available on rural electrification networks. This will involve evaluation of possible modification to the conventional standards of quality of supply in the context of end-uses of power vis-a-vis the cost of supplies of different standards

7. Determine appropriate design parameters for facilities to be constructed under rural electrification programs. This will be done in the context of the quality of supply and the expected levels of utilization in the network

8. Consider appropriate technology applications (such as use of local materials, labor-intensive construction, pole fabrication) and their impact on the implementation, costs, and operations of rural electrification programs

9. Assess the determinants of the capital and operating costs of rural electrification programs and the determination of these costs in the various

DMCs. This will also include comparison of cost differentials among programs of different DMCs and identification of explanatory elements

10. Examination of trends in energy demand for rural electrification programs with a view to developing "norms" of consumption levels for different classes of consumers, rates of growth in new connections, and price-consumption relationships

11. End-use analysis of energy consumption to specifically identify productive (e.g., agriculture, small industries) and other applications of electric energy. This will also include elaboration of factors and considerations that affect energy consumption in different end-uses

12. Review of tariff policies adopted in various DMCs and the assessment of the impact of such policies on the: (a) finances of the operating agencies; (b) consumer savings in terms of competing fuel costs: (c) promotion of energy use in different applications; and (d) use of scarcer resources in the economy. This analysis will also include examination of the beneficiaries of subsidies in the context of relative income levels in the DMC concerned

13. Assess institutional arrangements for implementation and operation of rural electrification programs with respect to: (a) soundness of approach and formulation of such programs; (b) efficiency in implementation and operations; (c) growth in consumer connections and energy use; and (d) promotion of productive uses applications

14. Evaluate rural electrification programs in terms of: (a) contribution to social change; (b) promotion of well-being of low-income groups; (c) acceleration of productivity increases and development in rural areas; (d) financial and economic returns on the capital invested; and (e) impact on the rural energy situation

15. Prepare indicative guidelines for improved formulation, implementation, and operations of rural electrification programs

16. Development of a framework of criteria for the evaluation of such programs

WORLD BANK DEFINITION OF PRODUCTIVE USES OF ELECTRICITY

John Schwartz
Chief, World Bank Resident Mission, Bangladesh

Thank you, Mr. Chairman. It is a pleasure to be here among you all, and it is also an honor, and I will be pleased to make some comments on Mr. Niblock's paper and say something about the World Bank's inputs in the rural electrification program. I am sorry we did not present a paper, but we were short of time, and, unfortunately, our friends from Washington would very much like to have participated in this seminar but were occupied with arrangements that were existing for some time and could not come. But that does not mean that we did not want to show our interest in this seminar. I think it is of great use to everybody--to the country and the substantial number of people sitting here in this room representing the great interest in the rural electrification program of Bangladesh.

If I may first turn to Mr. Niblock's paper--I listened to it with great inerest. I think he mentions a few very important points--that is, the productive uses of rural electrification. Personally, as I am interested also in industrial development and banking, I see very clear uses—all of them are not just agricultural uses. I think our estimates have been, when we started looking into the rural electrification program of Bangladesh, that almost 40-50% would be going for use by small-scale industries and for commercial uses and, also, a substantial portion to deep tubewells and other irrigation equipment. Our first estimates show clearly that there is a great use for electricity for uses other than in agriculture.

Now, the basic point that I understood from the paper is that this is not always clearly documented. And, while some good efforts in that direction have been made in the United States and in The Philippines because they have already been long associated with rural electrification, in Bangladesh it is quite obvious that the data are not yet available and are probably not yet being collected in a systematic manner. But, we must admit that this program has only recently started, and now is probably the time to do just that and set up a system which monitors the development of productive uses. We will be glad to look into that, and I am sure that USAID, which has been associated with this program already for some time, is quite interested in that as well. How, for example, the increase in employment and in improvement of family life is forthcoming from rural electrification is very important to know.

The point is made that it would also influence future lending operations and the selection of areas to be electrified, and I can only subscribe to that point. The question for us at the time we became associated with the program was basically how to select those areas. And, on the basis of present data available, it is not easy to do. So, our basic points were availability of infrastructure, the supply system already existing in the area for power generation, of course, and the potential of agricultural and other economic use. On that basis we came to an agreement with the Rural Electrification Board on the selection of areas.

Now, there are obviously in this project a number of elements that are unquantifiable. And, while we came to an economic rate of return for this project of about 17%, we had to recognize in that figure that, while it was already quite substantial, it might actually be quite higher. But how to quantify improved family life, how to quantify potential development in small industries and the like, and irrigation improvement is difficult from the start. In other words, one would have to monitor that and it can only be done with the areas that have already been electrified. I would fully support the proposal made by Mr. Niblock to do that in a more systematic manner, and I think the Rural Electrification Board should, indeed, give that course consideration.

As I remember, it was mentioned in the paper that rural electrification is not sacrosanct. You need other elements also, for example, to improve rural industries. The fact that you get power does not mean that you can then and there do business. You have to do other things as well: the provision of credit and infrastructure. And, again, these were areas that we carefully looked into when we started selecting the areas, and the infrastructure is important. You have to have water supply; you have to have certain roads; you have to have electricity already in the area; and, then, of course, the banking system or a policy towards developing areas in the country which would evolve in such a way as to attract industries or people wanting to invest in a specific area. And that link, by all means, is not always clear--and certainly not the provision of infrastucture and certainly not the provision of rural credit. Because in Bangladesh these things are still, in several of these rural areas, in a very early stage of development. And I would, therefore, say that while the program by itself is extremely important and would, perhaps, in the first instance basically connect households, the other elements will have to come there as well. And, that is not for the Rural Electrification

Board to decide. It is a question of general government policy.

Personally, when I was with the illustrious Chairman of the Rural Electrification Board, who is a very dynamic leader in this program, and he introduced me first to an electrified village, I was most impressed. We went around and we saw the actual enthusiasm of the people, but not just enthusiasm--we saw also the important developments from electrification. People were doing business in the evening, they were having schools, and some of the businessmen told me that they had done almost triple the amount of business than before. And, there again, you see, there are certain things that one cannot foresee completely when one starts with the program. There is obviously a large area of unquantifiable benefits that will undoubtedly flow from this program.

As far as the Bank is concerned, I want to say that we are most pleased to participate in this sector which was developed with the very good assistance of USAID and the consultants of NRECA. And, on the basis of my experience, when we came to appraise a generation project, I was very much in a position to convince our people that rural electrification is important. Although, obviously, in a country like Bangladesh with a shortage of generation, there has to be generation first before one can distribute to the rural areas, it is a point that is not always understood or kept in mind. And that's why we continue to emphasize this point as well to the Asian Development Bank and others who are also concerned with the generation question in the country.

I would like to thank the Chairman for giving me the opportunity to speak. I hope that we in the seminar will, indeed, go into some depth with respect to the productive uses of rural electrification, linkages with uses other than just agriculture, and, also, the necessity to set up a monitoring system to do just that and try to set up a system which could be used in future phases of the program to emphasize the areas where rural electrification should be undertaken and also the size of the programs. And finally, I would hope the seminar would be very, very fruitful for everyone here, and I congratulate the organizers with the idea of doing so.

Thank you very much.

PARTICIPANT DISCUSSION AND COMMENTS ON OVERVIEW PAPERS

Mr. SJOUFJAN AWAL, INDONESIA: Thank you, Mr. Chairman, ladies and gentlemen. I was intrigued by the common theme of Mr. Niblock and Dr. Shyam Rungta and what we experienced in Lombok about productive uses; in particular, its input into the rural electrification program. Mr. Niblock mentioned the choices that we might have to make between the integration, coordination, and the spin-off effects of rural electrification--and the need for complementary inputs into the rural electrification program. And, Dr. Shyam Rungta mentioned the possibility, or probably the desire, to have the area selection made by something like a rural development agency. Our experience in Lombok, which is one of the rural electrification sites in Indonesia, has shown that in one particular case another department introduced a water system using diesel power when electricity was already there, and a prospect in productive uses could not come up with the funds to fund the changeover. I was wondering if Dr. Shyam Rungta would elaborate more on this idea about the area selection of "RE" to be determined by some kind of rural development agency. Would you, please?

DR. SHYAM RUNGTA: I would like to share what little I know, or, at least, my thoughts with you on this. Once a government commits itself to rural electrification, it is, of course, not only committing itself to rural electrification. Basically what it is doing is to commit itself to rural development. It also has other programs which are designed to do the same thing: water, roads, health, schools, etc. All these different programs of the government reside in different parts of the government body, different departments. They are all using resources, and they are all planning to really use these resources for the development of rural areas. Nobody denies that electricity is a positive effect. There is no negative effect of electricity that I know of except when you get a shock from it occasionally by lack of insulation. The only question is how can we accelerate the benefits from this and other complementary inputs. And I, personally, do not believe in the sort of model-like integration or coordination or hands-off and so on. I think we need many different things. Certainly, there is a great need for coordinating. As I mentioned, since there are many different parts of the government designed to do the same thing and all are going to use the resources, many of which are complementary to each other; they can help each other to develop these resources. What I am simply looking for is that somebody should be responsible for thinking through development in an integrated, coordinated way--not necessarily having any executive authority, but certainly being in a position to say, "Look, you are doing this, you are doing this," and, once one resource has been made available, then trying to get some other input more quickly. The question of timing, etc., I really don't know. What I am simply saying is that somehow there should be a department responsible for rural development as such, and all these various inputs should then somehow be coordinated, integrated, and thought of consistently within that framework. That's all I can say.

MR. RATNAYAKE, SRI LANKA: I would just like to re-raise just one point raised by Dr. Rungta regarding the classification of benefits from RE schemes to social benefits and direct productive uses. Dr. Rungta mentioned that, because of difficulty in quantifying these social benefits, the REB would prefer to lay some emphasis on direct productive uses. I would like to raise the question here that, because the social benefits are difficult to quantify, we may not necessarily show the relative importance of what we could quantify and what we cannot quantify. One particular point I would like to mention is that in rural lighting, which probably does not qualify under direct productive uses, there is a very substantial benefit that countries can receive by changing from kerosene to electricity. And in Sri Lanka we have just gotten a very short analysis, and we find that the benefits that we could get are considerable by changing over to electricity just by reducing the fuel import bills on petroleum products.

The other point is that I find that even in many developing countries, for example, even in England, they had larger funds being released for regional development, and this is probably due to reduction in pressures on urban communities and so on. There is other development that can result from reduced pressures on urbanization and other infrastructure development that goes into cities and societies which may be--I am guessing--quite considerable. Unless we have some method of evaluating the order of priority for these pressures, I am suggesting that sometime they might exceed the order of priority that we place on direct productive uses so that I would like to suggest something like strategical development, if governments can decide on certain strategies. Maybe they can be of a higher order of priority then--particularly direct productive uses. Thank you.

DR. SHYAM RUNGTA: Let me first make clear one or

two things about how ADB works in relation to rural electrification applications. You know, we have certain limited resources every year by way of capital funds which we give out to various countries for various programs. Now, for Bangladesh--also for Indonesia, Malaysia, PLN, NEB, or CEB--we have a certain sum of money in our minds that we will give you as loans or grants, and we have to share among various countries and their needs and so on. Our loans are not tied to rural electrification or any one particular project. So, if PLN or NEB or CEB comes to us and says, "We want you to give us a loan for rural electrification," only then do we look at rural electrification. If you come for power generation or transmission or other distribution lines, then we look at those. And so on. So, the initial project formulation is the responsibility of the particular government or agency.

Secondly, when we do get an application for rural electrification, what we like to do is to quantify as much as we can the value that could be derived from any such loan--the benefits. I am not saying that the ADB does not put enough value on the so-called indirect productive uses. What I am saying is the analyst, the financing analyst, the economist, whose only project is to evaluate these programs, does not yet have enough techniques or tools to quantify in any reasonable manner the benefits which would arise from simply watching television or having the facilities for X-rays, etc. So, if the benefits of the project, without these things, let us term it the quantified basis alone, is something like 12%+ or so, ADB would not bother about going into the details of so-called indirect or other productive uses. We would say, "Fine with us," you know. We would give you the loan. But if it so happens that the quantified portions of the benefits tell us that the returns are only 2% or 3% or 4%, then we have to look into other aspects of the benefits and make up our minds as to whether those benefits are likely to add enough to make the use of these funds in this particular manner more useful to the country or in some other project. If your funds are tied--maybe USAID gives you funds only for rural electrification--in that case, take it. If those funds are not available for any other purpose, then you are better off taking it in any case.

So, the problem with government is how to allocate these resources between rural and urban, etc. We have a certain amount of resources, certain investment funds within the country, and certain funds that we get from outside of the country. When you have power shortages in urban areas affecting a large number of industries which are losing some of the output, compared to the possible benefits from rural electrification over a period of time through productive and other uses and so on (maybe those benefits we do not know yet and that was the whole point of Mr. Niblock's paper: that as yet our knowledge is uncertain), the dynamics may be such that the total benefits to rural areas may exceed what we perceive are losses from power shortages in the urban areas just now. We don't know. And that is why we need data and analysis and so on.

But, in the face of such a situation, the government is constrained. It has to be careful as to where it is diverting its resources. If you make $100 million available for rural electrification, those $100 million are not available for extending generation or transmission or improving or rehabilitating lines in the urban areas. So, it is a question of balancing these factors. And that is where we have to struggle within ourselves as to what we should be doing--how best we can help. One of the things that can be done is--and that is what has often bothered me--personally, I have been involved in one or two projects in rural electrification--every time we go we find that the value of displacing kerosene or diesel is greater than the cost of supplying electricity from the grid, etc.

And yet, if you try to negotiate with any government that they should charge the users in rural areas the cost of electricity, they will shy away from it for one reason or another. . . .

I see no reason why any ordinary, intelligent person using common sense would not be willing to pay, at least, the lower cost of electricity from these sources. And if they were prepared, then electricity can be made available to anybody, anywhere, at any time--if they are prepared to pay the cost of receiving it--because in that case they would be generating the resources themselves. The cost of supplying it can be extended infinitely. There is no problem there at all. The problem arises when you want to make electricity available at much lower costs and use resources in that sort of way. The productive users in the rural areas--like a sawmill, a rice mill, a sugar mill--they are already probably using some alternative means: diesel engines, irrigation pumps and so on. And that is what is going to be displaced in the first instance. When you bring in electricity, it is also our experience that a good proportion of the electricity, even in the residential sector, is really used by the more affluent part of the rural population, as was mentioned by Mr. Niblock; one-third of the population really uses only 10 kWh in a month, which is a very small amount of use. So, again, even in terms of distribution of the benefits within the rural context, the recipients are not always the poorest, if you like. And, somebody has to pay. If you are not paying the cost, then the cost is being paid by the general exchecquer, so to say. It is being borne by the people who are not using electricity.

So, these are some of the more fundamental questions which must be thought of. But, of course, the central issue before us here is to think of ways and means of accelerating the benefits from the use of electricity in the rural context, and that is where I am no better than you are, and I would like to learn as much.

COUNTRY PROFILES—RURAL ELECTRIFICATION AND PRODUCTIVE USES PROGRAMS

Electricity for Rural Development: The Indian Experience
H.C. Virmani

Status Report—Rural Electric Cooperatives in Indonesia
John Rumondor

Implementation of Rural Electrification and Its Productive Uses Program by the State Electricity Corporation
John Rumondor

Status of Electricity in Nepal
Badri Bindo Dhungana

Status of the Productive Uses of Electricity Program of the National Electrification Administration, The Philippines, October 1982
Pablo M. Pan, III

The Status and Structure of Productive Uses Program for Rural Electrification—Sri Lanka
C. Ratnayake

Productive Uses of Electricity in Thailand
Tienchai Sirikiratayanond

Status and Structure of Productive Power Uses Program in Bangladesh
Mohammad Alam Buksh

Rural Electrification in Malaysia
Dr. Ariff Araff

Rural Electrification: Productive Uses of Electricity in Pakistan
Abdul Majid

Panel Discussion on Status of Productive Use Programs By Participants
Chaired by Sabihuddin Ahmed

Developments in the Productive Uses of Electricity: The Philippine Experience
Dr. Frank Denton

Participant Discussion of Dr. Denton's Speech

ELECTRICITY FOR RURAL DEVELOPMENT: THE INDIAN EXPERIENCE

H.C. Virmani
Chief, Project Manager
Rural Electrification Corporation Limited
Bombay, India

The main thrust of rural electrification in India has been to increase food production through the use of electric pump irrigation. In 1969 the Rural Electrification Corporation (REC) was established. The electrification of rural areas had already made some progress by 1969 with about 74,000 villages electrified. It was recognized that, as a part of a new strategy for higher agricultural yields and multiple cropping requiring year-round irrigation of which a large part of the water must come from groundwater lifted by electric power, rural electrification and pumpset energization were prerequisites for rural development.

In 1969 there were 73,739 electrified villages and about 1 million irrigation pumps. By 1982 this had increased to 298,172 villages electrified and more than 4.7 million irrigation pumps electrified. More than 140,000 villages were electrified through the REC program--about 70% of the total villages electrified in India. At the present time 52% of the villages in India are electrified.

In 1970 the REC began to finance pump irrigation under a program called Special Projects Agriculture (SPA). Together with the National Bank for Agriculture and Development and commercial banks, REC extends loans for two to four years to cover the cost of pump connections. REC introduced another program called Special Projects Industry (SPI) to finance power connections in rural and small-town industrial sites.

Studies of irrigation reveal that the irrigated area is increased by 1.9 acres per pump in the advanced areas of India and by 5.6 acres in the more backward areas. Crop yields have increased an average of 124%; however, not all this is due to irrigation. Better farming practices and better use of fertilizer account for part of the increase.

Employment has increased due to irrigation, and each pump accounts for between 40 to 74 man-days per acre.

DOMESTIC, COMMERCIAL, AND STREET LIGHTING

Studies have shown that there is a close relationship between rural electrification of villages and an improvement in the standard of living. The use of electricity has popularized radio and cinema as a source of entertainment. It has also helped to minimize human drudgery in agricultural operations and paved the way for opening workshops, schools, dispensaries, and commercial centers and has extended working hours.

The shift to power-driven pumps has reduced the time required for lifting water for irrigation as compared to manual operations, giving the farmer time to pursue other occupations. Special radio programs exclusively for farmers have kept them informed of improved agricultural practices, family planning, health, and nutrition.

A study entitled "Social Soundness Analysis of Rural Electrification in India," sponsored by USAID, reported that 76% of the electrical users had changed their life styles, 36% reported that electricity had led to a better standard of living, 54% said that it had led to more convenient working and social conditions at night, and 28% said that contact with people from other villages had increased and the attraction of moving to cities had been reduced.

CORRELATIONS WITH ELECTRICITY

Another study conducted by Delhi University has revealed that the use of electricity, besides having a positive correlation with the agricultural and industrial sectors, has a positive relationship with attitudes of people, quality of life, working hours, children attending school, and population growth as well. The percentage of children attending school in electrified villages is much higher than in nonelectrified villages, and there is a positive impact on the attitude of people with regard to family size.

The study also indicated that the percentage of village electrification has a significant and positive correlation with (a) the proportion of cultivated area to the cultivable area, (b) proportion of gross irrigated area to gross cropped area, (c) the amount of fertilizer used per hectare, (d) area under high yield varieties to total cropped area, (e) intensity of irrigation, (f) proportion of workers engaged in agriculture, (g) percentage of literacy, (h) number of bank offices per lakh (100,000) population, and (i) length of surfaced road per 100 sq. kms. of area.

The estimated area irrigated, food grains produced, and employment generated as of January 1982 is given in Table 1 on page 66.

REC studies indicate that the average consumption of electricity per year has increased from 1,431 kWh in 1977-78 to 3,515 kWh in 1979-80 in the Haryana area. It is estimated that pump operation increased to 119 hours

per hectare in 1980-81 from 92 hours in 1979-80. The increases were mainly due to a drought during 1979 and 1980, which was one of the worst in this century. Drought damage to irrigated crop yields amounted to 18.11% as against 90.4% for dry land farms. Observations show that the rural electrification program was a vital factor in mitigating the effect of the drought due to increased electric irrigation pumping during these years.

RURAL ELECTRIFICATION AND GROWTH OF SMALL INDUSTRIES

Studies show that rural electrification has stimulated the growth of rural industries, both small agro-processing and manufacturing industries. Horsepower requirements range from 5 to 25 for these rural industries. The number of industries after rural electrification ranged from 0.8 per village in the lesser developed areas to 2 per village in the more advanced areas. Agro-based small industries have generated new employment opportunities that vary from 1.5 to 5 persons per industrial unit. Depending on size, these industrial units produce products with a value annually of Rs 10,000-25,000 per unit. The generation of additional employment from rural industries is equal to about 305 million man-days; of this amount REC programs have contributed about 176 million man-days.

NEW PRIORITIES

Under the country's new 20-point program for faster economic growth, a high priority has been accorded to rural electrification programs. The priorities decided on include, among other things, electrification of all villages, raising the potential of irrigation through electric pumpset generation, and the supply of drinking water to rural areas. In the first two years of the Sixth Plan (1980-85), 39,000 villages have already been electrified. At this rate the fulfillment of the plan target seems achievable. This will bring the country a big step closer towards realizing the cherished goal of 100% of the villages electrified through its rural development program.

TABLE 1: Contribution of rural electrification programs (January 1982)

Item	Unit	All India	REC Contribution
Additional irrigated area	Million hectares	3.98	2.10
Food grains produced	Million tons	20.42	9.26
Employment generated			
Agriculture	Million man-days	1307.6	437.0
Small industry	Million man-days	305.0	176.4

STATUS REPORT—RURAL ELECTRIC COOPERATIVES IN INDONESIA

John Rumondor
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PREFACE

The Government of Indonesia (GOI) has initiated a demonstration rural electrification (RE) program which is designed to provide electric power distribution in ten specified areas within the next two years. The objective of this program is to demonstrate conclusively that reliable electric service, and the social and economic benefits that accrue therefrom, can be made available to the very poor people at a price they are able to pay.

The State Electricity Corporation (PLN) is constructing seven RE systems in Central Java. Three RE pilot projects are being constructed on outer islands of Indonesia: South Sumatra (Lampung), Eas. Lombok, and South Sulawesi (Luwu). These three are organized as rural electric cooperatives (RECs), the first electrification projects in Indonesia to be organized in the"consumer owner-operator" concept, as authorized in Government Regulation No. 36/1979.

STATUS OF OUTER ISLAND RURAL ELECTRIFICATION PROJECTS

Organization

The GOI Directorate General of Cooperatives is the implementing agency for RE through cooperatives. Under this directorate is the Project Development Office for Rural Electrification (PDO-RE), which was formed in 1978.

In the first half of 1979, the PDO-RE organized the three RECs. Boards of Directors were elected, acting managers assigned, and temporary headquarters facilities obtained.

Physical plant

Funding for electrical distribution lines was made available through loans from the United States Agency for International Development (USAID) and the GOI. Funding for permanent generating facilities has been arranged through loans from the Canadian International Development Agency (CIDA) and the GOI.

It was recognized in 1979, the period when the RECs were organized, that the material/equipment procurement process, through international tenders, was a time-consuming activity. Therefore, in an effort to expedite RE and to gain valuable statistical data on consumer acceptance of electric service, "demonstration RE projects" were constructed at each of the three RECs.

USAID assisted in this endeavor by providing small-size (50-100 kW) generators for demonstration project power supply. Temporary power plant buildings were erected by each REC for housing these gen-sets.

Through the relatively rapid "purchase order process," material/equipment was obtained for constructing the demonstration project's electrical distribution system. Both primary lines (11.5/20 kv) and secondary lines (220/380 v) were installed at the Lampung and Lombok RECs. The distribution system facilities at the Luwu REC consist of secondary lines in two villages, with individual power supply.

In total, 1,500 kW of generating capacity is in service. Included in the distribution systems are 30 km of primary line and 35 km of secondary lines.

Consumer connections

The Lampung REC energized their demonstration RE project in May 1981. They are presently serving 1,350 member-consumers in a concentrated area near the village of Metro, Lampung. This demonstration RE project is slowly being expanded, with the limited construction materials available, to reach the target connection level of 2,000 member-consumers.

The Lombok REC completed installation of generating and distribution system facilities in mid-1980. They are presently serving 2,000 member-consumers in five villages near their headquarters in Aikmel, East Lombok. Due to the limited power supply, additional requests for service cannot be honored at present.

In Luwu, 750 member-consumers are receiving electric service in the two villages now served. Due to voltage-drop constraints in a low-voltage distribution system, the connection level in these two villages will not change significantly in the next few months. However, the REC is planning to expand the demonstration RE project to include a third village (and third power plant) by the end of calendar year 1982. Therefore, the consumer connection level should reach 1,000.

In summary, approximately 5,000 families will receive

the benefits of electric service in the demonstration RE projects--families who have never enjoyed the benefits of electric service. Although this number is not significant when related to the total population in rural Indonesia, it is viewed as a valuable "starting point" in RE development.

CONSTRUCTION PLANS, 1983-84

Material/equipment

The internationally tendered materials and equipment items for distribution system construction began arriving at the RECs in the first quarter of 1982. It is expected that sufficient material/equipment items will be in inventory at the RECs to start construction by March 1983. All distribution system material procurement, with the exception of poles, is funded through the USAID loan in quantities sufficient to construct more than 2,000 km of primary and secondary distribution line. Contracts for wood pole procurement are being executed, with funding provided by GOI loans to the RECs.

Consumer connections

During the construction period, scheduled to be completed by the end of calendar year 1984, new consumer connections should average 2,000 per month (the three-REC total). The consumer connection level is expected to increase more than ten times the present level by early 1985 and surpass the 50,000 mark.

SUMMARY

Although rural electrification in Indonesia is a relatively new endeavor, progress is visible, as explained in preceding sections of this report. As experienced in other developing countries, RE must "find its place" on the priority list of development projects. Once this has been established, rapid expansion can be expected thereafter.

STATUS OF PRODUCTIVE USES OF ELECTRICITY

Lombok Rural Electric Cooperative

At the REC located on the island of Lombok, 24-hour electric service has been available since March 1981, providing electric service to nealy 2,000 consumers. The Member Services Department in the REC is active in housewiring programs and other member-assistance programs. However, due to limited power supply, the REC has not actively promoted vertical load growth (increased kWh consumption by existing consumers).

Productive use installation that developed without active promotion are listed in Table 1 on page 69.

Luwu Rural Electric Cooperative

This REC energized distribution lines in one village (Bone Bone) in August 1981. A second village (Mangkutana) was electrified in June of 1982.

At present, electric service is only provided during a 12-hour period, dusk to dawn. This is due to power supply limitations, capacity, and operating costs of small diesel gen-sets. The REC will begin 24-hour operation in 1983.

Understandably, vertical load growth has not been promoted to date. However, "produce-use-of-electric service" will be a major activity of this REC when system expansion begins in 1983.

Productive use installations that developed without active promotion are listed in Table 2 on page 70.

Lampung Rural Electric Cooperative

This REC constructed their demonstration RE project in mid-1981. Only 12-hour service was supplied until July 1982, at which time 24-hour service began.

Like the other two RECs, temporary power supply is from small gen-sets and is limited in capacity. Therefore, promotion of productive uses of electric service has been deferred until the basic distribution system and permanent power supply are operational.

Productive use installations that developed are listed in Table 3 on page 71.

TABLE 1: Productive uses data, Lombok REC, Indonesia, November 1982

Type of business	Number of businesses	Average kWh consump. before bus's began	Average kWh consump. after bus's began	Average REC monthly revenue before bus's began*	Average REC monthly revenue after bus's began*
Tire repair shop	4	35	90	$3.70	$8.60
Battery charging service	5	23	149	$2.60	$13.70
Ice-candy preparation	53	25	163	$2.80	$15.00
Tailor shop	11	24	128	$2.70	$11.80
Furniture manufacturing	6	30	94	$3.30	$9.10
Coconut grinding	1	25	192	$2.80	$17.40
Poultry hatchery	1	35	127	$3.70	$11.50
Total	81				

*Rupiah U.S. $ equivalent

Total consumers: 1,970 (Sept. 1982)

Number of consumers using electricity for production: 81

Percent of consumers using electricity for production: 4%

Note: This REC began supplying 24-hour electric service in March 1981.

TABLE 2: Productive uses data, Luwu REC, Indonesia, November 1982

Type of business	Number of businesses	Average kWh consump. before bus's began	Average kWh consump. after bus's began	Average REC monthly revenue before bus's began*	Average REC monthly revenue after bus's began*
Ice/candy preparation	8	35	200	$4.00	$18.00
Beauty salon/parlor	4	19	48	$2.30	$5.00
Restaurant	6	25	90	$2.90	$8.70
Cinema	3	25	120	$2.90	$11.30
Radio service	5	17	32	$2.20	$3.50
Tailor shop	8	17	29	$2.20	$3.20
Stores	64	22	32	$2.50	$3.50
Total	98				

*Rupiah US $ equivalent

Total consumers: 739 (Sept. 1982)

Number of consumers using electricity for production: 98

Percent of consumers using electricity for production: 13%

Note: The REC began supplying electric service in August 1981.

TABLE 3: Productive uses data, Lampung REC, Indonesia, November 1982

Type of business	Number of businesses	Average kWh consump. before bus's began	Average kWh consump. after bus's began	Average REC monthly revenue before bus's began*	Average REC monthly revenue after bus's began*
Ice plant	1	150	400	$15.00	$33.80
Tailor shop	3	25	45	$4.20	$6.40
Furniture fabrication	1	35	50	$5.00	$6.80
Battery charging	1	20	150	$3.40	$15.00
Ice/candy	2	27	90	$4.50	$11.00
Total	8				

*Rupiah U.S. $ equivalent

Total consumers: 1,346 (Sept. 1982)

Total consumers using electricity for production: 8

Percent of total consumers using electric for production: 0.6%

Note: This REC began supplying 24-hour service in July 1982

IMPLEMENTATION OF RURAL ELECTRIFICATION AND ITS PRODUCTIVE USES PROGRAM BY THE STATE ELECTRICITY CORPORATION

John Rumondor

INTRODUCTION

Geographically, Indonesia consists of thousands of islands, which are administratively divided into 27 provinces, 240 Kabupatens (Districts, Regencies), 3,340 Kecamatans (sub-Districts), 63,000 desas (villages, rural communities), 282 townships (provincial capitals, capitals of Special Areas, DKI Jaya, the Special Area of the Capital of Jakarta Raya, District capital, municipalities, administrative towns).

The ultimate goal of the rural electrification program is to electrify all rural communities in Indonesia, covering not less than 63,058 villages.

However, in view of the limited funds of the government and the State Electricity Corporation (PLN), and also taking into consideration the existing conditions and developmental levels of villages as related to their preparedness for receiving electric service, PLN has established a policy for implementing rural electrification by stages. Priority will be given to villages with the greatest potential, as viewed from a regional development standpoint. This priority method does not disregard the supporting electro-technical factors such as: distance from existing power grid; availability of microhydropower potential, or the erection of a pilot diesel power plant, if necessary, relating to infrastructure capabilities.

RURAL ELECTRIFICATION

Since the beginning of REPELITA III, in which the government commenced the drive of "Electricity Entering the Desa/Village," PLN, as the main managing agency in the power sector (pursuant to Government Regulation Nos. 18/1972 and 36/1979), also equipped its organization at Pusat (headquarters) level with departments to be responsible for the national rural electrification program.

Wilaya (regional) and project offices of PLN are responsible for program implementation at the local level.

The major purpose of village electrification is to upgrade the community in general and to assist in village development.

The nature and characteristic of rural communities provide encouragement to PLN to solicit support and participation from the local populous in our rural electrification efforts. This participation begins during the planning stage, continues throughout the construction stage, and into the operation and maintenance period. Local participation during the planning stage relates to data collection and selection of villages to be served. PLN maintains close coordination with the local government, sectoral authorities, and agencies related to village development, in coordination with BAPPEDA (Regional Development Planning Board).

During project implementation, PLN solicits participation by elements of the local government, with their LKMD (Institution of Village Social Resiliency) and, in particular, KUD (Village Unit Cooperative). KUD participation is encouraged in the actual operation and maintenance of completed electrical facilities.

In REPELITA III (1979-80/1983-84) the Government/PLN has planned for the electrification of a number of 3,700 desas swasembada (self-supporting villages) with 625,000 estimated consumers. To date (October 1982), a total of 5,799 desas with 934,539 consumers have been electrified by PLN.

Productive uses

In accordance with the objective of rural electrification to improve the welfare of the rural community, the program for productive uses forms the essence or weight of the implementation of rural electrification.

Experience and observations show that the larger part of the use of electric power in rural communities is intended for purposes of a consumptive character, and mainly during the night. The load factor of power operation is still below 40%.

Therefore, efforts toward productive use of electricity have been actively pursued by undertaking investigations, interagency cooperation, and the preparation of work plans and policies for dealing with rural electricity.

Since the beginning of the USAID Rural Electrification Project, the problem of productive uses has been recognized and included in the implementation plan.

With the assistance of USAID, PLN has made a pilot project of the project area in Central Java, near Klaten. It is expected that the best possible ways will

be found for the productive use of electricity for the rural area of Central Java, to be further developed in other areas of Indonesia.

Problems encountered in the implementation of productive uses

In the early stage of implementation of rural electricity (the introduction of electricity to the rural community), the emphasis in the selection of the area or project still depended on the number and capability of prospective consumers. The productive uses were expected to be easily developed, or would develop by themselves as soon as electricity became available.

Actually, in many rural areas, clusters of small industries already exist. These are active and dynamic with good potential for growth, especially if rural electrification can reach them.

Therefore, in the beginning, there is a need for selection of villages for electrification with existing potential for industrial growth. Such villages can be made centers of groups of villages to be electrified. The designation of desa swasembada (self-support village) does not always run parallel with a desa's having potential for rural electrification.

In meeting the problems of development in an area, it is necessary for all agencies concerned with development to coordinate their efforts to achieve good results. For successful productive use programs, such collaboration is essential. Proper and timely availability of credit and marketing and policies supporting small industry growth are essential for the success of productive uses programs in rural electrification.

Many rural industries are not associated in one group, or cooperative, which would make them more capable of supporting their development.

Technical, administrative, and management skills in rural industries also need to be further improved.

PLN, which started with the operation of urban electricity, is still adjusting to rural electricity operation with regard to services and tariff policy.

On the other hand, dealers of diesel engines create special attractions in the promotion of their merchandise (attractive prices, credit facilities, and other attractive offers), causing many small rural industries to avail themselves of diesel units. This is contrary to the government policy of the conservation of fuel energy.

CONCLUSIONS AND RECOMMENDATIONS

For a more successful implementation of the program of productive uses, the following steps need to be given attention:

1. Officers of rural electricity undertakings should be more active in surveying rural areas to look for and contact productive use consumers/prospective productive use consumers, and supply to and receive information from these prospective enterpreneurs as they begin to make their plans for development and operation.

2. Close contact must exist between PLN and the consumer/prospective consumer to know what may be expected from PLN on the one hand, and to know the problems encountered by the consumer on the other hand. PLN should assist and further adjust its activities in the best way possible for the sake of progress and successful end results for both parties.

3. PLN should adjust its charges and tariff structure to make them more compatible with rural productive uses requirements.

4. The cooperation between agencies and authorities involved in the rural electricity program in a general way, and in productive uses in particular (both at the central and regional levels), needs to be improved. At the regional level, the role of PEMDA (local government) and its BAPPEDA (Regional Development Planning Board) as the planner and coordinator of all regional activities needs to be strengthened and further supported.

5. In the organization of PLN at Pusat, as well as at the regional level, a special unit is needed to permanently deal with the general development of rural electricity consumers and productive uses in particular.

6. Continuous support from the decisionmakers is necessary for the development of an effective productive uses program in rural electrification to meet present and future needs.

PLN (Perusahaan umum Listrik Negara)

Background information on rural electrification in Indonesia

Pursuant to the Decree of the Minister of Public Works and Power No. 016/PRT/1976, 29 October 1976, the letter of Decision of the Board of PLN No. 038/DIR/1981 as further authorized by the Decree of the Minister of Mines and Energy No. 1013/KPTS/M/PERTAMBEN/1981, and in accordance with Act No. 5/1979 on the Village Government, PLN defines "village," in the context of rural electrification, as a rural community/village not situated within a provincial capital, capital of a Special Area, DKI Jaya, District capital, municipality, or administrative town.

From the viewpoint of village (desa) development, villages are classified into desa swadaya ("self-propelling" village), numbering ±23,000; desa swakarya ("self-sustaining" village), numbering ±34,000; and desa

swasembada ("self-supporting" village), numbering ±4,000. Of the total Indonesian population, 80% live in desas.

The objective of the development in the power sector runs parallel with the national objective as included in the preamble of the 1945 Constitution, specifically "to improve the public welfare and the education of the nation."

In order to reach that objective, it is necessary to develop the power sector to cover the entire territory and population of Indonesia on an equal basis. Implementation will be done in stages and adjusted to the national capability.

Electric power, as a means of production as well as a means of daily life, plays an important role in the attempt to reach the target of development. The GBHN (the Broad Outlines of the State Policy) stipulates that power development is meant to be enjoyed by the rural as well as the urban population, to raise their standard of living and stimulate economic progress. The availability of electric power, in sufficient quantity on a timely basis, may stimulate the rate of industrial growth in other sectors of development.

In addition, the availability of electric power throughout the rural community, used extensively to improve the public welfare, will contribute to the realization of the policy of "equal distribution of development" ("pemerataan").

Electric power generation makes use of primary energy resources and, therefore, planning of development in the power sector is made an integral part of the general energy policy. This is particularly true with regard to the conservation and diversification of energy. Environmental impact analysis will be completed before any power development project is undertaken. This is essential to assure that the development, and the operation thereof, will be consistent with environmental conservation policies. Power development will also reflect the fulfillment of the demand for electric power in the industrial sector and the policy of equal distribution as one of the pillars of the three principles of development. Extension of power grids for service to industries and to rural communities requires abundant capital, and considerable time is required for its planning and implementation.

During REPELITA (Five-Year Development Plan) I and II, the larger part of development funds originated from the APBN (State budget) and APLN (PLN budget), the amounts of which increased year by year. Funding for power development in REPELITA IV will be increased further, resulting in more rapid development.

PLN policy—integrated planning

Electric power development must relate to energy resources, such as natural gas, oil, hydropower, coal, etc., and be consistent with the national energy policy.

Electric power also has the characteristic of "economy of scale," which means that area-wide system planning should be attempted. The system should be designed for future integration into an area grid.

Taking into consideration the national energy policy (in particular with regard to the conversion and diversification of energy) and the "economy of scale" characteristic of power operation, PLN considers it necessary to integrate power planning. Planning for rural electrification, urban installation, and service to industry must be integrated planning on a national basis.

In this regard, PLN is preparing and developing a national power plan extending to the year 2000.

ABBREVIATIONS

PLN (Perusahaan Umum Listrik Negara)	State Electricity Public Corporation
GBHN	The Broad Outlines of the State Policy
Pemerataan	Equal distribution of development
Desa	Village
PLN Wilayah	PLN Regional Units
KUD	Village Unit Cooperative
Swasembada	Self-supporting village
Swakarya	Self-sustaining village
Swadaya	Self-propelling village
Kabupaten	District
Kecamatan	Subdistrict
APLN	PLN budget
APBN	State budget
BAPPEDA	Regional Development Planning Board
LKMD	Institution of Village Social Resiliency

STATUS OF ELECTRICITY IN NEPAL

Badri Bindo Dhungana
Division Chief, New Construction
Nepal Electricity Board
Kathmandu, Nepal

Nepal has three geographical divisions. One is the plain area called the Terai. Another is the hilly region from 200-2,000 m in elevation. The third is the high Himalyan region. There is not sufficient material for industrial development, and minerals have not been fully explored. Our people mainly live on agriculture. Nepal has a possibility of agro-based industries, mainly in the Terai and mid-hilly region. The development of agriculture and agro-based industries requires a power supply in the villages. The development of small industries, hotel, tourist centers, etc., in cities also needs an efficient and reliable power supply--the development of electric power.

The history of power generation in Nepal shows a stagnant period of nearly 50 years until there was mobility in power generation, operation, and distribution with the establishment of the Nepal Electricity Corporation in 1962. The licensed area of the Corporation was limited to the Bagmati zone during its establishment, but it has now spread to three out of five development regions of Nepal. Most of our urban areas and some villages in the vicinity of these urban areas and power houses use electricity for domestic appliances besides lighting, while people in the villages use electricity only for lighting, with a limited number of rice mills and other uses. The uses for motive power are similar in villages and urban areas due to the pace of development in the country.

Nepal had its first hydro power generation of 500 kW in 1911 and one more of 900 kW in 1936. Until 1955, the balance was diesel generation with a total capacity of 6,280 kW until 1955. The initial investment for hydropower generation was too great for it to be developed during those days. During the last two decades, we have had help to construct in: Panauti (2,400 kW) from the Soviet Untion; Triguli (21,000 kW); the Gandak (15,000 kW) from India; and Sunkosi (10,000 kW) from the People's Republic of China. This year, the first of our underground power houses at Kulekhani (60,000 kW), financed by the World Bank, Kuwait, and the Japanese Government, is in operation. Devighat (14,000 kW) and Kulekhani IInd stage (31,000 kW)--both cascade projects--are under construction with Indian and Japanese assistance and are expected to be completed by 1983-84. Besides this, the Marsyangdi (66,000 kW) is under construction with the assistance of Germany, the World Bank, and Kuwait.

The level of investment is increasing year by year and has a direct effect on consumers through increases in the tariff. The buying capacity of consumers may not allow them to use more power, even if the requirement exists. The materials required to get a supply from point of generation to consumer terminals are not produced in Nepal. So, every year we are hit by increases in the cost of all materials which we use.

Nepal Electricity Corporation has had its own rural electrification program since 1968-69 with its own funds. Simultaneously, rural electrification work is being done by our government separately in selected low-priority areas. The increase in generation in different parts of the country and existing extension of transmission lines created a sense of having electricity in rural areas. These being scattered and thinly populated areas, they required more funds. Our government, with the assistance of the Asian Development Bank, is supposed to finance a ten-year rural electrification project with part of the investment by the Nepal Electricity Corporation in different development regions. The project is in a preliminary stage.

The average per capita income in Nepal is US $140.00. Most of our cities have electricity. Twenty-nine towns (Panchayats) get electric power either from hydro generation or other generation. We can say most of our 4,000 villages are outside of the electrified areas and need electricity either for lighting, or as an alternate to firewood for cooking in a severe situation of depleting forests, and finally for productive uses. The cost of generation, transmission, and distribution is rising. The capacity to pay dictates the need for cheap electricity. The return from cheap electricity due to limited use by rural consumers would be too small to run the commercial organization like ones which have to repay the loan from their funding agencies. We are faced with a tricky situation of costly generation and transmission and the desire to provide cheap electricity supply and repayment to our debtor. On completion of this rural electrification proposal, as outlined in Table 1, it is expected to service the new consumers as stated below.

TABLE 1: Tentative proposal for rural electrification

Regions	3.3 kv & 11 kv km	Low tension km	Transformers kva
Eastern	191	250	5,500
Central	534	900	60,000
Western	217	450	11,500
Mid-Western	385	500	5,000
Far-Eastern	160	320	4,000
Total	1,487 km	2420 km	85,000 km

PROGRAM OF PROVIDING DOMESTIC CONNECTION

There is no fixed program of giving domestic connections; however, the following number of connections are expected to be carried out:

Year	Eastern	Central	Western	Mid-Western & Far-Eastern	Total
1982/83	1,000	5,500	1,500	500	8,500
1983/84	1,000	5,500	1,500	500	8,500
1984/85	1,000	5,500	1,500	500	8,500
1985/86	1,000	5,500	1,500	500	8,500
1986/87	2,000	6,500	2,000	1,000	11,500
1987/88	2,000	6,500	2,000	1,500	13,000
1988/89	2,000	6.500	2,000	2,000	12,000
1989/90	2,000	6,500	2,000	2,000	12,000
1990/91	2,000	6,500	2,000	2,000	12,500

The system at the end of FY 2037/38 (180-81), under the control of the Nepal Electricity Corporation, consists of the following:

Power station	Installed capacity (kW)	Generating capacity in dry season (kW)
Pharping (1911)	2 x 250	400
Sundarijal (1936)	2 x 320	640
Panauti (1965)	3 x 800	1,500
Trisuli (1967)	7 x 3,000	21,000
Sunkoshi (1973)	3 x 3,350	10,050
Pokhara	4 x 256	1,024
Gandak	3 x 5000	15,000
Butwal	2 x 400 1 x 472	1,272
Kulekhani (1982)	2 x 30,000	60,000
Devighat (under construction)	14,000	
Marsyangdi (proposed for construction)	66,000	
Diesel (total)	21,692	20,146

Peak load generation of sales for recent years:

1971	1975	1976	1977	1978	1979	1980	1981
17,500	31,880	34,720	37,900	38,260	43,000	35,030	36,000

Generation:

	1971	1975	1976	1977	1978	1979	1980
Hydro generation, mWh	658.7	1238.4	1332.31	1483.10	1666.94	1844.62	1750.22
Diesel & generation, mWh	0.8	10.9	46.28	42.43	60.74	58.26	132.84
Total generation including purchase	659.5	1249.30	1378.59	1554.55	1819.7	1992.94	1977.75

Consumers:

	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980
Domestic	44,690	52,675	56,622	58,296	61,137	63,477	75,674	80,298	86,454	91,813
Industrial	599	823	929	879	973	1,122	1,446	1,590	1,783	2,003
Commercial	18	19	26	55	58	60	81	124	125	129
Total	45,307	53,517	57,587	59,230	62,167	64,649	77,201	81,972	88,362	93,945

Units sold, mWh:

	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980
mWh	465	591	647	758	874	934	1058	1232	1410	1374
% domestic	60	55	64	62	60	56	54	53	44	49
% industrial	9	10	21	24	26	24	26	24	25	26
% commercial	11	11	9	10	10	11	12	15	18	17
% others	20	16	6	4	4	9	8	8	13	8

Transmission line:

132 kW	Gandak Heatuda	154 km
66 kv	Trisuli Kathmandu	32 km
	Kathmandu Birjanj	121 km
	Patan Sunkosi	84 km
33 kv	Panauti Bharktapur	20 km
	Birgunj Raxaul	6.5 km
	Eastern Mid-Western	188 km

Distribution:

11 kv line	Feeder Line	386 KM
	Eastern Mid-Western	76 KM
	Eastern Mid-Western	268 KM

Recently the eastern development zone with its zonal office at Birantnagar came under this corporation's control.

STATUS OF THE PRODUCTIVE USES OF ELECTRICITY PROGRAM OF THE NATIONAL ELECTRIFICATION ADMINISTRATION, THE PHILIPPINES, OCTOBER 1982

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The National Electrification Administration (NEA), a government-owned stock corporation operating under the mandate to achieve total electrification of The Philippines on an area coverage basis, in addition has engaged in promoting economic and power-using activities in the rural areas through the following programs.

PROMOTION OF INDUSTRIES

Started in 1980 to continue the Power Use Small-Scale Industry Program started in 1973 and promote energy-related industries, this program has the following objectives: (a) development of small-scale industries (rural industrial cooperatives) in rural areas with coverage by electric cooperatives as priority; (b) promotion of the local manufacturing of equipment and materials to be used in the energy program of the country; and (c) development of industries to complement the tree plantation and Dendro thermal power plant activities of NEA.

To implement this program, NEA created the Directorate for Promotion of Industries (DPI) in 1980. The status of the program as of October 1982 is as follows:

Small-scale industries	
No. of projects (operational)	16
No. of projects (preoperational)	1
Total loan released (₱'000)	5,300
Total employment generated	790
Average income per member-worker (₱)	15
Total demand load (kW)	227
Energy-related industries	
No. of projects (operational)	2
No. of projects (preoperational)	1
Total loan released (₱'000)	2,090
Total employment generated	150
Average income per member-worker (₱)	22
Total demand load (kW)	75

Small-scale industries

Of the 16 operational small-scale industries, 12 are handicraft industries which produce garments, household accessories, novelty items, furniture, and cutlery; two are mini-ice plants; one is a mini-rice mill; and one is a wood box industry. The preoperational project is another wood box industry which is being restudied for market viability.

The pioneering efforts of NEA in promoting employment through small industrial cooperatives met with problems, particularly in the handicraft sector. Problems such as a weak institutional base and market diversification still beset these projects. The recent move of the government to implement a nationwide livelihood program can give the much-needed boost to this undertaking.

Energy-related Industries

Energy-related industries are implemented to support the development of alternative sources of power generated from locally available resources. Through a joint venture with the Farm Systems Development Corporation (FSDC), NEA implemented a Fabrication Shop Enterprise with the Kalipunan ng mga Irrigators Service Association (KAISA) members as beneficiaries. This ₱878,000 project manufactures gasifier equipment (devices used to produce combustible gas from charcoal or wood) for irrigation, utility vehicles, and fishing boats in the Southern Philippines.

To pioneer in the production of high-grade charcoal, a ₱600,000 Coconut Processing Industry with a rated capacity of five tons cocoshell charcoal and two tons copra daily was set up, also in the Southern Philippines. This project consists of a locally invented, continuous charcoaling kiln and copra drying plant utilizing the producer gas collected during the charring process to dry copra and fire red clay bricks. This provides coconut farmers in the area with better facilities to process their coconut products and produce other products as well. The kiln is also capable of converting hardwood species into high-grade charcoal, which can be undertaken when industrial market demand for cocoshell charcoal goes down.

With the increasing demand for charcoal, another type of kiln--a one-ton brick beehive charcoaling kiln--was set up within this site as a pilot project for ipil-ipil and other hardwood charcoal production. This will be

replicated throughout the country when the trees of the tree plantation program undertaken by NEA and other government agencies nationwide have reached their maturity.

Another project now in its preoperational stage will be set up in Central Philippines. This will also produce charcoal and utilize producer gas to fire red clay bricks. The bricks will be used in the construction of beehive kilns and the charcoal as fuel for gasifier equipment in this area.

TANGLAW

Started in 1976, Tanglaw (acronym for Toward an Agressive National Growth Through Light and Water) is a self-help community project designed to extend the benefits of light and power to rural public schools and other learning institutions. Among other things, the project aims to maximize the use of existing school facilities by making evening classes possible, as well as to help improve the quality of education in rural areas by allowing the use of modern electric equipment and tools, such as those utilized for vocational trades and science courses. A joint undertaking among NEA, the Ministry of Education and Culture, the electric cooperatives and the local community, the Tanglaw project was expanded in 1977 to include the provision of a potable and adequate water supply to the public schools.

School lighting

	As of Dec. 1980	1981	As of Dec. 1981
No. of schools energized	3,427	930	4,357
No. of schoolrooms energized	39,208	13,848	53,056

In 1981, 930 new schools containing 13,848 classrooms were energized by electric cooperatives, distributed as follows: 495 schools in Luzon, 143 in the Visayas, and 292 in Mindanao. This brought to 4,357 the total number of schools (comprising 53,056 classrooms) benefited by the project to date. Aside from accommodating more students through evening sessions, many of these schools now offer vocational courses, including tailoring, dressmaking, automotive mechanics, hair science and other trades using electric tools and equipment.

RURAL WATER SYSTEM

In coordination with the Ministry of Human Settlements, NEA also undertakes rural water system projects to provide adequate potable water supply to the barrios. The water system, which consists of an electrically driven pump, a storage tank, and a distribution system, is managed and operated by local water service associations.

For the year under review, 142 waterworks projects were completed: 46 in Luzon, 19 in the Visayas, and 77 in Mindanao. At the end of 1981, a total of 644 rural water systems have been installed, serving over half a million people.

No. of waterworks installed

	As of Dec. 1980	1981	As of Dec. 1981
Tanglaw	448	142	590
Bliss	50	-	50
Co-op	4	-	4
Total	502	142	644

Number of beneficiaries

	As of Dec. 1980	1981	As of Dec. 1981
Tanglaw	439,420	85,459	524,879
Bliss	15,000	-	15,000
Co-op	1,662	-	1,662
Total	456,082	85,459	541,541

THE STATUS AND STRUCTURE OF PRODUCTIVE USES PROGRAM FOR RURAL ELECTRIFICATION—SRI LANKA

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POPULATION AND ELECTRIFICATION DATA

Sri Lanka is a pearl-shaped island at the southern tip of the Indian subcontinent with an area of 65,000 sq. km and a population of 14.85 million people. Some 78.5% of her people live in rural areas, and a total of 14.9% of the housing units on the island are electrified. Table 1 (see page 85) in the following history of rural electrification in Sri Lanka indicates the population, population density, and the percentage of houses electrified in each of the 24 administrative districts.

The distribution of electricity is undertaken by the Ceylon Electricity Board (CEB), which is a statutory authority of the government as well as local government authorities (municipal, urban, town, and village councils) which usually purchase bulk power from the CEB During the last five years, however, the development of the electricity grid as well as the low tension distribution lines has been mainly undertaken by the CEB. The sources of funding for such work have been:

- Self-generated funds of the CEB (mainly used for developing the H.T. network and for a limited number of distribution schemes which give a high percentage of return on investment);
- Government funding via bulk allocations given to District Development Councils; and
- Loan funds from international development banks (Asian Development Bank ADB -funded Rural Electrification RE Project).

PROMOTION OF PRODUCTIVE USES

With the formulation of the ADB-sponsored RE project, it was considered opportune to establish special institutional arrangements to promote the productive uses of electricity in the new areas being electrified. This was deemed necessary due to the following reasons:

- A survey conducted in 1978 revealed that the number of actual consumers (particularly in the first four years after completion of the scheme) was considerably lower than originally estimated at the time of investigation;
- The routine workload of area (operations and maintenance) organizations did not enable the maintenance of an adequate level of service for promotional work; and
- The realization of interdependence of other sector organizations in developing the productive uses of electricity.

The CEB has, therefore, recently established a load promotion cell and a program to optimize the productive uses of electricity in the categories given below is being formulated.

Pump irrigation

There are many prospective areas in which lift irrigation can be effectively used. In some areas tubewells are presently being pumped with diesel-driven pump sets at a high cost of both installation and operation. While considerable economies can be effected on existing tubewells, substantial economic development is possible in other areas where the potential has not been exploited, mainly due to the absence of electricity lines. Puttalam and Mannar have been identified as the districts in which the potential is extremely good.

Rice milling

With the completion of large irrigation schemes, particularly the Mahaveli Diversion Scheme, large tracts of new land are expected to be brought under cultivation shortly. In addition, existing fields would have a more plentiful supply of water, thus enabling them to increase production particularly by doing two crops per year instead of one crop during times of water shortage. Thus, a large increase in demand is expected in this sector. Recently, a large number of small private hullers have also surfaced, particularly due to the increased open market for rice. However, this has resulted in lower capacity utilization of the larger mills operated by the Paddy Marketing Board. There needs to be careful economic consideration of alternative strategies to ensure that overall economies are achieved. This is due to the high percentage of waste and brokens in the case of the smaller hullers as opposed to the medium-sized rice mills.

Coconut-based industries

The optimum sizes of fiber, oil, and dessicated coconut mills are large units of around 100 kva requiring separate substations. However, the coir industry would have attractive possibilities for electrification.

Marine-based industries

Fishing in Sri Lanka is carried out mainly in small boats by fishing communities around the coast. There is, therefore, considerable scope for small processing units, such as sausage plants, as well as for cold storage units. The development of both types of industries will encourage further development of the fishing industry as well as remove the present imperfections in the fish marketing procedures which enable middlemen to make considerable profits at the expense of both the fisherman and the consumer.

Timber

The increase in transport costs of timber provides a good opportunity for small-scale sawmills closer to the areas of timber exploitation.

Small-scale village industry

New demands caused by the tourist industry have increased the potential of traditional handicrafts based on brass, wood, pottery, etc.

Closure of certain industries

With changes in market conditions, it is quite possible that certain industries may close down. In certain areas this has happened with respect to hand looms and even the larger power looms. In such instances alternative uses of these electrified establishments should be looked into. Often this may be possible if the market conditions of the particular area are investigated.

COORDINATION WITH OTHER SECTORS

Successful promotional activity involves the coordination of various functions of many different organizations. To facilitate such coordination, an "Inter Agency Coordinating Group" has been set up under the auspices of the Ministry of Plan Implementation. The purpose of this group is to ensure the smooth functioning of complementary functions of various departments.

THE DEVELOPMENT OF RURAL LIGHTING

Rural lighting is not generally described as a productive use. The present author is of the view that social and other indirect benefits of providing lighting for rural households, though not easily quantified, are of far-reaching value. These benefits may be summarized as follows:

- The opportunity cost of the alternative lighting source, namely kerosene. The following approximate economic comparison indicates the "national surplus" achieved by conversion to electricity:

  Kerosene cost (international cost) = 42.5 US$/barrel, 1 US $ = S.L. Rs 21.00

  Assumed consumption per rural household = 0.3 liters/day

  Cost of kerosene/day = 42.5/35 x 21/4.545 x 0.3

  Cost of kerosene/month = Rs 50.50

  Equivalent electricity consumption per day = 40 W x 4 hrs.

  Marginal cost of peaking power at L.T. (Sri Lankan system) = Rs 3.50/kWh*

  Equivalent cost of electricity/month = Rs 16.80.

  It is thus seen that the savings from conversion to electricity purely on the basis of reduced national fuel oil bills is considerable.

- Reduction of pressures on demand for migration to urban areas

- Increased facility for studying in homes, longer reading hours, etc.

(d) Development of rural community life--community centers, television, rural theaters.

All the above factors, though difficult to quantify, are nevertheless of considerable value to the nation.

In order to develop lighting for rural housing, the CEB is presently considering the implementation of reduced rating services to temporary and semipermanent village houses on the following basis:

- 0.5 mm^2 and 1.0 mm^2 wires to be used for service connections (rating 5A and 9A respectively)

- These houses to be provided with one 20 W fluorescent lamp as the main lighting point and one or two more additional points

- Tumbler switch to replace main switch for 5A services

- In the case of semipermanent walls and roofs, the wiring to be enclosed in buried or surface thick gauge PVC conduit.

HISTORY AND BACKGROUND OF RURAL ELECTRIFICATION IN SRI LANKA

Population and electrification data

* This figure is that obtained from a marginal cost study of supply to domestic consumers inclusive of both energy and peaking costs. The actual charge to rural domestic consumers is only 40 cts per unit at this level of consumption.

As noted, Sri Lanka is a pearl-shaped island at the southern tip of the Indian subcontinent with an area of 65,000 sq. km and a population of 14.85 million people. Some 78.5% of her people live in rural areas, and a total of 14.9% of the housing units on the island are electrified. Table 1 indicates the population, population density, and the percentage of houses electrified in each of the 24 administrative districts. A detailed districtwide analysis of housing units by type of lighting is given in Table 2 (see page 86), and it is seen that kerosene is being used by over 80% of the houses as the principal mode of lighting. From Table 1 it is seen that in over half the districts electrification has occurred in less than 10% of the households while over a quarter of the districts have an electrified household percentage of less than 5%. Table 3 (see page 87) gives the details of housing units by the type of lighting classified into the urban, rural, and estate sectors as well as the type of housing units. It is observed that only 8.3% of the total rural households are served by electricity.

The classification of the population into urban and rural at the years in which the census has been taken is given in Table 4 (see page 87.) During the period 1946-1971, the percentage of the rural population has been gradually declining, while in the period 1971-1981 the percentage of the rural population has increased slightly from 77.6% to 78.5%. This increase could be attributed to the development of irrigation schemes, particularly for new colonization schemes, and increased government funding of regional development.

A districtwide analysis of rural electrification projects showing the extent of work done during the last five years is given in Table 5 (see page 88.) From the data it is observed that many of the schemes are short extensions to the existing L.T. distribution network. However, with the formulation of a special RE project jointly funded by the ADB and the Saudi Fund, it is expected to undertake the expansion of electricity to rural areas on a systematically organized basis. The project includes the electrification of 1,150 schemes involving 1,190 km of 33 and 11 kv lines, 910 Nos. transformer substations and 5,140 km of L.T. lines.

THE PRESENT STRUCTURE OF L.T. DISTRIBUTION SCHEMES

Hitherto, very few organized attempts were made to increase the connections being made to the newly constructed lines. New connections were made upon request by the operational organization: area engineers suitably supported by commercial engineers in regional headquarters.

An analysis of the consumption patterns in light selected distribution regions representing mainly rural and semi-urbanized areas is given in Tables 6 and 10.1 (see pages 88 and 90.) Table 6 gives the breakdown of the consumption into tariff categories representing domestic, industrial, commercial, and religious purpose consumers. Table 7 (see page 89) repeats the above analysis in respect to the number of consumers in each category. A considerable variation of consumption patterns is observed. The areas Nuwara-Eliya, Balangoda, and Avissawella show a very low level of industrial usage while in the balance of the areas industrial consumption is over 20% of the total units.

The patterns of domestic consumption are analyzed in Tables 8 to 10.1 (see pages 89 to 90) and show a fair degree of similarity in the various areas studied. Of the total units sold, the highest concentration is in the unit category 50-150 units per month while the categories on either side, viz., 25-50 and 150-550, have total consumptions of an order slightly lower than in the 50-150 units per month category. This position is also seen from Tables 10.1 to 10.5 (see pages 90 to 92), where a high percentage of meter reading packs have a total of over 50% of the units consumed in the 50-150 units per month consumption category. A clearer position with regard to domestic consumption patterns would have emerged if the unit categories could have been taken at equal block intervals, but the above analysis was resorted to due to convenience, the categories concerned coinciding with the tariff blocks. With respect to the areas taken for the study, the average domestic consumption may be taken as 100 units/month.

TABLE 1. Districtwide classification of population, population densities and percentage of houses electrified

District	Population (1981)	Population density (per sq km)	% of houses electrified
Colombo	1,698,322	2,603	43.7
Gampaha	1,389,490	993	21.6
Kalutara	827,189	515	18.0
Kandy	1,126,296	522	17.7
Matale	357,441	180	7.1
Nuwara Eliya	522,219	363	10.6
Galle	814,579	487	12.4
Matara	644,231	517	9.7
Hambantota	424,102	163	6.0
Jaffna	831,112	401	25.4
Mannar	106,940	53	5.6
Vavuniya	95,904	36	3.3
Mullaitivu	77,512	39	3.7
Batticaloa	330,899	134	11.7
Amparai	388,786	86	12.5
Trincomalee	256,790	98	12.4
Kurunegala	1,212,755	254	4.3
Puttalam	493,344	166	10.5
Anuradhapura	587,822	82	6.6
Polonnaruwa	262,753	77	4.3
Badulla	642,893	228	9.9
Moneragala	279,743	50	3.8
Ratnapura	796,468	246	5.4
Kegalle	682,411	410	5.4
Sri Lanka	14,850,001	230	14.9

Source: Dept. of Census and Statistics

TABLE 2: Occupied housing units by type of lighting

District & type	Total	%	Electricity number	%	Kerosene number	%	Other number	%	None number	%	Not stated number	%
Total, all districts	2,811,406	100.0	418,418	14.9	2,316,869	82.4	11,600	0.4	9,469	0.3	55,053	2.0
Colombo	273,057	100.0	119,346	43.7	147,219	53.9	238	0.1	258	0.1	5,998	2.2
Gampaha	264,897	100.0	57,206	21.6	202,818	76.6	134	0.1	206	0.1	4,535	1.7
Kalutara	160,463	100.0	28,892	18.0	126,901	79.1	91	0.1	500	0.3	4,080	2.5
Kandy	191,320	100.0	33,862	17.7	153,811	80.4	27	0.0	255	0.1	3,366	1.8
Matale	67,458	100.0	4,803	7.1	61,696	91.5	10	0.0	104	0.2	845	1.3
Nuwara Eliya	108,690	100.0	11,513	10.6	88,846	81.7	130	0.1	116	0.1	8,085	7.4
Galle	145,475	100.0	18,055	12.4	125,602	86.3	94	0.1	135	0.1	1,589	1.1
Matara	121,862	100.0	11,843	9.7	108,494	89.0	30	0.0	166	0.1	1,328	1.1
Hambantota	80,157	100.0	4,818	6.0	74,479	92.9	99	0.1	157	0.2	602	0.8
Jaffna	159,984	100.0	40,631	25.4	116,042	72.5	64	0.0	1,052	0.7	2,193	1.4
Mannar	18,160	100.0	1,014	5.6	7,659	42.2	9,307	51.3	110	0.6	69	0.4
Vavuniya	17,171	100.0	565	3.3	15,563	90.6	40	0.2	187	1.1	816	4.8
Mullaitivu	13,515	100.0	501	3.7	12,654	93.6	15	0.1	85	0.6	258	1.9
Batticaloa	69,929	100.0	8,165	11.7	59,482	85.1	51	0.1	1,030	1.5	1201	1.7
Amparai	78,181	100.0	9,803	12.5	64,529	82.5	181	0.2	941	1.2	2,727	3.5
Trincomalee	48,343	100.0	5,979	12.4	40,752	84.3	135	0.3	691	1.4	787	1.6
Kurunegala	262,557	100.0	11,263	4.3	245,910	93.7	267	0.1	765	0.3	4,352	1.7
Puttalam	105,168	100.0	11,088	10.5	92,112	87.6	96	0.1	532	0.5	1,340	1.3
Anuradhapura	197,433	100.0	7,056	6.6	98,767	91.9	71	0.1	427	0.4	1,112	1.0
Polonnaruwa	48,181	100.0	2,076	4.3	45,468	94.4	21	0.0	126	0.3	491	1.0
Badulla	119,752	100.0	11,885	9.9	103,690	86.6	95	0.1	448	0.4	3,635	3.0
Moneragala	52,071	100.0	1,961	3.8	49,046	94.2	19	0.0	518	1.0	525	1.0
Ratnapura	158,033	100.0	8,609	5.4	146,092	92.4	356	0.2	568	0.4	2,409	1.5
Kegalle	139,549	100.0	7,484	5.4	129,237	92.6	29	0.0	89	0.1	2,710	1.9

TABLE 3: Occupied housing units by type and principal type of lighting by urban, rural, and estate sectors

Sector & type of housing units	Total		Electricity		Kerosene		Other		None		Not stated	
	Num.	Per	Num.	Per	Num.	Per	Num.	Per	Num.	Per	Num.	Per
Total, all sectors	2,811,406	100.0	418,418	14.9	2,316,869	82.4	11,600	0.4	9,469	.3	55,053	2.0
Permanent	1,173,995	100.0	398,891	34.0	739,061	63.0	3,838	.3	1,350	.1	80,856	2.6
Semi-permanent	1,457,329	100.0	16,710	1.1	1,408,295	96.6	4,277	.3	6,308	.4	21,736	1.5
Improvised	180,078	100.0	2,815	1.6	1,699,508	94.1	3,484	1.9	1,914	1.0	2,462	1.4
Urban total	509,459	100.0	233,869	45.9	261,089	51.2	352	.1	1,693	.3	12,457	2.4
Permanent	346,623	100.0	227,049	65.5	110,424	31.9	201	.1	424	.1	8,525	2.5
Semi-permanent	124,013	100.0	5,664	4.6	114,575	92.4	131	.1	568	.5	3,075	2.5
Improvised	38,820	100.0	1,157	3.0	36,088	93.0	20	.1	699	1.8	858	2.2
Rural total	2,084,496	100.0	172,394	8.3	1,867,717	89.6	10,799	.5	6,4751	.3	27,111	1.3
Permanent	776,450	100.0	161,554	20.8	597,414	76.9	3,443	.4	854	.1	13,184	1.7
Semi-permanent	1,168,549	100.0	9,265	.8	1,138,436	97.4	3,891	.3	4,511	.4	12,444	1.1
Improvised	139,496	100.0	1,575	1.1	131,860	94.5	3,464	2.5	1,115	.8	1,484	1.1
Estate total	217,451	100.0	12,155	5.6	188,063	86.5	449	.2	1,301	.6	15,485	7.1
Permanent	50,922	100.0	10,288	20.2	31,221	61.3	194	.4	72	.1	9,147	18.0
Semi-permanent	164,767	100.0	1,781	1.1	155,284	94.2	255	.2	1,229	.7	6,217	3.8
Improvised	1,762	100.0	83	4.7	1,560	88.5	-	.0	-	.0	120	6.8

TABLE 4: Population by urban and rural sector (census years)

Years	Population, '000			Percentage		
	Urban	Rural*	Total	Urban	Rural*	Total
1946	1,023.0	5,634.3	6,657.3	15.37	84.63	100.00
1953	1,239.1	6,858.7	8,097.8	15.30	84.70	100.00
1963	2,016.3	8,568.8	10,582.1	19.05	80.95	100.00
1971	2,848.1	9,841.8	12,689.9	22.36	77.64	100.00
1981	3,194.9	11,655.1	14,850.0	21.51	78.49	100.00

Source: Dept. of Census and Statistics

* The rural sector includes estates.

TABLE 5: Work contents of RE schemes undertaken from 1978 to 1982 (5 years)

District	No. of electorate	No. of schemes	HT line length (km)	SS capacity additions (kva)	LT line lengths (km)
Colombo	15	218	43.5	2778	161.61
Gampaha	13	374	41.02	3205	252.86
Kalutara	08	336	70.7	5152	369.36
Kandy	14	443	70.16	3725	644.32
Matale	04	32	10.85	600	46.95
Nuwara Eliya	03	53	9.65	900	63.22
Galle	10	232	56.93	3098	265.06
Matara	07	117	54.02	2200	249.50
Hambantota	04	35	30.34	900	71.84
Jaffna	11	274	28.70	1950	229.05
Mannar	01	-	-	-	-
Vavuniya	01	01	0.32	100	3.68
Mullative	01	01	-	-	3.8
Batticaloa	03	34	8.50	700	53.82
Ampare	04	42	26.24	1401	51.15
Trincomalee	03	25	23.20	1075	62.84
Kurunegala	14	117	145.76	3475	378.24
Puttalam	05	23	2.48	163	21.98
A'Pura	07	34	54.8	1450	48.78
Polonnaruwa	03	43	14.6	1550	103.65
Badulla	09	86	31.3	2071	155.208
Monaragala	03	24	16.3	1313	58.4
Ratnapura	08	70	33.45	2200	92.4
Kegalle	09	115	40.51	2955	178.51

TABLE 6: Analysis of units consumed by tariff categories, percent of units consumed in each tariff category

Area	Area total units	Combined domestic	Domestic	Industries	Commercial	Religious Purpose
Trincomalee	194,704	-	31.7	23.9	40.9	3.5
Anuradhapura	204,958	-	30.9	22.8	44.1	2.2
Negombo	1,021,453	-	60.1	22.0	15.7	2.2
Nuwara Eliya	513,350	0.1	52.3	1.4	44.8	1.3
Avissawella	423,133	0.2	77.2	2.8	16.4	3.4
Minneriya	211,741	0.2	29.9	32.0	36.0	1.9
Balangoda	130,206	1.3	57.9	4.3	33.2	3.2
Batticaloa	177,433	0.1	49.7	21.1	25.5	4.5

TABLE 7: Analysis of number of consumers by tariff categories

Area	Total no. of consumers	% of consumers in each tariff category				
		Combined domestic	Domestic	Industries	Commercial	Religious Purpose
Trincomalee	1,591	0.3	65.5	3.4	27.2	3.6
Anuradhapura	2,323	0.3	55.7	3.5	37.9	2.5
Negombo	13,665	0.2	81.7	3.4	12.6	2.1
Nuwara Eliya	4,866	0.3	79.5	0.4	17.9	1.9
Avissawella	6,453	0.5	81.8	1.1	14.5	2.1
Minneriya	1,863	0.5	63.8	6.1	27.5	2.1
Balangoda	1,846	1.2	78.8	1.2	15.1	3.7
Batticaloa	2,399	0.4	74.9	3.5	17.7	3.5

TABLE 8: Analysis of domestic consumption into unit categories

Area	Domestic total units	% of units consumed in each category				
		0-25 units/M	25-50 units/M	50-150 units/M	150-500 units/M	Over 500 units/M
Trincomalee	61,798	5.6	21.1	50.5	15.0	7.7
Anuradhapura	63,366	7.6	25.7	41.3	19.1	6.2
Negambo	614,301	6.2	23.9	46.3	20.3	3.3
Nuwara Eliya	268,525	7.1	15.2	31.8	27.8	18.2
Avissawella	302,274	6.3	22.5	41.3	24.7	5.3
Minneriya	62,441	6.5	23.7	40.6	24.3	4.9
Balangoda	75,427	7.9	26.8	44.1	19.0	2.3
Batticaloa	88,230	9.8	25.7	47.5	15.0	2.0

TABLE 9: Analysis of the number of domestic consumers into unit categories

Area	No. of domestic consumers	% of domestic consumers in each category				
		0-25 units/M	25-50 units/M	50-150 units/M	150-500 units/M	Over 500 units/M
Trincomalee	1,029	24.8	33.6	36.9	4.3	0.4
Anuradhapura	2,82	36.1	34.0	25.1	4.3	0.4
Negombo	11,121	29.0	35.6	30.1	5.0	0.3
Nuwara Eliya	3,870	36.2	29.1	25.5	8.1	1.2
Avissawella	5,255	29.5	34.6	29.6	5.8	0.5
Minneriya	1,186	33.4	33.9	26.6	5.8	0.2
Balangoda	1,454	28.4	37.3	30.1	4.1	0.1
Batticaloa	1,807	33.3	34.0	29.1	3.3	0.3

TABLE 10.1: Analysis of domestic consumption—percentage of meter reading packs by unit categories and percentage of total consumption, Trincomalee area

Units/month % of total consumption	0-25	25-50	50-150	150-500	Over 500
90-100					
80-90					
70-80				7.1	
60-70			21.4	-	
50-60			28.6	-	
40-50		14.3	14.3	7.1	
30-40	7.1	-	14.3	14.3	7.1
20-30	-	14.3	21.4	14.3	7.1
10-20	14.3	57.1	-	21.4	-
5-10	42.8	-	-	7.1	-
0-5	35.5	14.2	-	28.5	85.0

Total number of meter reading packs = 14

TABLE 10.2: Analysis of domestic consumption—percentage of meter reading packs by unit categories and percentage of total consumption, Anuradapura area

Units/month % of total consumption	0-25	25-50	50-150	150-500	Over 500
90-100					
80-90					
70-80					
60-70					
50-60		10	30	10	
40-50		10	30	-	
30-40		-	30	-	
20-30		70	10	20	
10-20	30	10	-	50	20
5-10	40	-	-	-	-
0-5	30	-	-	20	80

Total number of meter reading packs = 10

TABLE 10.3: Analysis of domestic consumption—percentage of meter reading packs by unit categories and percentage of total consumption, Negombo area

Units/month % of total consumption	0-25	25-50	50-150	150-500	Over 500
90-100					
80-90					
70-80					
60-70					
50-60		3.7	25.9		
40-50		-	59.3		
30-40		18.5	11.1	3.7	3.7
20-30		59.3	3.7	-	-
10-20	14.8	18.5	-	44.4	3.7
5-10	63.0	-	-	11.1	22.2
0-5	22.2	-	-	3.7	70.3

Total number of meter reading packs = 27

TABLE 10.4: Analysis of domestic consumption—percentage of meter reading packs by unit categories and percentage of total consumption, Nuwara Liya area

Units/month % of total consumption	0-25	25-50	50-150	150-500	Over 500
90-100					
80-90					
70-80		1.4		1.4	1.4
60-70		1.4	4.2	1.4	1.4
50-60		2.8	9.9	5.6	1.4
40-50	1.4	8.5	16.9	16.9	-
30-40	9.9	11.3	25.4	11.3	11.3
20-30	7.0	19.7	28.2	19.7	5.6
10-20	18.3	25.4	8.5	14.1	7.0
5-10	28.2	14.1	2.8	4.2	4.2
0-5	35.0	15.4	4.2	25.3	67.2

Total number of meter reading packs = 71

TABLE 10.5: Analysis of domestic consumption—percentage of meter reading packs by unit categories and percentage of total consumption, Avissawella area

Units/month % of total consumption	0-25	25-50	50-150	150-500	Over 500
90-100					
80-90		1.7		1.7	
70-80		5.1		-	
60-70	1.7	1.7	8.5	5.1	
50-60	-	6.8	13.6	1.7	
40-50	-	8.5	20.3	3.4	
30-40	1.7	13.6	18.6	13.6	
20-30	5.1	25.4	15.2	25.4	5.1
10-20	17.0	28.8	3.4	23.7	11.8
5-10	35.6	6.8	-	11.8	1.7
0-5	33.9	1.7	20.3	13.6	81.1

Total number of meter reading packs = 59

TABLE 10.6: Analysis of domestic consumption—percentage of meter reading packs by unit categories and percentage of total consumption, Minneriya area

Units/month % of total consumption	0-25	25-50	50-150	150-500	Over 500
90-100					
80-90					
70-80					
60-70					
50-60			9.1	9.1	
40-50		9.1	45.5	9.1	
30-40		36.4	36.4	9.1	
20-30		18.2	9.1	27.3	18.2
10-20	18.2	36.4	-	-	9.1
5-10	15.5	-	-	9.1	-
0-5	36.4	-	-	36.4	72.7

Total number of meter reading packs = 11

PRODUCTIVE USES OF ELECTRICITY IN THAILAND

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Electricity is a necessity for rural development, parallel to improving water sources, roads, irrigation, health, and schools. Electricity helps to develop the social and economic aspects of rural areas and gives rural people the chance for a better and more secure life. It brings with it the opportunity for better education through night adult education, radio, and television.

Electricity helps to increase the incomes of rural people. For example, rice production can be increased from one to two crops per year with the use of electrified irrigation pumps; it increases the working hours available to rural people for handicrafts, mat weaving, and cloth weaving in cottage industries. Factory owners using electricity are inclined to expand their operations and provide more jobs, which will increase people's income.

Many social benefits accrue with the introduction of electricity, including the expansion of health centers, hospitals, and schools, and the extension of tap water to villages. Standards of education will improve with the use of electricity; children will learn from radio and television programs. People who are ill will not have to travel to cities to receive health care when medical clinics which make use of electrified medical equipment are expanded to the villages.

From the effects of electrification listed above, it can be seen that electricity plays an important role in developing the country, and it is considered a prime necessity for a higher standard of living. Although investment in rural electrification gives a low internal financial rate of return to the sector, on the other hand, it gives a high economic benefit.

Accordingly, in developing rural electrification, if done extensively, it will bring about a beneficial effect to the responsible sector. To utilize electricity most beneficially in every way, electric pump irrigation, electrified rice milling, establishing repair shops with electric equipment, and teaching in adult education classes at night must be encouraged.

Due to the importance of the use of energy to rural development, the Provincial Electricity Authority (PEA) has established the Accelerated Electrification Project along with the reinforcement systems and the normal extension programs which consist of:

- Accelerated Rural Electrification Projects--The first stage (ARE I) was begun in 1977 and is to be completed in 1982. A total of 5,213 villages will be electrified. At present 80% of the total projects have been completed.

- Tambon Electrification Project--This was started in 1980 and completed in 1981. A total of 4,692 villages were included and about 60% were completed under the project.

- Accelerated Rural Electrification Projects--Second stage (ARE II). This project is financed from IBRD, OPEC, and SAUDI loans and include a grant from the Norwegian Government for mini hydropower. The project was started in 1981 and will be completed in 1985, and about 7,878 villages will be electrified.

- Village Electrification Projects--Through this program 4,000 villages will be electrified.

- Acceleratd Rural Electrification Projects--Third stage (ARE III). The remaining 3,700 villages to be electrified are targeted for completion in 1990.

- Normal Rural Electrification Project--The purpose of this project is to electrify 5,000 villages. The implementation plan has been submitted to the Cabinet for approval.

- During the implementation of the above project, the PEA has planned to operate normal extension programs jointly with the other projects. An average of 1,500 villages annually will be electrified through contributions of 30% from the consumers and 70% from PEA. This program will be operated independently in villages where the people can afford to construct the facilities themselves without waiting for implementation of other projects. In the course of ARE II implementation, PEA will construct two mini hydro plants with components that have been provided by the Norwegian Government. In addition, a master plan for further mini hydro development will be studied.

To select project villages, villages with a sound economic base will be considered first because of the importance of achieving a high level of productive uses of electricity. Some of the factors for a village to be considered are: the distance from a road, distance from a high tension line, number of households, number of potential consumers, number of shops, and the potential

for connections to public and welfare facilities in the village. These data will come from surveys of unelectrified villages, and the data will be processed by computer.

After villages have been electrified, a followup survey will be made to determine the level of productive uses of electricity by each village. The survey will include electricity use by rice mills, shops, schools, health clinics, and religious institutions. This information will also enable the responsible sector to understand how to help improve education in the villages. A Use of Electricity Development Unit has been established to process requests for electric service in the project areas and to teach people how to use electricity safely and productively in order to improve their incomes. The objective is to help rural people make the most beneficial use of electricity for social and economic development.

STATUS AND STRUCTURE OF PRODUCTIVE POWER USES PROGRAM IN BANGLADESH

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CHAPTER I--INTRODUCTION

Statistics of Bangladesh

Bangladesh is located in the eastern part of the Indian Subcontinent. The approximate area of the country is 55,598 sq. miles (143,993 sq. km). The total population is about 89 million. Density of population is about 1,600 persons per sq. mile. It is roughly located between 20.75° and 25.75° north latitude and between 88.30° and 92.75° east longitude. Although a low temperature of 36°F was recorded in winter, there is not usually much fluctuation from about a 45-55°F daily minimum to a 75-85°F daily maximum. Maximum normal temperatures recorded in summer are 98°F, although in some places this rises to 105°F or more. The monsoon starts in June and lasts until October. The average rainfall varies from 50-200 inches. The annual growth rate on the basis of adjusted population from 1961 is 2.59%. Some 91% of the 89 million people reside in rural areas. Per capita income of the country is only about $90.00.

*1980 Statistical Yearbook of Bangladesh.

Agriculture is the main occupation of the people, employing 80% of the labor force, and directly contributes 53% of the GDP. Bangladesh is marginally deficient in food grains, and 51% of the population is landless (having no land or having less than 0.5 acre).

Bangladesh has a per capita generation of 33 KWH (1982) as compared to India (175), Pakistan (195), Sri Lanka (133), and The Philippines (373) in 1980 (1980 United Nations' energy statistics). Only about 3% of the population is receiving the benefits of electricity in Bangladesh.

Only 14.6% (3.7 x 10^6 acres) of the net cropped area was under irrigation in 1980.*

Electricity has been provided to about 8,000 tubewells, shallow tubewells, and low-lift pumps.

Productive use of electricity

Per capita electricity or energy consumption is usually considered the yardstick of economic development of a country. In other words, the economic development of a country is dependent on the consumption and availability of electrical energy and/or other forms of energy. Because of the capacity of energy resources, every effort should be made to ensure that optimum benefits are derived from the available sources of energy. Because of flexibility, the use of electrical energy may bring many social and economic benefits to a country. But its use must be ensured in those kinds of economic and social activities that will bring the optimum benefit to the people it is serving. The productive power use program is not easy because it depends on the availability of other tools of development, e.g., skilled labor, credit facilities, raw materials, market facilities, communication facilities, etc.

It also depends on the ability of the institution.

CHAPTER II--STRUCTURE OF POWER USE DEPARTMENT IN RURAL ELECTRIFICATION BOARD AND RURAL ELECTRIC SOCIETIES

The Government of the People's Republic of Bangadesh has made rural electrification a constitutional obligation to the people. In order to implement its obligation, the Government of Bangladesh created the Rural Electrification Board (REB) in 1978 under

Presidential Ordinance, the REB Ordinance of 1977.

With the assistance of USAID, REB started an electrification program through Rural Electric Societies (RES). Each RES usually covers an area of three to five thanas (a thana covers an area of approximately 100 sq. miles). Each RES is headed by a General Manager, and the standard organizational structure, depending on whether it serves below 30,000 consumers or below 50,000 consumers.

Each RES is run by a Board of Directors (10 to 15 in number) elected from among the electricity consumers of the society.

The Bangladesh REB has made the productive power use program a vital part of the rural electrification program. Mere electric service connection is not the objective of REB. Economic well-being of the consumer and productive power uses are also important considerations of REB.

In order to implement the productive power use program in an effective way, REB has created a separate cell in the Directorate of Management Operation. A Power Use and Member Services Department has also been created in each RES. REB's Member Services and Power Use cell serve in an advisory capacity to the Power Use and Member Services Department of RES.

CHAPTER III

Power use plan in REB

REB has drawn up a comprehensive power use plan wherein priorities have been fixed as follows:

- o Consumer connections
- o Safe use of electricity
- o Utilization of single-phase motor through 10 hp.
- o Utilization of electric service in irrigation
- o Utilization of electric service in small business and cottage industry
- o Utilization of electric service in agro-based and other industry
- o Utilization of electric service in rural health and family planning activities
- o Utilization of electric service in the home.

Let us now look at what is happening in setting priorities in REB.

Consumer connections

Initially REB chose young men from the villages and trained them in basic house wiring so that they could establish a business to wire houses in the electrified villages. Now that the loads are getting more sophisticated with the addition of electric motors, REB is providing advanced electricians' courses as well as field training. REB is also seeking to establish a program whereas the RESs will call the village electricians in for periodic meetings to keep the village electricians up to date in electric equipment being utilized in Bangladesh, stress quality of work, and to motivate the village electricians to do a better job.

Safe use of electricity

REB understands that it has a responsibility to try to teach the village people to use electricity safely. Part of the orientation and training program for the village advisors includes safe use of electricity. The village advisors are encouraged to share this information with all the people in the villages. The Assistant General Managers of Member Services offers their services to give programs for groups of people in the villages and at schools.

Utilization of single-phase motors through 10 hp

REB made the decision to build a combination of a three-phase and a single-phase electric distribution system. This presented some problems because the people were not familiar with single-phase services and had a negative attitude about single-phase electric motors. Another problem was that there were no single-phase motors being manufactured or sold in Bangladesh.

REB was successful in getting the local GEC company to make 5 hp single-phase motors to be used for irrigation and operating the small No. 4 rice hullers. GEC is presently testing 7 1/2 hp and 10 hp single-phase motors. M/S. A.K. Khan Company has recently shown an interest in manufacturing single-phase motors.

REB assisted the RESs in holding meetings with the village advisors and other community leaders to explore the many cost advantages of using single-phase. At these meetings the REB demonstrated the 5 hp single-phase motor operating a 3/4 cuse pump (LLP). The demonstrations were successful, the farmers purchased all the single-phase motor pumpsets available, and presently there is a good market for single-phase motors.

The private sector became involved in installing single-phase motor pumpsets for irrigation. It appears that the private sector will share a portion of this market with the Bangladesh Agriculture Development Corp.

Utilization of electric service in irrigation

Successful irrigation requires more than installing a pump and motor. Farmers need to know how to manage the water, utilize cropping patterns, how to use fertilizer, and the best techniques in harvesting. As the REB has good communications with the pump owners

and village advisors, REB is trying to develop a program by coordinating the experiences of concerned organizations to teach the farmers how to get the best results from their irrigation equipment and the best production from their land. According to the Bangladesh Agriculture Research Institute, Bangladesh could obtain the same production of rice from four million acres of land that it does now from 25 million acres with better water management and farming techniques. This means that additional land could be used for soybeans, corn, cotton, peanuts, and other crops.

There are other economic reasons for using electric motors to operate the pumps for irrigation. Cost of energy, maintenance and life of equipment, and convenience are advantages in using electric equipment.

Utilization of electric service in small and cottage industries

REB is using the same concept in developing a program to promote small businesses and cottage industries as it did in promoting electric motors for irrigation. It is a new program beginning at Tangail RES-I.

The General Manager at Tangail RES-I called a meeting of RES officials, representative of government, and private organizations in order to coordinate a program to teach our goals. The last meeting of village advisors at Tangail was to determine the interest of village leaders in small businesses and cottage industries. There we learned of an electric-powered sugarcane crusher that has potential throughout Bangladesh. Members of the coordination committee are presently developing a plan to help the people in the village in the Tangail district with small businesses and cottage industries.

Utilization of electric service in agri-based and other industries

- o Cold storage
- o Carpet industry
- o Sugarcane crusher

Utilization of electric service in rural health and family planning activities

We plan to utilize our village advisors in the future to promote such programs. Up until now, we have been busy educating our village advisors in the first six priorities. This type of work will be more effective after we experience more success in agriculture and economic development.

Utilization of electric service in the home

REB thinks that it will be better to promote domestic use of electricity after productive uses in agriculture, business, and industry are successfully initiated.

In order to be successful in reaching the goals determined by our priorities, REB developed a plan to join hands with other government and private agencies interested in the same priorities and work together as a team to reach common goals. To that end, REB set up a monthly coordination committee meeting to ensure success in reaching the goals.

Coordination committees are set up at the RES. RES' Member Service and Power Use Departments serve as advisors. REB's staff obtains good ideas from these meetings that can be shared with all other RESs. Those on the committees are:

1. RES Coordination Committee for Irrigation (all RES)
   - o RES Directors
   - o RES General Manager
   - o RES Assistant General Manager (AGM) of Member Services
   - o RES AGM CO & M
   - o BADC Representative (Bangladesh Agriculture Development Corporation)
   - o Krishi Bank Representative (Agriculture Bank)
   - o IRDP Representative (Cooperative Management)
   - o Private businesses (e.g., ISGA)
   - o Volunteer organizations (e.g., CARE).
2. RES Coordination Committee For Developing Small Business and Cottage Industries (Tangail RES-I)
   - o RES Directors
   - o RES General Manager
   - o RES AGM of Member Services
   - o BSCIC Representative (Bangladesh Small and Cottage Industries Corporation)
   - o KRISHI Bank Representative
   - o Representatives from other commercial banks
   - o IRDP
   - o BADC
   - o Volunteer organizations.
3. RES Coordination Committee for Agriculture Development (Tangail RES-I)
   - o RES Directors
   - o RES General Manager
   - o RES AGM of Member Services
   - o Representative BARI (Agriculture Research Institute)
   - o Representative BRRI (Bangladesh Rice Research Institute)
   - o Extension Agent (Water Development Board)

- o BADC Representative
- o IRDP Representative
- o Krishi Bank Representative
- o Volunteer organizations.

Training program

RES had initiated a comprehensive training program for concerned personnel as follows:

- o AGM (Member Services and Power Use)
- o RES Directors
- o Employees
- o Village electricians
- o Village advisors.

Detailed training programs for the above categories of personnel are given below.

AGM Member Services and Power Use

Directed by REB Training Institute:

- o House wiring and safe use of electricity
- o Communications workshop
- o Single-phase motor workshop
- o Irrigation seminar
- o Seminar on good health habits and family planning
- o Seminar on utilization of electric service in small businesses and cottage industries
- o Seminar on utilization of electric service in the home
- o Seminar on utilization of electric service in agro-based and other industries.

RES Directors

Directed by RES AGM Member Services and Power Use. Suggests that Board of Directors be informed on items listed below:

- o Safe use of electricity
- o Single-phase motors and what they mean to RES
- o Irrigation
- o Communications
- o Utilization of electric service in small businesses and cottage industries
- o Utilization of electric services in good health habits and family planning
- o Utilization of electric services in the home
- o Utilization of electric services in agro-based and other industries.

Employees

Directed by RES AGM, Member Services and Power Use. Suggest that each employee meeting has time allocated for member service and power use training:

- o Safe use of electricity
- o Communications
- o Irrigation
- o Utilization of electric services in the home
- o Utilization of electric services in health and family planning
- o Utilization of electric services in small businesses and cottage industries
- o Utilization of electric services in agro-based and other industries
- o Single-phase and three-phase service.

Elaka District Advisors

Directed by RES AGM, Member Services and Power Use with the involvement of the Member Services Committee. Suggest that at each Advisory Council meeting there be time allocated for member services and power use training in:

- o Safe use of electricity
- o Irrigation
- o Utilization of electric services in good health and family planning
- o Utilization of electric services in small business and cottage industries
- o Utilization of electric services in the home
- o Utilization of electric services in agro-based and other industries
- o Communications
- o Single-phase and three-phase services.

Village electricians

Directed by REB training institute:

- o Basic house wiring
- o Advanced wiring including motors, etc.

Village advisors

Directed by RES AGM Member Services and Power Use and assisted by REB Member Services and Power Use Department:

- o Orientation
- o Safe use of electricity
- o Good health and family planning.

CHAPTER IV

Constraints on productive power uses program

The following constraints are usually faced in the implementation of productive power use programs:

- o Lack of availability of electrical materials and equipment
- o Unreliability of the power sources
- o Lack of credit availability to consumers as well as the utility
- o Lack of ability of the people to take risks
- o Lack of transportation facilities
- o Nonavailability of technical assistance
- o Nonavailability of generation capacity
- o Low per capita income of rural people
- o Brain drain of skilled/technical personnel from the country
- o Lack of entrepreneurial ability among rural people
- o Limitation of power supply
- o Migration of rural people to urban areas
- o Lack of experience in such a program
- o High cost of power
- o Lack of education among the people.

RURAL ELECTRIFICATION IN MALAYSIA

Dr. Mohammed Ariff Bin Araff, Senior Research and Development Engineer, National Electricity Board, Keala Lumpur, Malaysia

DEFINITION OF RURAL ELECTRIFICATION IN MALAYSIA

One definition given to rural electrification is as follows: "A rural electrification project is a project to supply electricity to a distinct rural community within any gazetted administrative area with a population of less than 10,000." Practically, most of the areas which lie outside the boundaries of major towns are rural.

CONTRIBUTION OF ELECTRICITY IN RURAL DEVELOPMENT

Our main emphasis in rural development is to raise the standards of living and restructure the society in rural areas. There is a wide range of uses of electricity in rural areas for both household and productive needs. Generally, the total demand from productive needs is higher than that from households. However, the relative demands from households and producers vary markedly from one area to another. The demand in an area may be dominated by one large consumer, e.g., a large cement factory, while in another area electricity is used for little more than domestic and public lighting. In addition to the various agro-industrial demands which develop from palm oil, rubber, and padi plantations, it is common to find several commercial activities. In a single village, for example, there may be sundry workshops in carpentry, welding, and repairs. Community demands may include public lighting and demands from a water pump, a police station, schools, and health centers.

The status of rural electrification in Malaysia is illustrated below:

Year	Rural population	No of rural households	Households with electricity	%
1970	6,352,515	1,072,640	345,602	32
1975	7,106,872	1,251,395	515,000	41
1980	7,869,718	1,441,188	790,000	55

The above projects were achieved through a series of government-supported programs:

Plans	Cumulative no. of villages	Total cost M$ millions
First Malaya Plan 1956/60	145	4
Second Malaya Plan 1961/65	443	18
First Malaysia Plan 1966/70	1,223	25
Second Malaysia Plan 1971/75	2,603	74
Third Malaysia Plan 1976/80 (Expected)	5,763	277
Fourth Malaysia Plan 1981/85 (Proposed)	10,212	868.5

It is envisaged that full electrification would be achieved in the first decade of the 21st century if the present pace is maintained. The connection rates in rural areas of 60,000 per year are anticipated for the 1981-90 period, based on current capabilities.

SUPPLY METHOD

There are three ways by which electricity is introduced into rural areas:

- o Public supplies from main grid system
- o Autogenerators serving single consumers
- o Autogenerators serving several consumers on a local network.

Autogeneration refers to isolated generators powered by diesel engines, small steam turbines, or mini-hydro turbines. The diesel engines have been installed in the rural load centers. Most of the costs are incurred due to the large and massive public network.

The main supply network to the rural areas extends from the high voltage (HV) mains fed from the national grid, which runs on the western side of the peninsula from north to south and extends through the center of

the peninsula to the east coast. The supply network has brought the lines nearer to the isolated agro- and wood-products industries, namely:

- o Palm oil refineries
- o Rice drying and milling complexes
- o Sugar mills
- o Timber mills.

This would further expand the growth of other agro-industries in the rural sector, providing greater job opportunities and better living standards, to counterbalance the flux of rural migration to the urban areas.

LOAD DEMAND SECTORS IN THE RURAL AREAS

The load demand based on rated capacity supply to the rural households and plants of the agricultural industries as anticipated by the end of Fourth Malaysia Plan (1985) is as follows:

	No.	Installed capacity/ consumer	Total (mW)
Rural households	1,090,000	0.400 kW	436
Palm oil mills	179	1,000	179
Rice mills	40	400	16
Sugar mills	1	4,000	4
Total			635

By the end of Fourth Malaysia Plan, the expected installed capacities of NEB power plants will be 4,160 mW. The rural sector demand would be anticipated to be about 15% of the total capacity available for the country. This does not include the administrative areas with a population of more than 10,000 people located within the undeveloped areas nor the demands from sawmills.

NEW APPROACH IN RURAL ELECTRIFICATION

The conventional method of extending expensive HV cables through difficult terrain and the setting up of diesel sets has incurred high capital expense in supplying the remote areas. The new approach is to harness available energy in the rural areas, instead of bringing energy from a long distance away. The means are discussed below.

Mini-hydro stations

The NEB is implementing 22 high- and medium-head mini-hydro schemes with capacity ranges between 25-500 kW. To date, five sets have been commissioned and another 11 are under construction while the remaining six are implemented on a turnkey basis. In 1981 the Government engaged three major consultants to carry out feasibility and design studies of another 104 potential and identified sites in Malaysia. The studies are now nearing completion and funding is being negotiated from the Asian Development Bank (ADB), World Bank, and other local and overseas financial institutions.

Most of the mini-hydro schemes are located in areas which are very remote and far from the reach of public utility systems. The ultimate plan is, of course, to bring the utility system nearer to these mini-hydro stations so that they can be synchronized, raising the load factor and hence the economic performance.

Solar photovoltaic electrical generators

There are areas such as the islands and rain-shaded locations where mini-hydro potential is uneconomical because of a low hydrological profile. The cost to extend conventional utility systems to these areas would be very expensive. However, solar photovoltaic electric generators, although expensive in terms of cost per kW basis, still show a favorable capital cost when compared with the extension of a conventional utility system. A village on the Island of Langkawi off the northwest coast of the Malaysian peninsula has been fully electrified by means of photovoltaic cells. The scheme adopts standalone systems and energy availability is limited. However, with more improvement in energy regulation, the cost of photovoltaic cells, and the availability of DC appliances, the future of photovoltaic cells would be very bright.

Cogeneration plants utilizing agricultural wastes

There are numerous agricultural mills which are scattered all over the country, and most of them are located in rural areas. If these mills could utilize all the agricultural wastes and cogenerate electricity in excess of their requirements, there would be a tremendous amount of electricity available in rural areas. The NEB is implementing two cogeneration schemes utilizing agricultural waste, i.e., rice husk, each with outputs of about 350 kW. This would increase the available energy in the immediate locality.

At the present stage, the above schemes have been implemented on pilot bases. It would take another Malaysia Plan to fully realize the advantages of this nonrenewable energy technology for the rural sector.

Estimated monthly mean daily solar radiaton (Q mWh/cm^2) from mean sunshine data in Malaysia*

Towns	Alor Setar	Sitiawan	Cameron Highlands	Senai	Mersing	Kota Bharu
Location						
Lat.	6°12'N	4°13'N	4°28'N	1°38'N	2°25'N	6°10'N
Long.	100°25'E	100°40'E	101°23'E	103°40'E	103°40'E	102°17'E
Ht. MSL	46 m	8 m	1,689 m	38 m	-	5 m
Jan.	555	497	434	494	431	438
Feb.	606	561	509	457	496	512
Mar.	600	546	500	503	531	566
Apr.	602	558	512	486	526	597
May	523	523	473	447	479	524
June	490	519	479	421	467	507
July	490	501	466	431	443	480
Aug.	485	490	456	442	458	481
Sept.	472	494	457	436	464	525
Oct.	486	467	426	432	453	454
Nov.	480	460	409	390	419	368
Dec.	484	456	394	404	371	337

*Source: School of Physics, University Science Malaysia, 1981.

Estimated annual production of biomass in Peninsular Malaysia in 1976

Wastes	Amount in tons
Coconut husk	705,630
Coconut shell	399,862
Rice straw	894,725
Rice bran	107,367
Cocoa pods	51,968
Tapioca refuse	206,989
Sugarcane tops	737,372
Bagasses	149,436
Pineapple bran	50,927
Sago refuse	32,740
Maize stalk	12,799
Maize cob	2,130
Groundnut shell	3,476
Wood residue (logging waste)	67,876
Animal dung (buffalo and cattle)	2,301,507
Total	5,724,804

If average biomass energy value is 4,500 kcal/kg, the energy potential would be 114,124 gWh (thermal).

Fresh Fruit bunches (FFB) processed in 1981 by the palm oil mills in Malaysia

State	No. of Mills	FFB processed (tons)	Solid wastes* (tons)	Energy value** gWhc (thermal)
Johore	46	4,386,185	2,894,882	12,824
Selangor	25	2,440,859	1,610,967	7,137
Pahang	34	3,064,469	2,022,550	8,960
Perak	24	2,084,694	1,375,898	6,095
N. Sembilan	8	888,388	586,336	2,597
Trengganu	7	581,300	383,658	1,700
Kelantan	5	160,811	106,135	470
P. Pinang	3	199,606	131,740	583
Melaka	2	143,528	94,728	420
Kedah	2	106,185	70,082	310
Sabah	13	867,174	572,335	2,535
Sarawak	2	161,841	106,815	473
Malaysia	171	15,085,040	9,956,126	44,104

Data obtained from the Palm Oil Registration and Licensing Authority.

* Solid waste represents 66% of the wet weight of FFB.

**Average energy value of fiber, shell, and stalk is 3,808 kcal/kg.; 86% of this energy from waste has already been consumed for cogeneration.

Thermal energy

1 Lcal = 4.1868 KJ

1KWH = 3.6 MJ

$$1 \text{ Kcal} = \frac{4.1868}{3.6} \times 10^{-3} \text{ kWh} = 1.163 \times 10^{-3} \text{ kWH}$$

$$E = 3808 \text{ Kcal/kg} \times 100 \frac{\text{kg}}{\text{ton}} \times (\quad) \text{ tons} \times 10^{-9} \times 1.163 \frac{\text{GWh}}{\text{Kcal}}$$

$$= 4428.7 \times 10^{-6} \frac{\text{GWh}}{\text{ton}} \times (\quad) \text{ tons}$$

$$= 4.43 \times 10^{-3} \frac{\text{GWh}}{\text{ton}} \times (\quad) \text{ tons}$$

Annual rice husk generation/energy availability (1981)

States	Estimated* rice husk (tons)	Energy** value qWh (thermal)
Johore	1,923	8
Selangor	15,351	65
Pahang	4,727	20
Perak	23,867	100
N. Sembilan	3,396	14
Trengganu	7,395	32
Kelantan	25,632	110
P. Pinang & Seberang Prai	12,311	50
Melaka	3,541	15
Kedah	97,975	415
Perlis	10,678	45
Total	206,796	874

* Estimation is projected from 1975/76 figures at 3% growth per year and 20% of the paddy production.

**Energy value of rice husk is 3,500 kcal/kg. Almost 100% of rice husk produced is not used for power or heat generation.

Machinery which utilizes electricity in the 60 FFB tons/hr palm oil mill

Process	Machinery	Capacity (kW)
Oil palm refinery	Fruit reception	20
	Sterilization	30
	Stripping	80
	Pressing	220
	Depericarping	240
	Kernel recovery	280
	Oil calcification	140
	Boiler	190
	Water treatment plant	15
	Workshop	15
	Lighting	20
	Oil dispatch	15
	Effluent treatment plant	35
	Miscellaneous	10
Total connected electrical load		1,310
Actual electrical load required (load factor 0.7)		917

Machinery which utilizes electricty in 30 ton/hr rice drying and 5 tons/hr rice milling, integrated complex

Process	Machinery	Capacity (kW)
Rice Drying	Aux. blowers 40	
	Suction fans	2 x 100
	Excavator	60
	Air compressors	40
Milling	Stripping	40
	Bran extract	40
	Separation	
	Aux. blowers	60
Total connected electrical load		520
Actual electrical load required (load factor of 0.6)		312

RURAL ELECTRIFICATION: PRODUCTIVE USES OF ELECTRICITY IN PAKISTAN

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DEVELOPMENT OF THE ECONOMY AND THE POWER SECTOR

In Pakistan, two state-owned organizations, namely, Pakistan Water and Power Development Authority (WAPDA) and Karachi Electricity Supply Company (KESC), are responsible for power generation, transmission, and distribution. The operations of KESC are, however, limited to the city of Karachi and its suburban areas. Thus, nearly the entire country falls under the jurisdiction of WAPDA. WAPDA was formed as a semiautonomous organization in 1959. Since then the power system has expanded at an exponential rate. In 1960, the peak demand of the WAPDA system was only 131 mW. By 1981, the peak demand had increased to 2473 mW or about 19 times over a period of 21 years. Similarly, the energy generated in the system has increased from 781 million kWh to about 13,206 million kWh, or about 17 times the generation in 1960. The number of consumers in 1960 was about 0.312 million. This number has already increased by 10.5 times to nearly 3.27 million.

During the last 20 years, the state of the economy has also changed considerably. The Gross Domestic Product (GDP) of the country in 1960 was about Rs 16,826 million. The estimated GDP in 1981, at constant factor prices, was about Rs 53,020 million, which is about 3.2 times the GDP in 1960. The population over the past 21 years has increased from about 42.88 million to about 83.0 million. Keeping in view these developments, the achievements in the power sector have been impressive.

One important indicator of the progress made by the power sector is per capita energy generation and consumption. In 1960, per capita energy generation was about 20 kWh as against 15 kWh per capita energy consumption. In 1981, the per capita energy generation had increased to about 168 kWh (8.4 times). During the same period per capita consumption increased to about 116 kWh (7.7 times). A brief summary of the growth in the economy and the power sector is given in Table 1.

TABLE 1: Growth of the economy and the power sector*

Description	1960	1981	Growth %
GNP** million Rs	16,803	56,237	5.92
GDP** million Rs	16,826	53,020	5.62
Per capita income,** Rs	373	681	2.91
Peak demand, mW	131	2,473	15.02
Energy generated, gWh	781	13,206	14.41
Per capita generation, kWh	20	168	10.67
Per capita consumption, kWh	15	116	10.23
No. of consumers	311,596	3,269,945	11.85

* Excluding KESC
**At constant factor prices

PROFILE OF CONSUMERS

To understand the developments in the type of consumers in the WAPDA system, comparative data on number of consumers in the WAPDA system for the years 1960 and 1981 are summarized in Table 2 (see page 110). Over the years, the domestic and commercial consumers have remained the most dominant consumer category (more than 90% of the total). The number of small industrial and agricultural consumers has increased considerably but their share in the total number of consumers remains relatively small. The percentage of growth in the number of consumers of all categories has been more than 10%. Agricultural consumers have shown the highest rate of growth of 17.9% per year.

PATTERN OF CONSUMPTION

In 1960, the major users of electricity in the WAPDA system were the domestic, industrial, and agricultural consumers who accounted for about 13.4%, 64.7%, and 11.1%, respectively, of the total energy consumption. However, the industrial consumers were the main users of electricity. Over a 21-year period, the share of the domestic, commercial, agricultural, and bulk supply consumers in the overall consumption has increased to about 20.5%, 4.9%, 23.4%, and 11.7%, respectively. The share of industrial consumers had declined to about 38.4%. In terms of growth in consumption, all the consumer categories have shown impressive potential for growth. Overall consumption has shown an annual growth of about 14% as seen in Table 3 on page 110.

RURAL ELECTRIFICATION

At the time of formation of the Pakistan WAPDA in 1959, only 609 villages had been electrified out of a total of about 43,327 villages in the country. Over the first 13 years (1959-60/1971-72) of WAPDA operations, the number of electrified villages increased from 609 to about 2,553. However, the growth of village electrification was accelerated in the next six-year period and about 3,450 villages were electrified. In 1977, the pace of village electrification was further accelerated, and during the five-year period 1977-78 to 1981-82 a total additional number of 6,981 new villages were electrified. The total number of electrified villages by June 30, 1982 stood at about 13,040, which is about 30.1% of the total number of villages. In the past five years the average target of village electrification ranged between 1,250-1,900 yearly. Under the budget year 1982-83, nearly 2,750 villages are expected to be electrified. Under the Sixth Plan period (1983-88), the number of villages to be electrified is expected to be increased to about 3,000 per year. Thus, by the end of 1988, all major villages in Pakistan are expected to be electrified.

TABLE 4: WAPDA number of villages electrified, 1960-1982

Year	Number of villages electrified		Percentage of total number of villages
	Total	Additional	
Pre-WAPDA	609	609	1.4
1959/60	904	295	2.1
1971/72	2,612	1,708	6.0
1976/77	6,062	3,450	14.0
1981/82	13,043	6,981	30.1

PRODUCTIVE USES OF ELECTRICITY

As was illustrated from the pattern of electricity consumption, the industrial and agricultural consumers continue to be the most dominant users of electricity in the WAPDA system and account for nearly 62% of total consumption. The growth of these two sectors may be seen from their share in the GDP over a 20-year period, as given in Table 5 on page 110.

In 1961, the industrial and agricultural sectors combined accounted for about 57% of the GDP against a share of about 76% in total electricity consumption. Over a 20-year period, their contribution to GDP has declined to about 49% but their share in total consumption has also dropped to about 62%. Effectively, the contribution of these two sectors, assessed in terms of ratio of share in GDP to share in consumption, has improved (0.75 in 1961 to 0.79 in 1981) over the years.

ECONOMIC BENEFITS OF ELECTRICITY IN RURAL AREAS

Although a large number of villages have been electrified in Pakistan, the number of domestic, commercial, and industrial consumers in rural areas is relatively small as compared to the total number of consumers in the WAPDA system. The average population per village in 1981 was estimated at about 1,400 persons in about 185 households. In a village of this size, there are about seven community centers, 14 commercial establishments, and one or two small industries. The community centers to a large extent are mosques, adult literacy centers, health clinics, and primary and middle schools, whereas the commercial establishments comprise small village shops, carpentry and smithy shops, and offices of agricultural staffs. The small industries consist of single motor units of flour grinding machines, rice husking and cotton ginning machines, oil expellers and saws. The most productive use of electricity is in the agricultural sector where electric tubewells are an important source of irrigation and provide considerable benefits to the farmers.

Two types of benefits are incurred from rural electrification, namely: (1) direct revenues from the sale of energy, meter rent and interest on consumers' security, and recovery of cost of service connections; and (2) indirect or surplus benefits to consumers in terms of cost savings relative to the substitutes of electricity, increased output due to cheaper and more available motive power, and improved quality of life. Socioeconomic surveys conducted under different feasibility studies of rural electrification projects in Pakistan have, time and again, demonstrated that the socioeconomic conditions of the people in villages improve considerably after the villages are electrified. This is because of higher production in agriculture

resulting in more jobs for the agricultural labor force, improved health and education facilities, better service by rural small industries, better exposure to mass media (radio and television), and better conditions for growth of cottage and small industries and commercial establishments. It has been proven that people are more satisfied with life in general after the electrification of the villages.

Once a village is electrified, the immediate benefit at the national level is the reduction in use of kerosene for lighting and diesel and mobil oil for operation of tubewells for irrigation and small industry. The operation and maintenance costs of lighting and motive power are considerably reduced. Under a number of projects, cost savings from conversion to electricity have been assessed in terms of benefits as a percentage of the annual electricity bill. The average results are shown in Table 6.

TABLE 6: Cost Savings of electricity relative to substitutes as percentage of annual electricity bill

Category	Economic benefits %
Electricity lighting	300
Small industry	100-150
Tubewells for irrigation	250-400
Tubewells for water supply	100-150
Weighted average	250-300

CONCLUSIONS

Although the number of industrial and agricultural consumers in the total number of consumers is very small, these two categories account for nearly 60% of the total energy consumption in the WAPDA system. Both these sectors make an impressive contribution to the GDP and the efficiency of their energy use, gauged in terms of ratio of contribution to the GDP to share in consumption, has improved over the years. Electrification of tubewells in rural areas has resulted in substantial savings to farmers in both capital investment and operation and maintenance costs, improved agricultural production and reduced import of fuels. Both these sectors have generated more employment opportunities, thus raising the standard of living of the people and providing greater satisfaction with life. The accelerated rural electrification program has brought a large number of new domestic and commercial consumers into the WAPDA system. Conversion from kerosene lighting to electricity has resulted in reduced consumption of kerosene and improved quality of life in rural areas. To accelerate the pace of rural electrification and bring more economic benefits to the rural areas remain the most important objectives of the Pakistan WAPDA, the Provincial Governments, and the Government of Pakistan.

TABLE 2: WAPDA growth in number of consumers by categories over the period 1960–81

Consumer category	1960 No. of consumers	1960 %	1981 No. of consumers	1981 %	Growth %
Domestic	238,807	76.6	2,479,453	75.8	11.8
Commercial	56,017	18.0	571,800	17.5	11.7
Industrial	13,191	4.2	111,484	3.4	10.7
Agricultural	3,300	1.1	104,108	3.2	17.9
Public lighting	200	*	2,090	*	11.8
Bulk supply and traction	81	*	1,010	*	12.8
Total	311,596	100.0	3,269,945	100.0	11.9

*Less than 0.1%

TABLE 3: WAPDA growth in energy consumption by consumer categories

Consumer category	1960 Consumption million kWh	1960 %	1981 Consumption million kWh	1981 %	Growth %
Domestic	81	13.4	1,858	20.5	16.1
Commercial	18	3.0	445	4.9	16.5
Industrial	390	64.7	3,482	38.4	11.0
Agricultural	67	11.1	2,125	23.4	17.9
Public lighting	5	0.8	58	0.6	12.4
Bulk supply	42	7.0	1,056	11.7	16.6
Traction	-	-	44	0.5	-
Total	603	100.0	9,068.0	100.0	13.8

TABLE 5: Contribution of the agricultural and industrial sectors to the GDP at constant factor prices

Sector of economy	1961 Million Rs	1961 %	1981 Million Rs	1981 %	Growth %
Industry	2,359	13.4	8,816	16.6	6.8
Agriculture	7,695	43.6	16,512	31.2	3.9
Other sectors	7,595	43.0	27,692	52.2	6.7
Total	17,649	100.0	53,020	100.0	5.7

PARTICIPANT DISCUSSION ON RURAL ELECTRIFICATION AND PRODUCTIVE USES OF ELECTRICITY

Chaired by Brigadier Sabihuddin Ahmed
Chairman, Rural Electrification Board
Bangladesh

These country-by-country presentations on the status of the electrification position of most countries and the status of the structure of their respective productive uses programs have been quite informative. Quite possibly, we will have many questions from each country. But, like electrification of villages, these numbers are also somewhat misleading. We used to do the same thing--thousands of villages electrified but a few hundred consumers getting electricity. So, I would like clarification on that--the number of consumers--like from our Malaysian friends we have heard that 55% sic of the rural population is enjoying electricity. That is a big thing.

In Bangladesh we found, when we tried to define area coverage of rural electrification, we would say so many square miles have been brought under area coverage. And if we didn't have square miles, we would say 30% or 40% are enjoying electricity. That is how we will move. And, secondly, my question will be if we can possibly quantify lighting. I mean, it has an indirect benefit to us in productivity. I would like somebody to throw some light on it--that we can quantify lighting if we want to measure it for productive uses purposes. Possibly this will help us in a great way to sell our program to future donors. As someone has found out in Bangladesh and they were telling me, they have been able to quantify the family planning benefits achieved through lighting. Now, that's a big thing. So, another thing is the marketing study of the power investment we make. It is very interesting, but I must finish here by saying you can understand how important is the rice mill connection we have banned for the time being in our rural electric system because it was going to be so costly. And, also, we want the rice mills to go down to the villages; so, we want rice mills of five horsepower. We want the landless to get more land. We do not want middle-class, 30-horsepower rice mills. And, we found that can really generate employment. But, as we said, we want to protect the bigger rice mills. Just the opposite from what we are doing. We can discuss this later.

About the power loom, it has not got all the plus points. We are not encouraging any more in Bangladesh--power looms, 2 kv systems. Both rice mills and power looms, because they are not the--how should I say--they are not generating employment, which is particularly important for a country like ours.

Now, gentlemen, keeping the time in view, I'll ask the panelists if there are any questions or anything in which they want to participate.

(RESPONSE TO UNRECORDED QUESTIONS): Yes, yes--the differences between before rural electrification and after electrification. And, our figures were monthly--not for the whole year. It is a monthly figure. And only for high electricity areas--rural electric societies--eleven electric societies have been energized. I have been able to collect information on five only, not all--because it needs, you know, thorough study, research.

I noticed with great interest that, with the rural electrification program, the country has tried to confront some bigger policy questions of unemployment and things of that kind. For instance, it was mentioned that if electricity leads to automation, then electricity will not be supplied even though it is in the rural context. And, similarly, some of the other things that you mentioned, I wonder if enough attention has been given to the question of what it will do to the acquisition of what I would call skills and technology over a time for Bangladesh. You could suppress--it is a trade-off between employment and technology in this particular cast--and it may develop that high-cost industries on that sort of basis make you uncompetitive, if you like, over a time, in any of the areas, although you have these industries at home, and so on. So, I was wondering to what extent any attention has been given to balancing the requirements of employment with those of the question of keeping your industries competitive over time, and, therefore, being cost effective.

ANSWER: We are doing this planning aspect in a coordinated manner, but, right at the moment, as I told you about the rice mill, we have a direct interest in it, and well proven, and also the World Bank and USAID have concurred with us that the unemployed womenfolk in the rural areas--they are definitely affected by the number of rice mills. Well, at the same time, we have not banned it. Now, we do not want to ban technology rightly to make it more cost effective because hand crafting is more expensive. So, what we have done is actually to force them to the lower, single-phase motors to reduce our investment and have rice mills possibly in every village so that drying and other things that even now the women are involved in as a part-time worker at the same mill instead of an automated rice mill. Now, in the case of automated rice mills, you will find there are many big rice mills. Day after tomorrow, we can take up what we have started hearing from the banking side on whether to stop the credit program to those industries. Power loans are still coming to us. We are not banning them, but we do not give any credit for power loans. That is how we are discouraging them.

Now a big rice mill--automated rice mill--we do not ban them and we do not refuse connection. But, the mill owner has to pay for the cost of the transformers we have to build for him; he has to pay for the investment in transformers. These are the kinds of discouragement we have induced. We have not banned.

(RESPONSE TO UNRECORDED QUESTIONS): Well, I have got the costs on actual prices. I said, to repeat, that barter prices for kerosene per household per month--the actual price the consumer has to pay--comes to about Rs 36--Rs 36, yes. So, we subsidize to that extent. Then, however, the cost of electricity, I have given it as marginal cost at peaking power which is very high. But, if you actually billed the consumer, I have a very low figure, you know, Rs 2 per month, which will not be charged--he will be charged a minimum of Rs 10 per month. So the comparison may be even stronger on the actual basis to the consumer. But, I took the bottom prices as well as the marginal power costs because that is really the cost to the nation.

(OBSERVATION OF INDONESIAN PARTICIPANT): With regard to employment and electrical equipment, there is a very interesting situation in the case of Indonesia. There are home industries like batik making and so on which are very labor intensive. Their contribution to the GNP may not be very high, but employment is high. There is a second level which you would call "modern small industries," and the third one is your bigger industries. Let us take the case of textiles. There were a large number of hand looms, and they have gone into power looms with a great demand for electricity. Now, what happened was, by 1974-75, a large number of big textile industries from Japan, from India, from various places, came in and created a tremendous amount of unemployment in our own area which had a large number of power looms as well as hand looms. Actually, some of the disturbances in Jakarta were largely due to the unemployment created therein. So, the question that arises is that, in a sense, probably in Bangladesh and Indonesia, there is little advantage to modernizing small industry because the large industries are still not sufficient. You have sufficient dynamism in the local entrepreneurs who are dynamic enough to bring their own technologies, mind you. They are very good at it. And they are the ones who are able to electrify and expand--and expand tremendously. So, the question here is that it would be a great advantage to be able to help these good entrepreneurs who are essentially self-sufficient, and, therefore, the competition is really between the very large industries which are highly subsidized--which have all kinds of five-year tax exemptions, and so on--while many of these industries suffer on account of probably 17 types of taxes that they have to pay. So, I suppose the question has to be viewed not purely in terms of just the employment factor alone which the home industries provide, but the dynamism of the small industry which is coming up in the modern sector, and I think electricity can be particularly helpful there as well as bring a great deal of technological improvement on a large, widespread basis. I thought you might want to keep that in mind.

(SMALL CLARIFICATION FROM THE MALAYSIAN DELEGATE): You mentioned 65% of the houses electrified at present--65% of the houses.

It is 55%. This is the figure we have for 1980. We have a rural population of 7.869 million, and the number of rural households is 1.441 million, and out of this about 790,000 households are already electrified. And this roughly makes up about 55% in 1980. The households include all houses--temporary and permanent.

In the rural areas, most of the houses are semipermanent. Either they are cement blocks, the bottom, and timber on the top, or, where the very rural houses--just now what we see is located on an island made up of fishermen, and the houses are really very poor, only made of wood, and they usually. . .it used to be that this particular village was located by the seaside. But, due to constant harassment by pirates from across the border, they were forced to move inland slightly away from the seafront, and they just dismantled their old houses and rebuilt them from the same timber. And the government gave them a subsidy to rebuild their houses for a few thousand dollars each, and they build their houses that way. And they are a very poor rural community. But, the majority in Malaysia, the rural communities, the houses are semipermanent.

(QUESTION FROM CHAIRMAN): How about the type of service connection? What type of lighting load is there, and is there a very high level of service connection? I mean, do you have a quality rating?

ANSWER: Oh, yes. The service quality is almost the same as that of the urban system. If they want three-phase supply, we give them three-phase supply; if they want single-phase, we give them single-phase supply. The quality of service and the size of service are the same as that in the urban household.

Normally, they need it. For example, in the illustration that we had just now whereby we have this small, standalone, portable cell where originally there was no electricity at all in that area. Then, we install these cells with a few lighting points and some power points, and then three months later we have all sorts of gadgets in the house, inclusive of coffee machines and all the rest of it, and they also use this electricity for pumping water where we have to increase the size of panel and the size of the battery because there is tremendous demand. They say, sadly, "My wife just refuses to use the handle to pump the water manually." So, there is tremendous demand the moment you bring in electricity--my whole experience is that even in certain rural areas, when electricity is installed in that particular area, the demand, for example, doubles within, say, a few years or so. Rural industry, in our experience, is the product of rural electrificaion. I think that is all.

DEVELOPMENTS IN THE PRODUCTIVE USES OF ELECTRICITY: THE PHILIPPINE EXPERIENCE

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INTRODUCTION

This paper provides a brief overview of the development of productive uses of electricity in rural areas based on Philippine experiences. It is both conceptual and empirical. A primary objective is to provide a frame of reference for examining the promotion of productive uses.

Many observers, including those with development planning experience, apparently assume that the primary demand for electricity in the rural areas is for personal consumption. Another assumption, which is apparently often made, is that the distributor of electricity can significantly increase productive uses by developing a "program" for this purpose.

These assumptions, or preconceptions, influence decisions regarding the development of rural electrification programs. Our experience in The Philippines is that reality is considerably more complex than is suggested by the above statements, and further that the preconceptions may be misleading in certain fundamental respects.

Philippine data on sales of electric power in the rural areas are examined to determine the prevalence of consumption/productive uses. In addition, presentation is made of information on electric consumption obtained from limited surveys of consumers. The survey data are examined with a view to determining productive uses.

RURAL ELECTRICITY USES IN THE PHILIPPINES

From 1976 through 1981, electricity sales of the rural cooperatives in The Philippines increased from 300 million kWh to 1.5 billion kWh, a fivefold increase. This sales increase was largely accounted for by the increase in number of consumers from 0.45 million to over 1.7 million. Consumers now total 2 million. As yet, no data are available on sales during 1982. This five-year period was a period of intense expansion of the electric distribution systems in the provinces. During this time, the concern of the electricity authority was to expand coverage; there was only a small effort to directly promote productive uses of electricity.

It is interesting to note how the consumers used these new electrical services. In 1976, 92% of all consumers were classified as residential. By 1981, this percentage had increased to more than 93%. On a per connection basis, consumption was thus overwhelmingly for home use.

These are the statistics which seem to stick in the mind of many development planners when they cite rural electrification as consumption rather than development oriented. Further examination of the Philippine experience tends to belie this view. Industrial users increased from about 1,400 in 1976 to 4,000 in 1981. In 1976, 21% of all sales went to industrial consumers. By 1981, this had increased to 35% of sales.

Industrial sales thus accounted for one-third of all sales by 1981. Irrigation pumps accounted for another 1% and commercial establishments bought over 16% of all electricity sold by the rural electric cooperatives. Residential sales were a constantly declining percentage of total sales. In 1981, residential users consumed about 40% of total electricity used. As we will see later, a significant share of the power sold to residential users is for some productive purposes.

Two conclusions may be reached from these data:

- At least in the Philippine context, a majority of rural power sales go for productive purposes.
- There has been very rapid growth in productive use, especially industrial use, of electricity which cannot be attributed to any "productive uses" program.

There are, at the same time, very large variations in industrial sales from one region to another. In two areas, not yet connected to the national grid, where power comes from high-cost and unreliable diesel generators, industrial sales were 14% and 10%, respectively, in 1981, and were actually declining as a percentage of total sales. In Mindanao, with reliable and low-cost hydropower, industrial sales accounted for 40-60% of total sales. Industrial use is growing very rapidly.

It is interesting to note that even for cooperatives in the most rural areas, productive use sales are significant if reliable, reasonably priced electricity was available. Three cooperatives, far from any industrial area of the country, average about 35% of sales for productive use, with industrial sales accounting for some 10% of the total.

Limited survey data have been collected regarding end-

use of electricity. Some of these data are relevant when considering productive uses potential.

PRODUCTIVE USES BY RESIDENTIAL CONSUMERS

A random selection of 350 residential consumers, in all economic classes, was interviewed regarding their use of electricity. In this paper, I shall only examine the productive uses which were cited. About one household in four indicated that they used electricity in their home for some income-producing purpose.

The most common uses were:

- o Lighting for a small store
- o Lighting for handicraft production
- o Refrigeration for food processing.

However, a wide range of small machines were also found. These consisted of sewing machines, welding units, small lathes, and drills.

Productive uses were about as common among upper-class as among lower- and middle-class residential consumers. However, the type of use varied quite significantly by income class. Among the middle and upper classes, productive uses typically associated with commercial activities were a small store run out of the ground floor of the house or a retail food outlet. Lower income groups tended to engage in activities which needed a lesser input of capital for inventory. Handicraft and/or tailoring activities predominated among the poor.

Accurate data were difficult to obtain, but it would appear that from 15-20% of residential power sales went for productive uses. The figures tend to be higher for low income groups.

Surveys were also made of 50 industrial enterprises from four regions of the country. The purpose was to determine the importance of electricity in the enterprise and to determine if the availability of electricity was important in the entrepreneur's decision to start his enterprise.

It was found that 75% of the businesses surveyed were established after electricity was brought to the area by the rural electric cooperative (one-third were established during the initial year of electrification). Some 78% of respondents indicated that the availability of reliable electric power was a key or necessary condition in their decision to start their business. Cost was also a key element in this decision, with half of the respondents indicating that electricity was at least 50% cheaper than the alternative power source (one-third said there was no viable alternative).

These enterprises were mainly small to medium sized, with 60% having fewer than 20 employees. Electricity was used for small machinery and lighting and accounted, on the average, for 20% of production costs.

CONCLUSIONS REGARDING PRODUCTIVE USE GROWTH IN THE PHILIPPINES

1. Productive use accounts for about two-thirds of all sales by the rural electric cooperatives. This percentage has been steadily increasing since program inception. Industrial sales alone account for 35-38% of sales for the most recent years.

2. Small businesses have expanded in number and electrical use at a steady pace. Employment among rural industries probably exceeds 65,000 persons. Employment has probably been growing at 10%-15% a year.

3. Residential consumers use a significant share of the electrical purchase in pursuit of income-producing activities. Perhaps as many as 400,000-600,000 persons engage in productive activities (part-time) relying on electricity sold under the residential category.

4. A negligible portion of this productive use growth relates to a formal productive use program by the electricity authority.

5. Productive uses growth is very strongly correlated with the availability of reliable and reasonably priced electricity.

PRODUCTIVE USES EFFORTS BY ELECTRICITY AGENCIES

Can an electricity authority significantly influence productive uses of electricity relying on in-house personnel, even if investment financing is available? The answer may well be no.

First, let us examine the investment needs of such a program. The Philippine rural cooperatives now sell about 1.7 billion kWh per year. To increase those sales by 10% would mean added sales of roughly 170 million kWh. It is possible to work back from this total to estimate the inputs required to achieve such an increase in sales. The value of 170 million kWh is about ₱150 million ($17 million) at current Philippine electric rates. Electricity costs constitute no more than 20% of value added for the average rural industry; thus, value added by industries would have to increase by close to ₱800 million to achieve a 10% impact on total sales. Since it requires a three- to four-to-one ratio of investment per unit of value added to increase industrial sales by 170 million kWh, it would require ₱2.5-3.0 billion of investment, far in excess of the annual budget of the rural electricity authority.

Some 500 new industries would have to be started, which would require a staff of, perhaps, 3,000 persons to process feasibility and loan papers, if direct loans were made. Thus, the electricity authority may not be in a position to increase electrical sales with a direct development program; the requirements are very large.

PRODUCTIVE USES DEVELOPMENT

In The Philippines, productive uses growth has been quite good. This has occurred without the electricity authority's significant involvement in a direct way.

How then did this take place? It is well to remember that electricity is the basis for virtually all economic development activities. There are dozens of agencies in The Philippines promoting economic development. The Development Bank of the Philippines (with World Bank and Asian Development Bank assistance) finances and provides technical advice to medium to large industrial enterprises. The KKK program, NACIDA, and others will do the same for medium to small industries and handicraft enterprises. At least a dozen other relatively large agencies provide similar assistance.

The rural areas of The Philippines are poor. At the lower end of the economic scale, people are desperately looking for means to improve their income. They will work longer hours, make new products, etc., if a better source of power and light is made available.

In part, productive uses will grow because of individual initiative. In part, they will grow due to supporting infrastructure developed in most Third World countries over the past three decades.

The electricity authority can, perhaps, best help the process by:

- o Assuring reliable and economically priced electricity on a 24-hour basis
- o Providing a modest coordinating referral function for potential entrepreneurs to help them obtain help from established development financing institutions
- o Perhaps helping to investigate and finance a limited range of innovative demonstration activities and enterprises
- o Providing an information source.

In summary, the Philippine experience may be used to argue that electricity authorities' primary responsibilities in the productive uses area are to be efficient suppliers of electricity and to provide a limited referral coordination function for local entrepreneurs. Perhaps, most importantly, the Philippine experience has shown that there is a strong, latent demand for electricity among a wide variety of consumers engaging or wishing to engage in income-producing activities.

PARTICIPANT DISCUSSION OF DR. DENTON's SPEECH

COMMENT NO. 1: I noticed in your presentation, Frank, that you said it seems that the income level of the consumers does not really have any effect on the number of productive uses, except on the type of the productive uses that they do--like the high-income consumer might go into the restaurant business, the low-income level into the handicraft. Would you elaborate on that, please?

DENTON: Well, our data are not as good on this as, perhaps, they should be because we really did not expect to find it happening this way. But we have four categories of income based on housing types that we use commonly in The Philippines; the highest category being a concrete, multi-room, modern house and the lowest category being a single-room nipa- or sawali-sided thatched roof house. We did surveys across each category, and the frequency of references to productive uses among residential consumers in each category is roughly the same. There were small differences, but they were not consistent and they were not big enough so that you could call them statistically significant. So people at the higher income scale were just as frequently doing some economic activity in their homes as were people at the lower end of the scale or vice versa. But, the type of activity was quite different. If they were in a class A or class B residence, the two highest categories, they were not doing handicrafts as a rule. They were more frequently running a small retail outlet or, perhaps, a small food establishment, something that required them to make a modest capital investment in inventory. At the lower scale, among the people in the class C and class D residences, it was usually something that was of a handicraft nature: sewing, basket weaving, making of slippers, small handbags, something that they could do with an extremely small capital investment. And it typically relied on just the use of the lighting for the lower income groups. Again, the data are not as good as I would like to see them.

RAY SHOFF: Frank, back in '71 when MORESCO was energized, I believe it was September 11th, and VRESCO on May 1st, we used to look at 25 kWh a month as a pretty much average figure for residential. I am curious to know now--and horizontal growth has been tremendous--and you mentioned the vertical growth in classification--do you have any figures on system average in the residential line?

DENTON: The last figure that I saw was somewhere around 38 or 39 kWh, Ray, per month per residential. But that number varies a great deal from one region to another. If you go through some of your own territory around Bacalaod, it's up around 65-70 kWh. If you go into the Sirsagaon and the more rural areas, it will be 19-22 kWh--something in that region.

QUESTION: I am not very clear about the kind of policy that you have in The Philippines in order to encourage the productive use of electricity because earlier on there was a kind of program, or, rather, choice that we can make--either integration or incentive for hands-off policy. So, now, what kind of policy are the people of The Philippines or the Government of The Philippines encouraging in order to increase the productive use of electricity? Or does it include some incentive from

pricing, or do you need to mention pricing as the main criteria in getting rural industries going? But, is there any other incentive such as tariffs or subsidizing or something like that?

DENTON: In general, there is no incentive. The co-ops use a flat rate. There are some exceptions to that, but they are the exceptions and not the rule. So, residential, industrial, commercial--they pay very much the same rate. The variations in rates were related to the fact that the cost of power is different in different regions of the country since it is an island nation. There is not a uniform national rate. The rate in an area is the function of the cost of power in that area. Referring back to Mr. Niblock's three models, the models he suggests were derived, perhaps, from an electricity authority's perspective. And, I suppose from the National Electrification Administration's perspective, it's a hands-off policy. But, from a national perspective, I was trying to say that it looks to me like the productive uses program of the national government got years and years ahead of the power supply program so that you had all of this infrastructure, you had all of the funds available, you had lots of enterprises operating--hand power or self generating--and it was only more recently that they decided to do something to provide a relatively economical, efficient, and convenient source of power. And that, perhaps, that is why, in part, there has been such a rapid growth in productive use sales in The Philippines without the electricity authority having any program. Certainly, there is a program from a national perspective if you step above the electricity authority and think about the national program. There is an enormous number of activities, a large quantity of money available for the encouragement and the furthering of economic growth activities, but it is not the responsibility of NEA.

QUESTION: In that case, is there any incentive at all given by the government to set up industries in the rural areas? And that incentive can also be termed a hands-off situation, then probably a subsidy in a coordinated rural development system.

DENTON: Certainly, it's not a hands-off view from the government's perspective. It can only be considered from NEA's perspective that productive uses is hands-off. I am not sure that I am knowledgeable enough to talk about what subsidies exist for development of industries in the rural areas.

Certainly you get loans on relatively easy terms from a number of different agencies in The Philippines. In the newest, large-scale activity, which I referred to as the KKK program, I believe they provide zero interest loans.

DENTON: Yes. So, there are very favorable financing terms--though that is a very recent program. It is only about 18 months old. So, it has not had very much to do with the data that I was referring to.

QUESTION: I might be searching for something in the rainbow, but I am very interested in your conclusion, if I may say so, insofar as productive uses related to income level of the consumers. Scarce as the data may be, if it is true that productive uses--the number of productive uses of the consumers--are not proportional to the income level of the consumers, then we would have a strong argument to electrify the villages, the rural areas, where the income level is lower rather than the villages of higher income level because since the frequency of productive uses is not related to income level, then, an argument can be made that because of that we should electrify those areas with low income levels so we can encourage productive uses. So, if you can get more data on that subject, I would be very much interested in getting the results.

DENTON: I think that is a very logical conclusion if you think about it, not from an empirical but a deductive basis. The lower income people are the ones who are most interested in finding additional sources of income. They certainly are the people who typically have the most time. They are most underemployed, if you will. A number of years ago, we made a survey. Again, as things tend to be, it was quick and dirty. We asked people what was the most valuable thing about electricity to them. And, among the lower income group, the most common response--it was an open question, we did not suggest any possible answers, we just said, "What does electricity do for you?". The most common response that we got among the lower income consumers was that it allowed them to work longer hours. It makes a certain amount of sense that people with very limited incomes would appreciate the opportunity to try to increase those incomes. So, they referred to a number of handicraft-type operations. But we have never really had time to go look at it seriously.

QUESTION: Are you going to do it?

DENTON: I do not know. I doubt it. There are too many other things. Maybe you can do it for us! I think there is a hint that our time is running late--maybe one more question from Mr. Niblock.

NIBLOCK: Dr. Denton, I found you made some very pertinent and cogent observations on The Philippines and I have one observation and a question. About three years ago, there was a team attempting to evaluate the impact of the Philippine program on production and incomes and the factors you provided. Unfortunately, at that time, they were unable to provide or to gain access to very useful information and they came to some surprising conclusions that there was not much evidence that the program, indeed, was providing these positive impacts. Now, my concern and question is how can this dilemma be avoided. This was seven years after energization of some of the early programs and the people who were doing a, perhaps, superficial job but spending a few weeks looking around the country could not decide if these things that you have reported happened were, indeed, happening. Indeed, I find a remarkable congruence or similarity between your findings from the samples of 350 households and the very detailed study of seven geographic districts in The Philippines that was made just last year. So the data,

once garnered, appear to be quite reliable and consistent, but the Philippine program and, perhaps, the whole notion of providing rural electrification as a contribution to development, was damaged by the absence of ready information to demonstrate what, indeed, the impact was from electrification. Now you sit in the NEA in Manila; do you believe it would be possible to simply establish a program for data collection and analysis from the beginning of the program so that other countries will not be embarrassed and in an awkward position just a few years after they have gotten started? They may have a marvelous program, as you indicate the program in The Philippines is proving to be, but these gentlemen will not be able to convince their ministries and their ministers of finance and other skeptics of the program that they have got something good. And it may be slowed down or may not get the financing that it merits.

DENTON: Something has really occurred to me here. I think I know why they reached such negative conclusions in that effort three years ago, Tom. They went to Leyte, and, as you know, three years ago in Leyte the electricity was around ₱1.70-1.80 in current prices per kWh, and they were having--their team referred to the fact that they were having--4-8 hours of brown-outs a day. The data I have suggest that, under those circumstances, you do not get much productive use of electricity. It is just that that is an exception in the program rather than the rule. Not much of our electricity is sold in such conditions, and we are eliminating them fairly rapidly. So, in part, I think they were not given enough hand-holding by NEA to guide them to the right areas of the country so that they could see things that were more representative. A mistake on NEA's part. But, I think it would be extremely valuable to have some sort of unit responsible for documenting the experiences in The Philippines because they are so massive. NEA is such an operationally oriented program or organization, I am not sure it will ever happen unless somebody provides some outside financing for it.

PANEL DISCUSSIONS

PANEL DISCUSSION NO. 1--THE PRIVATE VOLUNTARY SECTOR

Some Thoughts on the Use of Electrified Deep Tubewells in Agricultural Development
K.M. Adeeb

Participation of Caritas Bangladesh in Productive Uses of Rural Electricity
Rezaur Rahman

HEED Kamalganj, An Integrated Rural Development Project
Richard Rose

Productive Uses of Electricity: Importance to the Private Voluntary Sector
Susanta Adhikari

Participant Discussion on Presentations By the Private Voluntary Sector

PANEL DISCUSSION NO. 2--PRODUCTIVE USE ASSESSMENTS AND FINANCING PRODUCTIVE USE ACTIVITIES AND PROGRAMS

Productive Uses Assignments: An Integral Part of Rural Electric Planning...
Philip Costas

Financing the Productive Use Activities in the Rural Electrification Program of Bangladesh
Mohammed Ashanullah

Financing Productive Uses
Anand K. Seth

Financing Productive Use Activities in the Rural Electrification Program of Bangladesh
Syed Yusuf Hossain

Discussion Among Panelists

Participant Discussion

SOME THOUGHTS ON THE USE OF ELECTRIFIED DEEP TUBEWELLS IN AGRICULTURAL DEVELOPMENT

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Assistant Program Coordinator
Deep Tubewell Irrigation and Credit Program
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In Bangladesh, one of the major factors which has limited agricultural productivity is the need for irrigation during dry winter months. Unfortunately, many existing tubewells have been underutilized by local farmers due to lack of cooperation among farmers, shortages of spare parts or other needed inputs, and other factors. The main goal of the CARE Deep Tubewell Irrigation and Credit Program (DTICP) is to increase the agricultural productivity of farmers with land near deep tubewells (DTW), a type of well normally capable of irrigating from 50-100 acres if fully utilized.

In the DTICP, CARE works in cooperation with the nation's major source of rural credit, the Bangladesh Agricultural Bank (BKB), and the major supplier of agricultural inputs, the Bangladesh Agricultural Development Corporation (BADC). In effect, the project attempts to provide each participating farmer with a "package" of inputs for the cultivation of a winter season crop, usually a high-yield variety (HYV) of rice. CARE's role is largely managerial, ensuring that all farmers are organized and working cooperatively to maintain the DTW, and are able to distribute water, other inputs, and costs fairly among themselves. CARE works with BKB and BADC to ensure the timely supply of credit, fertilizer, seed, fuel and other needed inputs to the farmers' groups. CARE staff also plays an important role in training farmers in irrigations management and appropriate agricultural techniques.

The DTICP has been successful in increasing agricultural productivity, both by increasing the number of acres irrigated by each tubewell and by increasing yields per acre. When this project was initiated in 1977, CARE worked with 818 farmers in ten DTW sites. The amount of land irrigated by these tubewells increased by 80% and agricultural yield per acre doubled over preproject levels. Based on this and further success in subsequent years, the project has steadily expanded.

In the 1982 winter season, the DTICP worked with over 19,000 farmers around 215 tubewells in six thanas in Bangladesh. Nearly 14,000 acres were covered. The total value of credit and agricultural inputs distributed was over two crore taka (approximately $1 million). The acreage irrigated per tubewell averaged 65 acres--more than double the national average. Average production was over 70 mds. of paddy per acre (nearly three tons per acre); this is estimated to be over 50% more per acre than preproject yields. Because of this success, the program has been taken as a model for a multi-million dollar Asian Development Bank project and several other large-scale projects.

The Deep Tubewell Project also undertakes additional activities from time to time. CARE staff has assisted the Bangladesh Rice Research Institute in testing new varieties of HYV rice under actual farming conditions. The BKB has requested CARE staff to assist in the training of Bank personnel in irrigation management in the past. Recently, a women's health and development component has been added to some villages where the program is working. This component seeks to integrate increased agricultural production and human development services to maximize CARE's impact for all members of the community.

CARE-Barura in the Comilla district is one of the project areas which has been operating since November 1981, with five DTWs powered by diesel and five by electricity. This has made it possible to compile a comparative cost performance of diesel and electric DTWs at that site as seen in Table on page 122.

If we analyze the table, we can see that both systems have two cusec discharge capacity and show slight variation between them in the irrigated area of land and the hours of operation. It should not be forgotten that command area greatly depends on soil and topographic conditions, channel layout and water flow, seepage and percolation loss, etc. Thus, the figures should be read for general trends rather than specific comparisons. Bearing this in mind, the difference in maintenance and operation costs of 42.74% and 75.91%, respectively, is significant between electric and diesel.

In our experience, an electric motor is available on the market; it is easy to operate, cheaper, needs few spares, and major repairs are seldom required. Most of the diesel engines used in DTWs in Bangladesh require strenuous manual cranking, manual gear shifting, checking of oil pressure, etc., and the need for a trained operator. Operations, overhauling, and maintenance costs in diesel wells are expensive. They also need numerous parts which are often not available. This tends to argue for the use of electrified DTWs.

Farmers tell us of their great interest in electricity in the rural areas to promote economic development if a viable rural electric system is ensured. In addition, efficient supply of electricity in rural Bangladesh would

also promote the modernization of agricultural and industrial implements and machinery. For example, the farmers of one of the electrified DTWs at Barura in Comilla set up a crushing mill after receiving the connection. There may be many instances like this, or it may be only the beginning, but the evidence of development is there.

Regarding the disadvantages of rural electric DTWs, in our experience in another area, we have seen some DTWs without meters, which encourages pilferage. Also, full reliance on electricity could bring the irrigation schemes to a standstill during power failures. Erratic power supply and loadshedding are chronic phenomena in the country. Domestic consumers can afford to live without power; but during the peak period of irrigation, such disruption of power supply stops the operations of DTWs in the entire area as far as the power line goes, which is a threat to all standing crops. As an example, in one of the electrified DTWs in a CARE project at Parbatipur in the district of Dinajpur, farmers were without a power supply for two months during the irrigation season. The standing crop of 106 acres of land was on the verge of ruin. Had it not been for the intervention of CARE and an outside agency, the Railway Department, which authorized a special connection from its own power line, the entire crop would have been lost.

In Bangladesh, one of the major constraints which impedes efficient utilization of DTWs, agricultural inputs, and command area development is the absence of a cohesive working group of farmers. From our field experience, we have observed that, prior to the introduction of the DTW program, farmers purchased diesel and used DTWs on an individual basis according to their need for water. This eventually caused misuse of fuel, irrational distribution of water, and restricted command area. Lack of organization among the farmers resulted in arrears in DTW rents. Given that individual farmers purchase diesel and then use DTWs, what would be the case with electrified DTWs, when a farmer uses a DTW on an individual basis and does not pay the electric bill? A simple answer would be to disconnect the power line. In our experience, it is no easier to organize around an electric well than a diesel well, but organization is more essential on electric DTWs than on diesel wells.

The CARE-BADC-BKB DTW project proved successful with respect to command area development, increase of agricultural productivity, and timely payment of bills, rents, and costs of inputs through credit for both electric and diesel wells. Conciusive evidence of success is the sound investment and prompt repayment of loans by the farmers. This could be achieved because of effective organization of working farmers of the DTWs developed through motivation and extension services. Organization of farmers creates a sense of responsibility among farmers themselves.

Productive use of electricity is possible, but there are many subjects for further study regarding the efficient utilization of electricity for productive purposes in rural Bangladesh.

Operation cost/performance: diesel engine versus electric motor

Item	Diesel Operated DTW	Electric Motor Operated DTW
No. of DTWs	5	5
Discharge capacity	2 cusec	2 cusec
Hours run per DTW per season	1081.20 hrs.	1230.00
Hours run per acre per season	24.25 hrs	23.20
Consumption per DTW per season	780.20 gal. diesel	17337 kWh
Consumption per acre per season	17.50	327.08 kWh
Fuel/E.bil per DTW per season	Tk 19644.73	Tk 16752.97
E.oil/grease and gear oil per DTW per season	Tk 2826.40	Tk 219.50
Spare parts per DTW per season	Tk 1046.00	447.15
DTW rent per DTW per season	Tk 1800.00	Tk 1800.00
Total operation cost per DTW per season	Tk 25,317.13	Tk 19,219.62
Total operation cost per acre, per season	Tk 567.80	362.59
Total irrigation cost (cost of drainage, salaries of operators, managers, linesmen, misc.) per acre per season	Tk 690.00	489.64

PARTICIPATION OF CARITAS BANGLADESH IN PRODUCTIVE USES OF RURAL ELECTRICITY

Rezaur Rahman, Electrical Engineer,
CARITAS, Bangladesh

Caritas Bangladesh has its main office in Dhaka. There are six regions in which it operates; the regional offices are at Dinajpur, Khulna, Rajahahi, Mymensingh, Barisal, and Chittagong. In these regions Caritas activities are divided into two sectors, namely, development and social welfare under a central management.

Caritas Bangladesh is engaged in many activities involving education and training, research and development, agriculture and irrigation, production of jute handicrafts, production of agricultural machinery, pisciculture, social welfare, and health projects.

Development Education Services of Caritas motivates people of homogeneous groups to save for income-generating projects for economic uplift. Credit unions are formed and internal disputes are resolved. Bad habits of individuals and groups are identified and stopped. The continuous education process stresses such subjects as human dignity, human relationships, leadership, thrift, savings, planned and wise use of funds, democracy, social justice, service to each other, and accounting with bookkeeping. Family planning programs are given priority and encouraged.

Caritas, in collaboration with the Government of Bangladesh and Catholic Relief Services (CRS), is engaged in experimental activities in mechanical irrigation and groundwater development. Groups of farmers were organized, ideas were experimented upon, engines and pumps were suitably adopted, and technology was transferred to the rural environment. A pilot program is under way in the Modhupur Area where water and cooperative block management with good irrigation practices are carried out among the local participating farmers.

Jute handicrafts are produced on a large scale in various parts of the country under Caritas programs. Rural women are mainly engaged in this activity. The jute works began in 1973 and have been self-supporting almost since the beginning. It began with about 1,000 women employed. Now about 38,000 women are employed at home in 15 districts of Bangladesh. Jute products worth over $1 million were exported in 1975-76 and 1978-79 and received the President's award.

Marine fisheries is also an important field in which Caritas Bangladesh is involved. Several projects were organized. Traditional methods were found to be uneconomical because of diminishing returns. It was necessary to introduce alternative and diversified methods. Fishermen felt the project was meaningful to them and provided sustainable incomes. The program envisioned that fishermen would take part in all activities of the project, in addition to benefitting from improved living conditions. Productivity was increased due to the cooperative basis of the activitiy. Experiments were also carried out; for instance, pilot coastal fishing projects were designed to extend fishing time during the monsoon and thus enlarge the income of the fishermen. This activity has proven to be viable and will continue in the future. Fresh water fish ponds have been set up in the form of model ponds in all six Caritas regions. The results have been to develop and improve the socioeconomic conditions of the poor and marginal income people living from fish farming.

The Welfare Sector of Caritas includes programs for disabled persons. A survey is being conducted now in the different Caritas zones to identify the types of disabilities and means for treatment and rehabilitation. Moral support, together with financial assistance, is provided for income-generating projects. Caritas plays a vital role at times of natural disasters such as floods, cyclones, tidal surges, crop failures, and droughts. Victims are given relief. Fire victims are also provided with relief.

Now, I shall describe the project with which I am personally associated. This is the Mirpur Agricultural Workshop and Training School (MAWTS). It was originally established in 1973 for the repair and maintenance of agricultural equipment and vehicles, production of simple agricultural equipment and spare parts, and training of agro-mechanics. In 1977, fresh proposals were formulated in order to strengthen the activities of the MAWTS. In the new proposals, training activities were given high priority. As a result, it was decided to set up an adequately equipped training school for long- and short-term training in trades essential for maintaining mechanical equipment in agriculture. The training courses conducted are:

- Agro-mechanics--involving repair, overhaul, and reconditioning of diesel engines, petrol engines pumps, power tillers, and other mechanical implements and tools which will be in service in Bangladesh.

- Machinists--consisting of manufacture of spare parts and components for agricultural machinery and implements. The training involves advanced

machine tools and techniques required for the kind of machinery and implements in service in Bangladesh.

Research and development activities were also given high priority in sectors involving agricultural machinery: manual irrigation pumps, agricultural implements, threshers, rice dryers, storage tanks, biogas, and the like. Training received high priority but at the same time, in order that the project should continue to be self-sufficient, financing growing out of the earnings of the production of the workshops was encouraged. The criteria for future activities of the MAWTS will be to assist Bangladesh in agricultural and industrial development, keeping in mind mainly the small marginal farmers and rural industries. Accelerating food production beyond self-sufficiency and achieving a more equitable distribution of income, together with appropriate technology, will lead Bangladesh towards a more prosperous future.

The agro-mechanics and machine mechanics courses last three years, leading trainees to be skilled mechanics able to repair totally agricultural machinery, engines and machines, and to manufacture spare parts at the same time. The field mechanic course lasts nine months and gives semiskilled mechanics practical on-the-job skills in making minor repairs, adjustments, and servicing of engines and equipment. There is also an instructor's training course lasting one year. Thus, MAWTS trains its own instructors. The instructors' training course involves advanced practical training, lesson plan preparation, job planning, and cost calculations. In addition, instructional practices are taught. A one-week course for installation and maintenance of power pumps is also conducted from time to time.

For the three-year course, usually between 30 and 40 trainees are selected with about half for each of the agro-mechanics and machinists trades. For the field mechanics course usually between 15 and 20 trainees are selected. There are now 10 men undergoing the instructor's training courses. The candidates are selected annually on a competitive basis from rural areas of Bangladesh, primarily from poorer families who are unable to give technical training to their children. The main idea for the courses is that, on completion, the trainees will return to their home districts and serve rural Bangladesh.

To date, 82 trainees have graduated from the three-year course and 104 trainees are undergoing training. Eighty-six field mechanics course trainees have completed the course and 20 more are undergoing training. Ten trainees in the instructor's course will complete their training in March of next year. Sixteen candidates have already graduated.

Research and development activities play an important part in the program of the MAWTS. MAWTS, therefore, engages in appropriate technology. The rower pump designed at MAWTS is a manual irrigation pump. It is now manufactured at MAWTS and marketed in rural areas of Bangladesh on a large scale. Rice and wheat threshers have also been developed which are being used extensively in Bangladesh. In addition, hand weeders, single and double row seeders, animal-drawn harrows, and hand grinders are manufactured. Centrifugal pumps of 3/4, 1, and 2 cusec discharge capacity are machined and assembled in large quantity. Insecticide sprayers are also manufactured.

As described earlier, the object of the MAWTS is to assist Bangladesh in agricultural and industrial development, keeping mainly the farmers and rural industries in mind. Two workshops are already functioning in Dinajpur Town and Bhaberpara, Meherpur, in the Kushtia district where manually operated pumps are being manufactured at present and rower pumps are being serviced. In addition, other activities such as servicing diesel engines, petrol engines, agricultural equipment, welding and fabrication of machinery parts, and manufacture of spare parts are also carried out. Plans are under way for the creation of more workshops, such as the ones mentioned, in rural areas of Bangladesh.

To this end, funds would be made available and loans would be granted to individual entrepreneurs who are ex-trainees of MAWTS who would establish workshops and operate on a commercial basis. These rural entrepreneurs will not only be giving service to agriculture and industry in rural Bangladesh but will also be employing young men and training them in turn, making the whole program into a job-creating activity.

As a further boost to the development of rural areas of Bangladesh in the agricultural and industrial sectors, plans are being made to finance suitable and practical rural industries so the ex-trainees of MAWTS may operate on a commercial and profitable basis. These rural industries will be selected based on their specific requirements and viability pertaining to Bangladesh conditions. The MAWTS-trained mechanics will be given loans so that they may set up approved practical industries, together with their own capital. The loans would be repayable in appropriate installments. These industries will mostly meet Bangladesh requirements in the agricultural and industrial sectors: hand and small tools, agricultural tools and implements, agricultural machinery and equipment, manufacture and fabrication of metal products, and body building of various kinds of vehicles.

When all the above agricultural and industrial workshops and manufacturing activities become centered in the rural areas of Bangladesh together with many other similar projects sponsored by the Government of Bangladesh and private organizations, a large number of buildings and structures will be built. These buildings and structures will require wiring and electrification for lighting purposes. The workshops and factories will contain machinery and machine tools which will be operated by electricity. These workshops and factories will manufacture and fabricate machinery for the

agricultural and industrial sectors which may also be operated by electrical power. For example, the rice and wheat threshers which are now manually operated may in the future be driven by electric motors. The centrifugal pumps now machined and assembled in MAWTS may in the future be driven by an electric motor, instead of a diesel engine. The rural industries financed by MAWTS and operated by ex-trainees, together with industries managed by others, will also have machinery which will require electric motor drives and control, in addition to electrification for lighting, heating, and cooling purposes. The men working in the workshops and industries will require residential accommodations. The houses providing accommodation will require electricity for lighting, fans, refrigeration, radio and television, and perhaps for cooking purposes. The modern way of life and the modern age will have stepped into the rural areas of Bangladesh. Electricity supply will require adequate distribution and transmission systems in rural areas of Bangladesh to meet growing agricultural and industrial activities and requirements. Cheap and novel methods of electricity generation would also be called for. Here the Rural Electrification Board will play a very vital part in the electrification of rural areas of Bangladesh to usher in the revolution in rural agricultural and industrial activities. Rapid development of agricultural outputs, industrial growth, and communication systems tends to occur once electrification of rural areas has been achieved.

With MAWTS and Caritas, Bangladesh looks forward to active cooperation with the Rural Electrification Board and Palli Biddut Samities in electrification of agricultural machinery, workshops, and industrial projects. Working together through education and training, research and development, and production will be the last word on rapid agricultural growth and industrial progress in rural Bangladesh.

HEED KAMALGANJ, AN INTEGRATED RURAL DEVELOPMENT PROJECT

Richard Rose, Project Director,
HEED, Bangladesh

I would like to say first that HEED is very happy to be able to participate in this workshop.

I would like to develop my thoughts around some notes that I've made--more explaining HEED, certainly, but also explaining HEED from the unique position that we are in--in that we work in 200 villages in northeast Bangladesh where there is no electricity at all, where we are trying to act as change agents, and where we are doing extensive consciousness raising to help village people learn to utilize new technology as it is presented to them in a constructive way. Right now, we are experiencing rural electrification in the form of telephone poles and wires that are not quite connected yet at the pole. The only electricity we experience in our area of service comes to us from the old British system: we have 33 kv systems strung overhead where monkeys and birds and people move around and among them but really do not derive any direct benefit from them. About 40,000 of our people do experience electricity in the form of industrial use in tea gardens where most of the manufacturing process uses electrical energy.

We have been in our area of service for about six years now. HEED/Bangladesh is a registered Christian development agency in Bangladesh. It's an indigenous institution. I would say its structure is very similar to a YMCA. It is primarily an expression of Christian laymen--national Bangladeshi Christian laymen who are trying to use HEED as a vehicle for a compassionate expression of the love of Jesus Christ.

We have five areas of service. Foreigners, like myself, are involved in the institution as a part of transition. We are all here to work ourselves out of work (and we expect to be pretty much gone from HEED by the end of 1985) through the process of training young men and young women to assume leadership roles in skills that provide them with the ability to carry out development work. Our five areas of services are in community literacy training and management and leadership workshops for people in the village. Unlike a lot of training, we direct our training to illiterate people. We have learned through experience that illiterate people are not stupid people or dumb. Therefore, they can be very effective leaders--even though they cannot read or write--if we can learn to communicate this information in a way they can grasp and begin to use it.

We also do extensive work in agriculture. In my area of service, in Kamalganj, we have a population of about 200,000 people in 200 villages. We rotate and move through those villages with our staff. Some 60 activities are going on from our center throughout that 200 sq. mi. area--35 of those are in agriculture.

HEED has always operated contrary to the concept of utility development. We have always stuck very closely to a low capital investment model while electricity requires a high capital investment model. And, we have primarily concentrated on indigenous methods of enhancement among the people. There was a time in our work when we did not allow or encourage people to use fertilizer. We encouraged them to use other ways of enriching their soil, and only as fertilizer became stable in supply did we begin to encourage them to begin to use fertilizer. Electricity, to us, is an input--just as fertilizer is and labor is. And we basically work on a production model with people. We try to create useful, economic production models that will result in a profit to the producer. Therefore, we would look at electricity in the same way as we begin to encourage and enhance the villages with the use of electricity. So, as we look at rural electrification in Bangladesh and especially in the Kamalganj Thana, we look at it with a reluctance, and we look at it with excitement because we know that electricity is a positive kind of technology. Our concern will always be that technology be introduced in such a way that consideration is given to cultural and traditional procedures and life styles within the community. Very often, we are concerned that technology, as it comes into a community, does change the community. It does change the community. But, very often, it comes in a way that does not allow the community to make decisions about the changes. We spend a great deal of our time working in that area.

I was excited yesterday as we shared information about the three kinds of approaches to rural electrification (productive uses) in Bangladesh: the integration, the coordination, and the hands-off approaches. HEED is just now beginning to work in the area of coordination in which we have today begun to have discussions on rural electrification ourselves. We have been working in engineering areas--primarily on solar dryers, dryers utilizing electricity. We have been doing an extensive amount of hill development. We have 20% of our land in Kamalganj Thana in production. We have been trying to teach people how to use hill land for productive purposes. Another of those areas is in the flats near the

flooded areas of cane-sugar about utilizing a crushing machine. Forty percent of our population is landless. Therefore, 40% of our population is potentially unemployed. In fact, they wake up every morning unemployed, and they try to go find a job. The more opportunities that can be produced for these people, the more alternatives that can be created which they can learn and do, the more the reality is reduced that 40% of our population in Kamalganj Thana wakes up each morning unemployed. So, we look at electricity as a very positive thing. At the same time, as I said, we look at it with some reluctance. I am reminded of a story of a road project. I usually have to hike three or four miles from the nearest road to most of the villages that we work in. So, I ride my modern motorcycle that distance and hike the rest of the way. It's interesting what a simple dirt road will do to a village where people are used to being isolated or insulated from outside distractions, and how a road introduces vehicles and how vehicles introduce inquisitive people and how the solidity of the community begins to become infringed upon--and how people who like convenience will begin to move into that village and begin to set up shops and do other things that begin to significantly modify how people need to react and relate to one another--and how all of sudden, traditional and cultural rules have to begin to be defined to the outsider--and how other structures have to be created to continue to support and maintain these outside influences and allow some consistency of the community that existed before the road was built. I think electricity is very much like that. In my community, we all go to bed when the sun goes down. We know what will happen if electricity comes. We will be able to stay up later.

We teach 3,000 people a year how to read and write; 1,500 of those people are men--farmers working in the fields--and the only time they have for education is from about 8:00 to 10:00 o'clock at night. We now work with kerosene lights. None of them necessarily feels like Abraham Lincoln. They're tired. They've been out in the sun all day, and now we are asking them to spend two hours learning how to read and write their language in a room that is full of kerosene smoke--a very, very poor reading environment. We see the electrification of school buildings to be very beneficial both to children during the day and to adult education in the evening. The interesting part about electricity to me in Bangladesh is that probably most of the people in Bangladesh--75% of the population--have lived for thousands of years without any. It's only been in the last years of technology that batteries have been introduced, and it is amazing how many 12-volt car batteries and truck batteries are out in the villages which people have rigged for lighting and to support their television sets and keep their short-wave radios going. As electricity comes into these villages and becomes a convenient source of energy, the battery population, I am sure, will disappear.

As I said earlier, we try to look at technology. We try to deal with it as it affects the person. So, we are, again, anxious for electricity, excited about electricity. Anxious because we are not quite sure how it will affect the population; excited because we know there are very long lists of positive results of the electrification process.

The other area that we are working in (and we have worked in this area not just looking at electricity) is looking at people as an energy source. They are an energy source as electricity is an energy source, as diesel oil is an energy source, as petrol is an energy source. But, I am afraid without any prompting from the Rural Electrification Board, I would have to say that electricity is probably the most consistent and convenient energy source. It was stated earlier that the simplicity of electricity is the flip of a switch. The "simplicity" of a general diesel engine is the hand cranking and the fooling around with the diesel oil and the smell of it and the fumes of it. Electricity, therefore, as a convenience, replaces very often a very inconvenient energy source--and that's people. We all know that if we work for people, they have to be the most inconvenient energy source. They get sick, they have emotional situations at home that they bring to work, they get distracted from work completely by a range of problems. There are many reasons why people as an energy source are extremely inconvenient. But, Bangladesh is a labor-intensive community. And, as electricity comes into that community and begins to replace that inconvenience of people, somehow, I think it is the responsibility not only of those who are selling electricity but those in voluntary agencies like HEED to try to be ahead of that transition so that we can prepare people for change and transition in work. It is amazing to me that even in a simple transition that might occur today, so many men or women have routed themselves into a traditional behavior pattern on a day-to-day basis that they take two and three and four--sometimes six months to cope with the truth of the reality that they have been changed. And then they begin to work at coping with the change and somewhere--a year to 18 months later--we have a whole human being again.

These are the kinds of things that HEED is concerned about, and we continue with those concerns to look forward to working among the rural electrification people. And, we are hoping--and, maybe, I'm hoping--that what I have shared today with you--those of you who are working in funding rural electrification--will consider this other reality. Capitalizing or investing in the things that make electricity available to people is a very important investment, but I think, also, side by side with that is the implication of electricity: how it changes people, how it changes their society, their culture, their traditions, and their willingness to invest and to put energy into that other part of the process of rural electrification in a basically developing country.

PRODUCTIVE USES OF ELECTRICITY: IMPORTANCE TO THE PRIVATE VOLUNTARY SECTOR

Susanta Adhikari, Director
Christian Commission for Development in Bangladesh (CCDB)
Dhaka, Bangladesh

In this distinguished gathering of experts in the area of rural electrification, mine is a layman's position in today's workshop: "Productive Use of Rural Electricity."

In this paper I have attempted to share some of our experiences on the role of electricity in our activities, and how it can be productively used in the future.

But first, let me tell you something about our organization. We are a private, nonprofit, nongovernmental organization called the Christian Commission for Development in Bangladesh (CCDB) engaged in voluntary welfare/development activities in various parts of the country through projects in the areas of fisheries, agriculture, health and family planning, weaving, poultry and livestock, literacy, etc. The CCDB is an organ of the National Council of Churches Bangladesh (NCCB) and is affiliated with the World Council of Churches (WCC), Geneva, Switzerland.

When we began work ten years ago, one CCDB scheme called for the construction of ice plants. We ordered four diesel engines. When implementation was going on, we soon learned that electricity lines were to pass near our ice plants. We immediately switched to electric motors instead of diesel ones.

Then there was the case in our health project in Company-ganj, Noakhali District, where we brought electricity from a mile away to facilitate the operation of rural hospital facilities. With the availability of an electricity connection, patients requiring medical examinations and surgical treatment who earlier had to be transported to town hospitals no longer needed to be ferried to distant places.

And, again, because of the availability of an electricity connection at a later time in one of our projects where we have a poultry/livestock and disease control program, we switched from kerosene refrigerators and incubators to electric ones to store medicine and hatch eggs.

The above gives us a view of what we did when there were no electric power connections when we began work in these areas.

Let us now look into the present project activities of the CCDB. In Rajshahi and Pabna, in our Agricultural Development Project, we have installed over 1,200 diesel-operated power pumps, which will increase to nearly 2,000 by 1984. All these pumps have been planted in the fields and are miles away from electricity sources. Because so many pumps are being installed in the project area, production of rice, wheat, and other crops is increasing rapidly due to the availability of water during the dry season. This calls for increased power-harvest operations where electric power may play a major role. There is also the possibility of using electricity for running generators instead of using diesel. In turn, there would be an increase of different types of workshops and repair centers which could require electric power.

In all CCDB projects, strong emphasis is given to leadership training and adult education. Since most beneficiaries work during the daytime, training courses must be conducted at night by lantern light. Such leadership and other training courses could be conducted by electric light with probably larger participation.

There can be other possibilities for using electricity in our project areas, for example, rural industries.

From the above examples, the lessons we learn include:

- CCDB's rural development schemes had to be designed under the constraint of nonavailability of electric power. Hence, potentials in rural development remained latent.

- Development education and communication in all CCDB activities would have taken on a different dimension if electricity were available at the clientele level.

- Like all technologies, electricity, too, must be introduced within the sociocultural context in any given situation. The CCDB did experience initial resistance when new technologies were introduced in the rural areas.

Finally I wish to say that it has been my great pleasure to share with you CCDB's viewpoints in this workshop.

Thank you.

PARTICIPANT DISCUSSION ON PRESENTATIONS BY THE PRIVATE VOLUNTARY SECTOR

QUESTION: I am Sjoufjan Awal from Indonesia. I am intrigued by the comments made by the gentleman from HEED. He mentioned the other aspects of rural electrification that we should consider--the cultural, the traditional changes--that might be the side effects of the presence of rural electrification. Sometimes, cultural and traditional rules might be modified to accommodate the changes, I agree. But, what I am trying to find out, as far as the speaker is concerned, is he alarmed about it--or is he trying to accommodate the changes? Because at one time we talked about the same things in Indonesia. In fact, some factions were scared of rural electrification for the simple reason that without electricity the people would go to bed early, get up early in the morning--which makes them healthy people. And then with the introduction of electricity, they will start watching television late at night, etc. Would the gentleman elaborate a little bit on that issue? Thank you.

ANSWER: (By Richard Rose) We are not--at HEED--I do not think we are concerned or frightened by change. In fact, thats what we are all about. My expression is a plea to those essentially initiating change from the top down to seriously consider the implications from the bottom up. Sombody used the term yesterday--well, I cannot remember--the term that I use is a "connector." And very often we experience programs heavily capitalized from the top down need very highly motivated justification, and that justification very often moves more quickly than the changes that can be made from the bottom up. Therefore, the gap that is created can cause undecided implications. Our motivation is to understand the implications of change and to help people participate in many decisions about them and not just end up living with them.

QUESTION: I need some clarification from CARE. He said that he got some electric pumps in Barura. Whether these users are paying electricity bills regularly--because we found some difficulty in getting the revenue from this electric pump.

ANSWER: Well, the way our system operates, we do not have or leave any outstanding rents and electricity bills because these are paid by the Krishi Bank on loan. After the harvest, the farmers pay off--repay the loan. So, in our program, no. We do not leave any outstanding rents or bills, but in other projects outside our program where there is nonexistence of a good, cohesive group of farmers, there, this sort of problem will arise--and it arises, which I have explicitly pointed out in my paper.

QUESTION: Do you have a suggestion to get rid of these problems?

ANSWER: Well, first of all, what we have found in the field is that electricity and the users, the farmers, they use deep tubewells and the source of energy as a single consumer. So, these farmers have to collectively work together and double up on their sense of responsibility to pay off the bill in proportion to their land holdings, which is the way we do it. And this needs organization--a very good farmers' organization.

COMMENT: For the participants, one of the very major concerns of the Rural Electrification Board here in Bangladesh has always been to get all of their cooperative societies to establish early and firmly the principle that users should pay their bills on time. There has been directly, from the top, very strong leadership in this area, and it is trying to establish a very strong principle. So, I can appreciate the concern which the idea of tubewell owners or tubewell societies not paying their bills must have immediately generated in the Rural Electrification Board here.

QUESTION: Another point--this is regarding your meters. You said that meters are not there in some of the areas, which encourages pilferage. How many cases have you found out?

ANSWER: Well, it was my personal observation of three to four that I came across casually--but not in our project area. That's outside our project area.

QUESTION: And do you know who is responsible? I mean, is it that the organization has not given or that the people have taken out?

ANSWER: I would not hold the organization responsible for it. There is also evidence of stealing of copper wire--high tension wire. So, the reason a meter is not there or copper is not there is quite obvious which, of course, is very disruptive in the implementation of the program.

QUESTION: Bangladesh is training some technicians for the repairing of agricultural equipment, machinery and irrigation pumps, etc. Have they any program to

include members of the Rural Electric Society within those training areas?

ANSWER: At present, we are engaged in training mechanics mainly for the agricultural sectors. These mechanics will be available for the industrial sectors, but we do not now train any electricians to be useful in rural electrification schemes. We have programs and projects which are planned solely at present, and we intend to expand our activities in different parts of Bangladesh and set up more training institutes, and these training institutes will have syllabuses for training electricians who would be useful to rural electrification. But these are future plans. It would depend mainly on the availability of funds.

QUESTION: I have observed that most of your workshops and activities are outside the rural electric area/cooperative area. Can you change your program and can you recruit your men and give importance to recruiting technicians who will be trained from the rural electric area?

ANSWER: We select our candidates from rural areas, from poor families. Usually, selection is carried out on a competitive basis. A written examination is held. All tests are taken before candidates are selected. Most suitable candidates who have passed, who have done better than others, are selected, I should say. There may be exceptions. It is hard to specify that we will select every time from areas that have rural electrification now, but we would encourage selection of candidates who would be from areas under the guidance of rural electrification teams.

QUESTION: Do you want to tell me about agriculture programs in you area; I mean, irrigated farms or something like that?

ANSWER: We do have irrigation programs. We have extensive tubewell programs—clean water and sanitation. In fact, yesterday, somebody said something about a clean water system, and I perked up on that because we sink about 150-200 clean water tubewells in the 200 villages each year as well as twice that many for irrigation purposes, and we modified our irrigation program because most shallow tubewells are 60-80 feet and were not producing clean water. For the additional cost of two more lengths of pipe, an irrigation well could become a clean water well, and it does not affect the plants at all. They like the water just the same. So, we have almost gotten out of wells for the sole purpose of irrigation. By adding an extra 40-60 feet of pipe, we are getting into wells that not only provide irrigation but clean water so that, wherever people are, if they crank the crank, they get clean water instead of only irrigation water. This has changed our whole pattern of implementation over the last year and a half. We are not electrified anywhere. We are using all diesel or petrol pumps at this point. We are looking forward to that option.

QUESTION: Do you know whether these pumps are near our system? We have built one substation there in . . .

ANSWER: Well, we hope to meet with the Sri Mogul center within the next three to four months--sooner, if possible--since the lines are not in place, to map out where the power is, which villages it relates to most closely, what systems we already have implemented that are now mechanical instead of electrical, and how we might modify and begin to work with people to modify to fit that. But, we really have not done the homework yet and, until we complete that, I do not have an answer.

QUESTION: (comment) I think if you can take initiatives, we can--supply you to farms, you know.

QUESTION: We've been hearing some very interesting reports from individual PVO's. I was wondering whether or not you, as a group, have any institutional arrangement to record your experience and make it available on a wide basis. I do not really know to whom to address the question.

ANSWER: Well, let me answer for HEED. In our agricultural area, we do extensive data collection because we are doing extensive cropping research which is affected significantly by irrigation programs. So, we do have extensive data, and we do work very closely with the agricultural coordinating organization for voluntary agencies within Bangladesh. We also work very closely with the Bangladesh Government. They have all of our data. We have rain pattern data and pretty extensive information about land use within our 200 sq. mile area, and scientific data with regards to cropping and implication of a variety of crops versus irrigation patterns, and so on. If that is helpful . . .

QUESTION: Then, I wonder if the AID Mission plays any role in facilitating this spread of information that is coming about from very different sources.

ANSWER: AID funded our project until the end of 1979, and they received extensive data from us, I think--at least the reports would indicate so. Since January 1st of 1981, we have primarily been funded by voluntary funding agencies.

QUESTION: I was not so concerned with the funding, but, perhaps, does the AID Mission play a role in this, to facilitate this?

ANSWER: (By James Norris) At this time, the AID Mission has not been collecting and disseminating information from the private voluntary organizations in the country in this particular area. What we have been doing is working with the Rural Electrification Board on a quite thorough and extensive program of evaluation of base-line surveys, developing the information as this project really gets under way so that we will--not only now, but some years down the road--have the accurate information that will be needed so that we can state with certainty what the impact has been and what the

results have been. We have a very comprehensive program of base-line surveys of all of the areas and, of course, we are dealing with areas where there is no electricity--before the cooperative society is created--so that it is a relatively pure situation. It is not a question of extending electricity to fill in the gaps; it's a question of putting electricity into an area that has none. Keeping in mind that the implementation of rural electrification here is only several years old, we are not yet at the stage of disseminating results. We are at the stage of very thoroughly documenting what is happening and evaluating what is happening and having an extensive series of surveys along the way.

QUESTION: (above speaker continues I have one question of my own in particular for CARE. What is your experience in the area which does have rural electrification now in terms of farmer preference as to whether they electrify or do not electrify both of the deep tubewell projects that you are involved in and also for the shallow tubewells, which, in Bangladesh, are all privately owned? Although you are not directly involved with the shallow tubewells, I am sure you have observational experience.

ANSWER: (By K. M. Adeeb) Honestly speaking, there is a great demand for electricity in rural areas, and farmers look forward to electric connections. But, on the other hand, when they go through the bitter experience of load shedding and erratic supply, they, at times, regret--and that is during the peak irrigation period. But, considering the cost of operation and the other costs--irrigation costs--they do prefer electricity. There is another advantage with electricity that, once they get the connection to operate the deep tubewell, they can pull out another connection to power some other agricultural implements, which we have observed in our project area too.

QUESTION: And, what other activities have they typically instituted at the same time they were getting the connection for the well?

ANSWER: For instance, as I have mentioned in my paper, they have introduced crushing mills. And, that is also--that depends on the harvested crop production. Because if they do not get good production, the necessity for the crushing mill will not be there. It comes one after another. So, I personally feel that if electricity is there and the deep tubewell is fully utilized and if the crop is good, definitely the other things will automatically follow.

QUESTION: Have you noticed that a difference--let me ask a question which is specific to Bangladesh now. In the country, because of the river system here, the country has historically had a problem that the western half of the country and the eastern half of the country have separate power grids because the river system is enormous here and it will be about next month before, as a result of a very, very expensive project, the two--the power grid in the east zone and the power grid in the west zone--will, for the first time, be connected. There is a whole separate, very interesting engineering story which I will not get into now on the enormous task that this actually entailed. But, is your experience with the load shedding problems, the severe outage problem, is this in the western zone.

ANSWER: It is in the northern part where they get the . . . across the river.

QUESTION: Across the river--on the side where they have had the worst problem?

ANSWER: Exactly.

QUESTION: But, have you had any similar problems on this side of the river?

ANSWER: Not as much as we had on the other side.

QUESTION: Hopefully, with the east-west interconnector coming on line next month, that may become somewhat less of a problem.

ANSWER: We hope so.

QUESTION: About electricity outages--my impression was that for agricultural pumps, the reliability level is not that important, and if we allow such a number of hours per day in which the farmer can pump his water, it could be quite sufficient. But, what the representative for CARE has been telling us so far is that outages are a problem. Could you elaborate on such a problem--the situation of the lines failing for long durations? I think once you mentioned two months. But I wonder if a normal type of outage would normally last that long.

ANSWER: Well, during that time there were some technical difficulties in the grid as well as in the power station. And, it is not only that the dust bowl was affected--the entire area. I mean, we were receiving similar complaints. And we were reading in the newspaper also that on the other side of the river they were facing a lot of problems with this electiric supply; it was very, very erratic. For two months there was no electricity--it was true. And, it was not only the problem in a particular area but in the local station. We also observed that in the adjoining tunnels where we were working, they really had a disastrous crop during that season due to lack of electricity.

QUESTION: But, the serious problem that you alluded to is if you have an outage that extends over a long period--more than a question of hours. . .

ANSWER: Yes, exactly, more than a question of hours. Because, since we cover a pretty vast area of land and we have to irrigate, say, for instance, 106 acres, as I mention in my paper, we have to follow periods of irrigation. So, if it has been a long time since there was a power supply duration, then, definitely, it often creates a lot of problems.

QUESTION: On the other hand, we noted your earlier comment that, even with all of these problems, the farmers still prefer electricity. So it is, as with everything, there are good points and bad points.

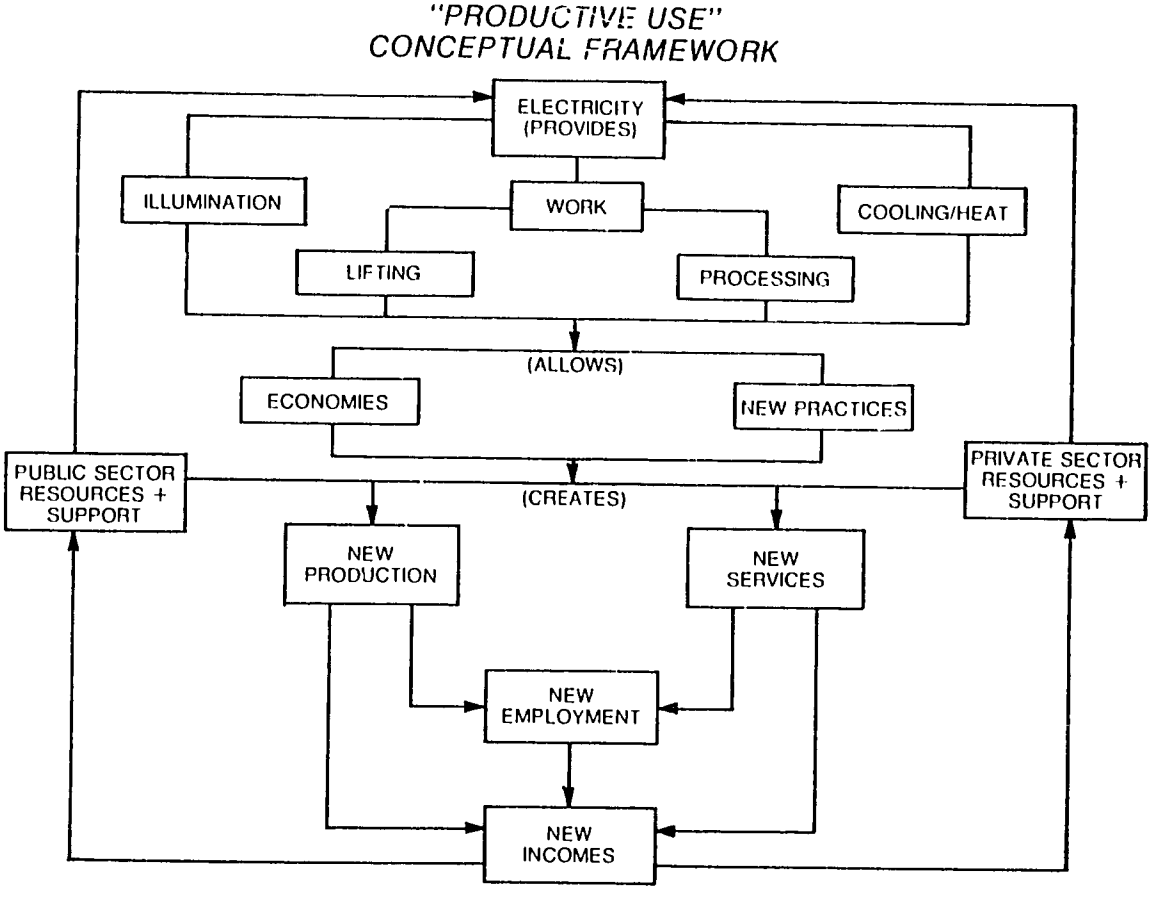
ANSWER: That's right. It's a mixed experience, I would say.

Regarding this discussion about load shedding, I have some experience that this is not a problem. In March 1982, I visited different areas, and I have some information about one instance covering the irrigation of 22 acres of land and another in which 20 acres of land were irrigated by one electric shallow tubewell. Both were satisfactory. At that time, I asked the farmers whether it is problem or not for irrigation purposes. The farmers' opinion is that for irrigation it is not a problem. Normally, load shedding occurs in the evening between 6:00-9:00 p.m. So, I do not consider load shedding as a vital problem for irrigation. This is my opinion--an observation. Thank you.

PRODUCTIVE USES ASSESSMENTS: AN INTEGRAL PART OF RURAL ELECTRIC PLANNING AND PROJECT FEASIBILITY STUDIES

Philip Costas, Assistant Administrator For Economic Analysis International Programs Division, NRECA, Washington, D.C.

Ladies and gentlemen, panel members, as the prologue to the presentation which is entitled "Productive Use Assessments: An Integral Part of Rural Electric Planning Project Feasibility Studies," I would like to mention that, last December, I prepared a planning concept paper designed to familiarize AID Mission staffs with the dynamics of rural electrification in developing countries. The paper focused on the assessment of key activities and practices generally thought necessary for the efficient planning and development of rural electrification projects. Productive use of electricity is a central concept incorporated in this planning model. Much of what I will say this morning is extracted from the logic of that planning paper. The paper itself includes a series of checklists and worksheets that assesses seven specific areas of electrification development. Copies of the paper will be provided to each participant. I trust that you will find the planning worksheets and checklists in the paper useful as background information during your country productive use action planning session on Thursday. Moreover, as a preface to this presentation, I have prepared a diagram depicting how I view electricity as an integral element of rural area development.



I think this diagram, to me, consolidates and synthesizes much of what we are discussing in the seminar and workshop. I would like your comments on it. But, as depicted on the flow diagram, I see electricity providing illumination, work, and resistent energy to enterprises and households. This transformed electric energy, in turn, allows enterprises and individuals to adopt new practices. Practices, if and when adopted, lead to the creation of new productive activity for the enterprise or individual. In turn, new employment and income opportunities are created as a result of this new production. Especially note the crucial supplementary support lines that must be provided by both the private and public sectors. This morning we had a panel discussion on the PVOs. This is very crucial, as we have learned through the discussion. The support and integration that, in reality, we must have in a program for productive uses. In a few minutes, we will be discussing credit. Without private and public support and resources, only minimal employment gains can be expected. Hopefully, this diagram will explain to you why I consider it important to undertake the specific productive use assessment I shall suggest today during the planning stages for rural electrification.

Before I get into the body of my talk, I want to emphasize that the success of any productive electrification use program will depend on its leadership, its staffing, the resources provided and program activities undertaken. Moreover, in my opinion, this especially holds true during the planning for rural electrification project development wherein the basic goals and parameters for project impact are established. If adequate leadership, staffing, and resources are not provided for assessing productive end use potential during the rural electrification project design planning stage, maximization of economic gain from project inputs will not only be deferred, but, most importantly, may forever be lost.

Now, for my presentation.

First, in the country-level planning stage for rural electrification development, typically numerous potential project sites are studied, and the sites with the greatest expectation of being successfully implemented are selected for investment appraisal. Some of the sites selected for appraisal may already be partially electrified; others may have no central electric power supply source. However, more importantly, the operating purpose of undertaking this site comparison analysis is to articulate the expected benefit costs associated with developing rural electric service in varied geographic areas of the country. The policy and/or use purpose of undertaking site comparison analysis is usually to develop a strategy staging plan for comprehensive countrywide rural electrification development. In turn, this comprehensive plan is often used as a basis to interest international development agencies either in funding in-depth site-specific technical feasibility studies or appraising groups of suggested project sites from the comprehensive plan for rural electric program funding.

During these country-level rural electrification planning stages, assessment of national, regional, and local rural development programs and goals is essential, as well as assessment of rural electric power supply options and costs. These assessments are needed to lay the foundation upon which explicit and meaningful benefit and cost criteria can be derived that will prioritize areas in accordance with optimizing productive use of electricity nationwide. Furthermore, during country-level planning for rural electrification, potential project benefit impact data should be collected and analyzed on a regional basis. Agricultural agencies and organizations should be surveyed to ascertain how electrification likely will affect project area farm production and employment. Regional businesses and banking establishments should be surveyed to ascertain how electrification has, or most likely will, affect project commercial and credit activity. Regional health and educational institutions should be surveyed to ascertain how electrification may affect rural skills development, health status, and migration patterns.

COUNTRY-LEVEL RURAL ELECTRIFICATION PLANNING

Suggested regional impact data to be collected:

- o Expected farm production and employment gains
- o Expected commercial activity gains
- o Labor skills development gains
- o Rural health gains
- o Population migration.

Summary findings from these surveys then should be used to construct benefit criteria utilized for project prioritization. It is highly desirable that skilled rural economists and electrical engineers be assigned and lend leadership to these benefit impact assessments, preferably as permanent productive uses of electricity staff of the country's lead rural electrification agency. These same individuals, furthermore, ideally should take the lead and coordinate the productive uses of electricity assessments that need to be undertaken during in-depth site specification project feasibility studies and analyses.

Next, for your general information, let me mention that in-depth site-specific feasibility analysis for grid-connected rural electrification projects generally will be conducted in the following manner. (However, where power supply plant is necessitated as part of system design, the flow of analysis may be somewhat different.)

Rural electrification feasibility analysis

General elements included:

- o Demand and energy forecasts
- o System design and costs
- o Institutional plans
- o Pricing tariffs
- o Project supplemental input requirements
- o Financial forecast and analysis
- o Project economic sensitivity analysis.

First, estimated grid power supply costs, consumer price sensitivity, power reliability levels, and demand are ascertained, and project-wide 10- to 15-year demand energy forecasts are constructed based on project subarea, load sector, or zone forecast.

Next, based on forecasted load sector electric requirements and their energization timetable, the most appropriate and efficient electric system is designed and project investment costs are estimated. Institutional and pricing requirements necessary to support and operate the project system are determined next. Based on pricing sensitivity assessments, the estimated investment costs and administrative operating requirements, responsive pricing tariffs, plus staffing, training and investment plans and budgets to implement the project are developed. While these tariffs and plans are being developed, supplemental consumer credit requirements and rural development input activity necessary to support viability and to support the project demand estimate should be assessed. Salient recommendations should be made from these supplemental input assessments and incorporated in the project staffing, training, and/or financial plans as is appropriate.

Next, judgments and analyses are made on the technical, institutional, and financial soundness of overall project design and assumptions. Finally, economic sensitivity analysis and returns are estimated for the project. Optimally, an experienced power economist and rural agricultural specialist should be assigned during rural electrification project feasibility analysis with the function of making assessment analyses and developing plans related to the productive uses of electricity. Their function and level of effort will vary according to the scope and nature of project dimensions, however. Certain functions of activity, though, are common and needed from these specialists for any type of project under analysis. For example, during the load forecasting stage of project analysis, these basic assessments should be made in the project area by the productive use specialist: potential residential community facilities, agricultural enterprises, and private business and manufacturing enterprises should be surveyed to assess: first, potential consumer experience with and need for electricity and electric equipment; second, historic expenditures on other types of energy sources; third, the economic ability of consumers to pay for electric service; and, fourth, credit availability at the local level to pay for observed consumer electric equipment needs.

Productive use assessments

Useful in developing realistic project load forecasts:

- o Household electric use needs
- o Agriculture electric use needs
- o Private sector electric use needs
- o Public sector electric use needs
- o Other energy expenditure patterns
- o Disposable income patterns
- o Local credit sources.

Findings from these assessments should then be discussed with other study team members before project load and energy forecasts are developed. On the other hand, to assist project engineers to design the most cost efficient system, the study's productive use specialists should assess: first, project consumer needs for power reliability; second, in-kind contributions that project consumers may expect to make; and, third, special end uses of electricity and electrical equipment needs that may arise from agriculture and large load consumers in the project area.

Useful in planning responsive project engineering design:

- o Household power reliability needs
- o Agriculture power reliability needs
- o Private sector power reliability needs
- o Public sector power reliability needs
- o Anticipated construction "in-kind" contributions
- o Special agriculture electric end-use applications
- o Special large load electric end-use applications.

Consumer expenditure levels and end uses for kerosene, diesel oil, electric batteries, and wood-based projects should also be assessed by the specialists in respect to consumer electric needs before suggested pricing tariffs are developed by the project engineers and incorporated in a study analysis.

As implied earlier in my talk, the productive use specialists should work especially closely with the specialists developing the institutional and training plans for the project. Assessments should be prepared to determine what areas of new skills development will be needed to handle new employment opportunities that should be developed in the project area; what new credit sources will have to be developed to finance new electric-based enterprises in the project area; and what supplemental infrastructure requirements are needed to support new agricultural and manufacturing activities expected to be developed in a project area with the introduction of electricity.

Now, based on these end use skills, credit, and infrastructure assessments, the specialists then should prepare a detailed action plan for project productive use development, say, for a three-year period, for the study team. This action plan should identify: productive use goals for the project; productive use activities that need to be undertaken; the agency, department, or person to perform the activity; the funding source for each activity; the month and year to undertake the recommended productive use development activity; and possible constraints that may be faced in implementing the desired activities. Priority attention of the action plan should be focused on those activities that will lead to the establishment of new local enterprise and agriculture activity in the project area.

Project study

Suggested elements of productive use of electricity action plan:

- o Project study productive use of electricity goal statement
- o Identification of productive use activities to take
- o Identification of expected constraints to be faced in implementing activities
- o Person/agency who will implement activities
- o Suggested funding sources for activities
- o Suggested timeframe for each activity.

In summary, productive uses of electricity assessment, indeed, is an essential and integral part of rural electric project planning and analysis. Productive uses of electricity specialists can contribute in-country-level rural electrification planning by: assessing potential regional production and employment benefits that may accrue in the rural economy through electrification; assessing supplemental development preconditions and programs to actualize these potential regional economic gains; suggesting project implementation priorities based on these benefit assessments and supplemental development input requirements; and by giving leadership, guidance, and assistance to followup the in-depth site-specific project feasibility study with respect to productive use of electrification matters.

Productive use specialists can, furthermore, contribute directly in the project feasibility analysis by: first, assessing potential electric end use and consumer credit needs in the project area and assisting project designers to develop more meaningful and measureable load forecasts, consumer assistance plans, suggested consumer pricing schedules, and project financial and economic sensitivity analysis; second, by assessing potential consumer support, project area commercial development needs, and government infrastructure plans in order to ascertain and suggest supplemental project area interventions required to foster local manufacturing and service industries for electric hardware and equipment in the project area; and, finally, by developing a detailed project action plan that will lead to the creation of new productive activity and employment opportunities in electrified households, farms, private enterprises, and community facilities during the first two years of project energization—a plan, furthermore, that lends itself as a monitoring device for use by project and program managers during project development.

In conclusion, I must admit that implementation of all the end use assessments suggested today appears overly refined, costly, and time-consuming. They may not be fully appropriate, necessary, or possible in certain country settings. However, based on our mutual experiences, I think most of us would have to agree that we cannot expect productive use of electricity to develop spontaneously overnight in our project areas. We must plan for it, we must commit leadership and resources to see it develop, and the earlier we get to the job of looking at and planning for productive end uses, the better.

Now let us turn to The Financing of Productive Uses Activities and Programs. During the past day we have learned that the productive application of electricity has been experienced in different ways, and with different levels of result or success among the different countries represented here. Much of this may be explained by physical factors, such as the agriculture base and the transport base, which differ from country to country. The level of technical skills developement and methods application found in each country's rural areas, furthermore may help us explain why productive applications of electritity varies from country to country.

Although our experiences differ, we have gathered here in Dhaka to explore ways on how we can better go about implementing activities that increase the present level of productive end-use of electricity in rural areas. One of the most important elements in any rural area development program is its funding or financial plan. Without financial resources, only limited program development activity can be initiated.

This holds especially true, when one desires to implement program activity to put electricity to productive use in a rural setting, where income levels are low and credit sources for private investment are limited, and carry high costs. In most evaluation studies made on rural electrification, credit availability and lack of financial credit counseling to consumers have been cited as major causes constraining the growth of productive utilization of electricity.

This morning the following people are gathered to focus their attention on the subject of "Financing Productive Use Activities and Programs."

- o USAID/D, Claude Reece, Project Division Officer
- o World Bank/D, Anand K. Seth, Department Chairman
  Mission
  ADB, Dr. Shyam Rungta, Project Economist
- o Local Bank, Mr. Mohammad Ahsanullah, Deputy Controller, (Farm Management), Krishi Bank, Bangladesh,
- o REB Representative, Mr. Yusuf Hossain, (Member Finance)
- o Recorder, Kenneth Cureton

I would like to start today's discussion by having Mr. Ahsanullah brief us on what programs his bank has in promoting general development within the PBS service areas of Bangladesh. Mr. Ahsanullah, will you please begin.

FINANCING THE PRODUCTIVE USE ACTIVITIES IN THE RURAL ELECTRIFICATION PROGRAM OF BANGLADESH

Mohammad Ashanullah, Deputy Controller
Krishi Bank, Dhaka, Bangladesh

The economy of Bangladesh is basically rural, mainly based on agriculture. The development of the country means the development of the vast rural and agricultural sector of the economy. But the agriculture of the country is generally backward and production is stagnant because of the sector's basic characteristics. So, the development of the country needs a coordinated effort of different organizations.

Bangladesh Krishi Bank (BKB), along with other organizations, is pursuing a course for development of agriculture and allied activities through its program of rural finance. BKB, being the premier agricultural credit agency of the country, its lending program covers financing of agriculture, cottage and agro-based industries and many diversified productive activities in the rural areas. The Bank's current lending involves all term credit under its normal program (NP) and short-term crop loans under its Special Agricultural Credit Program (SACP). During the fiscal year 1981-82 total institutional agricultural credit distributed was Tk 4128.50 million of which BKB alone advanced Tk 2710.40 million, which is about 66% of the total. The number of recipients of credit was 362.430.

It appears from the trend of BKB's lending operation and diversification of its loan portfolio that the BKB is ever expanding both in volume of credit and diversification of productive lending activities. The Rural Electrification Board (REB), through its program of electrification, provides an opportunity for an expanded lending operation of BKB. Many projects such as cold storage, ice plants, modern rice mills, poultry and dairy farms, etc., so far financed by BKB (run by electricity), are mostly urban centered, so it would be worthwhile if some projects in the rural areas are implemented and financed jointly by the two organizations. But currently there are problems with electric power in the rural areas, and the bank's collaboration with the REB is negligible. Electric power is needed in most projects for their implementation, and there are many areas, where these can be productively implemented. So there is a vast scope for collaboration between the BKB and the REB in the rural areas.

It is generally recognized that rural electrification is an important infrastructure development program for the economic development of the rural areas. With a view toward providing cheap and reliable electric power to potential rural consumers the Rural Electrification Board (REB) was established in 1977 and started functioning in early 1978. The Board has drawn up a master plan to accomplish the task of electrifying the whole rural countryside in five phases from 1978 to 1995 with a projected expenditure of Tk 25,000 million to Tk 30,000 million. The REB is implementing the program with financial assistance from USAID, KFAED, IDA and from Finland.

Rural electrification is vital for the task of massive transformation of the rural economy of Bangladesh. Electric power is necessary for almost all productive use activities of the economy. The major fields in the rural economy which represent the productive use activities are: (1) agriculture, mainly irrigation through deep tubewells (DTW), low lift pumps (LLP) and shallow tubewells (STW), and processing and storage facilities for agricultural produce; (2) small cottage industries, agro-based industries and commercial enterprises; (3) health; and (4) social welfare. It is estimated that about 57% of rural electric energy consumed will be for irrigation and rural industries. If demand for electrified irrigation grows in the future, then the energy use for productive purposes is estimated to grow to 80%.

So far the REB, in its implementation program, has created 80,155 different facilities through 13 projects in seven districts of the country. A total of 2,496.4 miles of line was energized by the REB which provided a total of 33,347 connections, including 32,044 domestic, 462 for irrigation installations, 648 for industries and 273 for street lights. This progress of the REB highlights the growing importance of its role in creating productive use activities in the rural areas.

There are many potential areas in the rural agricultural sector where the BKB and the REB could collaborate for development. Some of those areas are described below.

IRRIGATION

Irrigation in agriculture is mainly done by DTWs, LLPs, and STWs. The BKB is financing the acquisition and operation of these machines. It has been found that these machines operate more efficiently and economically by use of electricity. A BKB comparative cost analysis shows that the total recurring costs for 9,000 hours were Tk 86,978 and Tk 47,511 for a diesel engine and an electric-motor-operated STW, respectively. Similar comparison of cost of operation and maintenance also holds true for DTW and LLP. A USAID study shows considerable cost savings in both investment and operation of these machines run by

electricity over diesel. It has also been found that, as a result of increased hours of operation of the machines run by electricity, acreage covered also increased considerably. Here lies the potential for massive increase in irrigated areas as envisaged in the Second Five-Year Plan (SFYP); but a very small number of these machines are electrified even today. By 1978 only 888 DTWs out of 7,470, 97 STWs out of 12,613, and 926 LLPs out of 36,730 were electrified. With the advent of the REB things have changed slightly. So there is a greater scope for the BKB to finance irrigation along with the REB. The Bank has projected the funding of 30,000 STWs during the SFYP. It has already provided funding for 10,255 STWs involving a credit of Tk 237.80 million by 1981-82, while the Bank's total funding supplied rose to 21,990 STWs. Besides, the BKB also financed the purchase of STWs supplied by the Bangladesh Agricultural Development Corporation (BADC) and others supplied under IDA credit. During the year 1981-82 BKB financed the purchase of 2491 LLPs against a credit of Tk 29.90 million advanced to the farmers. The Bank also financed purchase of 37 DTWs at a credit of Tk 1.90 million advanced to both individual and groups of farmers in the same year. Besides financing the purchase of the equipment, the BKB also sponsors the command area development project of DTWs in collaboration with CARE and BADC. In 1981-82 the project operated with 235 DTWs covering 13,410 acres. The BKB's support of the project involved a credit of Tk 19.73 million extended to 15,666 small farmers. So, it is found that there is a great potential for the collaboration of BKB with the REB in the field of irrigation.

AGRICULTURAL PROCESSING ACTIVITIES

Processing activities include establishment of small-scale electrified rice mills, flour mills, oil mills and sawmills in the rural areas. BKB already financed a few small rice and flour mills. Large-scale finance for big projects on the line are mainly urban-based. There is potential for financing such processing mills in the rural areas if prospective entrepreneurs are available. In the sugarcane growing areas (outside the mill area) of the country there are some crushing machines for sugar-making which are presently operated by bullocks. Besides, some shoe making units, noodle machines and bakeries can also be added to the list. These units can be electrified and financed by the BKB if prospective entrepreneurs are available in the field.

RURAL WORKSHOP

In order to provide servicing and maintenance facilities to irrigation and processing activities, a chain of workshops needs to be established in the rural areas. The BKB has already sanctioned 170 small workshops involving a credit outlay of Tk 21.25 million, of which 40 have already been set up in the thana headquarters during 1981-82. In view of the need, there should be a manifold increase in the number of workshops. So this is an area of use activities where the BKB can collaborate with the REB increasing the quantum of its finance.

RURAL INDUSTRIES

Small-scale rural industries such as handlooms can be electrified and financed by the REB and the BKB if suitable entrepreneurs are available in the field. Besides, other cottage industries can also be undertaken by the agencies for development through electrification and finance.

REB's PROGRAM

There is wide prospect of the BKB's financing the formal programs of the REB. The BKB can finance the domestic connections where it is difficult for individuals or groups to do so. The BKB also can finance productively the electrification and operation of different commercial enterprises (such as different shops in the rural bazaars) in the rural areas. Thus, it would facilitate the implementation of the program of the REB productively.

During FY 1982-83 the BKB projected for credit advance Tk 3,170.00 million as against the target of Tk 2,700.00 million in the preceding year. The money will be provided through the Bank's short, medium and long-term credit. Out of this the Bank plans to advance Tk 225.00 million to finance agro-industries and cottage industries development. For irrigation development through different systems the BKB plans to advance Tk 485.00 million during 1982-83. Besides, the BKB very recently has undertaken a crash program in 170 thanas to utilize all the irrigation equipment by issuing loans on the order of Tk 3,100 million in collaboration with BADC and the Ministry of Agriculture. So this projection of the Bank can be synchronized with the programs of the REB.

The BKB's credit projection for the next year indicates its potential for increase in the finance of productive activities. On the other hand, the REB is pursuing its course for electrification of the countryside which is essential for creating productive enterprises and occupations. So, if the efforts of these two agencies are properly coordinated, then the development of the rural countryside of Bangladesh would be greatly accelerated. This paper envisages that both the agencies would come up with concrete proposals for collaboration in the effort for rapid development of the country.

FINANCING PRODUCTIVE USES

Anand K. Seth, World Bank Resider ''ssion,
Dhaka, Bangladesh

I can very strongly endorse the basic thrust of the paper by M. D. Ashandullah, Bangladesh Krishi Bank. I think we would all agree the future of agriculture development, rural development, in Bangladesh is very strongly linked to what happens in the rural areas, and particularly what happens in the agriculture sector, and the growth in that sector is very, very likely to come from what happens in irrigation. So, the emphasis in the BKB program is on irrigation, and this is in the national program on irrigation, I can very strongly endorse, and the World Bank is fully and deeply involved in Bangladesh, as in some neighboring countries, in pushing for as rapid as possible irrigation development.

I just thought I would make two specific comments on the paper and respond to your lead question. One was about the very small percentage of rural irrigation facilities that are presently electrified. And, while clearly one aspect of this has been the lack of adequate connections, lack of adequate lines, another problem that farmers very often pointed out is that having the connection is not enough; you have to have the power flowing through it. And their experience in many rural areas is that 50% of the time, you do not have the connection live, and that is one major discouragement to the farmers to actually come forward for the electrification program because you need water when the crop needs water. There is no point having the pump working a week from now when you want it today. And that, I think, is one basic reason why electrification programs are going a bit slow on the demand side and why 90% of the connections are, in fact, domestic rather than productive in rural industry or irrigation.

Responding to your question, Philip, about the World Bank involvement on the demand side for rural electrification. We have programs with BKB, and we support agriculture credit in general. Our basic strategy has been to tout flexible programs which can cater to the various needs of the farmers, of the rural people, as they come up, rather than try to find very rigid programs beforehand. Part of the flexibility reflects in our using, besides BKB, all the banking channels in the country. As you well know, in the agriculture sector, BKB is the lead agency as far as volume of lending is concerned. If you look at the number of borrowers who are actually participating in agriculture credit, BKB's percentage is slightly lower and a very large proportion of borrowers are borrowing from commercial banks and from the cooperatives. Our approach basically, in Bangladesh, has been to try and support all the possible outlets so that farmers and rural people can get their credit needs met from whichever happens to be the most convenient outlet from that person's point of view.

FINANCING PRODUCTIVE USE ACTIVITIES IN THE RURAL ELECTRIFICATION PROGRAM OF BANGLADESH

Syed Yusuf Hossain (Member Finance)
Rural Electrification Board
Dhaka, Bangladesh

INTRODUCTION AND SCOPE OF STUDY

Any development strategy and growth path in the ultimate analysis are largely a function of the availability and provision of energy in one form or the other--as well as energy's effective and productive uses in the economy. One of the foremost of them--the provision of electricity--has, in fact, been responsible over the last few decades for revolutionalizing the socio-economic scenario on a global scale.

With regard to the economy of Bangladesh where 90% of the people live in the rural areas, approximately 80% of the labor force is employed by the rural sector and around 55% of the GNP is contributed by rural agriculture. Whether it is agriculture and rural industries, or public health and education, or family planning and population control, the key factor is the provision of rural electricity, adequate and reliable in service, reasonable in cost and the maximum possible in coverage. But the foremost question which has been engaging the increasing attention of the strategists, planners, as well as implementors, is the primary issue of productive uses of rural electricity--the use which may act as the prime mover, in lifting our rural and the national economy out of its massive poverty, stagnation and low-level equilibrium trap. To ensure the success of the productive-use program, adequate and appropriate financing conducive to such a program is the key factor.

The Area Coverage Rural Electrification Program is not just a program for construction and creation of electric facilities for prospective consumers. The key to the success of the rural electrification program lies in the productive uses of electricity in the rural areas. It is the productive-use activities, their multi-dimensional impact on the various sectors of the economy and the generation of externalities which can help the developing economies to break out of the vicious circle of low income and poverty to lead to a path of self-sustained process of growth and development.

With the availability of electricity in the rural areas, productive activities can be expanded many times, having direct bearing on employment, output and income in the economy. In Bangladesh, with her predominently rural sector, any meaningful change in the national economy is only possible when there is significant change in the rural economic structure. For a change in the rural economic structure, productive activities through use of electricity in the rural areas can have a large contribution.

The benefits and impact of the rural electrification program on the economy directly and indirectly, particularly when it is primarily rural-based, hardly need any over emphasis. From the financial and economic point of view, productive uses of electricity are fundamental to a rural electrification program. In a similar manner, adequate and appropriate financial arrangements and necessary institutional support are key to a productive-use program, in the absence of which the desired end results cannot be achieved. As such, financing for the productive-use activities in the rural areas may be treated as an important prerequisite for an effective rural electrification program.

The productive-use program through electricity can increase productive efficiency in terms of cost and output in two different ways: (1) electricity replacing the process of producing the output or rendering the service; and (2) bringing in newer areas which would not have been possible but for electric energy. Here it works as the inducement for investment.

As an example, we can take the case of pond fisheries. This project is possible in any village and also without electricity. With the use of electricity, this project will ensure not only much greater financial return to the entrepreneur but also raise society's total output, income and the community's nutrition requirements. Electricity requirements for this project may be through the use of electricity for lighting which attracts insects which would serve as food for the fish and also by use of an electrically run motor to dilute the pond water as necessary for providing oxygen and to protect the fish from prematurely dying out.

In Bangladesh, due to the early stage of the Area Coverage Rural Electrification Program and productive-use activity still to gain momentum, it is only normal that not much has been done to refine the analytical concept for broad-based specialized productive-use financing to cater to particular needs and to make this conducive to productive investment. In such circumstances, the experience with regard to appropriate financing of a productive-use program as an aid to the productive-use concept has obviously been limited.

However, a humble attempt has been made in this paper in a simplistic manner to focus on the existing credit facilities in the rural areas of Bangladesh for financing the rural-based activities where productive use of electricity can be made, emphasizing the necessity for certain corrective measures, including institutional support.

FINANCIAL ASSISTANCE NOW AVAILABLE--ITS DIFFERENT ASPECTS

Under the existing arrangements of various financing schemes by different financial institutions, entrepreneurs who come up with any productive use program in the rural areas using electricity can avail themselves of those facilities. As per existing bank policy and arrangement, finance is provided to all productive projects with the basic criterion that the repayment of the loan within a predetermined period, along with the interest, is ensured by the borrower. The activities involving productive performance, using electricity and in the rural areas, are given priority treatment, considering their impact and benefits to the rural economy. The possible projects using electricity in the rural areas of Bangladesh may be listed as follows:

1) Agricultural sector	Irrigation (deep tubewell, low lift pump, shallow tubewell), harvesting, crop processing and storing.
2) Industrial sector	Food and agro-based industries, textiles, metal works, paper products, leather and rubber, glass and ceramics, wood/coir and bamboo products, etc.
3) Commercial sector	Repairing workshop, poultry/duck farm, fisheries, etc.

Financing for such types of activities is now mainly provided by the organizations mentioned:

Organization	Area of financing
Bangladesh Krishi Bank	Agriculture, cottage and agro-based activities.
Commercial Bank	Economic activities.
Integrated Rural Development Program (IRDP)	Viable activities through cooperatives.
Bangladesh Shilpa Bank	Industrial activities.
Bangladesh Shilpa Rin Sangsta	Industrial activities.
Local cooperative bodies	Small local projects having socioeconomic benefits.

In financing projects using electricity in the rural areas Bangladesh Krishi Bank has taken the lead in this regard, though this is not considered to be adequate. In the productive use area, Bangladesh Krishi Bank is already financing, besides irrigation schemes, processing activities like small-scale electrified rice mills, flour mills, oil mills and sawmills in the rural areas.

In the sugarcane growing areas, crushing machines for making molasses could be profitably converted and run by electricity. Small-scale shoe making units, power looms, bakeries, rural workshops to provide maintenance facilities for irrigation equipment, and processing activities could also be added to the list. Bangladesh Krishi Bank could take the lead in developing enterprising entrepreneurs by providing requisite finance with suitable covenants. In FY 1982-83, a sum of Tk 225.000 million is planned to be advanced by the Bangladesh Krishi Bank to finance agro-based and cottage industries.

At present, three types of credit facilities are available from the Bangladesh Krishi Bank: (1) short-term, for which the maximum maturity period is 18 months; (2) medium-term, which covers the period from 19 months to five years; and (3) long-term, for which the maturity period is more than five years.

The credit facilities given for the aforesaid projects are being divided into two categories with respect to their recovery plan. The first is a project loan for which recovery begins only after the production of end-product starts. The other is a working capital loan which is recovered within three to six months time, depending on the cycle of production.

To encourage the entrepreneurs in the field of productive uses of electricity in the rural areas, the loan repayment schedule is normally fixed considering the projected operating margin and fund flow position of the project involved. The general principle in this regard, as obtained from Bangladesh Krishi Bank, is that, as far as possible and subject to special consideration, if any, a considerable portion of the margin (40-50%) should remain with the borrower, and only the balance is apportioned for debt servicing. The spread of the debt servicing schedule is fixed after careful consideration of the project pattern, its intensity, income to be generated from the loan and the marketing time required. In fixing the repayment schedule, a moratorium period is allowed, depending upon the gestation period of the project. Some examples are shown on the next page mentioning the repayment schedule with moratorium period.

Name of the project	Repayment period	Moratorium period
Low lift pump	5 years	6 months
Poultry/duck farm	4 years	6 months
Tea garden factory	5 years	1 year
Deep tubewell machine	7 years 6 years	1 year 6 months

Apart from the normal financing of projects, the Bank has recently introduced further new schemes which can be utilized for the productive projects using rural electricity. An example of these new schemes is the "Rural Finance Experimental Project." This is a project for meeting the credit needs of the lower income groups of the rural populace. The main objective of this project is to test different models of loan operations at variable rates of interest ranging from 12% to 36% per annum in order to identify a viable rural financing system for giving maximum coverage of credit to the target groups at a rate of interest acceptable both to the borrower as well as considered viable for the lending institutions. Any entrepreneur with a productive project using electricity in rural areas involving least capital involvement (labor intensive technology), viz., poultry farming, pond fishery, repairing workshop, handicraft production, metal industry, etc., can avail himself of financing from the aforesaid scheme.

FINANCING OF PRODUCTIVE USE PROJECT-SPECIFIC DATA

Now we shall refer to some specific data in connection with project financing of productive uses of electricity in rural areas. Let us take the case of irrigation projects. At present, irrigation projects are mostly run through diesel-operated engines in our country. Despite the benefits to be derived by using electricity in irrigation projects, nonavailability of electricity in rural areas has been the reason for absence of productive use in this subsector. The farmers are keen to have electric connections for irrigation since studies have shown that electric motors would be much cheaper to operate than diesel-run motors, as well as increasing the command area. Ths cost involved for conversion of a diesel-operated keep tubewell into an electrical one is as follows:

Cost item	Amount in Tk
Electric motor (3-phase)	18,000 (25 hp)
Starter	3,000
Main switch	1,800
Wiring	3,000
Foundation	2,000
Total	30,800

The comparative position of a deep tubewell's (DTW) operational cost, being originally diesel operated and subsequently converted to electricity, is shown hereunder:

A) Operational cost	Diesel operated (Tk)	Electricity run (Tk)
Fuel/electricity cost	30,000	19,000
Managerial cost	2,000	2,000
Operational cost	2,000	2,000
Repairs/ maintenance	500	Nil
Drainage	3,500	3,500
Water distribution	4,000	4,000
Total	42,000	30,500
B) Command area	45 acres	65 acres

The above position depicts the direct benefits derived and cost saving by using electricity in DTWs. The revenue return will also increase considerably due to increase in the command area. It can also be seen that the initial conversion cost for the electrically run DTW is recoverable in approximately one year's operational time by reducing the irrigational cost per acre, taking into account the operational cost and the command area covered.

With regard to the industrial sector, it can be seen from a recent study conducted by the Bangladesh Bank on productive uses of electricity that, although the small industrial units in rural areas in the majority of the cases are financially and economically viable irrespective of using the diesel or electrically operated machines, yet, the maintenance and running costs are comparatively much higher in the case of diesel-operated units which would make the electrically operated units more viable financially and economically.

The credit facilities now available for small and cottage industries are precisely listed below:

S/No.	Credit line	Amount in million Tk	Ceiling of loan in million Tk	Designated bank
1)	III-IDA credit (1065 BD)	666.0	3.000 . . .	Sonali Bank Janata Bank Agrani Bank
2)	NORAD credit			
	a) Small	33.0	2.500 . . .	Krishi Bank
	b) Cottage	33.0	0.025 . . .	Janata Bank Sonali Bank
3)	a) USAID b) Krishi Bank	11.7 23.4	0.015 . . .	Krishi Bank
4)	IRDP/DANID and Janata Bank	0.7	0.020 . . .	Janata Bank
5)	UNCDF	110.01	0.020 . . .	Krishi Bank
6)	Special credit	117.5	0.200	Sonali/Janata Agrani/Uttara Pubali/Rupali Banks

The above-mentioned credit facilities can be utilized for productive uses activities in the rural areas. The clearance and approval of the project from the Bangladesh Small and Cottage Industries Corporation (BSCIC) is a precondition for receiving credit facilities from the above. BSCIC also provides the technical assistance required for the project, beginning from preliminary appraisal to the end-use of the loan, which ensures smooth implementation of the project.

The projects which can be funded out of the above-mentioned financing and where productive use of electricity is possible may be listed as follows:

- o Light engineering workshop
- o Improved blacksmithy
- o Agricultural tools and implements
- o Manufacturing of agricultural pumps
- o Education equipment (geometry box, scales, etc.)
- o Machine screw
- o Spice processing units
- o Sports and athletic goods
- o Spectacle frame
- o Coir products
- o Tailoring and garments
- o Food preservation and processing
- o Carpet factory.

The procedure for extending credit by a commercial bank to the entrepreneur for productive uses of rural electricity in small and cottage industries is enumerated below:

1. Receive the loan application through BSCIC

2. Make technical, economic, and financial appraisal of the proposal with the help of BSCIC officials

3. Examine credit worthiness of the entrepreneur

4. Sanction and disburse the loan under intimation to BSCIC

5. Supervise the end-use of credit

6. Recover the credit with the help of BSCIC.

The period with regard to repayment of loans for the small and cottage industries sector will depend on the nature of each individual project, and it also varies from lender to lender. For example, the loan for small industries financed through Krishi Bank shall not exceed 15 years' time for amortization, including a grace period up to five years. In case of a USAID-financed projected, fixed capital loans will be made available having maximum repayment periods of five years with one year's moratorium. Working capital loans will be advanced with a repayment period of one year, taking into account the project's cycle of production and marketing of products.

Requirements for funds and the appropriate on-lending terms for loans to rural-based small and cottage industries will depend upon the type and size of the industry along with due consideration of its gestation period. To develop an idea concerning the funding requirements for this sector, some examples giving investment costs for different projects are listed below. The reasonable amortization periods for such loans, as revealed from the case studies conducted by Bangladesh Krishi Bank, are also mentioned hereunder.

- Cold storage--A 2,500-ton-capacity cold storage plant requires a total investment of Tk 10.0 million with a repayment period of ten years.

- Fish freezing plant--A five-ton-capacity/day plant needs a Tk 5.80 million investment with the repayment schedule spread over eight years.

- Rice mill--An automatic rice mill with a four-ton-capacity/day requires the investment of Tk 8.0 million with a repayment period of eight years.

- Flour mill--A major flour mill with a 25-ton/day capacity needs a total investment of Tk 14.0 million with a repayment schedule of ten years.

- Sawmill--A Tk 0.10 million investment is required for a sawmill of moderate size with four years' time for loan recovery.

AN OVERVIEW OF FINANCING ASPECTS

"It is no good to do things in a hurry. Desire to have things done quickly prevents their being done thoroughly." This common saying, with respect to management, is equally applicable for a prudent financier while taking up any project. The Area Coverage Rural Electrification Program is a new concept in our country. It is a fact that productive uses of electricity in the rural areas are key to the viability and success of the rural electrification program and fundamental for a rural-based national economy. On the other hand, mere availability of electricity and ensuring financial assistance will not automatically achieve the desired end results. Some other factors also have a vital role to play. Thus, a good financier must ensure the fulfillment of all related criteria before sanction of projects and disbursement of funds.

The productive uses of electricity, apart from credit needs, are dependent, to a large extent, on the availability of certain other prerequisites, viz., skilled labor, raw materials, markets and the supporting infrastructure. They will also depend on the ability of the institutions responsible, either in the government or in the private sector, to effectively develop and implement an action program which would encourage and assist the use of available electricity in the rural areas in economic and socially productive uses in the least costly manner.

As has already been mentioned earlier, a fundamental prerequisite for the success of a productive power use program is adequate, appropriate and timely financing. With this end in view, the financial institutions should arrange their financing plans in such a fashion to ensure three basic points: (1) softer loan terms with reasonable amortization schedules having easy access by the potential entrepreneurs; (2) timely and adequate funding; and (3) supervisory need both for technical assistance and ensuring proper utilization of funds.

In order to ensure the success of the productive-use program of Area Coverage Rural Electrification in Bangladesh, the government should also take the initiative by providing the necessary financing in this regard through the Rural Electrification Board, at least until such time as there are adequate and suitable funding arrangements by the financial institutions to meet the funding gap. In fact, the Project Proforma for the Area Coverage Rural Electrification, Phase-I, recognized this important aspect and provided for such power use loans by the government. But later on, due to resource constraints, this did not materialize. Alternatively, it is also felt that a separate specialized financial institution could be set up to cater to the specialized funding needs, with substantial equity participation by the government for launching suitable projects. This specialized credit institution for productive use programs for rural electricity may have ex-officio representatives from the government and Rural Electrification Board for project selection and suitable financing.

The initiative and the investment by the government deserve serious consideration, even on pure economic criteria, since the initial investment, in long-term dynamics, may pay back richly in terms of economic benefits through value added to be derived from such

investments. There are certain productive use projects which require small investments with shorter gestation periods while others need big investments with longer gestation periods. The smaller projects, involving less capital investments, may be given priority in matters of funding rather than big, prestigious projects involving big capital investment. This will entail two-dimensional benefits:

1. Mobilize more entrepreneurs into the productive field

2. Minimize the element of financial risk on the part of the financier. The failure of one or two small projects among many will lead to partial loss of the total investment, whereas, failure of a single big project may jeopardize the viability/liquidity of the lending institution to the detriment of many others.

Finally, proper attention is also to be given to five basic factors to ensure the smooth and appropriate financing of the productive-use activities in the rural areas:

1. Priority for financing is to be determined for the productive-use activities. Employment creation and income generation with least cost investment may be the criteria in view of our poor per capita income and due to a vast unemployed and under employed rural labor force.

2. Financial assistance may be provided for manufacturing electrical components and parts within the country which will ultimately be consumed through our productive-use program in agriculture and industry. A productive-use program cannot continue to be import based for a long period which would prolong the implementation of the program, making it socioeconomically less viable. The Rural Electrification Board has, however, already taken the necessary initiative to encourage the local manufacturing of electrical components for the purpose. Single-phase electric motors of small horsepower were not produced in this country as well as there being a ban on importation of the same. The Rural Electrification Board has moved the authority in the government to lift the ban and, meanwhile, obtained special permission from the government for some importation of the said electric motors apart from taking special efforts with GEC Bangladesh, Ltd., for production of single-phase small horsepower electric motors locally.

3. Possible sources, both within and outside the country, should also be explored for arranging the funding for a productive-use program as well as for electrical component manufacturing projects which would help in such productive-use activities. The existing commercial banks and financial institutions may take care of the special needs of this sector by introducing loan portfolios with softer terms and special financial covenants both for agricultural and the rural industrial sectors. In the context of rural Bangladesh, agro-based industrial equipment using electricity may be accorded priority. In the initial stage of the program, patronage financing for those productive-use programs which generate externalities in the economy and have linkage effects to the national economy may also be considered. The question of subsidy for the initial period until break even point on selected cases may be a worthwhile proposition.

4. The rules and other procedures for obtaining financial assistance should be designed in such a way as to ensure easy access by the potential small entrepreneurs and provide for speedy sanction and quick disbursements desired to suit specialized requirements.

5. The financial institutions and other related organizations, by themselves, may launch some pilot projects in this regard covering the feasibility studies and technical assistance so that implementation of the projects becomes easy and attractive to the potential entrepreneurs.

CONCLUSION

Though electricity consumption in the rural areas of Bangladesh is still to peak, the ratio for productive-use purposes is already substantial. Agricultural and industrial load, in terms of kWh consumption and the revenue position, compared to the domestic load and the revenue thereof, is much greater in some of our Samities. This indicates an increased rate of productive uses. In some of our Rural Electric Societies (PBSs), viz., Dacca PBS-I and Comilla PBS-I, productive use activities contribute 77.37% and 73.01%, respectively, of the total revenue (as of September 30, 1982). However, taking all the energized PBSs into consideration, the contribution of productive use activities in the total revenue would be somewhere around 50%. But, with the rapidly increasing demand for electricity for irrigation purposes, productive use consumption is estimated to be the major portion of total consumption.

We believe that in the productive-use program and their financing aspects, in order to be effective and fruitful, there is a clear need for meaningful collaboration between the organization providing the rural electricity (REB), those responsible for making productive and effective uses of electricity (BADC, BSCIC, IRDP, etc.), and the financial institutions providing the much needed financing (BKB and others) for efficient implementation of the projects. It is imperative that the productive-use schemes and appropriate financing in this regard, along with availability of electricity in the rural areas, have to be closely coordinated so that maximum productive utilization of electricity, the basic input in modern productive process, can be ensured.

The views expressed in this paper are the author's own and do not necessarily represent those of the organization for which he works or the Government of the People's Republic of Bangladesh.

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DISCUSSION AMONG PANELISTS
Philip Costas, Moderator

PHILIP COSTAS: Mr. Reese can you please comment on the experience USAID has had with the rural financing farm credit experimental pilot project here in Bangladesh?

COMMENT: (Claude Reese) Prior to our establishing the project, we felt that we should target in on a specific group. So, our project started by targeting the group to those with incomes of 6,000 takas, more or less, or with landowners of two acres or less.

We also included the landless, and we tried to make credit available to these individuals who, in the past, customarily relied on moneylenders at rates of interest of 50% or greater. We used the nine financial institutions—six nationalized commercial banks, the Agricultural Development Bank, and the two cooperative associations. We built certain incentives into our program. Basically, we improved the lending procedures—instead of the farmer or borrower making six or seven trips to the bank, we came up with a shortened lending procedure. We tested eight variables, including such areas as group vs. individual lending; we used the village agent as the instrument of change; we used the small farmer service center; we used the area development approach; and we used the bankers' ombudsman approach. And, we experimented with rates of interest varying between 12% and 36%. We also had a savings component. We also made sure that a loan recovery was monitored with improved procedures. Supervised credit is very important in this type of lending. We also made sure the branch profitability records were initiated, and we made loans, without restriction, for agricultural-related and small business purposes.

As I said before, the experiment lasted five years. The experiment ended on the 31st of August 1982, and our evaluation report indicates numerous benefits. I'll just highlight one or two relative to this particular topic.

A large portion of the lending went to nonagricultural or activities other than crops. One-third went for crop production, one-third went for agricultural purposes, and one third went for nonagricultural purposes. The project reached 85% of the target group. And, although the ultimate use depended on the branch outlets, in some areas, all the loans were for agriculture and livestock. In other outlets, near the towns and bazaars, a high proportion was used for trade. We had some problems in the group lending project as we discovered that group lending model productivity was lower than any of the individual models.

As I mentioned a few minutes ago, the project did have significant effects on informal credit. In a sociological survey which was done, an intensive report was made and indicated the moneylenders had suffered as a result of the RFEP (Rural Finance Experimental Program) at a viable rate of interest. Interest rates were charged to make sure the banking institution was viable.

We feel that the RFEP was active, very active, in lending to rural producers for various production enterprises. I know you evaluators listed some 38 types of activities that borrowed under the RFEP project. I feel there are many benefits, lots of benefits, as a result of this project. I would theorize and say that these benefits could be utilized by the existing banking institutions to make sure that they have a viable project and to make sure that the borrowers know what they are borrowing for; that the loans are made for acceptable loan periods; and the ability to service the debt is taken into consideration.

For those of you who are from countries attached to an AID Mission, I probably would suggest that you talk to our Mission regarding getting some information on this RFEP experiment.

Thank you.

QUESTION: What was your cost of funds, including the cost of operation, on an average?

ANSWER: (Mr. Reese) Cost of funds, on an average, was about 7% or 8%.

QUESTION: Does that include the cost of operation?

ANSWER: (Mr. Reese) No, this is excluding administrative expenses.

QUESTION: But, if you include your operation, what was the cost, on an average basis, of the total funds, if you spread it out?

ANSWER: (Mr.Reese) I would say close to 12%.

QUESTION: Thus, you break even, roughly?

ANSWER: (Mr. Reese) Cost of funds plus administrative expenses are close to 12% or 13%. Included in this is no profit margin for the lending institution, and one has to take into consideration budget and budget reserves. This is important in undeveloped countries.

QUESTION: I have one question of Dr. Rungta: How does this 12% compare to other developing countries--the cost of lending out in the rural areas?

ANSWER: (Dr. Rungta) Well, I really cannot claim any intimate or personal knowledge of the data on this. All I can tell you is that 12%--what he's talking about--is a nominal rate of interest which is really not very high at all given the rate of inflation in the country and so on--so, I would say that is not any significant burden on anyone. At the Bank, when we have loans, we use something like 12% as a cutoff, but that is a real rate of interest which is ahead of inflation--therefore, very high. So, I would say that, you know, the 12% would be a very reasonable rate of interest. Certainly, if I were to generalize from the open market rate of interest in India--even on large sums of money--this would be a very moderate rate of interest that you are charging in the rural contract. Twelve to 15% could be a really low, in my opinion, low rate of interest.

COMMENT: (Mr. Reese) Basically, we at AID, in 1976, decided that what was needed in Bangladesh was a viable system of lending to small farmers in the rural areas. So, after much thought and consideration between the Government of Bangladesh and the United States Agency for International Development, we, in 1977, authorized a $7 million program to finance technical assistance and for funding for a credit program. The basic objective was to carry out an experimental credit and savings program. What we were thinking of was a viable lending system to benefit both the lender and the borrower. The basic project goal, as established in 1977, was to contribute to the establishment of an effective nationwide credit system for the small farmers and the rural producers. We utilized several of the financial institutions, all the national commercial banks, the BKB, and two of the cooperative banks here in Bangladesh. The results are numerous--and I'll pause here and pass it back to the previous speaker, and I am prepared to deal with this at length later.

COMMENT: (Mr. Hossain) Now, to cut short, because of concern with time, I am not going to discuss this financing aspect, which I have mentioned, by the BKB and their covenants and by some other commercial banks and in cooperation with the Bangladesh Small Cottage Industries Corporation. For some of the projects, there is a condition for funding by some of the lending institutions that the Bangladesh Small and Cottage Industries Corporation is to have approved those schemes to ensure monitoring and to ensure the return of the capital borrowed and all the details that I mentioned in the paper. One of the fundamental aspects that I mention in the paper is that I feel the Government of Bangladesh should come forward in rural electrification financing by taking the initiative of providing loans through the REB in long-term dynamics. From the economic point of view, it will be profitable because initially, even if it is an investment of Dhaka resources, in long-term dynamics through the productive use content, through the cost benefit analysis, it can be shown that ultimately it will pay back much more than the initial cost of investment. And then, I have mentioned this to show that, though it has been mentioned before by my friend from the World Bank, domestic connections are still a large component of the total connections. But it is worth noting that the proportion or the ratio of the revenue from productive uses programs in some of our PBSs--particularly Dhaka PBS--Dhaka Rural Electric Society--and one or two more, the ratio of the revenue from productive uses of total revenues for the PBSs is 77% and 73%. So, what we want to emphasize is that even if the program is picking up the ratio which is already high, and this ratio is expected to go up with the demand for electrification for irrigation, and particularly for the small and cottage industries, our policy is to create a viable flourishing class of people--not concentrated growth of wealth but wealth to be dispersed through the distributive justice in an egalitarian society. And, lastly, I again to go back to our friend from the Krishi Bank, I mentioned that there is a need for collaboration between not only Krishi Bank and the Bangladesh Rural Electrification Board, but the need of continued collaboration extension between REB, BADC, IBRD, the Agricultural Development Corporation, the World Development Program, the Bangladesh Small and Cottage Industries Corporation, BKB and the financial institutions, so that our productive uses can be financed by the BKB. And, if necessary, I have also suggested that a separate financial institution could be created with suitable covenants to finance only the productive uses activities of rural electricity, and, in that respect, it could be formed by the government and other representatives and representatives from the REB who will understand the need for productive uses, why to use these productive uses, what would be suitable financing for these productive uses, etc. Thank you, Mr. Philip, and thank you all.

QUESTION: Mr. Hossain, I would like to have a little expansion on your last point there--the institutionalizing. What was the last comment you made? Institutionalize as a formal . . . ?

ANSWER: (Mr. Hossain) I suggested that the government could come up with the formation of a separate financial institution only catering to the specialized needs of the financing, appropriate financing, for productive uses in the rural areas through electricity.

QUESTION: Do you have any comment on that, Dr. Rungta? Any experience in other countries? If, indeed, has there ever been in any national agency that you are familiar with, a specific, a country-level bank? This concept . . . Dr. Rungta.

ANSWER: (Mr. Rungta) Well, I was actually very interested in the concept of variable interest rate experiments that they are making here. Back in 1967, I suggested that to Sudan--to the commercial banks there--that there is no need for a specialized agency and so on. They are already in the business of providing credit and mobilizing savings, and the so-called risk factor is purely a question of certain defaults, certain difficulties, and not being able to meet payments on schedule and things of that nature. And, occasionally, of course, there could be a purely bad debt. But, that was something people could experiment with in terms of interest rates. Your servicing costs are high. There is a certain risk of default, and so on. And, these matters could be taken care of by charging a slightly higher interest rate so that you pay for your cost of funds and cost of servicing. And, this is exactly what the village moneylender does. After all, he is in this business to make money; he lends money; he charges a higher interest rate to compensate for the bad debts of some others, and so on, and, in the process, makes a lot of money for himself. And, if he can do it, why doesn't a commercial bank with all the expertise and the resources and organization provide a similar sort of service to the rural people? As far as I am concerned, it could be the Krishi Bank or any other institution which could, in fact, look after the total rural needs. After all, what are the needs of the rural areas? They could, in fact, from one establishment, cater to the needs of the rural population for some appliances, for some agriculture, some carry-over when the crops are bad; they need some money for consumption, in fact, to carry them over. What is needed, to my mind, is a spirit of service. You can't just sit in your building and expect everybody to come and beg and not know your customers; you know, one comes and he tells you some heart-rending story about crop failure and his daughter's marriage and this and that, and you just turn a deaf ear and you don't listen to anything and you insist, and so on. You have to have a one-to-one kind of relationship with the people you are serving. The banks would have to have people who go out into the villages, know the customers' conditions and talk to them, create confidence, create a two-way relationship, and so on--assess their needs. That is the way of assessing the risk and being able to really then cater for the postponement, the resettling of their loans and so on and so forth. From what little I know of India and other places where I have had the opportunity to grow up, I think the villagers are basically very honest people. And that is how the moneylender survives. If they were not, they would not be able to survive at all. The question is that the village moneylender is able to take one year with another and average out his cost of funds and recoup and make some profit--and that is the sort of thing that is needed. You know, call it a thrifty fund or call it a cooperative or something commercial. I would have been quite happy to call it a rural development bank because rural banks can provide all of these facilities through one establishment from just one place. But the thing is that you must go out and not just stay in your own little building and be pushy about it. Thank you.

COMMENT: (Mr. Hossain) Can I add some comments to that, Phil?

PHILIP COSTAS: Mr. Reese first, please.

ANSWER: (Mr. Reese) In response to what Dr. Rungta said, there are two main points that I would like to indicate to you this morning. One is that I am in full agreement with the Doctor that at this stage we feel that there are no bases for the no-financing decision for this specific purpose. Bangladesh here is adequately served by a large network of commercial banks, by the Bangladesh Krishi Bank, and by the cooperative structure. What I would suggest here is that the benefits that accrued from the RFEP, which had a five-year history here in Bangladesh, should be carefully considered and implemented. Further, one significant benefit of the project mentioned by the evaluation team indicated that this project, the RFEP project, had a significant effect on informal credit in the project areas causing moneylenders to substantially reduce their rates. So, basically, RFEP has done well in the benefits that accrued as a result of the project, and I feel that these could be extended by the national commercial banks, the BKB, and other lending institutions.

COMMENT: (Mr. Hossain) Well, thank you for the comments, but, you know, it probably has been taken more seriously than it deserved. I mentioned that it could be one of the possible alternatives. There is a BKB and there is a government, and what I wanted to mean, to go back to our experience and also the experience in the United States, there is an RFC--Rural Financing Corporation--also Rural Cooperative Financing Corporation--which looks after the specialized needs with particular emphasis on the rural electric cooperatives also. And, in Bangladesh, to go back to history, there has been a Power Development Board. Some could argue that this Power Development Board could also look after the rural electrification aspect as well. But, it has been justified that a separate institution was necessary after 25 years of its existence when nothing could be done about rural electrification in this country in spite of all the rhetoric in this regard. So, the Rural Electrification Board was justifiably set up out of the Power Development Board as a separate corporation to run the affairs of rural electricity, area coverage, with all these productive uses. Now, it seems that we have to depend for productive uses and the success of this program on some other institutions. So, of course, there is another question of subsidies. Now, if there is a question of some loss in investment, if there is a question of some need for subsidy, BKB or any other organization will come up with the commercial criteria of, "Sorry, we could not finance," and all these things may happen. So, what I meant was that for better, effective coordination and collaboration, we could probably do it as an extension to the Rural Electrification Board--probably it could be an argument. And, I meant it that way. But, of course, there could be doubts about that.

COMMENT: (Mr. Anand Seth) I heard this bit of information which might be useful to all participants: that in Bangladesh we have nine different credit agencies lending to the rural people; that there are 4,500 banking outlets. Presumably, they should be able to reach many, many rural people. And yet, as of this moment, 65% of the unions do not have a bank branch. It is also interesting to note that 55% of all the banking outlets are financially losing money. So, given this, that is possibly directly related to excessive duplication. The total lending volume going into agriculture is split up into so many different agencies, so many different outlets sitting one on top of each other. In some places you will find three bank branches in the same building all on different floors while neighboring unions do not have a bank. It is that kind of a situation. Therefore, it should be along the lines of what has been mentioned by the panel earlier to get a few viable outlets spread out far enough to cater to the entire needs of the borrower rather than split up the banking volume or the credit volume into a number of specialized agencies--none of them can be viable.

PARTICIPANT DISCUSSION—FINANCING PRODUCTIVE USE ACTIVITIES AND PROGRAMS

PHILIP COSTAS: Thank you. Now, we will open the panel to any questions from the floor. Yes, Dr. Aziz Pabaney.

DR. AZIZ PABANEY: This is an unusual question. I do belong to the group on productive use for rural electrification, but I might raise some questions. To begin with, let me whole-heartedly endorse, I might say, talking from the bottom of my heart--the question of going out on a one-to-one relationship is absolutely firstclass. I think this is not only needed for banks, it is needed for rural electrification and for productive use. I think we find that, unless you have a personal relationship with the productive user, I don't think you are going to get very far. So, let me endorse that whole-heartedly. And something else which may be news for engineers, because most people around here are engineers, and mostly urban oriented--I don't think they realize that the rural person is really, basically an honest person. He is the one who is the best payer of debts by and large. And, I think we should appreciate that, not only in the field of banking but also in the field of problems that electricity lines--you know, to set up electricity infrastructure has its problems. It has its difficulties, but if we honestly explain it to the man, I am sure he will understand. But, I think it is very necessary for the engineers, particularly, to understand the rural mind and to honestly trust the rural individual. I think that if you go honestly to him, he will respond honestly. Let me whole-heartedly endorse that aspect of it.

The other one is, in terms of the problem of most of the banks--I mean it's quite all right to say, "Let us go out and let us have programs and so on and so forth," but when it gets down to it, I think there is an old dictum that says, "Bankers are basically conservative." And I think that is part of the problem that we face. And I might say, the programs that we have--oh, I suppose I am talking of Indonesia now, but I think this is true of Bangladesh or India or anywhere--are very collateral conscious; they are not one-to-one related. I don't think they appreciate a man's worth. They take his property worth, and the property can be squandered, but a good man can stand on his feet and deliver the goods, but they don't give it. Now, in our own particular area, which is rather active industrially, by the way, these are all small industries but very active—if you give them anything on credit, they'll start giving you a lecture on the banks. And they are government programs, by the way, of credit facilities at 10% and 12-1/2% . . . The difficulty is that they get terribly bureaucratic. They are collateral oriented, and one of the biggest difficulties we find is that when a man needs, let us say, Rs 12 million, they might come up with four million. I know of a case of a furniture maker who got a loan for raw materials, but he bought himself a truck. That is what he needed. They wouldn't give him the 12 million he needed. He just got four million--that's all it was. But he is a good furniture maker, he buys his own truck, he delivers the furniture. That's the kind of stuff that he goes for. Now, we try to tell him—I said, "How about buying some electrical equipment?" He says "The bank won't give me any more credit unless I pay that back." And that goes on all over the place. So, you get into the problem of--we talk of viability a great deal. The question is--all right, you need 12 million for viability, why do you give him four? And this is an oft-repeated problem all over the place. And he doesn't get enough because they don't know the man and they don't have that one-to-one relationship in terms of what he can produce. This is part of the difficulty, I think, in not recognizing the entrepreneurial ability of the person. So, I think it would probably be worthwhile if they got some training in recognizing the worth of a man and the worth of an entrepreneur who can deliver the goods to supplant the collateral orientation which might be there. I think the World Bank and the ADB might put in some effort in trying to retrain the managers of local development bank in that direction. That might be very helpful.

APPLAUSE

PHILIP COSTAS: Do you want an immediate response on that last suggestion? Or do you have another comment or question?

DR. AZIZ PABANEY: I have some questions. I hope you don't mind if I can take a little time.

PHILIP COSTAS: O.K. Just so we make it less than five minutes.

DR. AZIZ PABANEY: I have a disturbing question here. Personally, I am entirely in agreement in terms of dispersal of wealth. I think it is very necessary--particularly our cottage industries--that the poor sectors are particularly taken care of well. I don't think there is any question on that. We will agree with that. But let me go to the other side of it, and I have been talking with some of the World Bank consultants in our

programs in Indonesia. There seems to be a confusion in terms of social orientation on banks. Now, I'm giving you the problem which I raised yesterday. We have entrepreneurs who are pretty good. Some of them employ ten persons; some of them employ 60. They are good producers of furniture, they are good producers of garments, and they want to get into the export market. They want to expand. I don't see any reason why we should not get socially oriented on this. They are the ones who are willing to expand. They are the local entrepreneurs. They don't get any foreign collaboration, and they are willing to go ahead. I don't see any reason why we should not support them because it is here that you are building the real base of small industries which will hopefully turn into medium ones. So I think that kind of confusion of a social business here might affect the dynamic small industry entrepreneurs which I think would be very unfair to them. They are the ones who will build it up, so I think these two should not be confused.

One more thing--I think there is a complacency around here with regard to electricity being the best thing. In our own particular area where industries--there are about 3,000 of them--there are probably at least 1,000 of them that use diesel engines, and they have been using them for a long time and they don't wait for electricity. An entrepreneur goes ahead and does his thing and he doesn't wait for it. And, I can tell you, many of them buy reconditioned engines and they can tell you, by and large, they last for ten years and they don't need much maintenance. Now, there may be some questions there, but they feel that way, and they are the ones who make the decisions. So I think that kind of complacency that electricity is the best thing and so on and so forth--I don't think is necessarily acceptable.

Now, the question that arises is, by and large electricity is distributed by people who are essentially bureaucrats, and the diesel salesmen are the ones who really sell. Now, the question is, how are you going to do the selling of electricity? This is a very important question and you have very stiff competition, I assure you. And the diesel engines are not bad. So, I think this is a question that should be raised.

And one more point, if you don't mind, is on spending money on rural workshops and developing rural workshops. In the Klaten area in the last three to five years there has been a revolution in transport. We have a large number of trucks, a large number of motor bicycles--almost everybody is on wheels. And I can assure you that the thing that has developed most in the Klaten area in terms of any of the industries or services are your workshops. You find them all over the place. And, I can assure you no training institute, none of those financiers, ever has them. These are self-developed institutes. I think the problem lies in how you can help them improve their services. So I am wondering if we are unnecessarily wasting too much time and money on trying to develop these kinds of workshops. You might as well get to the workshops that are already there and help them improve. Thank you.

PHILIP COSTAS: Thank you very much, Dr. Aziz. I think you raised many, many good issues. The one that, I think, to me is a crucial, underlying concept or problem that we are all facing in all topics is this matter of what should be the skill capability of the people in our programs that are dealing with productive use.

PHILIP COSTAS: Other questions from the floor at this time?

QUESTION: I am Abdul Khan. My question is about the nature of financing. So far, the panel has discussed only financing from banks. But I suspect there is a possibility for mobilizing some savings from the villages? I know that in Bangladesh the irrigation facilities have already helped some of the big farmers to earn more than what they used to. At the moment, possibly, they are spending that money simply on consumption. Now, how do we mobilize this savings from there to the willing entrepreneurs? Many of the farmers are not willing themselves to be entrepreneurs because they may lack education or have some cultural adjustment problems. The question is whether the banks can do anything here. Maybe they can--maybe the Krishi Bank branches or some other branches can go to them--sort of motivate them. But, in my opinion, the cooperative of rural electrification can be very instrumental in mobilizing these savings because those big farmers are members of the cooperatives and would be entrepreneurs and also members. Now, here, without directly supporting what Dr. Rungta said about building a new institution, I would say the cooperatives can possibly take up a new role in banking, which they do in urban areas. I would like your comments on this point.

The second thing that I was going to ask was whether the rural banks would insist on collateral. You see, I don't know how the Krishi Banks give loans. Many of the people--the artisans and others--don't have much to offer as collateral. We have to judge on their merit--on their own training, on their education or on their potential, which is different. So, the rural banks may have to use different standards in assessing the creditability of their clients. And, on this point, I would like a comment from Mr. Ashanullah. Thank you.

PHILIP COSTAS: Thank you. You have two questions, from what I understand. The first one, mobilizing local savings, and the second one on collateral. Would any panelist like to address the first question?

CLAUDE REESE: In our rural finance project, we had a savings component, and we paid the individual farmer for his deposit real rates of interest varying from 11-15%. What we saw as a problem was that many of the participating institutions were hesitant to amass deposits that they could not really lend at viable rates of interest--interest that covers costs of funds, administrative expenses, bad debts and some sort of return to the lending institution. This is one of the problems as we saw it. Mobilizing of savings is vital in any financial institution. Funds come from two

sources. They come normally from the government treasury or they have to be generated internally by the savings of individuals. In all projects, the institutions that we experimented with financed as much as 1/3 of their loans with locally mobilized funds. RFEP indicates that, with an active policy of mobilizing savings, adequate funds could be generated and there would not be that heavy drain every year on the national treasury. So, mobilization of funds, as mentioned, is an important aspect that the banks, financial institutions and governments should pay much attention to. Thank you.

PHILIP COSTAS: Thank you, Claude. Anand has a comment to make at this time.

ANAND SETH: You mentioned something about the role for cooperatives in mobilizing savings. As you know, in many of the neighboring countries and, particularly, in Bangladesh, this has been one major feature of cooperative activities. What has probably not been appreciated widely is that this has been a fairly successful activity that, in the case of RFEP, for example, which you mentioned has a very wide national program here, 48% of the total lending is financed by their own savings. So, it is quite a successful program. And, by the same token, I was going to say that it would not be very sensible to start another bunch of cooperatives to start mobilizing the same savings because then you come into the same problem where both agencies would be competing for the same resources, neither of them having a viable amount. Thank you.

PHILIP COSTAS: And, now, the second part of your question dealt with collateral.

RESPONSE: Yes, about the collateral, you know the Bangladesh Krishi Bank is essentially an agricultural bank, and its lending involves the rural areas. Of course, we also have some projects, big projects, both in the rural and urban areas. But, in recent times, actually, the Krishi Bank has simplified its lending procedure very much, and in terms of collateral, I think, particularly for small farmers. At this time we don't need any collateral. There is a limit, for example, of 6,000 taka for the small farmer or small entrepreneur. We don't need any collateral--simply a personal guarantee or a personal endorsement granted from the group is sufficient. But for bigger projects, I think we do need collateral.

PHILIP COSTAS: Other questions? Yes, sir.

QUESTION: BKB has extended, actually, several activities for financing of activities of productive uses electricity in the sector of irrigation, agro-industries and other industries. BKB has financed the construction of lines, but there are consumers who cannot change diesel engines to electric engines for lack of refinancing them by the BKB. There is no provision to give second loans for the same purposes. One of the big problems in our rural electric cooperative areas is for the BKB to help make arrangements to take this diesel to other areas where there is no electricity and change the diesel circuit to an electric circuit, or, at least, they can give second financing to the consumers. I think it would be a very good official action. I want to call it to the attention of BKB's representative and explain the facts as to how we can help the consumers to change diesel to electric circuits in the case of shallow tubewells. Thank you.

PHILIP COSTAS: Do you have any problem with the question? Do you need clarification?

MD. ASHANULLA: Yes, I think it is a good question, and in this connection I can say that the BKB recently has started financing the deep tubewells and lift pumps in addition to the shallow tubewells. And it's a problem that in many areas there is no electricity yet. So, the BKB is financing the deisel-powered engine. But, BKB has a long-term plan. If the lines are properly electrified and there are machines operated by diesel, then we can shift these engines to the far areas where electricity is not available and we can replace these by electric motors. But, we still--the BKB--did not do anything in this respect, and we have to plan to do it in the near future.

PHILIP COSTAS: One more question before the lunch break. Yes, sir.

QUESTION: I would like to address this question, rather, the problem, to the BKB participant. Now, I am not talking about electrical pumps. We in the voluntary agencies--we are dealing with marginal farmers, and I presume most of the farmers in this country are marginal farmers. Most of the marginal farmers are very poor, and we manufacture a pump--a manual irrigation pump--which we market. Most of the marginal farmers are unable to raise enough funds to pay for this manual irrigation pump. I have been contacting the Krishi Bank for credits to the farmers and, as the participant said, there is no problem in arranging credits for about 6,000 taka. Now, this pump, this irrigation pump, is mainly for use during the dry season for growing of what is known as robi crops in this country. If a marginal farmer can have one of these pumps and farm a crop--one crop in one season--his status, economic status, is completely changed. As we have been talking about generation of funds, marginal farmers should be able to generate funds on their own if they could be given credits and quick credits. I mean, the bureaucracy tends to take a very long time. Once we can give quick credits in one season, we can change the face, the status, the economic status, of a marginal farmer. Would our friend from the Krishi Bank like to tell how it can be arranged that marginal farmers in this country--and they are a very large proportion of the farmers in this country—be given credits as fast as possible before the robi season is over this year?

ANSWER: Thank you, I think this is a good comment. For small farmers, actually, we have an arrangement, and in recent days, I think, there is no problem in

financing the small farmer. The BKB is financing small farmers, particularly through its special agricultural program--you know, RFEP. I think it is available; I mean, the branches are spread throughout the whole country, and the BKB is financing the small farmers and, at this time, we have shortened lending procedures and the formalities, particularly for the small farmers. So I don't see any problem occuring before the season comes that will prevent them from getting loans. I think they are available there. And BKB finances, actually, the farmer or the group--whoever is interested. And if he comes to the Bank, the BKB is ready to finance. In addition to that, I think, besides this RFEP program, we are financing different projects to include different types of farmers--say, marginal farmers. And we are trying to develop some sort of procedure to include those people in this society. I think it is within the feasibility of the Bank.

QUESTION: What kind of guarantees are you providing on these pumps?

ANSWER: The guarantees? What kind of guarantee would you like?

QUESTION: In terms of serviceability, in terms of repairs, and so on and so forth.

ANSWER: Oh, there is hardly any repair necessary on these pumps. These are very simple, manually-operated irrigation pumps. The farmer should be able to carry on the maintenance. There are no machine parts. It's not an engine. This is not a machine--it's a PVC pump.

QUESTION: So, it does not break down? Is that what you are saying?

ANSWER: It should not normally break down. And if any of the parts wear out, it should be very easily repaired by the farmer himself. He does not have to depend on mechanics who are urbanized.

QUESTION: What kind of sales organization do you have?

ANSWER: This is being marketed in Comilla and Nokali Districts by MCC, and we, CARITAS, and the Mirpur Agricultural Workshop and Training School market it in Dinajpur and Kushtia. Of course, we have programs for marketing this elsewhere, but it depends on how soon we can organize the distribution activities.

QUESTION: Would you be prepared to accept a certain portion of the risk when you come to the Bank and introduce a customer?

ANSWER: Risk? What risk do you mean?

QUESTION: Well, default or, at least, on the pumps' repairs and things like that.

ANSWER: Of course, we don't have funds to float. We manufacture the pumps, and they are out for sale, and the banks, as I understand, BKB is there with government funds to give credits to the farmers. Now, the government stands--I suppose, BKB is a nationalized bank--and so the bank stands up for sureties of guarantees. And the farmers will have a certain piece of land as a guarantee as well.

PHILIP COSTAS: This will definitely be the last comment from the floor.

COMMENT: I should say this is a very important question for the country, but for this seminar, I think, it is not very relevant because we are talking about the productive use of electricity, and his pump is a manually operated pump. I think he should discuss it separately with BKB in a separate session. Thank you.

PHILIP COSTAS: Before we officially close the panel, does anyone have a closing comment he would like to make?

COMMENT: Well, a little while ago I talked about one side of the coin--that is, the Bank going out or the credit institution going out and knowing its customers, etc. I think there is the other side of that coin which I thought I should also mention--that these credit institutions, or the bank, in this case Krishi Bank, maybe, must also give their own officers enough discretion, which is very important. And it is possible that some of this discretion may be abused or, in fact, the officer may make some honest mistakes. But the bank must be prepared to accept those risks and accept them as a cost of operation and, obviously, pass them on in such a way as not to make these very costly mistakes.

Secondly, you know I come from this area, and I think one of the important ingredients is that we must respect our own country people--the farmers, the dispossessed who has no money and so on. The way he is treated is very, very important. We must have respect for him as a human being when he comes to the bank or you go to him. He is not just some nobody, you know, and he is not just begging, etc. It is very important that he be given proper treatment in your relationship to him and that you do not require that too many forms and things be filled out and take up a lot of time. If any forms have to be filled out and things like that, there should be your people to help the chap out and so on and to make him understand and things of that kind. That's all I have to say.

PHILIP COSTAS: I want, as part of the program committee, to thank each and every panelist and thank you very much. Mr. Heifner, the panel is closed.

CASE STUDIES

Experiences of Rural Electrification in Bangladesh
Mohammad Azizhar Ali

Agricultural End Uses of Electricity Case Studies
Mohammad Azizur Rahman

End Uses of Electricity—Agriculture
H.C. Virmani

Rural Electrification Agricultural End Use Case Study in Pakistan
Abdul Majid

Case Study of Sinar Rinjani Electric Cooperative (SREC)
Sjoufjan Awal

Productive Uses of Rural Electrification End Use Cases: Prospects and Problems—PLN's Experience
Dr. Aziz D. Pabaney

Small Rural Industries End Use Case Studies
Mohammad Ariff Bin Araff

Naawan Charcoal Making and Copra Drying Industry, Naawan, Misamis Oriental...
Melvin Eballe

End Use Case Studies, Thailand
Tienchai Sirikiratayanond

Small Hydro Development in Nepal
Pushpanath Sharma

Comparison of Electrified and Diesel Engine Drive Rice Hullers in Sri Lanka
C. Ratnayake and G. Upasiri

End Uses of Electricity in a Resettlement Colony
H.C. Virmani

Participant Discussion on Presentations of Individual Case Studies

EXPERIENCES OF RURAL ELECTRIFICATION IN BANGLADESH

Azhar Ali
Additional Secretary in Charge
Energy Division
Ministry of Energy

The experience of Bangladesh in electrification, and especially rural electrification, goes back to 1958. It started with the setting up of the then Water and Power Development Authority (WAPDA) of East Pakistan. This organization was established by an ordinance and started functioning in 1959. This ordinance speaks about rural electrification and electrification of the entire country in due course. Its objectives, benefits, and philosophy were laid out, after detailed deliberations, before the organization was set up. Many very interesting fields were introduced. In the 1960's we concentrated mainly on generation: all of our major power generation which is working now was either set up or planned in the 1960s. A lot of transmission also was constructed in much of the country. In the '60s, we had 54 towns, of which 21 were connected to the grid system transmission lines. So, we can say safely that the decade of the 1960s was mainly the decade of generation. Then came the decade of the 1970s. As most of you know, we fought the struggle of liberation in 1971, and a lot of these installations were damaged during the liberation war. A lot of power stations were damaged; a lot of them were destroyed. At many places there was no electricity after the liberation in 1972. So, 1972-1975 actually was a period of rehabilitation of electricity.

As of 1975, there was a massive expansion in transmission and distribution systems. We can call this decade of the 1970s the decade of transmission and distribution of electricity, and in this time we connected many rural areas, many villages, many marketplaces, many production centers with electricity.

In 1976, it was felt that the present power development board was expanding too much and a new organization was necessary for faster expansion in the rural areas for house connections in the villages. By 1976, we electrified about 380 rural towns with load centers. Then we found that we were on the verge of starting a massive electrification program for the benefit of economic development in the rural areas. So, we approached USAID in February 1976 to help us go further. And, we are especially thankful to Mr. Toner who was the Director of USAID at that time for giving us some help to introduce rural electrification programs. That led to the setting up of the present-day Rural Electrification Board. Four or five of our officers visited Manila in 1976—I think it was late March and early April. A symposium took place in Manila where there was disagreement about setting up an organization like the Filipino rural electrification organization. That is the historical background of electrification.

Now, electrification cannot go on alone, and it cannot be done--no work can be done--in isolation. There must be demand and supply. As I told you, the rural electrification programs went hand in hand with our other rural development programs after the introduction of International Rice Research Institute (IRRI-PADDY) in Bangladesh in 1966. IRRI-PADDY was introduced in the present Bangladesh in 1966, and created a new series of activities. Fertilization demand went up. You would be surprised to hear that up to 1966 we could sell only 100,000 tons of fertilizer. Up until 1964, we had about 250 power pumps, and they were located at Faridpur, Sylhet, Bhramburia, and Chittagong.

Now, as IRRI-PADDY was introduced in the rural areas, the demand for irrigation and fertilizer went up. And as demand for irrigation went up, the demand for electricity went up. So, these are all co-related things. We electrified a large number of deep tubewells, a large number of power pumps between 1967 and 1976. So, as you can see, rural electrification went hand in hand with other rural development measures. Now, during this period, we got very good support for rural development measures from USAID. USAID came forward for the rural development program in the mid 1950s. Based on the fine Ford program, they helped us to introduce the village aid program in the mid 1950s. AID means "Agricultural and Industrial Development" program. This continued until 1961. In the meantime, another new step was taken by USAID for the development of rural areas: the setting up of Union Seed Stores--seed and fertilizer stores. The construction of these union seed and fertilizer stores actually took rural development measures for the first time into the remote corners of the present Bangladesh. People directly got the benefit and started development activities in the rural areas for the first time. The brick and mortar building still exists, and it influences the attitude of the people towards economic development. These stores were also set up with the help of USAID, which continued between 1958 and 1961. Then, in 1962, another new step was taken by the government in cooperation with USAID, the establishment of a training and development center. A new rural development center was developed in 1962 in cooperation with USAID and the Harvard Group. I still remember Dick Patton, who used to give us the philosophical background for that project. He was a

great driving force, and in the present Bangladesh, wherever you go in the rural areas, you will see that in every nook and corner there is this type of building which has one long office building, two-storied, one auditorium, and a number of residential buildings. This rural development program is known as the Thana Training and Development Center.

And in the mid-1960s, along with this rural development program, USAID came forward to introduce two more things along with IRRI. The IRRI seeds were bought through the Ford Foundation and through the IRRI, and they were cultivated first by the Rural Development Academy in 1965-1966. But, for introduction of IRRI-PADDY, we needed fertilizer and irrigation, and, here again, USAID came to help Bangladesh.

And the last stage for rural development was rural electrification. Again, it was through USAID, and I already mentioned the name of Mr. Toner, who was so helpful. But I must say one thing, that after 1977, other aid-giving agencies were not very much convinced--except for those who gave us certain assistance for irrigation purposes in 1974-1975. And that was the first assistance for Bangladesh. The Asian Development Bank came into the energy sector in 1973 and helped us. That was the first aid commissioned by the Development Bank in the energy sector for the setting up of a power station at Bera Mara.

The World Bank came in the energy sector in 1978. Until then, they thought that this sector was not mature enough to receive their assistance.

Now, with this historical background, I shall say something about the institutional framework for your consideration of rural electrification.

I remember when the NRECA gentlemen sitting in the Manila hotel asked me, "Do you accept this program?" I said, "Exactly, I accept this program," the Filipino cooperative model which has been based on the NRECA model, I think. Now, in Bangladesh, these electrical cooperatives have been introduced and we are working with them for the last three or four years. But, cooperatives are not new in the history of Bangladesh. We started a cooperative, which is commonly known as the Raiffensien Cooperative, in 1904. That was followed by other cooperative acts. We had a Cooperative Act in 1948 for village cooperatives, and this Act was withdrawn in 1952. And, again, we go back to the village cooperative named after the Comilla Cooperative in 1962. Now, we are again practicing a new cooperative called an electrical cooperative. This is a controlled and guided cooperative. Various countries have had experiences with this type of cooperative and other types of cooperatives. How much has this type of cooperative offered the opportunity for voluntary participation of the rural people? This, perhaps, at this stage, may be given some thought for evaluation. And, based on international experience, perhaps, this may be discussed in some future program or symposium.

Today we are sitting here considering end-uses of electricity, and, as you can see, Bangladesh has felt a need for electricity. The need was felt there, and then the electricity came. It was not that electricity was given, then the need was felt. The need came with the introduction of IRRI-PADDY, with the introduction of fertilizer and irrigation--and electricity was provided. This need was not only there in the field of agriculture, it was also there in small industry. We had a small industries corporation set up in the mid-1960s. This was known at that time as East Pakistan Small and Cottage Industries Corp. (EPSCIC). They established various types of industries in rural areas, and electricity was, of course, given to those industries. Similarly, educational programs were undertaken. Night schools were started in many areas under the BAID program. Many of the rural areas around the subdivisional towns which have small diesel generators were electrified. In regard to health and quality of life, rural health centers were set up starting in 1958, and some of these health centers were electrified. It had the effect of modernization of life, and, at this moment, there is a very important demand for electricity because of the high price of kerosene. Kerosene is very expensive in the rural areas, and the people pay for electricity through kerosene. So, you can see that there is a need felt for rural electrification, but the main problem for electrification is the shortage of funds.

Bangladesh is now ready, both from the generation and distribution point of view, for a massive rural electrification program. We have 64,000 villages. We have about 100 million people—about 20 million households. So, from the generation and transmission point of view, Bangladesh is now ready for a massive rural electrification program. The electricity is now available, not very far from any place. But, what we need is funds, and those funds should be in the form of grants because rural electrification, like any other rural development measure, is not an economic program. Though it has other chain or snowball effects on the economy in the larger context. But, to start with, and especially in the present-day international market of high prices for all electrical facilities, loans are not adequate for massive rural electrification programs. So, funds should be given for rural electrification programs in the form of grants. And, again, in the present AID involvement, the grants also should not be only in the form of foreign exchange to buy goods. Some local currency for implementation of the development program through the rural electrification program will be necessary for the successful and effective implementation of any rural electrification program.

AGRICULTURAL END USES OF ELECTRICITY CASE STUDIES

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AGRICULTURAL END USES OF ELECTRICITY: CASE STUDIES IN RURAL ELECTRIC SOCIEITIES AREA OF BANGLADESH

CHAPTER I--INTRODUCTION

Bangladesh is predominantly an agricultural country with 85% of its population dependent on agriculture. Agriculture is the main sector of her economy; 55% of national income and 90% of export earnings come from agriculture. Rice, wheat, jute, potatoes, sugarcane, tobacco, oil seeds, and pulse are principal crops. The land of this country is very fertile, but average productivity is very low due to traditional farming practices. There is a constant imbalance of significant margin between the population and the food supply. The margin of the food deficit is still alarming. Average annual rainfall is 80 inches and 90% falls within the period from May to September. Therefore, the remaining period of the year is seriously hampered for growing crops due to shortage of soil moisture.

But the topography and the climate of this country are such that there is tremendous opportunity in most parts of the cultivable land to increase the cropping intensity and per unit yield, provided irrigation facilities are there. Chart I (on page 165) shows the present average yield and magnitude of increasing yield of the major crops if there is ensured irrigation of high yielding varieties and proper doses of fertilizers are applied. This scope for increasing yields has been experimented with and is well proven in the soil and climate of Bangladesh. The hard facts have rightly been understood by the Government. Government objectives have been focused on rural development, and top-most priority has been given to the field of agriculture, through which the objectives are aimed at:
(a) achieving food sufficiency, (b) creating employment opportunities, (c) improving the condition of the large rural population, and (d) increasing export earnings. Presently, the installed irrigation facilities from deep tubewell (DTW), shallow tubewell (STW) and low lift pumps (LLP) of Bangladesh Agriculture Development Corp. (BADC), Bangladesh Krishi Bank (BKB), and Bangladesh Water Development Board (BWDB) projects could reach 4.7 million acres but, due to underutilization, only cover about 2 million acres. Government development strategy for the agricultural sector during the second five-year plan (by 1985) aims at bringing a total of 7.2 million acres of land under irrigation through various agencies and various methods.

It is undoubtedly recognized by all that electricity is indispensible for the overall development of a country as 91% of the population of this country live in the rural area and as its economy is rural-based agriculture. Therefore, the Government of Bangladesh has also launched a Rural Electrification Program, forming a Rural Electrification Board (REB) which started functioning in January 1978. The Bangladesh REB made the decision that the productive uses of electricity would be a focal point of rural electrification. In doing so, the REB created the Member Service and Power Use Section under REB's Management Operation Directorate, and at each Rural Electric Society (RES) a Member Services and Power Use Department headed by an agricultural engineer exists with a view to assist consumers to use electricity in productive agricultural fields. REB's Member Services and Power Use Section is rendering service in an advisory capacity to the RESs for implementing the productive Power Use Program.

CHAPTER II--APPROACH FOR PRODUCTIVE USES OF AGRICULTURE

Electrifying the irrigation pumps

An electrified irrigation system gives less trouble, is easier to repair, and cheaper than a diesel system. The hourly cost basis of electricity and diesel for operation of different pumps is shown on the STW table on page 165.

Besides this, the installation and maintenance cost of an electric irrigation pump is considerably less than diesel and its life expectancy is at least 1.5 times more than

diesel. Therefore, the Government has taken the decision to convert existing DTW and LLP from diesel to electric in electrified areas. In Bangladesh, about 8,000 irrigation pumps have been electrified. The progress of electrification of irrigation pumps, along with other statistical information, is shown on Chart II on page 166.

Transfer of technological know-how

From research stations to the farmers' level, transferring technological know-how is done by the REB and RES contacting the research organizations and the agricultural extension department to attend a coordination meeting occasionally and training village advisors. From each electrified village one person is selected and trained who is called a "village advisor." Through him, all information is disseminated to all villagers of an electrified area.

Training program for achievement of the program

Proper and effective training have been given to the following official and nonofficial persons who are contributing a vital role for agricultural development:

1. AGM (MS) and his departmental staff
2. RES--Directors
3. Elaka Advisors
4. Village Advisors
5. Village Electricians.

For number trained see Chart III on page 167.

Credit facilities

Coordination meetings among REB/RES, the BKB, and other commercial banks are held to arrange financing for RES consumers wishing to buy electrical equipment and appliances.

Equipment and appliances

To make available equipment and appliances both effective and of suitable size, REB and RES Member Service and Power Use Divisions are contacting local manufacturers to manufacture the equipment and appliances according to the needs of RES consumers; e.g., single phase, 5 hp motors have been manufactured for the first time in Bangladesh by GEC to use the single phase power lines of RES. They are contacting manufacturers and banks to engage their dealers to work in RES areas. RES also has ensured prompt service by giving power connections and encouraging the consumers to use their dealers' services for economic benefit, e.g., GEC's Khanelin motor manufacturing company in Bangladesh for manufacturing electric motors and the ISGA agent of BKB and GEC for installing electric STWs in RES areas.

Agro-based industry

To give the benefit of electricity to every village within an electrified area, the REB and RES Power Use Divisions have been encouraging consumers to install small agro-based industries at each village, e.g., baby rice, flower, oil, pulse, and spice grinders, which can be operated by a 5 hp, single phase motor maximum. The REB has successfully introduced these mills in RES areas. Some agro-based industries which are already set up and connected for two years of RES energization which have a great impact directly for agricultural production are:

- o Cold storge
- o Poultry farm
- o Rice mill
- o Flour mill
- o Oil mill
- o Paddy dryer
- o Cane crusher
- o Sawmill
- o Small workshop supporting the repair of agricultural machinery, etc.

The REB's Member Service and Power Use Division is planning to motivate consumers to start backyard poultry, kitchen gardening, and minipond fish farming. Main problems before electrification were vaccination of poultry, artificial hatching and brooding. Installation of electrified fractional motor pumps for water supplies for domestic, fish ponds, and kitchen gardens will be insured at a minimum cost.

CHAPTER III--CONSTRAINTS

1. Lack of availability of appliances and equipment
2. Unreliability of electricity supply
3. Insufficient credit facilities
4. Lack of technological know-how at farmers' level
5. Lack of entrepreneurial ability of farmers
6. Lack of availability of inputs
7. Brain drain from rural to urban areas
8. Very high cost of appliances and equipment.

Our task is to provide guidelines to draw the greatest benefit from our existing resources by making efficient use of all renewable and nonrenewable capital. Isolated measures will mutually reinforce radical efforts and speedier reforms. Therefore, I also express my agreement with Mr. Thomas Niblock's approach of coordination, integration, and hands off.

CHAPTER IV--RECOMMENDATIONS

Aid-giving agencies/donor countries may come forward with investment proposals for rural areas where electricity has been provided. This will help in activating the economies of the areas and solve many problems, including unemployment among rural youth, food, education, health, etc. Financing may be provided preferably in small and cottage industries, where investment for the creation of new jobs is much less. Investment in big automatic rice mills and other similar

mills which may throw the rural women and men out of jobs should be discouraged.

Timer switches may be introduced in order to have better load factors.

Import duties, customs, and sales tax imposed on the raw materials used by General Electric Company Ltd., Chittagong, Bangladesh, should be withdrawn to encourage the use of locally manufactured motors, electric equipment, and materials.

Collaboration with foreign manufacturers by local manufacturers may be allowed to secure technological know-how.

A separate Power Use Research and Development Directorate should be created in the REB to cope with the growing requirement of power use research and development in the country.

Study load growth and plan accordingly for generation.

CHART I: Yield variation between traditional farming and improved farming practices

Name of the crop	Cropped area in hectares	Average yield (tons) per hectare for traditional practices with local variety	Average yield (tons) per hectare for improved farming practices with high yielding variety	Percent of increased yield
Rice	10,36,86,27	1.30	6.00	462
Wheat	5,9,11,98	1.75	3.46	198
Jute	6,34,850	1.46	3.12	214
Potato	1,02,124	9.60	21.21	221
Sugercane	1,48,769	45.00	101.42	225
Mustard	2,62,447	0.62	1.50	242
Pulse (Musur)	3,31,591	0.64	1.25	195
Tobacco	51,386	0.91	1.17	129
Cotton	7,598	0.46	1.15	250

STW — Electrical Cost

STW--Electric cost	Tk 3/hr	Area coverage 15-20 acres/season
STW--Diesel cost	Tk 8/hr	Area coverage 12-15 acres/season
LLP--Electric cost	Tk 7-8/hr	Area coverage 45-60 acres/season
LLP--Diesel cost	Tk 19/hr	Area coverage 40-50 acres/season
DTW--Electric cost	Tk 13-14/hr	Area coverage 65-80 acres/season
DTW--Diesel cost	Tk 25/hr	Area coverage 45-60 acres/season

CHART II: Statistics of rural electrification under Rural Electric Societies up to October 1982

Name of RES	Date of energization	Miles energized	Service connected: Domestic & commercial	DTW	Irrigation STW	LLP	Ind.	St. Lt.	Total per mile	Total Facilities created per mile
Dhaka-I	2.6.80	385.00	7749	92	21	112	205	81	8260 (21.45)	11482 (29.82)
Tangail-I	19.10.81	107.66	1802	22	9	2	42	4	1881 (17.47)	5328 (49.48)
Comilla-I	1.1.81	373.04	6080	21	8	22	5	33	6177 (16.55)	15309 (41.03)
Comilla-II	13.12.81	103.39	1384	3	—	17	7	4	1514	5567
Sylhet-I	12.10.82	40.00	560	—	—	—	3	4	567 (14.18)	1195 (29.88)
Sylhet-II	25.06.81	159.20	2088	—	3	2	12	17	2097 (13.17)	7426 (46.67)
Jessore-I	29.06.81	197.00	1879	28	19	10	26	14	1976 (10.03)	7719 (39.18)
Jessore-II	02.02.81	179.00	3424	4	17	3	47	81	3575 (9.43)	12153 (32.06)
Pabna-I	—	—	—	—	—	—	—	—	—	—
Pabna-II	—	98.00	995	—	2	—	47	7	1051 (10.72)	2947 (30.07)
Pabna-III	14.04.81	296.86	3996	9	32	67	62	62	4428 (14.91)	6951 (23.41)
Rajshahi-I	14.03.81	291.50	3112	2	6	27	55	33	3235 (11.09)	7019 (24.07)
Rajshahi-II	03.06.82	175.76	2741	3	2	1	64	33	2840 (15.16)	3897 (22.17)
TOTAL		2606.41	35810	184	119	263	575	373	37502	86993

CHART III: Villages Electrified, Village Electricians Trained and Village Advisors Trained

Total villages electrified	Village electricians trained	Village advisors trained	Total employees
650 (203)	201	148	58
665 (60)	66	31	42
1188 (172)	255	53	57
873	67	20	38
1216 (27)	98	20	39
842 (72)	121	50	50
613 (102)	99	75	56
503 (153)	107	80	53
398	74	—	30
674 (43)	39	20	39
640 (102)	142	214	53
825 (136)	175	50	44
606 (1213)	128	40	47
9693 (1213)	1672	801	606

END USES OF ELECTRICITY—AGRICULTURE

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We in India analyze the response to electrification in different sectors for three reasons:

1. To identify "successfully" electrified villages

2. To provide an empirical basis for forecasting exercises and to provide an understanding of take-off periods and rates of growth over the years. This is particularly important since past evidence indicates that targets set by state electricity boards have often been in wide variation with projects realized.

3. To provide an indication to SEBs of the tradeoffs between an intensive versus an extensive strategy of electrification.

Here I intend to give the findings and results of an analysis relating to response patterns over 20 years for the agricultural sector. The analysis is based on primary data collected from nearly 100 electrified villages in four states.

The major findings are:

- o During the first 19 years of electrification, average agricultural connections per village per year worked out to be 1.21.

- o A five-year average of connections per village per year of the pooled sample works out to be an average of 1.16 in the first five years, 1.0 in the second five years, 1.41 in the third five years, and 1.27 in the last five years.

Given the above results, we tested one more hypothesized patterns for a steep change in average annual agricultural response between the first and second decades after electrification. The logic behind this assumption is that, at the village level, electrification, just as any other agricultural input, would take about a decade or so to be fully accepted, especially since it represents a capital investment for the farmer. Further, in most cases, the installation of an electric pumpset entails shifting from (and, therefore, dismantling or selling) an already used mode of irrigation; the farmer may be somewhat reluctant to do so unless his existing mode of irrigation gets depreciated, or it may be highly uneconomical from the point of view of utility.

The hypothesis was rejected, with some qualification. We, therefore, derived a qualified conclusion that there does appear to be the effect of a steep change over a decade since electrification.

The expected number of cumulative agricultural connections in an average sample village in India, at the end of certain typical years, would be as follows:

End of year 0	-	1.08
End of year 5	-	5.40
End of year 10	-	12.14
End of year 15	-	18.84
End of year 18	-	22.86

The analysis, however, confirmed the earlier findings that availability of electricity leads to water availability for irrigation. The process through which impact is manifested are linked together through a causal sequence.

- o Changes in sources of irrigation
  - Decline in the use of tanks (reservoirs) and rivers
  - Increase in the use of dugwells and tubewells.
- o Changes in modes of irrigation
  - Availability of electricity leads to energization of previously nonenergized wells
  - MSU (1977) — Half of these were energized only because of the availability of electricity.
  - SIET (1977) — New wells dug and energized comprised one-third of all electrified wells, suggesting that there has been a significant increase in the numbers of both sources and modes consequent to rural electrification.

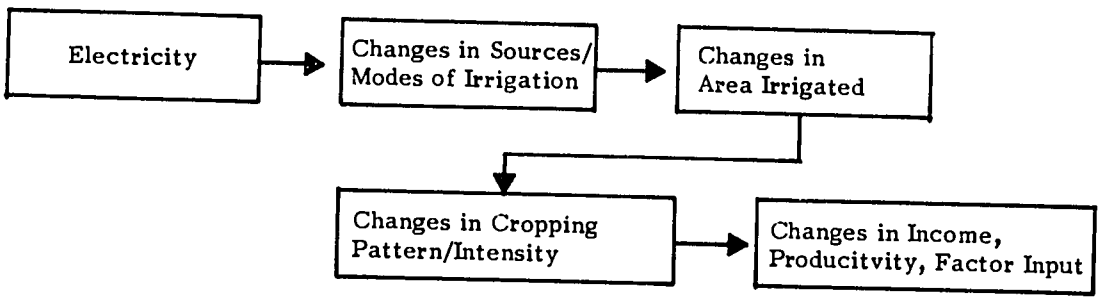
- o Changes in irrigated area
  - The analysis reported a general increase in irrigated area as a result of electricity reaching farms. The increase worked out to between 30-80%.
  - ORG SIET NCEAR PEO*
- o Changes in cropping intensity--All studies said this has happened.
- o Changes in cropping pattern--A marked shift towards cultivation of wet and highly remunerative crops has been reported.
- o Changes in production and income--Additional income per crop per year realized by pumpset users was found to be Rs 5,560 per pumpset and Rs 237 per person per acre. SIET reported a 78% increase in gross income from energization of old wells and 182% due to energization of new wells.
- o Changes in factors of production
  - A major part of the evidence relating to changes in factors of production relates to farm employment and use of draft animal power. The impact produced:

    1. A switchover to electrical pumpsets which resulted in a reduction in farm employment needed for lifting water
    2. The increase in irrigated area required higher human and animal labor inputs.

*PEO reported increase in the overall net irrigated area on the order of 203% consequent to rural electrification.

The overall net effect on employment and animal labor will be the sum of the two effects.

- A release of 17% of human labor due to electrification was reported. In the case of bullock labor, 53% of the respondents to the survey reported a release in use, and the average bullock days released per month per user was found to be 36 days. However, 94% of them said that the saved time was fully utilized for other purposes, while 5% sold their bullocks.



RURAL ELECTRIFICATION AGRICULTURAL END USE CASE STUDY IN PAKISTAN

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CONSUMERS IN WAPDA SYSTEM

In Pakistan two state organizations, namely the Pakistan Water and Power Development Authority (WAPDA) and Karachi Electric Supply Company (KESC), are responsible for power generation, transmission, and distribution. Whereas KESC operations are limited to Karachi city and suburban areas, WAPDA's jurisdiction covers the rest of the country. By the end of June 1982, WAPDA had about 3.6 million consumers connected in the system. Of these, about 2.7 million (75%) are domestic consumers, about 0.6 million (16%) commercial consumers, about 0.1 million (3%) industrial consumers, and 0.1 million (3%) are public lighting, bulk supply, and electric traction consumers.

PATTERN OF CONSUMPTION

The domestic and commercial consumers account for about 25% of total energy consumption. The share of industrial and agricultural consumers in the total consumption is about 38% and 24%, respectively. The consumption of the other categories of consumers constitutes about 13% of the total. Thus, from the energy consumption point of view, agricultural and industrial consumers account for about 62% of the total consumption, while the number of these consumers is only 6% of the total number of connections.

TUBEWELLS FOR IRRIGATION

So far, out of a total of about 43,300 villages in Pakistan, about 13,000 (30%) have been electrified. Of the total number of 0.1 million industrial consumers, only a very small number is to be found in the villages as village industry consists of single motor driven flour machines, oil expellers, rice husking units, cotton machines, etc. On an average, about one or two small industries are to be found in a village. The rural economy is, however, entirely dependent on agriculture and in most of the areas there is need for installation of tubewells. At present, there are, on an average, about eight to nine electric tubewells per electrified village. In the Province of Punjab, which has about two-thirds of the entire population of the country, nearly 73% of all the irrigation tubewells are to be found. Nearly 25% of the tubewells are to be found in the Provinces of Sind and NWFP, and only 2% of the tubewells have been installed in the Province of Baluchistan.

In Punjab Province, about 190,000 tubewells are estimated to have been installed by the middle of 1982. However, nearly 60% of these tubewells are still diesel operated and are a cause of a major economic burden to the farmers in terms of higher investment an operation and maintenance costs as compared to electric tubewells. These tubewells also account for high consumption of diesel and mobile oil, which is a burden on the importation of fuel into the country. In an effort to bring more economic benefits to the rural population, the Government of Pakistan is putting a great deal of emphasis on rural electrification, and the number of villages to be electrified has been increased from 1,000 to 3,000 per year. The number of tubewells to be electrified is also expected to be increased from the present target of about 6,000 to nearly double this number.

CASE STUDY OF A TUBEWELL FOR IRRIGATION

To illustrate the level of benefits achieved by the farmers from conversion of diesel tubewells to electricity, a case study of a typical tubewell for irrigation, to be found in most of the canal command areas in the province of Punjab, was carried out. The results from this analysis are given in Tables 1 to 5.

Operation time

A farmer who owns about 20 acres of cultivable land in the Punjab normally cultivates 10 acres of wheat, 10 acres of rice, 1 acre of cotton, 4 acres of fodder, 4 acres of sugarcane, and 1 acre for other crops over the autumn and spring seasons. The wheat and cotton crops require about four waterings to mature. Rice and sugarcane require about 16 and 20 waterings, respectively. The average number of waterings for autumn and spring fodder is ten and other crops require about two waterings. The average time per watering for different crops is about 3-4 hours. Based on these data, the estimated time of operation of the tubewell (Table 1) is about 1,100 hours per year.

TABLE 1: Estimation of operation time of a typical tubewell for irrigation in Punjab, Pakistan

Crop	Irrigated area acre*	No. Waterings Per acre	Total	Hours/ watering	Operation time in hours
Wheat	10	4	40	4	160
Rice	10	16	160	3	480
Cotton	1	4	4	3	12
Sugarcane	4	20	80	4	320
Fodder	4	10	40	3	120
Other	1	2	2	3	6
TOTAL	30				1098
				Say	1100

*Size of land holding = 20 acres.

Capital investment cost

To irrigate about 20 acres of land in both seasons, the average farmer would install a 22 hp diesel engine or a 15 hp electric motor as the efficiency of the electric motor is much higher. The cost of the diesel engine per horsepower is about $104 as compared to the cost of $32 per horsepower of the electric motor. The cost of the other installations in the case of the electric tubewell is about $100 less as compared to the diesel case. For the electric case, the farmer also saves about $400 as compared to the diesel case as the building for the diesel engine takes more space. The total cost of installation (Table 2) for the diesel and electric cases is about $4,488 and $2,180, respectively. Thus, the overall savings in the electric case is about $2,200.

TABLE 2. Capital investment cost of diesel and electric tubewells, 1982

Description	Cost* Diesel**	Electric***
Engine/motor	2,288	480
Other installation	1,000	900
Building cost	1,200	800
TOTAL	4,488	2,180

* $1 = 12.50 Rs

** 22 hp

*** 15 hp

Cost of fuel and electricity

For the same time of operation (Table 3), the cost of fuel in the diesel case is about $1,163 per annum as against the electricity cost of about $538. Thus, the farmer who converts to electric operation is saving about $625 in fuel costs alone.

TABLE 3: Comparison of fuel and electricity costs of diesel and electric tubewells

Description	Diesel	Electric
Diesel consumption--drums 1/	15.3	—
Mobil oil consumption--gallons 2/	61.2	—
Electricity consumption--kWh	—	12,320
Cost of fuel/electricity		
a. Diesel 4/	918	—
b. Mobile oil 5/	244.8	—
c. Electricity fixed charges 6/	—	204.3
d. Electricity energy charges 7/	—	333.9
e. Total cost	1162.8	538.2

1/ 1.50 hours/gallon. One drum consists of 48 gallons.

2/ 4 gallons per drum of diesel

3/ 11.2 kW for 1,100 hours

4/ $60 per drum

5/ $4 per gallon

6/ $18.24 per kW per year

7/ $0.0271 per kWh

Total annual cost of operation

The annual recovery cost of capital for a tubewell is assessed at about 15% of the capital investment cost,

which in the diesel and electric cases is about $673 and $327, respectively. To run the diesel tubewell the farmer has to pay the wages of an operator and mechanic, whereas in the electric case a part-time operation is adequate. The total cost of wages for the diesel and electric tubewells is estimated at about $576 and $192, respectively. The diesel tubewell has a higher operation and maintenance cost, which is estimated to be about $120 as against $40 for the electric tubewell. The total annual costs for the diesel and electric case are estimated at about $2,532 and $1,097, respectively (Table 4).

TABLE 4: Cost comparison of annual costs of operation and maintenance

Description	Cost, $ Diesel	Electric
Annual cost of capital*	673.2	327.0
Fuel/electricity cost	1162.8	538.2
Wages**	576.0	192.0
Repair and maintenance	120.0	40.0
Total	2532.0	1097.2

* 15% of capital cost

** Operator wages = $384; mechanic = $192

Net benefit of electricity

In the Province of Punjab, the rate of sale of water from tubewells is about $1 per hour. Thus, the net sale value of water (Table 5) is about $1,100. Against this sale, the diesel tubewell shows a loss of $1,432, whereas in the case of the electric tubewell there is an insignificant gain. However, as compared to the diesel tubewell, the net benefit of electricity is about $1,435, which is about 270% of the annual electricity bill. Thus, conversion of a diesel tubewell to electricity is a cause of major economic benefit to the farmer.

TABLE 5: Net benefit of electric tubewell as percentage of annual electricity bill

Description	Value, $
Annual value of water*	1100
Net benefit from	
a. Diesel tubewell	-1432
b. Electric tubewell	+2.8
Net benefit of electricity	1434.8
Benefit of electricity as percentage of annual electricity bill	267%

* $1 per hour

Indirect economic benefits

Apart from direct cost savings, the electric tubewell offers the farmer much better availability of water at a moments notice, less time lost due to unexpected repairs, especially during critical times of irrigation, clean and easy operation, and potential for irrigating more acreage at a much lesser cost. Because of the lower cost of capital investment, more farmers can install electric tubewells. Irrigated agriculture can also come within the reach of the farmers having small landholdings wh can install small horsepower motors.

CONCLUSIONS

As compared to diesel-operated tubewells, the electric tubewells offer considerable benefits in terms of savings in capital investment cost, fuel cost, wages, and operation and maintenance costs. Although, in the case study presented in this paper, the net benefit of electricity is about 270% of the electricity bill, the benefits of electric tubewells are on the order of 400-600% in many other areas where the cropping pattern requires a higher number of waterings per acre which results in longer operation time.

CASE STUDY OF SINAR RINJANI ELECTRIC COOPERATIVE (SREC), EAST LOMBOK, INDONESIA

Sjoufjan Awal, Chief, Rural Electrification Project Development Office, Department of Trade and Cooperatives, Indonesia

THE SITUATION, CALENDAR YEAR 1980

The Sinar Rinjani Electric Cooperative (SREC) rural electrification project had passed the feasibility study test, loan fund arrangements had been completed, and an organization had been developed to construct, operate, and maintain SREC. The service area of SREC is densely populated, and engineering studies revealed that a 200-km electrical distribution system (primary and secondary line total) could reach 15,000 consumers.

With a relatively high density (75 consumers per kilometer) and, conversely, a relatively low investment per consumer connection, it seemed apparent to all parties concerned that SREC would be a financially viable project. Aside from project financial considerations, SREC would provide electric service in an area where inhabitants had never enjoyed the benefits of central station electric service; thus, social and economic benefits for consumers were major considerations.

When it became apparent that the material/ equipment procurement process for international bidding was a time-consuming activity, and project implementation would span a two- or three-year period, SREC management and controlling agencies decided on an interim step. It was agreed that a demonstration rural electrification (demo RE) system would be installed which could provide electric service to 10-15% if the potential consumers.

The benefits expected from the demo RE system were: providing electric service to segments of the SREC service area at an early date; obtaining consumer-acceptance statistics (actual consumer connections as a percentage of total potential); obtaining kWh consumption data; and maintaining credibility in the SREC service area.

The demo RE system was installed and became operational in the last half of 1980. Power supply for this electrical system was from relatively small 100 kW gen-sets which were operated from dusk to dawn, approximately 12-hour service.

EVENTS IN 1981

Decisionmaking

Management of SREC became aware that "productive use" of electricity could not be developed in their demo RE project if electric service was available only 12 hours per day. They studied the benefits versus detrimental aspects, which are listed as follows:

Beneficial aspects

- o With 24-hour electric service, cottage industries and small commercial loads may develop.
- o Consumers throughout the service area would become confident that SREC could and would supply efficient electric service without use limitations.
- o Revenues from kWh sales should increase.

Detrimental aspects

- o Initially, 24-hour service would be very costly. A considerable amount of diesel fuel would be consumed, and labor costs would increase.
- o Engine maintenance costs would also rise when service hours doubled.
- o The SREC staff was small in number. They did not have "productive use specialists" or anyone on their staff knowledgeable in this field.
- o The additional revenue to be expected from 24-hour service may be insufficient to pay the salaries of additional personnel. The revenue would also be insufficient to establish a loan program for assisting members in electric appliance/equipment procurement.

After an in-depth study of the above listed pro's and con's, SREC management decided to begin providing 24-hour service.

Effects

At the time 24-hour service began, approximately 1,300 consumers were connected to the electrical distribution system, and the evening peak load was about 200 kW.

The daytime load, during initial months of 24-hour operation, was only 10% of the peak load, and most of this resulted in system losses (transformer and line losses).

As expected, operating expenses increased substantially. Monthly fuel costs rose nearly 40%; power plant labor costs increased by more than 30%; and power plant equipment maintenance costs more than doubled. Generating costs per kWh delivered rose from (US) 0.05 cents to (US) 0.08 cents.

Action

In an effort to build off-peak (daytime) load and to increase generation efficiency, SREC took the following actions:

- o Opened a small retail store to sell electrical wiring material/equipment and small appliances. Because available funding for this enterprise was limited to the Rupiah equivalent of US $8,000, electrical equipment for small industries (three-phase electric motors and associated control equipment) was not included. SREC financed small appliance procurement for consumers through soft loans.

- o Began contact with existing small industries which were presently using other power sources in their business activity. One such industry was a rice mill located about 200 meters from the SREC power plant. A diesel engine was in use at this location, performing a function that could be performed by electric motors, possibly 25 hp total. Operations at the rice mill were ideal for daytime (off peak) use of electric service.

- o Kept a watchful-eye for potential electric loads that were developing in the demo RE service area. One potential connection was a pumping load for a village water system evidenced by the fact that ditches were being dug within the demo RE service area (for laying water pipe in a central water system). This type of electric load would be used during daytime hours.

Obstacles

Proper business management of the SREC electric store posed a problem. Since electrical materials/equipment were "new" in the SREC service area, inexperienced sales personnel were relied upon to sell and handle financing arrangements.

The owner of the rice mill raised some questions that were difficult for SREC staff to answer:

- o What are the electrical equipment requirements to convert to electricity?

- o Where can these items be obtained and how much will they cost?

- o Is financing available through the SREC, the supplier, or from another source?

- o How much will the monthly electric bill total?

- o Will SREC provide technical assistance for the conversion to electricity?

The installations of the village water system progressed. Workmen who were contacted by SREC staff could not provide information on plans for a power source for water pumping.

THE SITUATION, 1982

SREC expanded their distribution system and have now reached their horizontal expansion goal of 2,000 consumer connections in the demo RE area.

The SREC power plant is now loaded to capacity during peak-load periods. Unfortunately, although a sizeable number of consumers did put their electric service to use for productive uses, THE DAYTIME LOAD remains at approximaely 10% of the evening peak. Off-peak vertical load growth, of any significance, has not occurred.

Power costs per kWh delivered in the demo RE area are now (US) 0.12 cents, as compared to (US) 0.08 cents when SREC began providing 24-hour electric service. (This 50% increase is due almost entirely to increased engine maintenance costs, since the figures above are adjusted to the same fuel price level.)

The SREC electric appliance store is in financial trouble. Loans that were extended to consumers for appliance procurement are not being repaid on schedule. Cash turnover is insufficient to sustain adequate restocking of appliances.

The rice mill continues its daily operation, using its own diesel engine. (It has not availed itself of SREC electric service.)

The village water system (financed by a government agency) is in full operation, using their own electric generators. (They did not request SREC electric service.)

Construction materials/equipment for the main distribution system are arriving at SREC in large quantities. Permanent headquarters facilities are under construction. Planning is in progress for construction of an extensive distribution system, with construction scheduled to begin in the first quarter of 1983. Design of the permanent power plant is in progress, and generating equipment is being ordered.

Management and staff of SREC are now "very busy" in the activities listed above. Operating problems in the demo RE system receive little attention. Meanwhile, vertical load growth is at a standstill; the rice mill (and other potential conversion loads) remain unserved; and potential electric loads like the village water system are of little apparent interest to the busy SREC staff.

GENERAL QUESTIONS FOR CONSIDERATION ARISING OUT OF A PROJECT SUCH AS THE SREC

Questions of a fundamental nature

- o Was the demo RE system a worthwhile venture, considering that construction of the main distribution system and permanent generating plant would begin within 3 years after construction start of the demo RE system?
- o Considering all factors, was it necessary to provide 24-hour service?
- o Considering that the demo RE system was an "interim project," was promotion of "productive uses of electricity" necessary?

Specific questions

The SREC organization

- o Which comes first: staffing a productive use department to assure that consumers utilize electric service productively or productive use installations which will increase income to fund a productive use staff, to be employed at a later date?
- o What was SREC's responsibility in the proposed conversion of the RICE MILL for electrical operation?
  - In the determination of electrical equipment requirements and cost?
  - In assisting with financing electrical equipment procurement?
  - In estimating monthly energy billing?
  - In providing technical assistance for the conversion?
  - Should SREC supply all distribution system equipment, including a three-phase transformer bank and metering?
- o Was it SREC's responsibility to contact the key people responsible for the village water system installation regarding power supply?
- o Was the electric appliance store beneficial to productive use promotion when considering the following:
  - Small capitalization ($8,000)
  - Inexperienced management
  - Undesirable results in the appliance loan program.

PRODUCTIVE USES OF RURAL ELECTRIFICATION END USE CASES: PROSPECTS AND PROBLEMS—PLN'S EXPERIENCE

Dr. Aziz D. Pabaney, Productive Uses Advisor to the PLN, Jakarta, Indonesia

PLN is a state electricity corporation with a mandate to provide electricity to the whole country in both urban and rural areas. Having to cover large territories, it has a considerable choice in selecting areas, especially for rural electrification, subject, of course, to the demands made upon it from the national, provincial, and local governments.

On occasions, strong local governments have been able to secure rural electrification for their areas, with their own specific conditions and support, and PLN has responded to such demands. Special mention may be made of East Java and some in Central Java, besides others.

Since this session is concerned with cases of end users, PLN's limited experience and some study of the productive uses of rural electrification in the case of kabupaten Klaten, in Central Java, is presented here. There are many problems still unresolved and we seek your valued comments and suggestions.

Kabupaten Klaten is one of the most densely populated districts in Indonesia, with over 2,000 persons per sq. km. It is located between the trading centers of Solo and Yogyakarta in Central Java. Much of the land is fertile, but ownership is highly fragmented with about 1/3 of the population landless. Agricultural productivity is high and the district of Klaten has over 3,000 rural homes; small industries of 50 different kinds ranging from rudimentary roof tiles and batik to iron foundries and machinery, power looms, and garments.

An organized and systematic effort at rural electrification was started as a joint venture between USAID and PLN in 1978. Here 98 villages are to be electrified in the area north of the Yogya-Solo highway.

EARLY EXPERIENCES OF RURAL ELECTRIFICATION SINCE 1965 IN KLATEN

Strong local demand brought PLN electricity to the kecamatans (subdistricts) of Ceper, Pedan, and Wedi. They are known for their foundry industries, the hand and power looms, and garments, respectively.

While not all industries in these areas were electrified, those that were expanded considerably with the result that the 1,000 kva substation at Ceper is overloaded and experiences voltage fluctuations. Thus, one finds power loom factories that use part electricity and part diesel as there is an insufficient supply of power. Several have plans for expansion and await additional electric power, as in the case of Kusuma Textil which has 37.5 kva from PLN (6 kv line) and two diesel generators. Pak Wahyu, the owner, has plans for expansion which are definite. He needs 70 kva at present and perhaps 100 kva if the textile market improves. They produce coarse cloth.

In the subdistrict of Wedi, SONY, a garment enterprise, is well known. Pak Suharno and his wife (who does the marketing) are natives of Wedi and employ ten workers who are skilled. Electricity has made this necessary as they use electric scissors, electric seamers, especially for heavier coats and jackets, and an electric press-iron. Much of their sewing is done in 60 surrounding households. In all, therefore, they provide employment for over 70 persons in production and, perhaps, another 20 in sales.

JOINT PLN-USAID RURAL ELECTRIFICATION PROJECT IN KLATEN

The joint PLN-USAID rural electrification project of 98 villages may be considered in two phases. In the first phase, three villages were electrified in 1979 as a pilot project with two years' experience, and the second phase began as a crash program where 23 villages got electricity by June/July 1982.

The three desas electrified in 1979 are near the town center of Klaten and are relatively prosperous villages. In about 8 months' time, 85% of the households had electric connections. A recent survey* indicated that productive uses were particularly enhanced in the three villages as follows:

- Nearly half of the electrified businesses reported use of electric lighting to enable them to "do more work" than they did prior to electrification.
- Sixteen percent of the electrified businesses reported used PLN electricity to operate equipment or tools used in production.
- Electrification enabled 31% of the electrified business to increase the level of their production, sales, or service. Thirty-two percent of the businesses reported increased hours of operation due to electrification and 22% reported increased income due to electrification.

- Twenty-eight percent of the electrified businesses felt that they could make greater effective use of PLN electricity in the future. The major reason cited for not currently doing so was lack of money or capital.

- About one-quarter of the households in the study villages had home businesses. Over half of these households use electric lighting for "doing more work" than they did prior to electrification, and about 12% used electricity for equipment or tools used for production.

- More than one-third of the nonelectrified households with home businesses in all four villages felt that they could make productive use of electricity in their home businesses.

*Klaten Area Surveys, International Statistical Programs Center, Burea of Census, Washington, DC, August 1981.

Two cases of enterprises that have benefited from electrification of the three villages over the last two years are described below.

Yuhana Konpeksi (garment enterprise in desa Gedaren)

Ibu Yuhana, a woman entrepreneur, started as a self-employed tailor in 1968. By 1978 she employed 12 workers and had plans for expansion. The coming of electricity and a Bank loan, especially for small-scale industries, made this possible.*

The bank loan helped build a shed that houses 40 seamstresses, cutters, designers, etc. She has an electric supply of 2,600 W. Most of her machines are electrified.

Motor Workshop, Mbangun Dadi, Desa Gedaren

Klaten has undergone, more or less, a revolution in transport in the past 3-5 years. The largest growth has been in cycle and motor car workshops that have proliferated in the countryside. A large growth in truck transport has necessitated services, especially for diesel trucks.

The coming of electricity has enabled these workshops to run a compressor, spray wash cars, electric welding, hydraulic lifts, and a test injection pump for diesel engine testing, all using electricity. Most other workshops use electric spray painting, grinders, etc.

SOME RECENT EXPERIENCES

While shortage of materials has made it difficult to electrify all the 98 desas in the PLN/USAID area of Klaten, a crash program helped bring electricity to 23 villages by June/July of 1982.

Since the original emphasis of the program was on household connections, the productive use aspects had to be surveyed afresh. Recommendations were made by the Productive Uses Program (PUP) for providing electricity to these locations and industries on a priority basis. Lift irrigation sites were also included.

*Bank Indonesia has initiated the KIK/KMKP Program for loans to small industries. KIK refers to Investment Credit up to Rp 10 million ($15,000) repayable in 6-10 years at 10.5% interest. KMKP is Permanent Working Capital up to Rp 10 million at 12% and 3 years to pay.

Lessons from the Crash Program indicate that:

- Any delay in providing electricity to industries in need was likely to get them to opt for diesel power--the RE system thereby losing good clients for 10 or more years. This often happens in Klaten.

- Again, without productive uses as a high priority, it is likely to result in the omission of some of the more productive villages.

- Main feeders may get built on one side of the village, while the productive uses units may line on the other side.

- Thinking is emerging in PLN that, in case of shortage of materials, the productive uses must get priority and that the main feeders should be built close to productive units in the villages.

The value of electricity meeting the needs of rural industries is evident in recent initiatives in Klaten. As noted earlier, the PUP had predicted a doubling of the daytime loads if new lines and additional power were made available to replace the old 6 kv lines. It has taken a full 18 months to get various parties concerned to respond to this need and they have responded. This has advanced the calender for connection in these areas by about 2 years.

Some of the results have been far beyond expectations. From the village of Batur Jaya, known for its village foundries, have come two applications from pribumi entrepreneurs, who want to develop electric furnaces for high-quality steel castings. Al Hadji Bilal has asked for 1,100 kva and Pak Santoso, along with the local cooperative enterprise, a connection for 865 kva. Both factories are under construction as this report is being presented. In addition, in the village of Sidhowayah, located in the USAID-supported area, the power looms will also get electricity earlier to replace their old and noisy diesel generators.

SOME CONCLUSIONS

In several developing societies where the spread of rural electrification has been minimal, as in Indonesia, it seems advisable first of all to get rural electrification to reach those areas and enterprises where it is needed

most so as to help accelerate the development process. Rural electrification then becomes a part of the national development effort.

Our experience indicates that locating existing enterprises and locating potentials for productive uses growth in the rural areas, and taking electricity to them adequately and at a price they can afford, may be one of the better ways to accelerate the process of growth and development in rural societies. Besides, such an approach would help the entrepreneurial capabilities of the nation, an ability that is usually rare in any society, and which need not be underestimated; rather, nurtured and helped in every way. Rural electrification is only one of these.

SOME PROBLEM AREAS

In PLN's efforts, many problems have emerged and have yet to be resolved. We present some of the more pressing ones for your valuable comments and suggestions.

o What are the better ways of locating rural areas with potential for productive uses in the quickest possible way?

This is an especially pressing problem for a large state electricity corporation such as PLN. This could help the planning process, budgetary allocations, etc., in establishing productive uses as a priority in rural electrification systems.

o Getting rural industries to use electricity for productive purposes presents some problems in Indonesia which are complex. Again, taking the case of Klaten, some of the problems are as follows:

- There exists about 8 mW of captive power in the rural industries of Klaten. It is a national objective to reduce the use of diesel power.

- An adequate supply of electric power is only beginning to be introduced in the rural areas.

- Several industries already use diesel power, some of which needs immediate replacement or repair.

- Any replacement becomes difficult because the existing tariff and charges are largely based on urban needs and large industries. Electricity is, in some cases, more expensive than diesel power. (For example, for a 60 kva connection, the connection charge would be nearly Rp 75 million, or US $10,000, to be paid in $115,384 cash. Most rural industries purchase second-hand reconditioned diesel engines such as a 60 hp engine for about Rp 1 million or $1,500, and often on credit.)

e. Many rural industries are seasonal and peak seasons may be for 6 months or less. However, the contract charge is payable for a full year, making electricity expensive at off-peak seasons.

o While it is cheaper for PLN to supply bulk power to bigger industries and, therefore, the electricity rates are cheaper, the problem remains: "What is the optimum charge for small industries in rural areas?" Perhaps, better still, what kind of a "package deal" can be offered to rural small industries so they can afford to use electricity and benefit from it and so benefit the community at large.

o In most countries, rural electrification systems operate and expand under a variety of demands and pressures, especially "to electrify many villages and household connections." PLN is concerned about the high cost and low electric loads in 24-hour periods within the rural electrification system. How is a balanced system to be developed, and spread over the country, which has both productive off-peak loads combined with night-time household and socially beneficial loads?

Productive uses data, PLN—Klaten Project—Central Java, Indonesia, November 1981

Type of business	Number of businesses	Average kWh consump. before business began	Average kWh consump. after business began	Average REC monthly revenue before business began	Average REC monthly revenue after business began
Tire repair shop	3		150		$18.20
Battery charging service	10		750		$81.40
Ice-candy preparation	5		3000		$174.50
Tailor shop	17		160		$20.50
Furniture manufacturing	15		350		25.50
Metal polishing/ jewelry	7		160		20.50
Irrigation, lift pumps	12		3600		$410.00
Poultry hatchery	5		475		$36.40
Lumber mills/ rice mills	4		2000		$122.00
TOTAL	78				

1. Number of consumers = 2,017 (September 1982)
2. Number using electricity for productive uses = 78
3. Percent of consumers using electricity for productive uses = 4%

SMALL RURAL INDUSTRIES END USE CASE STUDIES

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Historically in Malaysia, extension of electricity to the rural areas began immediately after the Second World War. The main objective then was to provide security in the villages against terrorists. The main uses of electricity were then confined to domestic and public lighting and communication. The electricity was mainly provided by standalone diesel electrics.

These rural stations started to supply electricity to various tin mines, where it was mainly used for water pumping and lighting to make the industries more productive and cost effective. However, our rural electricity program only started in a proper planned and coordinated way in 1956, when the National Electricity Board was the sole body responsible for implementing the Rural Electrification (RE) program, but funding comes from other sources such as the Government and the World Bank, in addition to those funds provided by the NEB.

Productive use of electricity in the rural areas can be divided into the following categories:

- o Small rural industries:
  - Gravel pump tin mining
  - Timber product industries
  - Rice milling
  - Rural commerce and services.
- o Large rural industries:
  - Palm oil mill
  - Rubber processing plant
  - Pineapple cannery
  - Wood processing plant for making tiles, plywood, and other building materials
  - v. Sugar refinery.

SMALL RURAL INDUSTRIES

Timber industry

Timber industries in Malaysia started well before the Second World War. Initially, timber activities were limited to making planks and poles, mainly for building materials. Although most of the earlier timber mills by now have developed and consolidated themselves into fully integrated timber industries, a lot more timber mills have developed over the years, providing direct service to rural consumers and, as a supporting industry, to the larger integrated timber factories.

In addition to the small timber mills, other service-oriented activities have also developed to support the various rural industrial activities, such as:

- o Electric motor repair and manufacturing shops
- o Mechanical repair and manufacturing shops
- o Auxilliary activities such as servicing control gear and wiring.

As a result, industrial activities related to the wood industry such as manufacturing of equipment and furniture are well spread all over the country.

Tin mining industry

In the early 1950s, 40% of the total energy generated by the National Electricity Board was utilized by the mining industry. At present, however, only about 10% of the electric energy generated is used by this sector. The reduced percentage clearly indicates the diminishing importance of the tin mining industry in the national economy, but the quantum of electrical energy used has, of course, increased substantially.

Fifty percent of this energy is utilized by the small "gravel pump tin mines." The long-term effect of this industry, which spread well over 40 years, is the development of pump repairing and pump manufacturing industries in the rural areas to such an extent that the majority of Francis- and Pelton-type pumps of less than IMW capacity are made locally, together with the manufacturing of electric motors for use with the pumps.

Rice Milling

Traditionally, the milling industry is dominated by diesel motive power. However, by the middle of the 1970s, almost all rice mills in the country, big and small, were finally electrified. However, due to the recent hike in the cost of fuel oil on which 85% of the electrical energy produced in Malaysia is dependent, we have embarked on a special program to identify alternative sources of electric energy and help rural areas become self-sufficient in energy.

Towards this end we have compiled some statistics (which are included in the appendix) to evaluate the viability of the various "alternative energy" projects which, hopefully, will spur auxilliary industries.

CONCLUSION

In our experience, productive use of electricity in the rural areas is a very slow process. Many cottage industries such as potteries, weaving, and handicrafts do not require electricity; this allows the special character of the craft to be maintained. However, there are industries which should be best located in the rural areas where land and labor are relatively cheap. Such industries are:

- o Furniture manufacturing
- o Manufacturing and assembling plants for bicycles, toys, electronics, etc.
- o Processing and refining of rural raw materials such as rubber, oil palm, and sugar, etc.

In Malaysia, we have carried out some surveys where it was indicated that there is very little improvement in the short term in the productive use of rural electricity during the initial period of electrification, apart from the initial conversion from the mechanical motive power which already exists in the village to electric motors. Improvement in productive use of rural electrification is gradual unless there is active intervention by agencies which are also responsible for rural development.

NAAWAN CHARCOAL MAKING AND COPRA DRYING INDUSTRY, NAAWAN, MISAMIS ORIENTAL, PHILIPPINES—A CASE STUDY

Melvin Eballe, General Manager, Misamis Rural Electric Service Cooperative, The Philippines

The Philippines is predominantly an agricultural country. It draws its economic life blood from agriculture as it is one of the major sources of the country's foreign exchange earnings as well as the chief source of livelihood of more than three-fourths of the population in the rural areas of 80% of the total population of the country.

The singular agricultural commodity which has elicited urgent attention is the commercial production of coconut for it has provided a versatile economic source for the country. Almost three-fourths of The Philippines' commercial cropland is devoted to coconut palms.

While coconut has bright prospects as a commercial crop because of its myriad uses which makes it the "tree of life," it is also beset with problems. Foremost of these is the maintenance of quality in the production process of the two most useful of its products--charcoal and copra. The traditional processes involved in the production of charcoal and copra are fairly simple--the use of a pit or drum method and the use of solar heat or "smoking" dryers, respectively. The resulting products are inferior in quality; thus, coconut farmers have to contend with lower prices for their products.

Today we will not fail to notice a towering 60-foot structure in the coconut province of Misamis Oriental, Southern Philippines--the pioneering contribution of the National Electrification Administration (NEA) to the coconut industry. Implemented at a cost of ₱700,000 pesos in 1981, the project is rated to produce 5 tons of charcoal and 2 tons of copra daily and utilizes the integrated approach in coconut processing.

It is found in the municipality of Naawan, a simple farm community whose total land area is almost covered with coconut plantations. Although gifted with such endowments, farmers of Naawan oftentimes are on the losing end of the prevailing "buyer market" trends of the industry. This is attributed mainly to lack of technology and a centralized marketing system.

With the establishment of this pilot coco-charcoal and copra drying project in this town by the Directorate for Promotion of Industries of the NEA through the Misamis Oriental I Electric Cooperative, the quality of charcoal and copra has improved. Further, utilization of "producer gas" in the manufacture of other products has been proven. One of the distinguishing features of the project is the 60-foot vertical kiln that continuously produces charcoal. While there are numerous innovations and earnest efforts at developing and improving apparatus and processes toward the manufacture of acceptable quality of coconut products, particularly copra and charcoal, very few have attained a level that could merit favorable endorsement by no less than The Philippine Coconut Authority is the device known as the "JSR Kiln," a Filipino invention fabricated at the plant site.

The apparatus which utilizes power for its moving parts principally consists of a vertical cylindrical steel kiln lined with locally made clay bricks and divided into preheating, charring, and cooling zones for the production of high-grade charcoal. The highly combustible gas produced during the charring process is suctioned off and used to fire clay bricks. The hot air during the brick firing is collected and channeled to a copra-drying compartment.

The resulting charcoal and copra exceeds the traditional qualities ever offered to the export market. The copra retains its fresh whiteness and the charcoal is practically free from ashes and moisture. Ipil-ipil and other hardwood species have been tested and yielded the same result.

The beneficiary of this project is the Bagong Lipunan Community Association, a cooperative organization of 50 families living in the BLISS settlement composed of 50 houses and community facilities financed by the government. Aside from having their employment in the plant, it is envisioned that in the near future cottage industries utilizing coconut waste products like husk and water will be established in their respective houses. This will further augment their incomes and achieve the integrated approach to coconut processing at a very low cost, benefitting a majority of the poor. These beneficiaries are the landless seasonal workers and employees of the town. While most of the NEA's implemented power-using projects are run by the Association's Board of Directors, this project is managed by the Project Board, which is a separate and distinct body. It is composed of two elected members from the workers, two from the Association's Board, one from the lending institution (NEA/MORESCO I) and the Association's President as an ex-officio member. NEA and MORESCO I, represented by the General Manager of the latter, are represented because of the ₱100,000 equity exposure of each entity. The 5,000 sq. m. of land

donated by the municipal government forms part of the equity of the member beneficiaries--a prerequisite in the establishment of the project in the municipality.

As a corporate enterprise, the most visible effect of the project is the dynamic participation of the members in this economic undertaking. After a year of operation, profit has yet to be realized. While the market for charcoal and copra is not a constraint as a majority of the industrial users have a high demand for the project's premium quality products, higher production output is still to be attained. Low productivity is caused by a small volume capacity in the cooling zone. Movable steel containers are envisioned to solve this problem. Presently, a ₱40,000 additional equity is being worked out to finance this capital investment.

For the period ended December 31, 1981, the project's financial status is as follows:

	As of December 31, 1981
Financial Condition	
Current assets	₱ 79,533.00
of which: Finished goods	11,812.00
Raw materials	42,889.00
Accounts receivable	1,200.00
Others	23,633.00
Fixed assets	513,929.00
Other assets (deferred debits)	128,799.00
TOTAL	₱722,262.00
Current liabilities	₱ 26,975.00
Current equity	250,000.00
Long-term loan	500,000.00
Accumulated losses	(54,713.00)
TOTAL	₱722,262.00
Financial Performance	
Total sales	₱320,409.00
Gross profit (loss)	(44,373.00)
Operating profit (loss)	(10,339.00)
Net profit (loss) for the period	(54,713.00)

Non-cash charges like depreciation amounting to ₱32,091 constitute the bulk of the net loss for the period. The beneficiaries are optimistic that the project will become viable when the problem in the cooling zone is solved. Another reason for optimism is the increasing demand for bricks in the government-sponsored wood charcoaling program. In the next few months brick production will be intensified.

END USE CASE STUDIES, THAILAND

Tienchai Sirikiratayanond, Chief,
Monetary Section, Rural Electrification, Provencial
Electricity Authority, Thailand

Thank you, Mr. Chairman, and other delegates.

In Thailand, industrial consumption is the main objective of rural electrification. We have surveyed 4,000 rural villages, and from this survey we know that there are about 4,000 rice mills that use diesel engines. The rice mills used engines of 15 and 20 hp after rural electrification began about 2 or 3 years ago. We have about 1,100 rice mills which have converted to electric motors of 10 and 15 hp. Each rice mill consumes energy at 500 kW per month. And we have a study on the benefits of electric-powered rice mills. Each rice mill can save about 5,000 baht per year. Using an electric motor instead of using a diesel engine reduces maintenance and capital cost.

Besides the small rice mills in the villages, we have a plan for irrigation pumping in the first stage of the rural electrification project; we plan to supply electricity to 230 pumps. The average size of the pumps is 230 hp. This is not really to provide electricity to irrigation pumping only. The agency that would take care of these pumps is the National Energy Authority. At present, in the first step, 80% are completed, and the other 20% will be completed in the early part of next year. After we complete these 230 irrigation pumps, they will provide water to 226,000 acres.

For home uses, we made a survey that shows that after the first few weeks of electrification, the people will feel comfortable and secure using electricity. At first, the people in the rural areas will buy electric appliances such as fans, irons, television, radios, and refrigerators.

A case study of a village which has been electrified for two years shows 94.5% of the consumers are residential and 3.5% are commercial, 1% are rice mill customers, and 1% are public building customers. Next, the study shows the average energy consumption per month. Residential use consumes about 64.5% of the total energy consumption of the village, commercial customers consume 12.2%, rice mills consume 8.5%, and public buildings consume 4.8%.

The case study shows the increasing use of electric appliances. For example, there were nine irons used during the first year of electrification and this figure increased to 92 in the second year; fans increased from 31 in the first year to 143 in the second year; radios increased from 8 to 30; televisions increased from 40 to 61; refrigerators increased from 7 to 35; ranges increased from 3 to 4; and rice cookers increased from 3 to 15 in the second year.

That's all. Thank you.

SMALL HYDRO DEVELOPMENT IN NEPAL

Pushpanath Sharma, Chief Engineer,
Small Hydel Development Board
NEPAL

INTRODUCTION

Nepal, with its rich traditions, is sandwiched between India and China and situated on the southern flank of the Himalayas. Nepal has a total land area of 141,577 sq. km, with a population of about 15 million and a population density of 106 per sq. km. It has been divided into five development regions, 14 zones, and 75 development districts.

Geographically, the country is divided into four regions according to their height above sea level. The northern region of high snow-clad mountains has about 33% of the total area (i.e., 46,720 sq. km), located at altitudes of 5,880-8,848 m. above sea level.

The central region of densely populated hills covers about 36% of the total area (i.e., 50,968 sq. km). It consists of a chain of mountains known as the Mahabharat Range and extends from east to west with altitudes ranging from 1,830-5,880 m. This region has innumerable perennial rivers and streams extremely suitable for hydropower development.

The Siwalik region has poor water retention capacity and is a small strip of hills running from east to west comprising about 8% of the total area (i.e., 11,368 sq. km) at altitudes ranging from 610-1,830 m.

The southern region of Terai covers about 23% of the total land area of Nepal (i.e., 32,562 sq. km) and ranges down to 300 m. below sea level in altitude. Four world class rivers—the Saptakosi, Saptagandaki, Karnali, and the Mahakali--and their tributaries, fed by snow and glacier melt from the Tibetan plateau and the Himalayas and by monsoon rainfall, account for nearly 90% of the country's surface water.

RESOURCES OF ENERGY

About 85% of the total energy use is consumption of firewood. The average per capita consumption of firewood is 600 kg per year while the regeneration is only 80 kg per capita per year. As a result, 120,000 acres of forest are depleted every year. The government has been carrying out programs and accelerating reforestation and effective management of forest uses, and seeking to utilize alternative energy sources expeditiously.

No significant success has been achieved in the economic exploitation of oil resources. No coal mines are yet located within Nepal. Solar energy has only been used in traditional ways for crop drying of fodder and cereal grains. The assessment of the technology necessary for the development of wind power has not yet begun. Forest resources are being rapidly depleted.

If Nepal is endowed with any natural energy resource, it is water. Out of the total annual runoff of water of 17 billion cu. m., 1.5 billion cu. m. come from within the country, which is equivalent to a water depth of 1.1 m. over the entire country. Added to this, the favorable topograpical features of Nepal give the country a hydropower potential of about 90 million kW. This is equal to about 600 kW per sq. km.

Until now, only about 0.17% of the hydropower potential has been developed and only 4.5% of the total population is served by it. It has been estimated that 25,000 mW of hydropower could be economically developed within a relatively short period.

DEVELOPMENT STRATEGY

Nepal's water resources for hydro generation have been planned in three main categories. First are large-scale projects like Karnali (3,600 mW), primarily aimed at export to neighboring countries. Second, medium-sized projects up to 100 mW will be used to meet internal consumption in relatively developed regions like the central region and the Terai. And, third, are the micro-hydro projects, primarily considered to be useful for the hilly and remote areas.

Rural electrification program

The rural electrification program launched by His Majesty's Government of Nepal consists of two subprograms: one for the Terai and one for the hill and mountain regions. In the Terai and relatively developed areas, extension of the electric distribution system lines from the power grid has been proposed and is being executed.

In the hill and mountain regions, the subprogram consists of installation of small and micro-hydro electric generating plants. The integrated program is a high priority in bringing rural electrification to the hill regions where the greatest part of the agrarian population is concentrated. These areas have no supply

of electricity and, I am afraid, due to their isolated mountainous locations, there is no prospect for years to come of adequate supply of electricity from future large hydro projects.

Development program

Under the policy guidance of His Majesty the King, His Majesty's Government has liberally expanded its program for power development in the hill areas. The present status of small hydro development in Nepal is shown in Appendices I, II, and III.

Six small hydro plants are now in operation. The first micro-hydro station in Dhankuta (2 x 120 kW) was completed in 1968, and the second one was in Surkhet (3 x 115 kW). A small hydro development board was created as a new institutional arrangement in 1976 to give special attention to small hydro development. Since 1976, His Majesty's Government has already undertaken the construction of 30 small hydro projects throughout the country.

Problems

Nepal faces many problems in the construction of small hydro projects, as described below.

Lack of appropriate technical capability

Hydropower planning, design, and construction is a highly specialized job. Due to the lack of trained and experienced manpower in this field, most of the projects are not making good progress. Many of the difficulties are in the fields of research and design. Proper design work requires good research records with appropriate data and drawings. Experienced surveyors are not available in sufficient numbers and small hydro development personnel are limited in engineering experience.

Lack or unwillingness of good construction contractors

Reputable contractors are not interested in small jobs in remote regions as long as they can enjoy the benefits of large-scale projects at more accessible and developed areas. Due to the lack of qualified contractors in remote areas, the work is carried out either departmentally or by employing contractors with lesser qualifications, which has led to poor quality work and delays.

Difficult accessibility

The locations of small hydro projects are generally inaccessible by road, and there is a problem of transportation of both men and materials to the sites. The only means of transport is either by manpower or animals. Consider for a moment a 10-meter long pole being carried on men's shoulders on a rough mountain track, bags of cement being carried on the back of a person with the help of a rope, and, in some remote places, even sheep being used for transporting cement, salt, rice, and other goods of smaller size. Helicopters are used for transporting heavy objects which cannot be transported by either men or animals. The standard charge for a helicopter is Rs 20,000 per hour and it can carry a maximum weight of 1,400 kg. Using a helicopter adds nearly 7.5% to the total cost of these projects when compared with projects accessible by road.

Nonstandardization of generating equipment

Material and equipment are procured through competitive bidding. The same type of equipment from different manufacturers has different features and characteristics. It is felt that equipment should be similar and standardized for ease of operation and maintenance. For different stations, different training is required for operators, and separate spare parts inventories must be kept. If the design of the equipment could be standardized, some economy could be achieved, but this has not been possible since we have to import our equipment from neighboring countries and abroad.

High cost of development

Though the small projects are cheaper to build, management and administrative costs involved in these projects are the same as for large projects. Costs of developing these projects are affected by many factors. The cost of engineering, such as research and design, is no less important in a small project than it is in a large project. Skilled laborers will not be available locally, and skilled laborers demand a higher pay scale and better facilities which also increase the cost of development.

Low load factor

The foremost problem of mini-hydro plants is the low load factor with a high investment per kilowatt. The greatest demand is during the evening hours, and most of the energy consumed is for lighting. People in these remote areas, at least for the first few years, will not make use of electric power for industry. It will take time to build industrial and commercial loads in these areas. The power supply agency or some other organization will need to promote the productive uses of electricity for these regions. The Government does have a plan to provide low-interest loans to help establish cottage industries, install irrigation pumps, and develop other agro-based industries.

CONCLUSIONS

The main aims of the establishment of small hydro electric projects in the hills of Nepal are: to prevent rapid deforestation that is presently threatening the ecological balance of much of the country; to promote development stimulus for this remote population by providing power for cottage industries and a productive life for the people well into the evening hours. At present, all activities are severely restricted to daylight

hours. Electricity, it is hoped, will play an important role in adult education and other social benefits.

In order to meet these goals, the power supply should be economical, reliable, and substantial. Electric tariffs will have to be subsidized, and, in order to encourage productive uses, off-peak tariffs are to be introduced. Furthermore, in the future, high capacity generation with greater compactness must be chosen, contrary to the present practice. This may lead to few hydro sites and a greater expenditure on power canals but will, nevertheless, permit the construction of projects in the one to two MVA range under prevailing conditions, resulting in much reduced costs. The way to the most economical implementation of such projects has been to build them with up-to-date technological skills.

Improvement of load factors will make small hydro plants a more economical infrastructural development. This requires adequate support from other organizations within the country to develop local industrial consumers in these remote areas.

APPENDIX I
PROJECTS UNDERTAKEN BY SHDB

No.	Name of project	Installed capacity in kW	Total cost in Rs	Accessibility	Remarks
1.	Namche First Phase (Solu District)	4 x 125	2,41,00,000	a. By plane up to Lukla & 1 day trek to site b. 8 days trek from Sunkosi	To be completed in fiscal year 1984/85
2.	Phidim (Panchthar District)	2 x 130	65,00,000	3 days trek from Ilam	Completed in fiscal year 1981/82
3.	Baglung	1 x 175	48,27,000	a. By plane b. 3 days trek from Syanja	To be completed in fiscal year 1982/83
4.	Doti (Doti District)	2 x 100	98,00,000	a. By plane b. 4 days trek from Dhangadi	Completed in fiscal year 1981/82
5.	Jumla (Jumla District)	2 x 130	1,04,00,000	a. By plane b. 7 days trek from Nepalgunj	To be completed in fiscal year 1982/83
6.	Jomsom	2 x 130	1,05,87,000	a. By plane b. 7 days trek from Pokhara	To be completed in fiscal year 1982/83
7.	Syanja	2 x 50	28,61,400	By bus	To be completed by fiscal year 1982/83
8.	Helambu	2 x 30	30,00,000	7 days trek from Dhulikhel	To be completed by fiscal year 1983/84
9.	Gorkhe	2 x 3	22,23,000	By bus & 3 hours walk	Completed
10.	Dhading	1 x 32	20,00,000	By bus & 3 hours walk	Completed
11.	Manang Bhot	2 x 80	53,81,000	10 days trek from Pokhara	To be completed by fiscal year 1983/84
12.	Chame	1 x 40	25,00,000	8 days trek from Pokhara	To be completed by fiscal year 1983/84
13.	Dhandeldhura	2 x 40	35,00,000	By plane or by bus & 1 days trek	To be completed by fiscal year 1983/84
14.	Darchula	2 x 50	35,40,000	By bus via India	To be completed by fiscal year 1982/83

APPENDIX II
PROJECTS FUNDED BY ADB

No.	Name of project	Installed capacity in kW	Total cost in Rs	Accessibility	Remarks
1.	Illam (Illam (District)	3 x 160	4,80,50,000	By bus	To be completed in fiscal year 1984/85
2.	Terathum	2 x 100	61,12,000	6 days trek from Dharan	To be completed by fiscal year 1984/85
3.	Dhunche	2 x 100	86,29,000	3 days trek from Trisuli	To be completed by fiscal year 1984/85
4.	Bajhang	2 x 100	77,42,000	a. By plane b. 15 days trek from Nepalgunj	To be completed by fiscal year 1984/85
5.	Tatopani	2 x 500	3,68,99,000	4 days trek from Pokhara	To be completed by fiscal year 1984/85
6.	Serpodaha	2 x 100	96,17,000	5 days trek from Chaurjhari	To be completed by fischal year 1984/85
7.	Chaurjhari	2 x 100	91,51,000	a. By plane b. 7 days trek from Nepalgunj	To be completed by fiscal year 1984/85
8.	Bajura	2 x 10	63,75,000	a. By plane to Sanfe Bazar b. 6 days trek from Sanfe Bazar	To be completed by fiscal year 1984/85

APPENDIX III
PROJECTS UNDER THE ASSISTANCE OF UNCDF

No.	Name of project	Installed capacity in kW	Total cost in Rs	Accessibility	Remarks
1.	Bhojpur	2 x 125	70,48,000	a. By plane b. 6 days trek from Dharan	To be completed in fiscal year 1984/85
2.	Khandbari	2 x 125	72,36,000	a. By plane to Tumlingtar & 1 days walk b. 7 days trek from Dharan	To be completed in fiscal year 1983/84
3.	Taplejung	1 x 125	42,84,000	a. By plane b. 5 days trek from Dharan	To be completed in fiscal year 1983/84
4.	Okhaldhunga	1 x 125	51,20,000	a. By plane b. 5 days trek from Katahari	To be completed in fiscal year 1983/84
5.	Ramechhap	1 x 75	42,50,000	a. By plane b. 4 days trek from Sunkosi	To be completed in fiscal year 1983/84

COMPARISON OF ELECTRIFIED AND DIESEL ENGINE DRIVEN RICE HULLERS IN SRI LANKA

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and
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INTRODUCTION

Paddy production in Sri Lanka has been gradually developed over the last few years and the index of production with the base at 1962 has gone up as follows: 167.47 (1977), 188.76 (1978), 191.43 (1979), 212.99 (1980). During the next decade, paddy production is expected to increase many fold due to the development of major irrigation schemes, particularly the Mahaveli Development Project. The milling of paddy is generally done by either small-scale "custom mills" or medium-scale rubber roll hullers.

CUSTOM MILLING

This type of mill has a production capacity of about 3,000–4,000 kg. per day and consists of a steel cylinder in which the rice is made to move against an adjustable barrier by the rotation of an inner cylinder. They are generally driven by motors of approximately 15 hp. The output arrives mixed in the form of rice, husk, and the remaining unhusked paddy. In this process, the "head yield" is low as the rice grains usually break down and, because of this, it is not an efficient process when considering the quality of the output.

MEDIUM-SCALE RUBBER ROLL HULLERS

In mills using the rubber roll hullers, the process involves several operations which are, in sequence, as follows:

- o Cleaning the grain of all extraneous matter.
- o Removing the husk by rubber roll hullers. The hullers consist of two rubber drums revolving in opposite directions at different speeds. The gap between the rollers is adjustable to accommodate different grain sizes. The shearing action of the difference in roll speeds strips off the husk.
- o Removing the bran layer from the brown rice. This is achieved by passing the brown rice through an annulus formed by a rotating core covered with an abrasive coating and a wire screen. The bran is removed by the friction and is aspirated out through the perforations in the screen. To reduce grain breakdown, the bran is removed in several passes.
- o Grading the polished rice into head rice, large brokens, small brokens and points.

A flow chart of the process is given in Figure 1. It can be seen that this process is of a much higher level of technology than the custom hullers and the output is of higher quality than in the simple custom hullers.

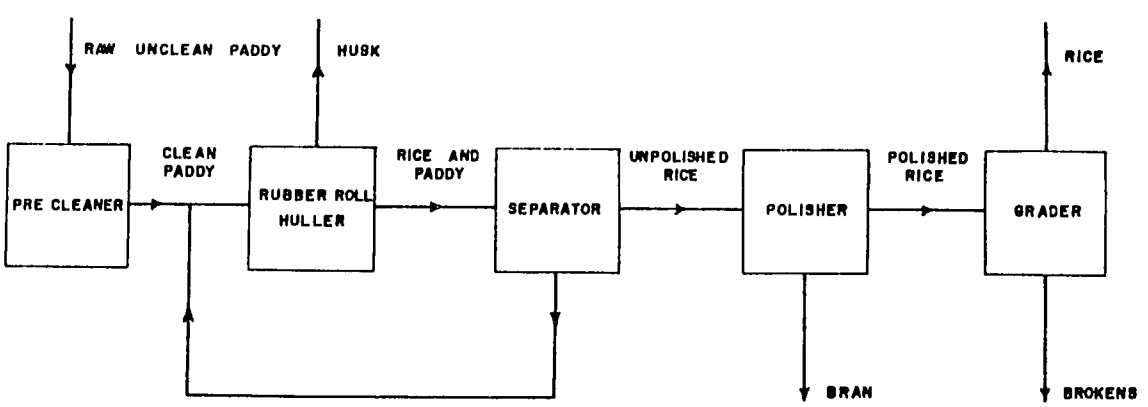

FIGURE 1: FLOW CHART OF THE PROCESSES IN A SEMI-AUTOMATED MEDIUM-SIZED RICE PROCESSING PLANT

STUDY OF ENERGY REQUIREMENTS

Custom Hullers

A survey of some of this type of hullers was conducted in the main rice growing areas of Anuradhapura and Pollonnaruwa and the results are tabulated in Table 1. It was not possible to examine either production records or energy consumption records in these mills, and the data used are those supplied verbally by the owners or managers. Thus, the level of accuracy of the analysis is rather low. However, it may be surmised that electricity is preferable to diesel-powered plants by a cost ratio of 1 to 1.25.

TABLE 1: Production data obtained from small-scale "custom" mills

(A) Electrified mills

Mill	Bushels/ day	Electrical units/day	Units/kg
1	250	60	0.0115
2	300	152	0.0243
3	50	6	0.0057 (R)
4	90	20	0.0107
5	30	20	0.0320
6	50	14	0.0134
7	150	20	0.0064 (R)
8	225	48	0.0102
9	300	50	0.0128

Average partial productivity of electrical energy (after rejecting data obtained from mills 3 and 7) . . .

= 60.9 kg/kWh

At a marginal energy cost of 1.64 Rs/kWh

Cost of production = 2.7 Cts/kg

(B) Engine plant driven mills

Mill	Bushels/ day	Engine consumption, litres/day	Litres/kg
1	15	1.75	0.0056
2	20	1.75	0.0042

Average partial productivity of energy is engine plant driven mills

= 204 kg/L.

Cost of 1 litre of diesel (international rate)

$$= \frac{40}{35} \times \frac{21}{4.545} \text{ Rs/l}$$

= 5.28 Rs/l

Cost of production $= \frac{5.28}{204}$ Rs/kg

= 2.6 Cts/kg.

Assuming maintenance costs at 30% of fuel expense, the cost of production adjusted for maintenance expense

= 2.6 x 1.3 Cts/kg

= 3.38 Cts/kg.

Rubber Roll Hullers

Tables 2 and 3 give the data obtained for similar types of rubber roll hullers which are powered by diesel-driven engines and electric motors, respectively. For the examples taken, it is seen that the electrified mill is more advantageous by a cost ratio of 1 to 1.2. However, it is to be noted that many individual variations are possible due to the efficiency of the other factors of production. Another important factor is the level of management and the utilization efficiencies of plant due to personnel factors. Hence, the study needs to be augmented with more data from similar mills but the comparison may be taken as an approximate guide.

TABLE 2: Performance data of engine plant mill

Month	Quantity of paddy milled (kg)	Quantity of fuel consumed (litres)
1	139,136	970
2	148,619	879
3	76,268	394
4	72,574	507
5	99,203	698
6	102,321	825
7	127,150	752
8	164,659	902
9	141,662	1,101
10	165,933	1,155
11	90,919	684
12	131,198	1,078
13	136,238	1,038
14	111,222	757
15	58,086	430
16	18,734	150
17	18,735	163
TOTAL	1,202,657	12,483

Note: The above data have been obtained from a paper entitled, "A case study of the causal model approach for partial productivity measurements at the firm level," by K. Ramanathan, Consultant, National Institute of Business Management of Sri Lanka.

The partial productivity of energy input is therefore

$$\frac{1,802,657}{12,483} \text{ kg/litre}$$

$$= 144.4 \text{ kg/L.}$$

Using the international cost of diesel as US $40.00 per barrel we have the cost of one litre of fuel =

$$\frac{40}{35} \times \frac{21}{4.545} = \text{Rs } 5.28$$

The energy cost of paddy milling =

$$\frac{5.28}{444.4} \text{ Rs/kg}$$

$$= 3.7 \text{ Cts/kg.}$$

Diesel driven plants have a high cost of maintenance and if a factor of 30% is added for this aspect we have the cost of milling paddy by engine at plant

$$= 3.7 \times 1.3 \text{ Cts/kg}$$

$$= 4.81 \text{ Cts/kg.}$$

TABLE 3: Performance data of electrified mill

Month	Energy in units, kWh	Maximum demand recorded KVA	Production in metric tons
January	8,310	96	415.9
February	2,921	90	102.0
March	357	3	—
April	699	45	—
May	429	3	—
June	353	27	—
July	240	28	—
August	774	96	50.0
September	11,476	103	430.0
October	9,695	105	420.2
November	10,082	102	439.7
December	3,276	100	94.8
TOTALS	48,612	798	1,952.6

The partial productivity of the electrical input is therefore

$$\frac{1,952.6}{48,612} \text{ M.Tons/unit}$$

$$= 40.2 \text{ kg/kWh.}$$

At an off-peak energy cost at M.v. of Rs 1.66/unit, the energy cost of paddy milling

$$= 4.1 \text{ Cts/kg.}$$

CONCLUSION

In both types of rice hullers studied, the electrified mills seem to have a cost advantage in the region of 1 to 1.2. However, the necessity of repeating the studies on a more detailed basis needs to be emphasized.

END USES OF ELECTRICITY IN A RESETTLEMENT COLONY

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The present case study pertains to end uses of electricity in a resettlement colony. In 1975 the Delhi Administration decided to build resettlement colonies for the slum dwellers and squatters, the majority of whom had migrated from villages in different parts of the country in search of gainful employment. In all, 34 resettlement colonies were organized, mostly on the outskirts of the city. Each family was allotted a plot of 21 square meters free of cost and was further given a loan of Rs 60,001 to build a house.

The colony named Mangolpuri, which is the subject of this case, has 27,000 households constituting 26 blocks of row houses. Facilities like water supply, sewerage, public transport, health, schools, posts and telegraph, recreation and market centers, and electricity have been provided by the Government. The residents of the area are mostly skilled, semiskilled, and unskilled laborers, petty shopkeepers, vendors, barbers, tailors, sweepers, gardeners, peons, class IV government employees, and workers engaged in small-scale industries in and around the industrial complex.

We undertook this study in December 1981 to find out the satisfactions and problems of domestic consumers, and also to find out the reasons for nonadoption of electricity by nonelectrified homes. About 37% of the families had adopted electricity whereas 63% had not. Two random samples of 100 families each were drawn from both the groups; the respondents were male or female adult members of the families. The data were collected by personal interviews using a questionnaire. The major findings of the investigation are discussed below.

REASONS FOR INSTALLING OR NOT INSTALLING ELECTRICITY

The most powerful influencing factors for taking electricity were the desire of the families to light their homes better for more comfort and convenience (91%), to facilitate their childrens' study (90%), and a basic necessity for household activities (77%).

The other reasons pointed out were: (a) an economical fuel (57%), (b) previous contact with electricity in their erstwhile homes (33%), (c) a status symbol (30%), (d) influence of neighbors, and (e) for taking up economical activities at home (7%).

The reasons given for not taking electrical connections were:

- o Nonavailability of funds for procuring electric connection (80%).
- o Application made, awaiting connection (20%).

An analysis of the background information revealed that caste and earlier experience with electricity have no influence on adoption or nonadoption of electricity, whereas education, occupation of the head of the family and family income showed a positive correlation with adoption of electricity. In the group that have not adopted electricity, the majority were illiterate and were self-employed in private service and their income was low, while in the group that have adopted electricity, 80% of the heads of the families were educated, and 70% were government employees and had higher incomes.

END USES OF ELECTRICITY

All the families who adopted electricity were using it primarily for lighting purposes; 87% of them used it for running fans, 50% for radios, 22% for grinders, 20% for irons, 13% for televisions, and 10% for occasional cooking. The monthly electricity consumption of the families ranged from 5-68 kWh per month. The per capita annual consumption ranged between 12.5-203 kWh, the mean being 77 kWh and mode (average) 60 kWh. The problems and reasons reported for the restricted use of electricity were:

- o Nonprovision of power points
- o Nonreceipt of electric bills
- o Improper functioning of meters
- o Inadequate supply of electricity
- o Frequent power cuts.

IMPACT OF ELECTRIFICATION

School-going children

The hypothesis that there is no association between electricity and the number of children going to school was disproved. It was found that from among all children of school-going age, 98.3% of the children in the electrified group were attending school while only 35% of the children in the unelectrified group were attending school. Similarly, a significant association

between electricity and number of hours of children's study was found.

Since it is possible in this finding for income to be an influencing factor in the number of children going to school, this influence was also examined. The data were analyzed by taking two income groups: (a) the income group between Rs 350-600, and (b) the income group between Rs 600-1,500. It was found that there existed no significant association between the family income and the number of children going to school.

Number of working hours

It was found that there is a significant association between electricity and the number of working hours of the family members. The respondents in the electrified houses utilized the extended hours in the performance of gainful activities and leisure. The female members could leisurely complete all their household activities and take up activities of their interest which were economically gainful. About 22% of such families were engaged in the business of selling ground chilies and other spices. This occupation was fetching a family on an average Rs 400 per month.

ECONOMICS OF LIGHTING FUEL

Problems in using kerosene as lighting fuel were reported both by the electrified and the unelectrified households. Families having electricity experienced these before adoption of electricity whereas the families not having electricity are currently facing these problems. Problems stated by all the respondents were the high cost of kerosene, nonavailability of kerosene, difficulty in procurement of kerosene, problems of storage, and cumbersome use.

The average cost of lighting per month in the electrified houses worked out to Rs 51, whereas in the unelectrified houses the monthly average expenditure on kerosene worked out to Rs 7.50.

It is here concluded that electricity in homes is a resource which, if adequately supplied, can provide the means for the development of skills, knowledge, and overall improvement in the quality of life for the family.

PARTICIPANT DISCUSSION ON PRESENTATIONS OF INDIVIDUAL CASE STUDIES

CHAIRMAN: Mr. Adbullah Almeida from The Philippines, now a consultant in Bangladesh, you may now ask your question.

MR. ALMEIDA: The United Nations, not from The Philippines anymore—although I have been involved with rural electrification. My question is not actually a question that, you know, requires an answer, but rather by way of a comment and an observation.

We have discussed here the productive uses of rural electricity, but I would like to view this just like this session--we view this as a laboratory type for exchanging experiences. One of the side issues in looking at this issue is to look also on the unproductive or nonproductive uses of electricity. For example, a lot of case studies have been mentioned in these sessions, and I could also recall a lot of cases wherein there is an unproductive use of electricity, rural electricity. The coconut industry was mentioned and, in this case, a look at the unproductive use of power in coconut, I remember was using an electric boiler to process coconut to produce oil. Now, from the total energy standpoint, this is an inefficient way of using electricity. A side issue that goes with this probably has to mean that productive use of electricity should also connote efficient use of electricity. For example, rice mills and sawmills for the timber industry have been mentioned, and I could recall, in my own experience, that electricity was promoted, per se, but there is a lot of inefficiency in its use. For example, I see motors driving pulleys using flat belts, and there is a lot of slippage, and probably a campaign towards, you know, chaining this to some other kind of a belt drive--like a B-belt or a direct-gear drive--should also accompany the program. These are probably the side issues that the workshop could look into--the total energy concept, the total use of energy. It does not stop at the billing meter of the consumer. It should stop at the final output of the product. And, for rural industry, there should also be some look at what extent such an issue could be appreciated--such an issue as whether certain rural industries with a certain energy content per dollar value should be promoted over and above one that has a higher energy content per dollar value. Therefore, a rural industry whose kilowatt hour per dollar of output is less would probably be a good measure. A rural industry's job-generating capacity per kilowatt hour input should probably be looked upon by the workshop. These are mere comments and observations, Mr. Chairman.

CHAIRMAN: Very good, thank you very much. This just needs a lot of thought. Thank you very much for presenting such a thought-provoking question.

Any other?

DR. MOHAMMAD ARIFF BIN ARAFF: Thank you, Mr. Chairman. I think I would like to make a few statements with regard to the comment from the gentleman from The Philippines. Obviously, we in Malaysia find this thought-provoking--the use of electricity where there is, as we call it, the result of converting conventional means of energy to electricity, which means that we are making the industry less efficient. For instance, I did mention that in poultry, for instance, rural poultry, we are not asking the industry to be called to turn to electricity because we know very well that rural poultry does not need electricity. Another thing, also, is that we are not asking, say, for example, poultry farms to convert to electricity because they do not really require electricity for most of their processes. What is the most important thing here is that in Malaysia we are trying to look into rural electricity as a total energy question and, at the same time, energy conservation. And, therefore, to this end we try to find ways how to make the rural population or the rural areas energy independent. Now, they produce their own energy, especially the ones that can recycle from their waste materials or from indigenous sources like hydro or solar or something like this. Therefore, we approach the question in its totality. And we have no program at the moment whereby we can convert anything that can be supplied by electricity into electricity. If it can be done productively and cheaply by using other means or by using horsepower or anything like that, we continue to do so. Thank you.

CHAIRMAN: Thank you very much. Any other?

Yes. Mr. Awal from Indonesia.

SJOUFJAN AWAL: I was ready to take a nap until this conversation, energy-efficiency, rural electrification was brought up. On the outside I had to say that those are not good ideas--energy conservation, energy efficiency undertaking and whatnot, but I think in rural development, rural electrification included, one ought not to be sidetracked by these novel issues. To me the main thing is to give the rural people what President Marcos said one time—a quantum jump in their livelihood. In fact, I will even go to the other

extreme. If there will be ways of energy, let it happen in the rural areas. Thank you.

CHAIRMAN: Thank you very much.

COMMENT: I am also from Indonesia. I might mention that the Indonesian Government policy is to promote all types of energy uses which could be useful and available. Now, in our own experience in the Klaten area, we have found that, by and large, most of the industries--let us take some of the very small industries of food-making--essentially use firewood.

As a matter of fact, most of the heat energy utilized by, I would say, almost 100% of the industries, is by nonelectrical use. Now, let me give you an example of one of the industries which has 100 power looms; it uses electricity and has demanded electricity, in fact, for a long time. But, when it goes into the question of sizing, particularly in terms of heat energy which is utilized for the sizing, they go in for the use of certain diesel fuels, apparently, it seemed to me. I think it is a question I would like to pose to the rest of you. I don't know what your experience is, but this is purely a practical observation of many of the industrialists, small and big, that in terms of utilizing heat energy, they do not use electricity. So, the experience of others would be useful here. Thank you.

CHAIRMAN: Any other?

DJURZAN HAMID: I have a small question for Dr. Aziz Pabaney. My name is Djurzan Hamid from Indonesia. I am from the Directorate General of Power, Ministry of Energy. One thing which I would like to ask Dr. Aziz is concerning the criteria for determining the priority of the sectors to be electrified. I would like to ask Dr. Aziz to explain a little bit concerning their program.

DR. AZIZ: In regard to this question regarding the criteria, the main task is to electrity rural areas and the basic use of electricity in rural areas, which we have found in a survey, is lighting and some other utensils--electrical utensils which make life much easier in the rural areas. So, that is the initial purpose of rural electrification: to provide lighting and some power point and to make the rural population enjoy electricity vis-a-vis the urban population. However, the rural industries are a spin-off from the rural electrification activity. And, as far as we ourselves in the government are concerned, we would like to implement rural electrification throughout. However, the monies are lacking. Therefore, those areas which are accessible to the national electricity grid in that area of work shall have the first priority. And, for those areas that require, say, for example, standalone diesel generators, they have second priority. And, the third priority would be, then, the introduction of small gas turbines and photovoltaics and mini-hydro and things like this. But, normally, the resources are equally divided between various states. We have, for example, about 13 states in Malaysia, and, therefore, each state is allocated certain funds. In many states they have achieved, say, 80% or 85% rural electrification, and, therefore, such a state will be allocated less funds while to other states which are relatively poor in the progress of rural electrification, we allocate more funds. But, nevertheless, it is what we call proximity to the urban area that gets first priority, and the further afield we go, and the less priority it gets. I think that answers the question.

CHAIRMAN: Thank you very much. Gentlemen, we have finished our question hour. Our next program will be chaired by Ed Gaither. Before we conclude, we must thank all of you for staying with us and also to these learned authors of the papers who have presented very, very good papers, illuminating and highlighting a large number of very interesting points.

SPECIAL USES

Women's Role in the Productive Uses of Electricity
Akhtari Begum

Productive Uses of Small Renewable Energy Systems
Paul J. Clark

Participant Discussion and Comments on Special Uses

WOMEN'S ROLE IN THE PRODUCTIVE USES OF ELECTRICITY

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INTRODUCTION

It is now accepted that electricity constitutes an important infrastructure service facility and a most convenient form of energy for faster growth of industries and modernization of agriculture.

The development of electricity received due priority in the development plans of Bangladesh. In 1947 the total generating capacity in Bangladesh (then East Pakistan) was only 21 mW. By 1970 it rose to 223 mW. Still, in 1970, the per capita consumption of electricity was only 14.7 kWh, one of the lowest in the world.

In this paper we will discuss the extent of activities by women for productive purposes and the consequent demand on the use of electricity for such activities.

It is assumed that employment on farms has reached the saturation point; hence, off-farm productive activity is essential to generate employment, increase family income, and improve the lifestyle of the people.

In the predominantly rural agricultural Bangladesh, about 12% of the labor force is employed. If disguised unemployment is considered, the unemployment rate will be about 33%. The possibility of absorbing this unemployed labor force in agriculture is limited. With the increase in population and other factors, the number of landless, near landless, and marginal farmers is increasing every day. A possible alternative way to absorb this labor force is to employ them in off-farm activities--in high labor-intensive small and cottage industries.

WOMEN IN PRODUCTIVE ACTIVITY

The participation of women in productive activity is becoming visible. Traditionally, women used to remain engaged in household tasks and also actively participate in agriculturally related activities, having a great impact on total production in the agriculture sector.

According to the Bangladesh population census report of 1974, there are about 25,181,000 men and 6,440,964 women in the civilian labor force. The table below shows the civilian.

TABLE 1: Percentage distribution of civilian women labor force (10 yrs and over) by agricultural and nonagricultural labor forces, 1974 and 1961

Economic category	1974 No.	1974 %	1961 No.	1961 %	Line or inter-censal growth rate per annum, %
Total civilian labor force	0.87	100.0	2.64	100.0	-5.1
Agricultural	0.61	69.8	2.42	91.8	-5.7
Nonagricultural	0.26	30.2	0.22	8.2	+1.6

No. in millions.

Source: Bangladesh Population Census Report, Table 41, p. 40.

The sharp fall for women in the agricultural labor force from 91.8% in 1961 to 69.8% in 1974 is explained by the fact that many women workers were placed in the category of housewives in the 1974 census because they were not wage earners.

Current Situation

The Bangladesh Institute of Development Studies (BIDS) conducted a survey in 11 selected thanas of Bangladesh. It was revealed that, contrary to the conventional belief, off-farm activities play an important role in the rural economy of Bangladesh. In the study area, 42% of all workers were engaged primarily in off-farm activities. Another survey conducted by the Centre of Social Studies, Dhaka University, in three villages in Barisal district also found that 41% of the workers are primarily engaged in off-farm activities.

The BIDS study revealed another important fact: industrial occupation is more important among the two

most disadvantaged groups in the society, the women and the landless. About 69% of female workers are engaged in industries compared to only 17% of males (of total workers). The study showed that about 33% of industrial workers are women: Table 2 provides more dimensions.

TABLE 2: Distribution of female workers by age, religion, and worker type (in percent of total female workers)

Characteristics	Enterprise Rural	Urban	Total
Age			
Children (up to 15)	25.3	10.8	24.5
Adult (16 to 54)	71.1	51.1	70.0
Old (55 & over)	03.5	38.2	05.5
Religion			
Muslim	79.9	77.8	79.8
Non-muslim	20.1	22.3	20.2
Type			
Female family based	83.8	56.3	88.2
Permanently hired	06.2	20.4	07.0
Casually hired/ price rated	09.9	23.2	10.8

Source: RISP Report, p. 99, Table 5.15.

From this table it appears that 70% of the female workers are adult and 30% are either children or old. The main reason for the large number of industrial workers being adult females is that most rural industries are located at home and run by unpaid family members. Unlike agriculture, they participate actively in family industries inside the house without violating tradition. Some 84% of the female workers have been found to be unpaid family labor.

With regard to the distribution of women workers in terms of product groups, it appears that the female workers are mainly involved in the production of: jute handicrafts (68%), lime (68%), paper bag and box (67%), coir rope and cordage (64%), fishing nets (63%), mats (63%), dheki products (56%), coir mats (55%), basketry (49%), spinning of yarn (48%), pottery (47%), oil making (43%), and silk weaving (39%), etc.; 63% of the total women workers are employed in the textile sector.

The study also reveals that most of the women's activities are related to crafts and these crafts are clustered in far-flung village hamlets.

In the urban areas, also, women are participating more and more in nontraditional activities and working outside the home. The probable factors influencing the increased participation of women in urban and rural nonagricultural activities are:

- Poverty and economic stress
- The rise in prices of consumer goods
- Women having lost the main breadwinner of the family during the war had to take up the responsibility of maintaining the family.

A definite change seems to have occurred in the attitude of both men and women towards women taking jobs outside the home. So, the findings from these different sources reveal that men and women are involved in off-farm activities in Bangladesh. With increased population pressure on limited land and increasing unemployment, off-farm industrial activities become an obvious alternative.

Institutional support

Different public and private agencies undertook programs to help women take a more active part in income-generating activities. The Bangladesh Small and Cottage Industries Corporation (BSCIC) is the prime mover organization in Bangladesh for the promotion and development of small and cottage industries. BSCIC helps private sector enterpreneurs establish new enterprises and use the capacity of existing ones.

Based on the study reports by BIDS, UNDP, and BSCIC about women's participation in rural industries and off-farm activities and relevant information from other sources, BSCIC undertook a project for developing enterpreneurship among women. With assistance from USAID, the BSCIC started the project on a pilot basis in four thanas; namely, Kaunia in Rangpur district, Swarupkathi in Barisal, Laksham in Comilla, and Sherpur in Jamalpur district. The purpose of the project is to make women owners of cottage industry enterprises through development of entrepreneurship by assisting them to set up small, micro, and cottage industries, both modern and traditional, and generate employment and income among women and family businesses.

The activities of the project will be expanded in the second phase to other areas of Bangladesh on the basis of the results obtained in the pilot thanas and resource availability. The extension and field officers will be responsible for motivating and organizing productive activities.

In other areas of the country general promotion and extension services will be provided to women enterpreneurs. Credit and other facilities will be

arranged from internal and external sources (NORAD, special credit, etc.). Women will be assisted in the marketing of their products through BSCIC sales and display centers.

There are other existing governmental women's programs. The Integrated Rural Development Program (IRDP) under the Ministry of Local Government is working in selected thanas to train and educate women to become economically productive. Mothers Clubs, under the Ministry of Social Welfare, have been organized with multipurpose functions: skill training, health care, family planning, etc., with emphasis on self reliance.

Under the Ministry of Women's Affairs, Bangladesh Women's Rehabilitation and Welfare Foundation (BWRWP) serves and trains destitute women. Bangladesh Jatio Mohila Sangatha (BJMS) runs centers to train women in handicrafts, etc.

Swanirvar Cell under the Ministry of Agriculture is also involved in women's programs.

Other organizations working in this field are Gono Shasthaya Kendra, Bangladesh Rural Advancement Committee (BRAC), Prashika, Karika, Bangladesh Mohila Somity, Concerned Women for Family Planning, etc.

NEED FOR RURAL ELECTRIFICATION

As already discussed, expansion of employment in agriculture is becoming difficult with increasing landlessness in Bangladesh. Nonfarm activities have to be increased; small and cottage industries have to be expanded. The studies mentioned earlier show that women along with men are participating actively in income-generating off-farm industrial activities. With organized programs like the BSCIC's off-farm income generating activities can be expanded to a great extent, making a valuable and effective contribution to the country's income and employment situation.

But providing credit, extension services, marketing services, etc., are not enough for expansion of industrialization in the rural areas. Infrastructure services like transportation, electricity, gas, and water are essential for industrialization and for making women free to pursue other activities by reducing their household chores. The success of the women's program and increase in productivity will depend on the expansion of the supporting facilities which use small machines.

Electricity is required for the production process of the following products in which women are predominantly involved:

- o Coir rope and cordage
- o Jute yarn making
- o Oil making
- o Silk weaving
- o Food processing
- o Agricultural products processing, etc.

Rural electrification means more than connecting electric services. Developing the personal and economic well-being of the people in the rural areas is a very important consideration. Women in Bangladesh, along with others in less-developed countries of the world, are so tied down with their household work and child care responsibilities that they get very little time to participate in other activities. Unless facilities are provided for lightening all of the household work such as electricity, gas, and water, women's opportunities to participate in the development programs will be severely retarded.

Present state of art of electricity in Bangladesh

As mentioned earlier, in 1970 per capita consumption of electricity was only 14.7 kW, one of the lowest in the world. The first Five Year Plan (FFYP) of Bangladesh (1973-78) was launched with the objective of removing the imbalance between generation and distribution facilities by building up adequate distribution facilities and undertaking an effective rural electrification program, primarily to provide power to irrigation pumps and tubewells, small and cottage industries, and bazaars and educational institutions for the benefit of the rural population.

But physical achievements fell short of targets in almost all the sectors in the plan period. Under the rural electrification program, 198 thanas were electrified during the plan period as against the target of 293 thanas to be covered. As far as village electrification was concerned, 1,218 villages were electrified as against the plan target of 1,000 villages. In the case of low lift pumps and deep tubewells, achievement was disappointing. The reasons for this low achievement were resources constraints, shortage of construction material, pressure of global inflation, etc.

Two Year Plan (1978-80)

The Two-Year Plan was launched to continue the FFYP program with greater emphasis on the expansion of the distribution system and removal of the imbalance between generating and distribution facilities. The Rural Electrification Board was established to undertake a comprehensive program for electrification of irrigation, bazaars, and homesteads in rural areas.

During the Two-Year Plan period, the Power Development Board (PDB) and the Rural Electrification Board (REB) participated in the expansion of the distribution network. Efforts were largely related to procurement of substation and line construction materials and equipment, construction of buildings, and organization of Palli Bidyt Samities (PBS). The PBS's were registered during 1978-1979.

The physical performance of the Two-Year Plan also was not very satisfactory. Only 10 out of 26 projects were completed. Only 46.67% of the targets of pumps and tubewells to be electrified was achieved. The target for electrification was 50 thanas in the Two-Year Plan, and actual thanas electrified were 54. The target of villages to be electrified was 500, whereas 261 villages were electrified.

Though it was expected that the deficiencies in the power system of Bangladesh would be removed to a great extent during the First Five-Year and Two-Year Plans, in actuality it did not happen.

The Second Five-Year Plan (1980-85) was launched with the aim of removing the deficiencies and increasing system capacity so that the supply of electricity no longer remains a constraint to economic growth of the country. In this plan period, generation and distribution of electricity will be expanded in order to accelerate economic and social development. The plan also aims at acceleration of rural electrification programs to promote rural development and to improve the quality of life in the rural areas and improve the quality of supply and services, particularly to ensure reliable supply to the productive sectors of the economy.

With the experience of the past plans, we have to be very careful about the performance of the present plan. Proper implementation of the projects in this field is the precondition for success of the program of industrialization in the rural areas.

CONCLUSION

The foregoing discussion reveals that women along with men are increasingly participating in off-farm income-generating activities for a better life style. Various government and nongovernment organizations are also pursuing specific programs for augmenting the participation of women in productive activities, especially in industrial enterprises. In order to implement the women's programs successfully and ensure massive participation of women in off-farm industrial activities, the provision of electricity to their doorstep is a must.

The present rural electrification program should give more importance to the vital concept of the use of motive power by women workers. The RISP study reveals that most women's activities are related to specific crafts and these crafts are clustered in far-flung village hamlets. While selecting REB activity, the current emphasis is on the availability of growth centers. This is a correct approach to the extent that it will help the growth of small industry. But another correct approach now will be to provide electricity to craft clusters where most of the craft persons are women.

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PRODUCTIVE USES OF SMALL RENEWABLE ENERGY SYSTEMS

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INTRODUCTION

The subject of this paper is the productive use of small isolated power plants. One may ask why it is necessary to deal with decentralized energy systems as a separate subject. In a nutshell, the reason is that a small, isolated power plant, as a miniature utility system which is isolated from the grid, is dependent on uses of the power at or near the site. The option of sending excess power to other demand centers does not exist. Moreover, there are special problems with small isolated power plants which draw energy from renewable sources, such as the sun, falling water, or wind. The sun does not shine all the time, and small streams typically do not flow 8,760 hours of the year. Yet, unlike thermal power plants, the majority of costs in renewable systems are fixed, and are incurred whether or not the plant is operated. Therefore the objective with such systems is to develop productive uses of excess energy which are available during periods of low demand, and to increase the efficiency of energy use during periods of high demand but limited energy supply.

The purpose of this paper to is explore means of achieving this objective and, specifically, to share some ideas on recent developments with end uses of small renewable power plants. Since time and space do not permit a review of all the renewable energy technologies, the example of small hydropower will be used to address this problem.

BASIC PRINCIPLES

Before turning to the specific question of end-uses with decentralized hydropower, we shall first quickly review a few of the basic principles governing the economic performance of small isolated hydropower plants, which will help put the discussion of end uses in the proper context.

Hydropower, like other renewable energy technologies, is characterized by high capital costs and low operating costs since, theoretically, there is no fuel cost. Small hydropower projects, therefore, tend to be more economical when the user of this technology is able to take advantage of the low operating cost. In short, high capacity utilization of a plant yields lower kWh costs.

This point is illustrated in Fig. 1, showing the relationship between plant utilization rates with unit energy costs Fig. 1(a) and capital cost margins Fig. 1(b) for small hydro projects documented in a northern district of India. The two tables clearly show that costs at these plants have a strong correlation with the pattern of energy use. Where energy use is low, unit costs are high. It is not uncommon to find very low capacity utilization rates for small isolated hydropower plants in developing countries, generally speaking.

Fig. 1(a). Comparison of load factors to generating cost for five 200kW projects in Uttar Pradesh State, India[a]

Project	Average load factors (%)	Average kWh cost (cents)
Guptkashi	23.6	7.0
Genti-Cherra	20.3	8.3
Tilwara	22.3	10.1
Koti	10.7	27.5
Deoprayag	4.1	62.5

[a] Assumes full depreciation over 6 years.

Fig. 1(b). Comparison of load factor to capital cost for typical 50 kW plant in Uttar Pradesh State, India[a]

Load factor (%)	Capital cost per kW ($)
10	212
20	675
30	1,150
40	1,613
50	2,075
60	2,537
70	3,000
80	3,475
90	3,938
100	4,400

[a] Assumes standard Uttar Pradesh State tariff rate and full capital recovery.

Load characteristics are usually highly variable with isolated systems, resulting in low load factors. One of the reasons for low capacity utilization is that energy use is frequently sporadic in rural areas. A low load factor indicates low average consumption of energy, but with sharply higher energy usage during brief periods of time.

Low load factors often reflect high demand for electricity for lighting at night or cooking during mealtimes, with generally low power use at other times of the day.

Low annual load factors may reflect power demand variations that are linked to seasonal changes in the farming cycle, where peak energy use is during irrigation periods and times of the year when agricultural goods are processed, and lower energy use at other times of the year.

A final point, which relates back to the principal theme of this workshop, is the importance of promoting "productive uses" of electricity with small isolated rural power systems.

It is quite common that the primary use of power in newly electrified remote rural areas is for lighting. The problem with this is that a lighting load, particularly in low-income rural areas where people do not have much income to spend on electricity, rarely generates sufficient revenue to a decentralized project to make it economically viable. Lighting may, in fact, yield economic benefits since it has been seen to extend work hours, increase productivity by providing better indoor light, and improve study habits of school children. However, in most cases NRECA has observed, projects seem to fare much better when the emphasis is placed on "productive uses" of power. Increased production of goods and services means additional income to the user, which in turn enhances his ability to buy other goods and services, including electricity.

To summarize, then, with small, isolated powerplants which rely on renewable sources of energy, unit costs for power are greatly dependent on the capacity utilization rate of the plant, where the ideal is to use all the available power in economically gainful activities.

Recent history with such projects in developing countries, however, shows that this ideal is difficult to achieve, since:

- Demand for power is typically low and highly variable
- Productive uses of power are rarely found to take the leading role, which they must if projects are to succeed economically.

It is this view that the solution to this problem involves:

- The development of "load-leveling" applications of the power plant during off-peak periods
- The selection of productive uses, wherever possible, in doing so.

Finally, low capacity utilization in small isolated hydro plants is also a function of intermittent flows. Most of the very small plants are run-of-the-river type, since providing storage capacity tends to make capital costs prohibitively high for plants at the lower end of the capacity range, say, under 100 kW.

So, a third objective would be to develop applications of the power that can store energy by other means, or in other forms, for use during dry seasons.

ELECTRONIC LOAD CONTROLLERS

In recent years, an important technological innovation has come along in the development of micro-hydropower which promises to be very useful in addressing the problem of leveling out loads on small isolated plants. This innovation involves the use of an electronic load controller to simplify the problem of balancing power output with a varying load on the system.

The main impetus for this new development was to reduce the inordinately high cost of governing equipment for very small schemes. Since loads are variable, there must be some mechanism to continuously regulate the turbine speed so that the generator frequency can be kept constant. If a load on the system shuts off, the tendency of the turbine-generator is to speed up, potentially causing damage to the generating equipment and the end-use machinery that is still being served by the plant. A conventional governing device, acting as a regulator between the generator and the turbine, senses frequency changes in the generator, and acts, by means of a mechanical, hydraulic, or electronic process (or a combination of these), to modify the turbine speed by reducing the flow of water entering or striking the turbine. Conversely, a governor operates in a reverse mode when the load on the system increases by increasing the flow of water. These are complex devices, and can often represent the most expensive component of a very small hydro plant.

An electronic load controller, on the other hand, protects the system by switching power to alternative loads when power from the primary end uses abates. It senses frequency or voltage changes electronically, and directs excess power to "ballast loads" in order to keep the generator frequency constant.

If the load controller is a sophisticated computerized system, or more than a simple load switching device, it can play an important role as a load manager, controlling power output to various machinery according to the changing needs, optimizing the distribution of power between end uses, and making decisions when problems arise.

Apart from costing a fraction of a conventional governing device--perhaps one-tenth the cost in the case of a simple device--an electronic load controller

allows the plant to operate at full capacity at all times, to the degree that water is available. Under conventional governing, the plant's power production, and hence the utilization rate, is limited not only by fluctuations in the supply of water to the turbine, but also by fluctuations in the demand for energy.

In short, the substitution of a load switching device for a flow controlling device not only reduces the capital cost of the plant enormously, but opens the door to the development of numerous load-leveling end uses which can dramatically improve the plant's load factor.

APPLICATIONS

What are some of these applications? Although the load controlling technology is now fairly well established, the problem of finding appropriate uses that can take advantage of this device--that is, uses that can operate with a minimum of human supervision at any time of the day--still requires a great deal of research and development. Some applications, however, are quite straightforward.

Resistive heating elements

The simplest and most commonly used ballast device is an ordinary resistive heating element. When the primary load drops off, the load controller simply "dumps" the excess power through a resistive coil to heat water, for example, for use in community baths or to clean clothes or cooking utensils. This is not a particularly productive use of the power, but hot water can have a beneficial impact on community health, for one thing.

Resistive heating elements may also be used for refrigeration, heating air for drying crops or heating homes, or for cooking purposes. Perhaps the most interesting of these is the use of excess power for cooking.

Energy storage cooker

Deforestation is a severe problem in many parts of the developing world. It exacerbates flooding and landslide activity, and contributes to erosion and the depletion of cultivable land.

In Nepal, where the widespread and heavy use of fuelwood for cooking has resulted in the devastation of that country's forests in many regions, research on the use of electrical energy from small hydro plants to substitute traditional cooking practices has been undertaken by Cornell University's Department of Agricultural Engineering.

This research has produced a simple heat storage cooking method whereby a low level of power is run through a resistive heating element imbedded in a bed of stones, which stores the energy (see Fig. 2).

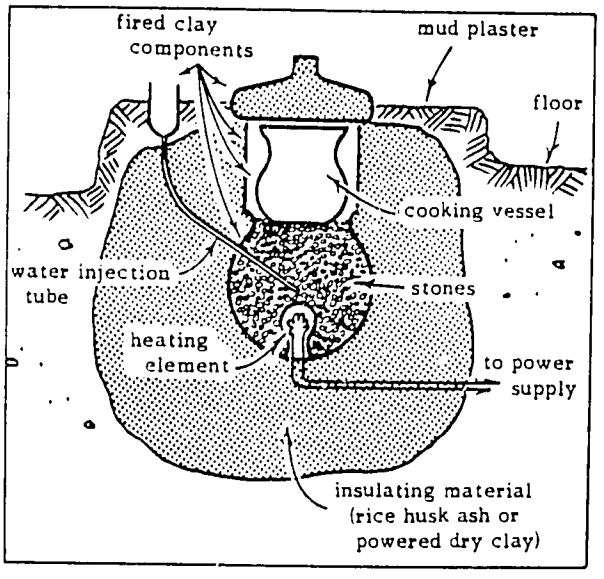

Fig. 2. Schematic of the heat storage cooker based on research undertaken at Cornell University.

There are several advantages to this approach:

- o Power input required is low--only 250 W, whereas conventional electric appliances require up to 1,500 W.
- o Since energy is stored, power can be applied during off-peak periods, leveling out the load curve.
- o Efficiences are considerably higher than with conventional wood and gas stoves--results of a prototype show 21% thermal conversion efficiency, compared to 3-6%.
- o The systems are relatively cheap, costing only $6 if local labor and materials are used.

Battery charging

A second short-term storage-type application which is already commonly found in developing countries is battery charging. Alternating current is converted to direct current by means of a rectifier and stored in batteries.

In some Asian countries, serious consideration is being given to battery charging as a wholly new approach to conventional rural electrification in very remote areas where power requirements are modest, essentially for lighting and to operate radios and small appliances. The idea here is not only to level out the load, but also to reduce distribution costs.

Under one approach, a battery charging facility is located centrally, perhaps next to the powerhouse, and used batteries are brought in by the villagers to be

turned in for charged ones. You might call this "bringing the people to the power," instead of the "power to the people."

A variation on this approach is also being considered in Malaysia in cases where AC power is distributed to houses. In this case, rectifiers are located in each house to store the power in a decentralized mode. A "current limiter" restricts the amount of power going to each house, preferably during off-peak periods; the power is stored in batteries for use at the appropriate time. Again, this scheme is only appropriate in situations where electric power requirements are minimal.

Electric arcs

Another class of ballast uses involves the operation of electric arc processes to produce a number of commercially useful commodities.

Electric arcs operate on a simple principle. An electric charge is passed between two poles to fuse together elements such as hydrogen, nitrogen, oxygen, carbon, and calcium into commercially useful forms such as nitrogen dioxide or calcium carbide. Many of these elements are found in plentiful quantities where small hydro stations are located in rural areas. Calcium is found in limestone; carbon in coal. Oxygen, nitrogen, and hydrogen, of course, are found in the air.

One such use would involve the production of calcium carbide using locally available limestone and coal which would be fused electrically in a simple electric arc furnace. Calcium carbide is a fuel which in the past has had widespread use for lighting purposes in the West. Under this approach, pellets of the calcium carbide are placed in a small container. Water is dripped on these to produce acetylene gas, which can be burned directly, giving off a bright white light. It can also be used to provide gas for welding purposes.

A second electric arc process worth mentioning is one which produces nitrogen oxide for use in nitrogenous fertilizer.

During the early part of this century, nitrogenous fertilizer was produced by combining oxygen and nitrogen in air by means of an electric arc discharge process. Based on cheap hydropower, this method worked very well until the advent of even cheaper natural gas, which was used to produced ammonia-based fertilizers. The enormous price increases for fossil fuels, however, are giving rise to renewed interest in the electric arc process for producing fertilizer on a small-scale, decentralized basis.

The Kettering Research Laboratory in Ohio recently tested a 3 kW prototype arc reactor which is shown in Fig. 3. The arc reactor is operated by supplying power through a high-voltage electrode at one end of an iron pipe, which serves as the other electrode. Air is introduced tangentially through two air ports located at opposite sides of the pipe, which causes the arc to climb in a swirling vortex-shaped path. Temperatures inside the resulting core area reach higher than 2000°C, to produce nitric oxides. These are then passed through a mixture of limestone and water to produce high quality calcium nitrate fertilizer which can be applied by simply adding the enriched water to irrigation canals.

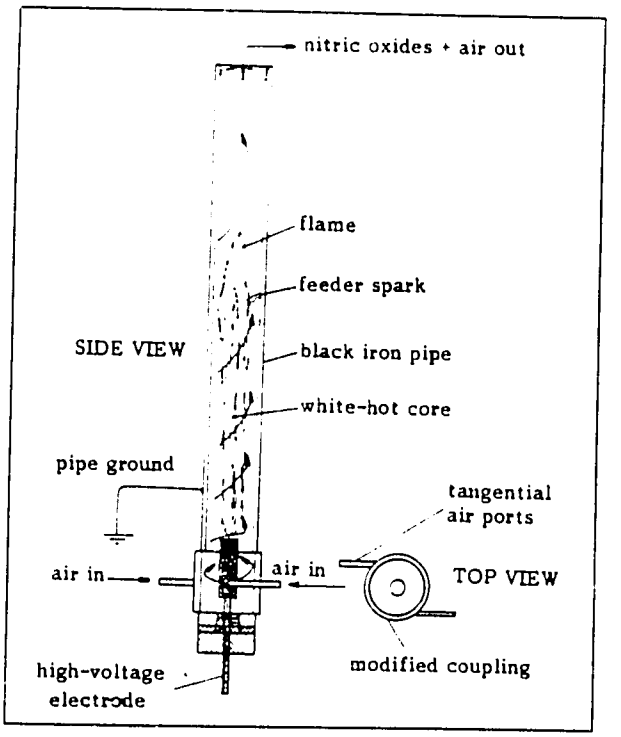

Fig. 3. Schematic of a reaction cell of a nitrogen fertilizer generator.

Other applications

Many other ballast-type applications may be possible to produce products on a decentralized basis. Some of these currently under study include an electrolyzer to produce hydrogen from water or hypochlorite from brine and a pyrolyzer to produce char briquets for cooking from biomass such as pine needles.

CONCLUSION

Economics, it seems, is becoming less and less a science and more a matter of guesswork, and perhaps a little wishful thinking.

There are a few fairly durable economic principles, however, that still hold true. One of these is that economic growth depends largely on increasing the productivity of labor and the productivity of invested capital to create an economic surplus.

Increased productivity, at least in case of the United States, has been dependent on two essential ingredients: technological innovation and proper management of the products and methods which result from it. Electrification, for example, was a

technological improvement in the delivery and use of energy which had a vast impact on urban and industrial activities in the U.S., beginning in the late 19th century. But a concerted effort was required to bring the economic and social power of this innovation to bear on the needs of the rural sector.

In the context of this paper--specifically, the issue of developing new and productive uses of isolated renewable energy systems -- the important technological innovation of electronic load controllers may give impetus to a major improvement in the economic performance of these systems. But other developments, primarily relating to the issue of management, must accompany this innovation to allow it to achieve its practical, economic value in a remote rural context.

The first, of course, is to identify and develop beneficial uses of off-peak power. This is a function of research and development, and will require on-site assessments of the materials locally available that can be converted to useful products, and the plant's power use characteristics, in order to match appropriate uses with varying quantities and periods of excess energy.

It will require training to help people use this technology to its best advantage, and to install and operate the machinery that can use the power for economic gain.

It may require financial assistance to procure this equipment, and additional assistance to ensure that the power and the products which result are used efficiently or successfully marketed.

It is NRECA's view that this process rarely happens spontaneously. In the United States, overcoming the constraints to productive use of electricity in rural areas did not happen overnight. It was the result of a concerted, dedicated effort on the part of several diverse groups, including rural electric cooperatives, banking institutions, agricultural extension services, electrical equipment manufacturers and their distributors, and major universities. The cooperatives took the lead in this activity. They created member service departments to conduct sign-up, promotional, and educational drives to provide financing for equipment purchasing, and to perform many other services that helped expand the productive use of electricity in rural areas.

The lesson to be learned from the U.S. experience is that properly conceived and implemented promotional/educational programs, integrated into other developmental efforts, are vital to the success of rural energy programs.

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PARTICIPANT DISCUSSION AND COMMENTS ON SPECIAL USES

COMMENT: I am Najibur Rahman from the Rural Electrification Board of Bangladesh. I have some questions with regard to decentralized power generation to Mr. Paul Clark. He has stated two load factors with respect to kilowatt hours--kilowatt hour cost is coming down with the load factor higher. On the other chart, he has shown that with increased load factors, kilowatt costs are high. Is it not a contradiction?

PAUL CLARK: I am sorry if I gave that impression. What I tried to say was that as load factors increase, the cost of producing electricity, in terms of the kilowatt hour cost, comes down.

RAHMAN: Yes, that is clear, but what about your kilowatt capital cost? You know, you have said that as load factor increases . . .

PAUL CLARK: Take a look at the second chart. What the chart shows is that if you have a capital cost that is fairly high and a low load factor, the chances of recovering that capital without an enormous subsidy from some source is unlikely. In other words, capital cost and delivered cost are related by the utilization of the plant. I do not see much difference between the question of load factors and kilowatt hour costs and load factors and the capital costs. It's just another way of saying the same thing.

RAHMAN: I would like to quote an example. Say you have a 50 kW hydro plant and your load factor is changing. So, kilowatt cost--is it changing?

CLARK: Uh--maybe I do not understand the question. But if you have a 50 kW plant, and your load factor is 10%, you are not going to be able to sell enough power, earn enough revenue, with a 10% load factor to pay for a plant that is anything over $500 per kW installed. In other words, your cost of sending ower to people is a function of the capital cost of the plant and the operating cost. Now, the operating cost is low, but the capital cost can vary tremendously. In some cases in Asia, the cost varies from $300 per kW to $3,000 per kW installed.

RAHMAN: Now, in connection with the hydro plant, if the capital cost has been invested, you know, so, kilowatt cost--I mean, what about the load factor? Is it not the same?

SAM BUNKER: Could I take a shot at this? I think what Mr. Clark may have been after was the fact that there are varying construction costs, as you can see from his chart, from, say, $675 per kWh to maybe $3,000 or $4,000 per kWh. You cannot afford to put in a small hydro plant if you are going to have a load factor as low as 10%. That is, you would have to build it at a cost of $675 per kWh in order to make it economically viable. That is a very difficult thing to do--almost impossible with small hydro. Average small hydro costs are something in the order of $2,250 per kWh. You have to have a load factor of at least 30% or more in order to make it pay, and I think that was the point of your chart.

RAHMAN: His chart shows that with the increase in the load factor, the cost per kilowatt is also increasing.

SAM BUNKER: No, I do not think he was saying that. Can I interpret his chart?

PAUL CLARK: I can take another crack at it. If you have a higher load factor, you can afford to spend more money building your plant. In other words, if you are going to earn more revenue, you can have a higher margin of capital cost to recover that capital if you have a high utilization of the plant. One aspect of this is that instead of developing a site that may last 5 or 10 years and need to be replaced using very simple designs, you might be able to spend more money in reinforced concrete for your civil works, for example, and have a plant that will last 30 years. I am introducing another problem, the business of useful life, with that comment. But the point of that chart was that load factors have a lot to do with the revenue you can generate from a plant. If you have a high load factor, in other words, you are selling a lot of power, and you can afford to spend more money building the plant. It's a sort of backward way of saying it.

SAM BUNKER: Paul, I think we will have to break it off here because I would like to give some other people an opportunity. Briefly, I think he is talking about a break-even point for plant construction. The gentleman from Sri Lanka, please.

COMMENT: My name is Ratnayake from Sri Lanka. Just one more point about this question of load factor. I think we would find, with more study, schemes would be of mixed generation. I mean, we will most certainly not have a single, small mini-hydro plant feeding an isolated

area. In that context, I think the main criteria for the output plant is the water availability and not really the load. Because, if you have a mixed system, you can always run your hydro as much as you want until you finish up your water. Or you program your mixed hydro-thermal situation in such a way that you maximize the water availability. In most practical situations, what I feel is that the plant factor--not the load--the plant factor of the hydro is determined by the water availability conditions. This would probably be the governing factor.

The other point I would like to bring out is that in Mr. Paul Clark's address, he mentioned two uses. One is electrical cooking and the other is nitrogen fixation. I think both of these are very costly in terms of electrical energy. For cooking, I think the efficient forms of energy are really other forms of direct heat. I was, of course, impressed by the electrical cooker that was presented. It is a very high conservation model. But, the fact is the same type of conservation of heat itself in the cooker is available in other direct heating forms--even kerosene and so on for heating--is probably more economical than using electricity where electricity is fundamentally produced, at least, marginally by, again, petroleum products and heating them in a boiler and so on.

CLARK: O.K. Well, I think the point is that this is unused power. The opportunity cost of this electricity is zero. This plant is not being operated at certain times. The power cannot be sold. So, the economic cost of power in the situation I was describing is very low. I would not suggest something like this where you do have alternative uses of electricity that are more desirable and useful to the community. But, this is just a load-leveling sort of application that is useful when you have access to electrical power resulting in low capacity of utilization of your plant.

SAM BUNKER: Mr. Pabaney, would you like us to know what you have on your mind?

PABANEY: I am wondering--please remember, we are really working on an experimental level. It's a pilot project, and, therefore, we are really trying to learn, and one of the questions that has arisen in our work in Central Java--there are seven areas--they have recommended, let us say, three persons in each area of productive use, as is mentioned in the chart here. Now, I think this is something that I will also pose to my organization. We are in an area where the concentration of industry--these are all small industries--is quite large. Now, the number of people to be contacted and to be convinced and the kind of work required, I would suspect, in our area, is much greater than in other areas. Though I am not too sure number three really holds for this place, I cannot give you an answer. This is one problem, no? Another one that occurred to me was that part of the problem that we face, in most of our areas (and I am speaking especially for Indonesia where less than 10% of the rural areas are electrified), the question that we face at the present moment is in terms of trying to find out what priorities we can have in terms of the existing need. So, I am asking a question: it is mentioned here that we should try to get the communities and the others to understand the productive use program. I think the question may be posed the other way around. The productive use program should try to understand what the people need, and I personally think there is a lot of nonlistening done so that what is probably most important is to find out what the people need. And I can assure you it is not only a question of existing need; it is a question of what they project. And part of the training we are trying to find out with our own trainers is how to listen. I think part of the problem is that we really do not understand entrepreneurs. It happens to be a specialization of mine, incidentally, and I can assure you these people happen to be persons who are rather unusual, and the better we learn to understand them, the better it would be. So, it should be turned the other way around to try and find out how we can look at what they want.

Another thing that occurs to me, and this is troubling us in the larger PLN organization, is how much can an electric producing and distributing organization and a productive use program do? How much can they do? I mean, after all, we do not want to take the functions of everybody. And part of the problem is we have a feeling, for instance, in terms of technical assistance, marketing and so on, that there are other agencies that should do it. And, by the way, let me assure you that most bureaucratic organizations do not know very much about marketing, and I am not so sure they are very helpful, whether it be industrial organizations or marketing ones. These are very specific things which industrialists know much better than we do. And I am not so sure how much we can be helpful. We could probably lead them astray. So, it's a question of trying to understand what the people want and, more than anything else, let me just put it this way, perhaps, our major objective is to try and see where there already exist some good enterprises--where there are enterprises which are making a go of it. We better get to them and help them where they need it. And, it would probably be worthwhile to try to understand them so that electricity's needs would be to really try and find out what these people realiy need and try to get it there. Thank you.

SAM BUNKER: Yes, go ahead please.

BRIG. SABIHUDDIN: On the first paper by Mrs. Akhtari Begum, I have some comments, and I do not know if I am right or she is right, so, I will ask for some clarification. First, you have emphasized cottage industry and women's role in that. The industries you have named here--coir rope, jute, yarn making and all--have you clearly established the type of investment that is required? The type of machinery that is required for it? And what is the employment number for this industry? I am asking this question because we have about $10 million--$6 million from the USAID--specifically for extending loans and importing things and going toward productive uses. And when it boiled down

600 new families in a month. And this is going on without fail every month, and over the last several months in Bangladesh 3,500 new families are getting electricity every month. Thank you.
to naming things and working out what we needed, we found (we did not contact you, that's true)--but the DC couldn't provide us with any clear suggestions like a particular machine made in Japan. With an address, I get the quotation, I import it, and I turn it on. That way we will--but I could not start the job, I confess, because a lot has been said but, really, very little groundwork has been done. Now, one question is this, and then I want to tell you one thing which we have shown to the foreign delegates yesterday; I wish you could have accompanied us. Rural electrification that we started will promote cottage industry because it was thought that rural areas were meant for some sort of cottage activity only. Now we are finding that we are attracting more industry from the city to the rural areas and, in fact, it is heartening that what we thought would be 10% of the total electric consumption for productive uses today already in this society (which we have displayed yesterday)--within the last 2 years, their total kilowatt consumption for industrial purposes is 60%. Now that does not happen just anywhere in the world. This shows one thing: there are conducive conditions that are required and it is not cottage industry, but all subservient industry. If we cleared that conducive condition, the private sector is ready to move into that area. If I can give power in any volume or to any size industry, I feel that the other conducive condition has been met in the rural areas--that rural areas should no longer be restricted to cottage industry only. But, the women's role and cottage industry, if you can give us specific proposals, the Rural Electrification Board will be interested to finance this program, and I undertake this.

Second, you have mentioned certain data on the state of electricity of Bangladesh. Here I want to clarify something. I had the same doubts when I heard it from various people. I was not here when the power board handled the First Five-Year Plan. But unfortunately there are certain aspects we have to note. In 1973, Bangladesh's total generation was, if I am not wrong, 250 mW or so. In the First Five-Year Plan, the power board increased their generation capacity 100%--even after the liberation war of 1973-1978. So, this performance was absolutely, I have to say, one of the highest compared to any sector. Besides, when you have said that 1,000 villages and 293 thanas (our thana is a county)--Bangladesh did not have a secondary transmission system, and these 293 counties meant about 350,000 miles of 33 kv line that was done in the First Five-Year Plan. And this thana distribution system was not planned. A small distribution system, 33 kv line, transmission, and 0.4 small 500-kv transformer was added to it. So, it was not a distribution system, it was actually a secondary transmission. And these 1,000 villages, whatever it was, were electrified, and they were not electrified in the fashion we are currently doing. They were electrified for lighting only or for rice mills. Just give a small average of 33.4 people a little technical understanding and give power to ten houses, so 1,000 villages did not have more than, say, 2,500 consumers. We want to remove this definition we have discussed before. We would like to say how many people got electricity. Let us not bluff. One man running all over the village, we say village electrification. Still I want to give them credit because if these 293 thanas--that means almost everywhere geographically--but these towns did not have transmission system lines. The electricity was running on a generator--one of the big towns of ours. Until 1975, there was no transmission line in the north, am I right? Until 1975-1976. This was the pathetic story. So, the First Five-Year Plan, I will tell you, people criticized a lot--the power board or the power sector did--in the circumstances they worked, much more was possible. But, the plan was much too optimistic. That was the reason for failure, if you compare the two. Second, I want to tell you another thing. This rural electrification would not have been possible if that secondary transmission system was not built. Because in 1974 when the USAID was asked to finance this program, Mr. Turner laughed at it. He said, "How are you going to get electricity? You need transmission lines to take it to that area. Then you build up a big system." O.K. Your observation on the Two-Year Plan--for people who are involved in the electricity development program, there is not such a thing as a two-year plan in electricity. Am I right? It is impossible, and then also with the donor's money. So, the plan was impractical because if you have a donor's money it takes 2 years to give a tender and for the material to come. We have calculated that by the time I sign an agreement, and with the conditions, preconditions and all--27 months is the best possible to get the material on the ground. And Mr. Sjoufjan Awal will say, "No, that's less." Yes? Do you agree with me? They have not gotten the material yet after 4 years! We must be practical and nobody has been able to make it smoother yet. So, the Five-Year Plan and its shortfalls--I think if the finance flow and agreement on all these are not streamlined, then I should say before the Five-Year Plan started, we should finalize all agreements and everything so that from the first day of the Five-Year Plan period we can do something. Today is the end of 1982, that is, 2 years of the First Five-Year Plan, and I can assure you I just finished signing an agreement with the World Bank and all. Then we have started. So, I will already have worked 2 years really in the Five-Year Plan by next year. Of course, then again, if you read in the newspaper, it's a shortfall. But, inspite of that, I want to tell you one thing (because I started in 1978) about the target achieved by the Rural Electrification Board. Until December we had a fixed target of construction of 3,900 miles. And we constructed 3,500 miles of line by then. As for the industrial and agricultural connections, we have not 100 or 200 as estimated, we have 300 persons--more than ever thought. Kilowatt-wise, we thought we would have 10% for productivity. In one we are averaging right now 60%. But, everywhere in all of the societies--12 of them combined--the domestic consumption is less than 50%. This was never dreamed in the Bangladesh

context. Then the consumers, not the number of villages, the target in the feasibility study for June 1982--it was 32,300 meters to be connected, which were to serve 80,750 families. And our achievement on that date was 36,000 metes--91,000 facilities created. And every day we are connecting 300 new homes, that is,

SAM BUNKER: Thank you very much. Some interesting observations and, yes, corrections, perhaps. We have already run out of time. However, we have had one or two interesting statements made that perhaps some of our panelists might want to respond to. I think, particularly, the statement made by the Chairman of the Rural Electrification Board about the possibilities of, perhaps, working with the Bangladesh Small and Cottage Industries Corporation. A comment on that, perhaps.

AKHTARI BEGUM: Thank you very much for the comments. I would like to answer the question of Mr. Sabihuddin as to what are the products for which electricity and power is necessary. I mentioned the products in which electricity can be used and those were the hemp and coir products, jute making, silk weaving, food processing, and agricultural products. It was found in the different studies that women are actively working in these fields, and while organizing certain programs of the Bangladesh Small and Cottage Industries Corporation, we have in that program seen that women want to participate actively in these programs. But this program involves--wants to make the women owners of those projects, that is, of small and cottage industries. That is, to be entrepreneurs. And in Bangladesh, we know (not only in Bangladesh but in some other countries of the world) women do not own the capital. The main thing that they lack is capital, because even in the house our inheritance law is such that women do not normally own property or anything. Whenever they want to do something and get some credit from a bank or any other place, it becomes very difficult. And it is, you know, always said that whenever women want to apply for some credit for some project--fixing a small factory or something like that--it is indirectly owned by the husbands or the brothers or the fathers--something like that. Whenever the women go to the bank and they ask for a loan, they are refused anything because they cannot show anything as collateral. So in these programs, we try to given them a loan without any collateral or security of that sort so that they can have some small amount of capital and set up some kind of cottage industry to produce some products at their homes while sitting in their homes. And these are the products where machinery can be used, but, because it cannot be done on such a small scale, it can be done in a cooperative sort of way, two or three peasants can group together jointly. They can ask for some loans and they can buy some machinery and start producing. Or it can be done at the common facility centers, like the products that have been produced under previous projects where they set up small machinery where women come and process their rope fibers and they take these processed fibers to their home where they produce these ropes and other products: mats and other things. In this way it is possible. I have only mentioned the areas where it can be done. I do not say that it has been done; there is the possibility. We are talking about the potential. And it is the purpose of any organization, governmental or nongovernmental, and the Rural Electrification Board and any other organizations who can serve these facilities to help the women so that they can produce these things with their help.

Regarding what Mr. Sabihuddin said about these areas where BC can given them help. BC is an organization which gives information about where we can get things, and they do the feasibility studies. BC does not give any aid directly. They only connect. They only advise the probable entrepreneurs who want certain sorts of services and facilities and give them information about where they can get it. BC helps with consultants and helps with facilities for doing these feasibility studies and all these things and subjects. So, if the Rural Electrification Board supplies these services to the people in the different areas, I am sure that entrepreneurs will be encouraged to get and set up small and cottage industries or even the smaller or higher scale industries, depending on the credit facilities, depending on the capital, depending on the real materials availability, and depending on the market facilities at home and abroad.

About the Five-Year Plan that Mr. Sabihuddin mentioned, I would like to say that it is a known fact in our country that our target is always kept on such a high level that, naturally, because of the resource constraints and other factors we cannot achieve it. Our achievement always falls short of the target, and, especially because of this inflationary situation and other situations, we are always lagging behind our objective. So it is quite possible that the Rural Electrification Board is doing a lot of things, and we only hope that this Board and other organizations all give us certain facilities so that women and men--I do not mention only women--because the people of the country can do something in this respect: start producing more and generate employment. Thank you very much.

WORKSHOP DISCUSSION GROUPS

Action Reports of the Delegates

H.C. Virmani

Sjourjan Awal

John Romondor

Mohammad Ariff Bin Araff

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Abdul Majid

Pablo M. Pan, III

C. Ratnayake

Trenchiai Sirikiratayanond

Alam Buksh

Guidelines for Discussion Group's Action Reports

Form 1

Form 2

Form 3

WORKSHOP DISCUSSION GROUPS

Action Reports of the Delegates

INDIA
H.C. Virmani
Rural Electrification Corp.

I have listed five goal statements here: (1) energize agricultural pumpsets for minor irrigation; (2) develop rural industries; (3) develop backward areas; (4) develop home or cottage industries; and (5) brighten homes and villages.

Now, with regard to the first goal, the reason is that we in India want to be self-sufficient in food production and not repeat our experience of 1966-1969 with drought-produced deficits in food and also save diesel fuel wherever possible. For industries, we want to create employment in rural areas and dispersal of income, and to utilize local resources. With regard to our backward areas, we want to bring in electricity though we know that we may not get very many productive uses. This is for social and political harmony. And with regard to home and cottage industries, we wish to create and utilize leisure hours and thereby increase productivity. With regard to goal number one--irrigation--our priority activity is credit. And, with regard to goal number two--industries--the target area is resource-based industries and activity, I would say, with the necessity of undertaking some feasibility studies. As to goal number three--to develop backward areas--I consider the target as coordination and integration of and participation in activities. With regard to goal number four, to develop home/cottage industry, I consider this target area as appropriate technology and that duty should be to develop small workshops in load centers to develop the technology for cottage industries. As far as brightening homes is concerned--goal number five--this is very incidental to the program, but it certainly pledges more revenue to the implementing agency and changes the lifestyle, attitudes, and education of the people. And, also, it saves kerosene.

Another target area is to develop appropriate electric motors of a size that could save energy. For this, I think standardization, research, and development would be the activity. I also think, for goal number three, that is to develop backward areas, some training and education is necessary to educate tribal people, particularly in the use of electricity.

Other problem target areas are credit, marketing, and financing because, as far as marketing is concerned, implementing agencies will wait for the consumer to come in and fill in the application, and will tell him, you do this, get the certificate showing your wiring is okay, then fill in this form, that form, and it takes a long time. Indians must be taught how to market electricity. With regard to marketing electricity, my approach would be as a shoe seller who sells lovely feet, not shoes. Indians should try to sell more productivity, not merely the connections.

With regard to credit, what is happening is that bankers normally do not finance a project as a whole. They will finance for the well, but they will not finance for the pumpset. What happens is that if the farmer takes a loan for the well, this becomes almost like taking a loan for the marriage of his daughter because he cannot utilize the well fully and cannot repay and can never afford a motor. And the second problem with credit is that credit does not follow the electrical infrastructure. Or, we can say the electrical infrastructure does not follow the credit system. In India, to solve the problem of credit, in 1978, the Rural Electrification Corp. (REC) started financing in participation with banks and the National Bank for Agriculture and Rural Development (NBARD). We said that we would all share the cost of taking lines there and then what we thought was that they, having shared the cost of lines, would be committed to the area and they would finance the pumps and rural industries. And, to a large extent it has proved okay.

I would also suggest that in India they ask the farmer to give some margin money while taking a loan. This should be waived, and the banks should be obligated to finance the complete project--not just part. The agencies responsible for it, I would say, are the commercial banks, the land banks, the REC itself, and the NBARD.

With regard to feasibility studies, I would not say the functional machinery or organizational system is available, and I would say the organization should be developed to cope with the work. The agency responsible for it is the Small Scale Rural Industries Department, which all states normally have.

With regard to small workshops, it is the same problem. There are very few which develop appropriate technology for the cottage industries.

With regard to participation, each department has its own time-bound program. They are given some money they have to spend; they care little as to what the REC here or the Rural Electrification Board (REB) in Bangladesh are doing. So, they go ahead with their program and REB goes with its program, and, as a

result, REB has done work in certain areas and women's programs in other areas. A mechanism should be developed whereby there is participation among agencies.

With regard to standardization, research, and development, in India there are a large number of manufacturers who manufacture motors of different sizes and different voltage, and REC is doing some work on it in collaboration with state electricity boards and manufacturers. Every 6 months they hold a meeting to develop standards and standards are discussed. In this case, the agencies responsible are REC, CBS, consumers, and the manufacturers.

And another point is training and education. I think there is a lack of institutes and dedicated workers. I would suggest that voluntary organizations should be encouraged to take up the educational program--that is, to educate on the uses of electricity.

And with regard to financing for backward areas, the resources are scarce and the financing should be based on the economic rate of return and social rate of return and not on the financial rate of return. That's all. Thank you very much.

INDONESIA
Sjourjan Awal
Director General of Cooperatives

As far as our goal is concerned, since these are rural electric cooperatives, we have two general goals. One is to improve the economic and social bases of the transmigration areas, which happen to be our first three project sites, through the development of services rendered by the cooperatives. The reason for this goal is to encourage and support the transmigration to the Outer Islands of people from the densely populated island of Java. The second reason is to implement the policy of developing cooperatives as the most suitable form of corporate business institution, which is called for in our constitution. We have planned to carry out quite a few items, but I would like to highlight two of them.

The first one is the drinking water system on the island of Lombok. This activity has shown us the need for closer coordination with the other agencies involved in rural development, for example, the Department of Public Works and the local government and its local planning board. The other one is to develop the food processing industry in Luwu, which is one of three sites. This activity has shown us the need for providing technical assistance, resources, and information services to prospective entrepreneurs. This will also call for cooperation from the manufacturers--both in terms of technical support and also their willingness in some way to share in the funding. As we have discussed earlier, a lot of funding mechanisms have been talked about, but one element that we probably forgot was the fact that the equipment suppliers, with the prospect of equipment being used and sold to particular areas, I think, should be called on to give some kind of funding support--probably in terms of direct credit to those who are going to purchase their equipment. Also, we have to make contacts with the more formal and conventional credit institutions such as banks, departments of finance, etc., and the local governments to assure funding for the kinds of projects.

From this exercise, we have learned a few lessons. One is that, because of the hectic schedule of implementing the projects, we have not paid much attention to the productive uses program. Once we went through this exercise, we realized that we have to re-think our organizational structure and staffing pattern. It has also shown us the importance of planning--five-year planning--and with modifications each year as necessary. Most important of all, it has shown us the need for good coordination with other agencies involved in rural development activity.

As we are leaving this place, we are determined to follow up these exercises with action. We are going to put more stress on planning and modification of our organizational structure and staffing pattern.

Thank you.

INDONESIA
John Romondor
PLN

Thank you very much, Mr. Chairman, delegation, and participants. I would like to apologize, Mr. Chairman, because I cannot fill in the whole list you have submitted to me and follow all of the columns. I only have in my mind the national program, and it is so broad I cannot specify all the projects that I have in my areas. So, in general, I would like to suggest some of what I have in mind at the moment. I would like to start from your Form 1 (and there is another form), but I add to Form 1 and Form 2--and that is what I say is the Action Program.

In Form 1, I have only one written goal statement, but it is already general--the whole nation:

- o How to get electricity to the rural productive users in Indonesia so as to meet their needs adequately. The reasons this goal is important to my country are: to improve the social and economic welfare of the people, and to conserve and diversify energy use. Before we go to an action, first of all, I would like to suggest we locate all of the rural productive use areas; that is, what we plan to do in the areas and the already existing "captive power" we call it in Indonesia.

- o To prioritize for the plan of rural electrification

- To improve the existing organization at the head office level, the regional level, and the branch or local level

- Training within the organization and at the consumer level

- To develop plans and programs--short-, medium-, and long-term.

Now, we come to program development. When we talk about agriculture in the Indonesian context, one thing that is important is lift irrigation in accordance with plans of the Irrigation Department, district plans, and local plans.

Second, small rural industry--also in accordance with the plans and programs of existing and potential industries in that area--and, in relation to the general and sectoral regional and local plans. Third, is home and cottage industry; it is the same as I already called number two. Fourth is the public sector. I think it is the same in all countries in accordance with the plans of programs for drinking water, hospitals, schools, etc.

Electrical equipment development is very important in my case. What I am seeing now is that we have several systems in Indonesia: the three-phase, four-wire multi-grounded system, and also the European system. One of the difficulties in our situation is the one-phase, four-wire, and multiple-grounded system. The motors we have in Indonesia are more three-phase motors, and the difficulty at the moment is that it is very hard to get single-phase motors here. That is my suggestion here in electric equipment development.

STAFFING DEVELOPMENT

First, I feel there is a need for training and education at the field work level--general training in how to work with rural people and rural entrepreneurs. Also needed is special training in locating and accessing loans and getting electricity to productive users.

PROMOTIONAL USE OF EFFECTIVE ELECTRIC EQUIPMENT

At the head office and regional office, there is a need for more orientation and workshops. For technical assistance I feel at the moment that there is a need for: (1) a productive uses consultant, (2) an electromagnetic expert in electric industry appliances, and (3) for specific end uses, resources of dealers and special institutions.

What about credit and finance? In my case, I start with the development of a packaged program to show the needs of rural productive uses. I mean here that I would like to ask the Minister of Finance for money and to finance people in the area, for instance rice mills or something else, and they will repay in 4 years in installments. That's the package program here--just started. Also, I would provide financial assistance for small and cottage industries.

And, on the last form, I will summarize some of the constraints. The first is insufficient coordination between agencies. The second is dependence on materials imported from abroad. Third is inadequate credit facilities for productive end uses. Fourth is newness of the productive uses program because we just started with this program. Fifth is a release in implementation. When you ask me how or what kind of steps you needed to implement this activity, I have three points here: to secure the appropriate personnel for the productive use program; to train the personnel; and, this is important, to extend power lines on time to the productive users.

Thank you very much, Mr. Chairman.

MALAYSIA
Mohammad Ariff Bin Araff
National Electricity Board

Mr. Chairman, gentlemen, since I am the only person here from Malaysia, I believe that this is my own opinion and I hope that you can take it as such. These are what I think are various goals and reasons for them and the importance of why we choose these goals in our country.

Since we are in different stages of our rural electrification, may I just say is that the first goal that I have is to improve rural technology. I believe that, through rural electrification, the improvement in communications, such as telephone and television, opens up new possibilities for the rural people to improve their technical knowledge, which can lead to economically productive social behavior. Then, we have the second goal, which is to improve social activity. Now, rural electrification makes possible the establishment of amenities such as cinema halls, sports complexes, village libraries, etc., and these amenities usually reduce pressure on population growth and lead to healthy and knowledgeable villagers. Our third goal is to widen the base of rural industry in order to increase employment activity and improve housing facilities. Our fourth goal is to reduce transmigration from rural areas to urban areas in order to reduce pressure on congested urban services. Our fifth goal is to improve essential services and commercial activity for the rural areas. And the reason for this goal is to reduce living costs in the rural areas and introduce new outlets and new markets for village products. And, finally, our last goal is to encourage village entrepreneurship. Electricity introduces a new opportunity which, otherwise, would not be possible to establish. And, these new entrepreneurships are based on related uses of electricity such as service industries, consumer goods, and entertainment enterprises. At the same time, we would encourage the improvement of the productivity of existing enterprises.

We have listed some of the suggested programs by development categories. Of course, in agriculture, we are quite advanced in this sector, and the only improvement we can think of in this sector is improvement to rural technology. I think an effort has been made, but I believe that a village information center would be an appropriate suggestion. Similarly, there are other industries in the field like small rural industries, home and cottage industries, public sector, and so on--these usually have a common target area which is, in our sector, usually the manufacturing of furniture, and the mining and building industries. Usually financing for this small sector is a real problem and, therefore, we suggest that in this area a certain amount of incentive or fiscal structure would be required to encourage industry into the rural area.

Secondly is determining our target for electric equipment development. Of course, the target area is usually in technology transfer, servicing, and home wiring, but what we have done in the National Electricity Board is that we already have existing facilities for renting equipment to consumers. This equipment is usually ceiling fans, water heaters, electric irons, and so on. But, I presume that in order to extend the productive use of electricity, we can suggest an extension of this facility to cover electric motors and all other auxiliary equipment, contactors, and all the rest which can be loaned--usually loaned or rented to consumers.

Of course, on staffing development in Malaysia, we are very short of qualified and trained staff. The best thing we can achieve in this area is to engage a consultant in certain cases, which we have done and, in many cases, we can send people overseas for training. This area is where I think a lot of development is taking place, and I suggest we should seriously think of establishing rural electric centers where information regarding the effective use of electricity in the rural areas can be disseminated. I think we have done this in one pilot project where we provide, together with other agriculture departments, some action plans for farmers using electricity as an improvement to their farming technology. At the moment, I have not feedback on this one, but I seriously feel that we should encourage what we call "rural electric centers."

And, finally, on the third form, I believe in our context the main them would be decentralization. At the moment, we have a lot of centralization in management of electricity in Malaysia where the National Electricity Board is the sole organization for the electricity activity, and a certain amount of decentralization is required where people in the villages or other offices in the villages can provide more efficient service than people in the headquarters.

And, in closing, I would like to stress that for the areas of training and manpower development, etc., this is the area where we are very much lacking because of manpower constraints, and this is where I feel the consultant is very, very much in demand in our country. Usually the organization that provides funding for our plan is either IBRD or the World Bank and, to a certain extent, the Asian Development Bank. Usually, in our experience, for any project to materialize from the very beginning to the end takes between 3-5 years.

This summarizes the conclusions that we feel we should take back to Malaysia.

Thank you very much.

NEPAL
Badri Binod Dhungana
Nepal Electricity Board

Honorable Chairman, delegates, participants, ladies and gentlemen. Our power situation of transmission lines and distribution lines is quite different from those of the other nations participating in the Workshop. We are underdeveloped among the developing. I have observed and learned from them many things in the lectures which we have had in this workshop. We have nearly 100,000 consumers in our country who are using appliances and have undertaken productive uses on their own incentive. There is no such thing as a productive uses program in Nepal yet, but with the increase in generation, we expect a productive uses program will be implemented within a few years. We now have a program for the extension of transmission lines and distribution lines which are yet under primitive conditions. Still, I hope when installation is complete, we will have a productive uses program implemented in a planned way.

We feel the following goals can be achieved: improvement of agricultural production and development of small-scale industries; promotion of the development, particularly, of cottage industries; the promotion of social activities; the development of standards for electric appliances which will help to promote the food supply in our country and will create employment and facilities for small farmers. It will promote the use of local resources and create employment. It will improve our educational standards and it will help the literacy program and create health services and family planning works. And we do not have national standards now. It will help to develop national standards, too.

For productivity use, the listing of priorities is the development of a list of target areas, as it proposes rice and wheat production, milling cereals and oil meals, woodworking, schools and health centers, and a set of national standards. And priority activity in the target area should be lift irrigation and tubewells. But first we need to supply reliable and efficient electricity.

The constraints which we are facing in implementing the activity are lack of reliable electric supply and lack of funds. To implement this activity, we have to provide more reliable funds and electric supply.

The rest of the constraints listed are actually of a similar nature because we have to promote the electrification program. To do this, we have to provide electricity and the necessary funds. The funding source is sometimes the individual and sometimes banks and governments in rural areas.

Thank you.

PAKISTAN
Abdul Majid
Water and Power Development Board

Honorable Chairman, distinguished delegates, and participants. I have used the sheet provided to me as a guide, and I have not strictly followed it page by page because a plan of productive use of electricity is already in vogue in Pakistan and has been for the last few years. In the past, about 1,000-1,500 villages were electrified per year. Now, the pace of electrification has been accelerated and the Water and Power Development Board (WAPDA) has fixed a target of electrification of 3,000 villages during the current year. The Government of Pakistan is planning to increase the number of villages electrified from 3,000 to 6,000 during this sixth Five-Year Plan. The total number of villages in Pakistan is about 43,000. Of these, 13,000 villages have already been electrified as of June 1982. Along with the electrification of the villages, about six to eight cable connections and two to three industrial connections are also installed. Thus, it is planned to install about 24,000 deep tubewells and about 9,000 industrial connections yearly if we achieve the target of 3,000 villages to be electrified per year.

Therefore, our program of rural electrification is already in the advanced stage. But, the biggest constraint is the shortage of power. In spite of the fact that WAPDA is providing about 150,000 connections per year, still there are pending about 300,000 connections, which include 250,000 commercial and domestic, 25,000 agricultural connections, and 25,000 industrial connections. A plan already has been formulated to increase the generating capacity, but it cannot be achieved before 1985. The load growth was faster than we planned because of a huge increase in domestic and extra loads by the Pakistani labor force working abroad. In the intervening period, WAPDA is proposing to meet the shortage by reducing system loses and educating the public on how to make efficient use of electricity and expand its use through newspapers, radio, television, and other public media.

The public is also being educated to use maximum electricity during offpeak load hours. WAPDA has also engaged an international consultant to advise and suggest the methodology of load management, which is an immediate necessity at the moment.

During the summer season, due to agriculture loads and motor loads, there is a low system power factor. To compensate, the reactive power elementary shunt capacitators are being installed in the system on a large scale, which also helps to improve the voltage. WAPDA is also taking necessary steps to force the manufacturers to improve the quality of electrical equipment and appliances through the Center Institution in the Ministry of Industry of the Government of Pakistan.

An ambitious program has also been charted and is being implemented to institutionalize the training of the staff and officers in planning, design, and use of modern conceptions and practices, especially in proper joining and connection of conductors and grounding. In this regard, USAID has agreed to provide the necessary help in the reduction of line losses, training, and institutional improvements, in addition to generation and the rural electrification program. Similarly, the Asian Development Bank is also helping to tide us over the shortage of funds by providing US $25 million for electrification of 900 villages within the next 2 years. Thus, our priority is to speed up all pending agricultural and industrial connections in the rural areas to have maximum production of food and self-sufficiency and reduce the use of petroleum in order to save foreign exchange.

Thank you, Mr. Chairman.

THE PHILIPPINES
Pablo M. Pan, III,
National Electricity Administration

Good afternoon, gentleman.

We in The Philippines feel that to come up with very intensive and thorough productive use goals would be a tremendous task. This is because in The Philippines, with the advent of the rural electrification program, almost all of the ministries have focused their attention towards the rural area. And so, this morning and early this afternoon, Melvin Eballe and I thought and struggled to come up with a very modest attempt to present productive use goals which could be attainable in our national electrification office and in the electric cooperatives.

May I cite, in passing, that in agriculture alone the Ministry of Agriculture had representatives who spent about 1 month in every district focusing their attention on rural development. We have the National Irrigation Administration which has gigantic projects in trying to irrigate the rural Philippines through large irrigation systems. And then we have the Farm Systems Development Corporation, which is developing small irrigation systems, with or without electric power. And for the rural industries we have the National Cottage Industries Development Authority, which was established 40 years before the National Electrification Administration. This agency is mandated to develop rural, small-scale industries in The Philippines. And then the cottage industries. I heard from the lady who presented a paper that the Ministry of Social Services and Development, just like in The Philippines, is

concentrating on developing other members of the family so they would be able to generate additional income. In The Philippines, it is also true that we have this ministry. Again, in the cottage industry, we have small development banks which are extending assistance--not financial but technical assistance--to our cottage industries.

For electric equipment development, in The Philippines we have private corporations which are suppliers to National Electrification Administration's electric cooperatives. We locally assemble and, sometimes, manufacture electrical equipment. And, to sum it up, gentlemen, in The Philippines now, we have the national livelihood program which was just started this year. The KKK--this is the national livelihood program--embraces all the programs of the ministries. And so, my friends, as to what we have reported in the first 2 days, we shall again attempt to continue, in our very small way, to contribute to rural development.

So, we have stated these goals. One is we shall continue to increase the number of electric-driven pumps, cold storage, and mini ice plants in the electric cooperative service areas. The reason for this goal is that, in some parts of The Philippines, there are areas which are overlooked by the agency that is supposed to look after the welfare of the fishermen. I am talking about developing more cold storage and mini ice plants. Also, in some areas, especially those very rural in nature, the Irrigation Administration has not been working. So, we feel that if we continue working, we shall contribute to the food production program in these rural areas.

Another goal is to propagate the program we started last year in helping the development of industry. We will propagate the copra, cocoanut, and brick-making industries. The reason for this is that better quality copra and coconut products will mean higher incomes to the coconut farmers. And higher utilization (I am referring to the brick-making industry) of indigenous raw material will mean less foreign exchange drainage.

Another goal we have set is to increase power utilization in the carpentry trade and furniture industry. In The Philippines at present, there are big corporations which are venturing into the export of furniture to Australia, Europe, and the United States. This industry was established by big corporations and happens to be located in urban areas. But we feel that we should give rural carpenters a chance to utilize power equipment because we feel that the use of power equipment would mean better quality products. And so we feel that, with this goal, the importance to the country would be export quality furniture, and it would mean "foreign exchange earnings" for the country.

Another goal is to increase domestic and school lighting consumption and increase the number of schools and community water systems. In this goal, my friends, we are alone because it is only the National Electrification Administration that has initiated this kind of program. This is why productive activities can be undertaken in school during the nighttime. We are targeting nighttime school use for children and adult education participants to be a productive use.

And then potable water will be available in the schools--especially in rural areas where there are no public water systems.

Another goal is to seriously consider the program for the manufacture of mini hydro and dendro thermal equipment components. Of course, this is not attainable in the very near future. But, when we have these mini hydros and dendro thermals operating, there might be parts which could be easily manufactured locally.

We have underlined that the activities to be undertaken by the electric cooperatives and the National Electrification Administration would be as follows: we should be contributing in the prefeasibility studies; we should be contributing and assisting in the preparation of the comprehensive feasibility studies; we shall help proponents in the evaluation of feasibility studies; and, when the electric cooperatives or the budgeted National Electrification Administration funds are available, we shall assist in giving them loans. In regard to the electric cooperatives, I think their responsibility is project organization.

Another goal is training. At present, we combine efforts with electric cooperatives to extend training to beneficiaries of this program.

Another goal is the coordination and procurement of supplies and equipment.

Friends, I think this is what is being attained in The Philippines now and, thus, these are our goals.

SRI LANKA
C. Ratnayake
Ceylon Electricity Board

Mr. Chairman, and gentlemen, the goals that we have thought fit to identify, as far as Sri Lanka is concerned, are described below.

First, the development of tubewells in dry zone areas of the island for food crops. The next goal we have classified is the development of lift irrigation from rivers. Both of these goals are associated with the irrigation development that is rapidly taking place in the country. We also find that in addition to the major projects which have been organized through large loans, the damming of large rivers and multi-purpose hydro irrigation programs, it is necessary to develop the dry zone areas in order, once again, to increase rice production, and also to make regional development possible in these areas. So, the first goal, the development of tubewells within the dry zone areas, is directly related partly to rice production and partly to regional development within that area.

The second goal which we have identified--the development of lift irrigation--is found to be necessary because the maximum amount of croppage is presently not being utilized, even the major irrigation project areas, because of the geography and the flow pattern in those areas. It is often possible to tap further up along our canals and our rivers to maximize the irrigation benefits in these schemes by lift irrigation projects.

The third goal, a universal goal as far as all electricity corporation are concerned, is the maximization of electrification in village homes. I would like to emphasize that, apart from the social benefits (increased living standards, better facilities for studying, and development within the areas), there is a very strong economic benefit in the reduction of petroleum imports which are becoming more and more scarce and more and more costly.

The next item is the development of ice plants in fishing communities. We have found that in many of our coastal areas the fishing communities are poor. They are fighting against tremendous market forces which they are unable to control and are often at the mercy of the middlemen who control the trade. It is, therefore, necessary for the government to step in and to ensure that these market fluctuating conditions are stabilized and that the fishermen have a possibility of storing their fish. This would immensely benefit the consumers who will have a renewable supply of fish and the benefit will accrue both to the producers as well as the consumer.

The next goal is the optimization of rice hulling capacities and the development of the necessary additional capacity. This is connected with the first two goals that we have discussed--the development of irrigation facilities. As I told you, we have prestigious projects for the development of rice production, but it is also necessary to ensure that rice hulling is done both in an optimum and self-sufficient capacity. I would like to discuss this a little further later on, but for the moment we will leave it at that.

The next item is the development of rural industry and cottage industries on an areawide basis. The reason for this goal is to facilitate regional development. We place strong emphasis on the fact that it is necessary to direct our resources toward the development of the regions in order to relieve the pressures of urbanization and the development of metropolises and the associated infrastructural costs that have to be borne by the country.

In respect to these six goals which we have thought fit to identify today, there are many constraints, and a plan of action could be tentatively laid down. Many of these are fairly common with respect to all our countries and have been discussed over the last 2 or 3 days. And, therefore, I would like to take your time only on two aspects which, I think, are rather particular to our case.

One is the electrification of homes, the development of the benefits of rural electrification to all of our rural consumers. One of the most serious impediments that we have come across is the fact that the connection costs and the costs of electrification are considerable. At the moment, we are charging both these costs to our consumers and I am sorry to say that not very many or a negligible amount of really rural cottages, thatched houses and temporary roofed houses, are electrified.

In order to reduce this cost, it is felt that the electrical standards that are being applied are not really related to actual consumption. We are considering, therefore, the proposal of introducing smaller rated switches for main control and smaller rated service wires. At present, the minimum service wire size connection--both rating as well as materials--for the entire island is a 30 amp connection. The actual current consumption in these houses does not exceed more than 1 or 2 amps and, therefore, I think there is a strong possibility of reducing these costs by reducing the cross-section of service wires and introducing a lower rated control switch.

The other item that I would like to bring to your attention is that, in the development of our rice hulling capacity, we would like to treat the entire situation in the overall picture. We would like to optimize, in the overall context, the capacity of rice hulling which is already available in the country as well as the additional capacity that is required. We would not like to beautify our statistics by saying that we have given so many connections for small industries, but we would like to say that they are productive in the actual sense of the word--in the final analysis. In this context, Sri Lanka has recently introduced a strong energy planning unit functioning directly under the President, and it is intended to ensure that suboptimization in different departments will not occur at the expense of national goals. At present, we have a situation in the rice hulling industry in the country of having a shortage of production, that is, an excess of capacity in some of our larger mills, with the advent of the government removing itself from the rice hulling industry. Some time ago, the government did purchase all of the rice from the farmers, milled it, and then distributed it on a ration basis, but with the advent of a freer economy, freed from the control policy, we have a fair amount of individual rice sellers--small-scale hullers--who are automatically developed within the country.

We would like to embark on a larger study, in fact, of the efficiencies and the changes in market conditions, if necessary. One possibility is, perhaps, the releasing of the estate mills into private hands. Another possibility is developing a marketing structure to collect the rice and hulling it with large-scale hullers. But it is premature to make comments on what could be the real possibility. Yet, we can identify that a study is necessary to find out what strategy would be appropriate for the final development of this particular sector.

The rest of the various constraints and the items that we have classified to work on are fairly normal. And,

therefore, I would like to conclude, Mr. Chairman, with the remarks that in Sri Lanka the rural electrification authority is not a separate institution. We have a single national authority for electricity, and rural electrification is small branch within the institution. But we have learned now that it is necessary to strengthen our institutional arrangements, and we are in the process of doing so. And I may add that, within these 2 or 3 days, I have learned a considerable amount both from the sponsors and also from all of the delegates.

Thank you.

THAILAND
Trenchiai Sirikiratayanond
Provincial Electricity Authority

Thank you, Mr. Chairman, and delegates.

For our rural electrification (RE) program in Thailand, we have identified five goals. The first goal is to provide electricity for household consumption. The reasons for first goal are to (1) raise the standard of living; (2) increase the quality of home life; (3) increase availability for educational, radio, and television programs and to promote literacy and farm development techniques; and (4) increase security and ease of movement in hours of darkness.

The second goal is to promote irrigation and potable water pumps. The reasons for this goal are to increase agricultural crop quantity, reduce medical expenses, improve water pollution control and improve sanitation, and make possible an adequate potable water supply.

The third goal is to promote home and cottage industry. The reasons for this are to increase activities in home life and reduce migration to the cities.

The fourth goal is to promote agro-industry--to decrease the number of unemployed and to increase the gross national product and per capita income.

The fifth goal is to provide beneficial training of personnel for future electrification programs, including the operation, maintenance, and management of rural distribution systems. These are five goals of our Productive Use Plan for Thailand.

For Forms 2, 3, and 4, I would like to summarize the constraints to our implementing the activity. We have reduced these to four constraints. The first: we found that in Thailand we have no integrated rural development. Electricity will go it alone without support from the other agencies. In this case, I would like to suggest, the other agencies that should assist are the Ministry of Agriculture, Ministry of Energy, and the Agricultural Bank; they should be involved in the program.

For the second constraint, we found that in the single-phase system, the rice mill owners when they want to convert from a diesel engine to a single-phase, 15 hp engine, cannot buy from the market. That is why we have to convert to the 20 hp, three-phase system. That is why more money has to be invested. This is the constraint.

The third constraint is that we found for the electrification pump in the rural area of Thailand, the paddy field is far away from the private household. If people want to use, maybe a 4 or 5 hp irrigation pump, they have to connect from their homes to the paddy fields--about 1-2 km. That is why they can use more money. In this case, I think that there should be a credit source from the agricultural bank to help them.

The fourth constraint is the lack of a technical assistance program for the consumer, both in lighting consumption and power consumption. Productive uses of electricity is very new to our program. After attending this Workshop, I think that we should have a consultant to help us to supply this program.

Thank you.

BANGLADESH
Alam Buksh
Rural Electrification Board

Thank you, Mr. Chairman.

Although we have been working in two or three groups, I will summarize the three into one.

Here, in Form 1, some goals have been stated; for example, consumer connections, utilization of electricity in irrigation, utilization of electricity in small cottage industries, electrification of agro-based and other industries, education and training, family planning, and health care. Also a goal is utilization of locally produced electrical equipment and material. These are some of the goals I have mentioned here, and the reasons they are important to the country are:

1. Provide electricity to rural people for better living standards through area coverage;

2. Utilization of electricity for irrigation. This is because of a shortage of food in our country and also to save foreign exchange;

3. Utilization of electric service in the small and cottage industry, proper use of locally available raw materials, creation of job opportunities, reduction in imports of finished goods, and increased per capita income;

4. Electrification of agro-based and other industries, augmentation of improved farming and processing of farm products;

5. Education and training, development of superior leadership, self-reliance, and sense of responsibility

among the common people. Then for family planning and health—acceleration of family planning activities and providing modern treatment facilities to the rural people.

Then, from Form 2, end use development, agriculture, the target area is, naturally, irrigation. There are a number of priority activities, but I have mentioned only one: the single-phase and three-phase line construction for irrigation purposes. And, for these activities in Form 3, I mentioned some of the constraints that we are facing: (1) funding; (2) shortage of materials; and (3) shortage of manpower. There are, of course, other constraints which are not mentioned here.

We have taken at least three major steps so far. Among these, we have arranged for foreign and local funds from different sources and better coordination and distribution of materials on project sites and extensive training. We are giving number one importance to extensive training, and in REB we have a separate Directorate of Training for that purpose. There are personnel agencies responsible, as we know, and the Bangladesh Government is involved--REB is also involved and the Directorate of Training. The duration ranges from 12-18 months. Constraints vary depending on the type and quantity of construction required. Training is considered a continuous process. We cannot say that 1 month of training or 2 months of training is the end--rather, it is always a continuous process.

Another major step taken regards small rural industry for end-use development; the target area for development is agro-based industries. This is our target area for program development and, here, the priority activity has been mentioned as identification of machinery and equipment. For this activity, certain constraints have been mentioned, for example: (1) lack of information, (2) lack of coordination among concerned agencies, and (3) lack of experienced and knowledgeable persons.

In addition, major steps have been taken so far concerning the extensive study and proper analysis of data; arrangement of regular coordination; and development of expertise through experience and training. Persons and agencies involved are the Directorate of Training, Bureau of Statistics, and the Planning Commission. For home and cottage industry end use, the target area is small and cottage industries, and the priority activity is the extension of loan facilities. For this activity, there are certain constraints: shortage of funds, delay and complex procedures for getting loans, and improper utilization of loan money. These are the three major constraints that we are facing, and for this purpose we have taken a number of steps. They are the arrangement of sufficient funds from the Bangladesh Government and commercial banks and the development of simple procedures for getting loans. We have suggested a number of proposals to different organizations, including commercial banks, to streamline and shorten the procedure, and provide loans in kind and proper monitoring. For this we are contacting the Bangladesh Small Cottage Industries Corporation, an autonomous body, and they are helping us.

For public sector end-use development, education and training have been considered as target areas, and we list a priority activity as being an extensive training program, and, in implementing this, we have some pressing constraints: (1) lack of funds, and (2) lack of training equipment and aids and inadequacy of experienced personnel. The major steps that we have taken so far are arrangement of funds from the Bangladesh Government, ensuring availability through REB training, and arrangement for local and foreign training. With these we have taken the help of our government. For end-use development—electrical equipment--the manufacture of electrical equipment, this has been considered as the target area, and here the priority activity, number one priority activity, is to contact manufacturers and ensure purchase of local products.

The constraints that we face usually are higher production costs due to high duties on imported raw materials. This is one of the constraints that we are facing when we manufacture certain equipment or materials. So, for this, we have taken the steps we have suggested to the Government: reduction of duties and taxes. In some cases these have already been reduced, and in other cases they are trying to reduce them. They are under active consideration by the Government.

And the second is monopoly in production due to the shortage of manufacturers. You know that Bangladesh is a very small country, and here the manufacturers of equipment and materials, particularly electrical equipment and materials, are very few because there have not been very many manufacturers in the past. So, there is a shortage of manufacturers and as a result there is a monopoly business in some cases, say, for example, motors, diesels. But the Government is also encouraging other manufacturers to come forward. And, as a matter of fact, a General Electric manufacturing plant was established a few years back. They still have yet to go into full production. When they go into production, and some other small entrepreneurs come in, then we expect that there will be competition and prices will be more reasonable. So, we have taken major steps in the reduction of duties, encouragement of local and foreign investment and the Government, at present, is very much encouraging foreign investors, entrepreneurs and local manufacturers. For this purpose the Government has already taken a number of steps.

The third constraint is lack of capital of manufacturers. Many people are willing to have industries, but there is a shortage of money, and for that purpose, extending loan facilities, the industrial sector, the Government, and different banks--through commercial banks and other banks--are coming forward with loan facilities, for example, Krishi Bank, industrial banks, and other banks--commercial banks.

These are some of the goals I have mentioned here. This is not the end. As you know, we have a comprehensive plan and program, and in my paper presented on Thursday to this seminar, I listed the goals along with other activities that have not been possible to mention here. I have given only some of the activities related to the agricultural sector and rural industry--cottage and public sector--and some of the constraints. There are so many difficulties and other constraints that could not be accommodated here, but some of the major constraints have been mentioned here, and I hope this serves the purpose.

Thank you.

WORKSHOP DISCUSSION GROUPS GUIDELINES

Form 1

Guidlines for Discussion Group's Action Reports

WRITTEN GOAL STATEMENTS	REASON GOAL IMPORTANT TO COUNTRY
1	
2	
3	
4	
5	
6	
7	

Listing of Priority Productive Use "Program" Activities

Form 2

(Fill In Each Blank Line)
(Refer to Goal Statements)

SUGGESTED "PROGRAM" DEVELOPMENT CATEGORIES	LIST TARGET AREA FOR PROGRAM DEVELOPMENT	LIST PRIORITY ACTIVITY TO BE UNDERTAKEN IN PROGRAM TARGET AREA
A. END USE DEVELOPMENT		
1 Agriculture		
2 Small Rural Industry		2
3 Home/Cottage Industry		3
4 Public Sector		4
B. ELECTRIC EQUIPMENT DEVELOPMENT		
1 Electric Equipment		5
2 Electric Appliances		6
C. STAFFING DEVELOPMENT		
1 Research/Marketing		7
2 Training/Education		8
3 Technical Assistance		9
4 Credit/Financing		10

"PLAN OF ACTION" FOR IMPLEMENTING PRIORITY PRODUCTIVE USE "PROGRAM" ACTIVITIES

Form 3
(Page 1 of 2)
(Fill In Each Blank Line)

NO. OF ACTIVITY (SEE FORM 2)	LIST CONSTRAINTS FACED IN IMPLEMENTING ACTIVITY, IF ANY	PLAN OF ACTION			
		LIST 3 MAJOR STEPS NEEDED TO IMPLEMENT ACTIVITY	PERSON/AGENCY RESPONSIBLE	FUNDING SOURCE	TIME SCHEDULE
1					
2					
3					
4					
5					

"PLAN OF ACTION" FOR IMPLEMENTING PRIORITY PRODUCTIVE USE "PROGRAM" ACTIVITIES

Form 3
(Page 2 of 2)
(Fill In Each Blank Line)

NO. OF ACTIVITY (SEE FORM 2)	LIST CONSTRAINTS FACED IN IMPLEMENTING ACTIVITY, IF ANY	PLAN OF ACTION			
		LIST 3 MAJOR STEPS NEEDED TO IMPLEMENT ACTIVITY	PERSON/AGENCY RESPONSIBLE	FUNDING SOURCE	TIME SCHEDULE
6					
7					
8					
9					
10					

WORKSHOP CONCLUSION

Closing Remarks on Behalf of Delegates
Sjourjan Awal

Review of Workshop
Samuel Bunker

Closing Remarks
William Joslyn

Closing Remarks
Jay Carter

Further Closing Remarks
William Joslyn

Comments
Dr. Aziz Pabney, C. Ratnayake, and Sam Bunker

Summary of Workshop Achievements
Edward Gaither

CLOSING REMARKS ON BEHALF OF DELEGATES

Sjourjan Awal

SAM BUNKER: Before moving into the closing session of this Workshop, I would like to call on Mr. Sjoufjan Awal from the Indonesian delegation to say a few words on behalf of the entire foreign delegation. Mr. Awal, would you please come forward.

MR. AWAL: Thank you, Mr. Chairman, for this opportunity. A lot has been said about how we feel about this Conference, but I thought I might underline a few things. We know that the Bangladesh Government has given a total commitment to this electrification program. But little did we know that all the officials here--the government officials--have so much interest and such close personal participation in this program. We were really honored to have been welcomed by His Excellency, Sultan Mahmud, the Deputy Chief Martial Law Administrator, and Minister of Energy and Mineral Resources. To us, it shows not only his official commitment but, observing the amount of time that he has given to this Workshop, from being here to welcome us to sending us off in a very big way, shows us his personal interest and personal commitment, which are far beyond just the call of duty. For that, through you, Mr. Chairman of the Rural Electrification Board (REB), please convey to him our deepest gratitude for his interest, participation, and encouragement to this Workshop--and, more than that, in a way, his encouragement to all of us.

I would like to make a few comments about REB and the organizing committee, the Chairman of REB, and the staff who have made our stay here very fruitful and enjoyable. The Conference delegates, from the very beginning when we arrived here, we were welcomed in very VIP way. The Conference has gone on very smoothly without any problem. The field trip was especially exciting and informative; we saw more than we expected. Your warm welcome to us is really appreciated. Also on the field trip, we saw the tremendous progress that you have made. If I may be a little bit sentimental, I would say that the REB can be described in the same way as the dance that was performed by the lady last night. I don't remember the name of that dance with that very fine footwork. It showed dynamism, discipline, precision, and rhythm. You can go slow when you have to and you can go fast when you have to. I don't know how to categorize your progress so far, but there are only two ways of describing it: either totally superior or truly superior. As a token recognition of this particular performance, Mr. Chairman, we would like to give you something--and probably it has never been done here before, but, at this point in time, I would like to "order" the Chairman to come forward.

Mr. Chairman, thank you very much for everything. I would encourage you to open this in front of the audience.

BRIG. SABIHUDDIN AHMED: He wants to make me a line man now! Thank you. Thank you very much. I was talking to Mr. Awal last night, after we finished the function. We had, I think, more than a 1 1/2 hour session in this hotel. We left about 12:30. We had a long discussion with him. I was telling him that I do not know how since 1978, when I started this rural electrification program, that somehow an international fraterization developed. I do not know. In 1979, I met him wherever I went in the United States, in The Philippines, in Indonesia; we have a formal friendship. Electrification is done in a much bigger way. Rural electrification is a very small thing in comparison to the traditional electrification that we have been doing. But, that fraterization, it never came up. But that may be the reason we have so much difficulty in moving. Please. . . thank you.

REVIEW OF WORKSHOP

Samuel Bunker
National Rural Electric Cooperative Association
Washington, D.C.

I want to open up this session with a quick review, as far as I'm concerned, of what happened over the last 4 days. The remarks that I am going to make and the interpretation of the various papers that were presented are strictly mine. I don't attribute them to anybody else. I probably heard things that you didn't hear--and, maybe, differently. But the purpose of this is really to refresh all of our minds as to what it is we've heard and talked about over the last 4 days.

The Conference itself, as you remember, was opened up on a fairly upbeat and positive note with the Minister's statement--particularly his statement that the productive uses performance in Bangladesh has far exceeded expectations to date. This, was adequately demonstrated in the trip that we took on Wednesday. This, was followed by Ed Gaither who gave us a clear and concise explanation of what is meant by area coverage rural electrification; how it came about or came into being as a concept, as an alternative to rural electrification; and how it is being applied in Bangladesh.

Tom Niblock talked to us on a number of subjects--primarily, emphasizing the need for data collection--information flow systems--to be established so that there is proper documentation of rural electrification around the world for funding and banking institutions and for the entities' own information. He also flagged what we have been talking about quite a bit since then--three alternative productive uses approaches: the integration approach, the coordination approach, and the hands-off approach. We have talked about all three of those over the last few days. He also brought to our attention that we really need to concentrate as well on off-farm activities as well as spin-off activities from rural electrification; that there is more than just agriculture and rural electrification. He also identified that funding levels of approximately 20% of the total investment in power sector development appeared to be an adequate level to accomplish rural electrification in most countries on a nationwide basis.

Dr. Shyam Rungta, from the Asian Development Bank, indicated the relatively good news, we thought, that the Bank is planning to expand its lending in rural electrification at the rate of approximately 20% annually as opposed to a projected 10% expansion in the overall power sector. He indicated that the Bank considered that productive uses was a far better way of carrying out a program than subsidies. He agreed that village-level data are important and indicated the need to emphasize or determine ways of quantifying social and indirect benefits of rural electrification.

John Schwartz, from the World Bank, primarily emphasized the importance of the need for a range of complementary development inputs within a project area in order to attempt to assure a successful rural electrification effort.

Finally, Ralph Bird raised the very important need, or identified an important need, for a free exchange of information on productive uses activities and that this kind of information needs to be institutionalized in some way or manner.

During the afternoon session on Monday, we heard a series of extremely interesting and important country statements about rural electrification in general and productive uses in particular. Unfortunately, I believe we found, and I think our tally of our evaluation sheets indicates, that we allowed far too little time for this; that it was not possible to do justice to these papers in the time allocated. I read a few of them, and they are very good, and I would certainly hope that they will be read by all of the participants.

Dr. Frank Denton closed the Monday session putting forth his view that productive uses activities, in one sense, have been going on in many, many countries for many years--way before the advent of so-called "rural electrification"--and that rural electrification is simply one of the elements of productive uses activities, and a late comer at that. His view was, of course, that the injection of electricity was really, in a sense, all that was needed and that it would be used. The theory that, I guess, somebody else described as the "sugar and ant" theory--put out the sugar and the ants will come. And, I think, that was Dr. Denton's message. He did make a point that in terms of The Philippine programs, anyway, it certainly was not a consumption program as he claimed many had indicated it was, primarily for household, domestic lighting. Indeed, only one-third of the power produced was being used for household lighting purposes and two-thirds, at least, were used for a variety of productive uses.

The second day of the Workshop, Tuesday, we had a very good session, I think, with a number of voluntary institutions--CARE, CARITAS, HEED, World Council of Churches--and, I believe, I speak for many of us when I

say we found this session particularly interesting and valuable. It was observed by many of the panelists that continual contact on a one-to-one basis allows for unique insights on how things really do work and, indeed, how things don't work. I believe, too, that any person seriously concerned and interested in rural electrification should take advantage of these substantial resources that exist in many, many countries--the private voluntary organizations. They do have an opportunity to look at things somewhat differently than, perhaps, those of us who are tied more closely to desks and bureaucratic organizations. Out of this session came comments concerning the need to understand the cultural changes that can occur when electricity is introduced into an area. The HEED representative made that point. There is need to understand the effects on employment with the introduction of electricity into an area. I think the term used was "substituting convenient electricity for inconvenient people." And, finally, it was recognized that private voluntary organizations have a very great potential for providing case studies about rural areas which can be extremely useful for those of us concerned with rural electrification.

The session on financing rural electrification brought out the views that development banks are interested in rural credit, but generally on a very broad front and not particularly targeted to narrow and restricted areas. The IDA, for example, supports agricultural credit programs generally--I think that was the term the representative used--but they do use all of the banking agencies, or like to use all of the banking agencies, dealing with or concerning rural credit. The problem, apparently, seems to be not so much a question of available credit but, rather, of the mechanisms of making it available. Bangladesh was a case in point. I believe the Bangladesh Krishi Bank (BKB) panelist indicated that there are some 4,500 credit outlets in Bangladesh, yet 65% of the unions do not have banks. It's a problem of duplication and improper spread.

We also heard about the number of credit institutions the REB is already working with--the BKB (already mentioned), commercial banks generally, the Integrated Rural Development Bank, and local credit institutions of all kinds.

We further heard about the rural finance experimental project from the USAID panelist--RFEP, I think it was called, which has worked on a number of different loan modelings and lending procedures and, apparently, has already, where instituted, had an effect on moneylender rates. The question that I didn't get a chance to ask, and maybe we can find out later is: What next? I understand the experiment is over. What are the implications?

Finally, in this financing session it was observed that rural people do tend to be very honest, that a one-to-one relationship is probably more important than collateral in the lending process, and that the need to identify new entrepreneurial activities may be less important than helping the existing entrepreneurs.

The Tuesday afternoon session consisted of a number of case studies on agricultural end uses, small industries end uses, home and cottage industries end uses, and special and secondary end uses. While not trying to catalog them all, we did hear about small hydro development in Nepal; electric- and diesel-driven rice huilers in Sri Lanka; the PLN cotton project in Central Java, Indonesia; the Sinar Rinjani Electric Cooperative in East Lombok; the Nawan charcoal-making and copra-drying industries in The Philippines; end uses of electricity in a resettlement colony built by the Delhi Administration in India; a study of tubewells for irrigation in the Punjab in Pakistan; and a number of others. Again, the creators of the agenda--that is us, the NRECA--made, I believe, quite a serious error in not allowing enough time for these case studies to be presented as they should have been. We were too hurried. They are good case studies. As with the country papers, I've read a number of them and I suggest that all of you do that.

The field trip I need not review. We all thought that was one of the high points--if not the high point--of the Workshop. And, I think, in terms of the productive uses of electricity, there was ample demonstration that the Minister's statement was, indeed, correct.

On Thursdav, the first speaker gave us a number of illuminating statistics concerning women in the rural workforce, pointing out the difficulty in getting these statistics. For instance, while 84% of the rural women in Bangladesh participate in non-farm activities of some type, as unpaid women working at home, they don't show up in the census as part of the labor force of Bangladesh. So, whenever you are talking about the rural labor force in Bangladesh, you are always getting a distorted picture. And anybody concerned with the productive uses of electricity needs to bear this in mind. It was pointed out that the use of motive power of all types by rural women is not fully understood; that what they do, how they do it, and how much time they spend with motive power is not understood, and this is something that should be researched and documented.

Finally, in Bangladesh, and I suspect that this is true in many, many countries, there is already a number of institutions, both governmental and nongovernmental, working on the problems of women and employment. Entities concerned with rural electrification, such as those represented here today, should become aware of these organizations and work with them on the productive uses of electricity.

The next speaker told us about the importance of end uses or productive uses options in the optimization of investment in decentralized hydropower systems, particularly those using renewable sources such as photovoltaics and, in this particular case, a small hydropower system. Examples given included energy storage cookers, batteries, electric arc furnace

fertilizer production, and several others. The introduction of electronic load controllers as a less expensive way of regulating the use of power from these generating systems was discussed, and we were reminded of the need for management inputs as well as the technical inputs in the operation of these kinds of systems.

The third speaker of the session gave us a very detailed and, very useful description of a model productive uses program in an already operating utility. This was designed, as I think we indicated to you yesterday, to be a starting point only for the thought process about how an action organization might be put together.

In the afternoon fourth and final session of the Conference, discussions were confined to individual country reports on the results of the various team workshop meetings in developing a productive uses program. Taken together, 10 country groups established over 20 separate categories of productive uses goals--goals as opposed to action plans and constraints--ranging from the very general to the very specific. Not surprisingly, the leading category among these was to increase the production and processing of agricultural goods which, of course, represents the backbone of any rural economy. Also frequently cited were the goals of developing small rural industries and cottage industries. Among others prominently mentioned were the reduction of transmigration to urban areas, the development of national standards for electric equipment, the encouragement of village entrepreneurship, the improvement of essential public services and, notably, the maximization of the electrification of rural homes. This final point is significant in discussing the value of productive uses of electricity. We should not underestimate the fundamental importance of developing a secure and more liveable home environment in which social and economic progress can take place.

And what are the constraints that were identified to achieving these goals? Again, there were a number of common elements that were identified in the course of the afternoon. The central theme from the preceding day's discussions which emerged is a very distinct picture of inadequate information, inadequate and inexperienced manpower, and problems with the overall institutional capacity to develop and promote the productive uses of rural electrification. More than one country group identified the lack of a clear authority to carry out a successful program and the absence of interagency coordination as twin constraints, indeed, to achieving their country's goals. Virtually every group cited the lack of funding and credit facilities to provide the impetus to growth of productive uses. It was a very, very common theme--and an obvious one. Again, this is largely a function of a conscious policy and plan to bring all of the necessary pieces of a productive uses program together.

Other constraints, such as lack of adequate and reliable sources of power and the unwillingness of suppliers and consumers alike to take risks, were also listed. These are all serious obstacles requiring the concerted attention of an informed, dedicated and, undoubtedly, tenacious group of individuals or entities if they are to be mastered. And I believe it is fair to say that with this Workshop and, in particular, with the exercises which took place yesterday, we are considerably closer to making a solid beginning toward overcoming some of these obstacles.

Specific target areas were established by each country group on which to take aim in the coming months and years. Concrete steps were identified to help carry out a comprehensive plan of action spanning a wide range of institutional and technical activities. In many cases, responsibilities for taking these actions were assigned to specific groups and agencies and sources of funding were identified. And, equally important, I think, in some cases, time schedules were actually developed.

This is where we came out, I believe, at the end of yesterday--at the end of four highly action-packed and very interesting days, and the task now, of course, is to see what it all means to us. So, we had this Workshop, and now what?

I think I might like to begin that exercise by calling on at least two gentlemen with me today at the table here who are with AID. I don't really have to introduce the gentleman to my left, Mr. William Joslyn, who is the Deputy Director of AID here in Bangladesh. He was with you on Monday, or was it Tuesday, Bill--so, I would very much appreciate it, Bill, if you could give us your views on this subject at this particular time.

CLOSING REMARKS
William Joslyn
USAID
Bangladesh

Listening to this summary is a very useful way to pull together a number of the pieces of the Workshop that I have heard and commented on. I am struck by the diversity of experiences. You know, the participants here come from this region, yet the examples that have been cited are all different and highly interesting. Some of the things that are happening in other countries are not happening here, and some of the things that are happening here are interesting to other participants. If I were searching for a common denominator out of the Bangladesh experience, it seems to me that the management of the various programs recognizes the importance to their programs' futures of having productive uses of electricity in the rural electrification program and the areas covered by rural electrification by recognizing that, in order to convince the donors and their governments that the projects are very worthwhile, and, indeed, to maximize the utility of them for the beneficiaries, management wanted productive uses of rural electrification. And, with the interest at the top level of the program, they then responded to the situation here to produce results.

Now, on the one hand, that sounds like Dhaka decided what they were going to do. But, from my observation, Dhaka decided that they were going to maximize the opportunities that existed in the various cooperatives. For example, because they recognized that many people wanted electrified wells, they made it easy for wells to be electrified. They gave priority to making the connections; they gave priority to responding to opportunities that existed. I was struck during the comments by the CARE participant on my panel that, after the wells got electrified, other things just happened. For example, an oil crushing mill. This wasn't in response to the Brigadier's decision that there were going to be crushing mills electrified but, rather, his direction that rural electrification was going to respond promptly to productive uses proposals and requests, and so forth. And so, while they were indeed trying to electrify wells, the very same priority applied to other opportunities that came along, and we suddenly have successes popping up that weren't centrally planned but were the result of a central decision to make them happen as quickly as possible when each opportunity developed. I think the net result is that you have a program that is very well regarded because it is doing a lot of the right things. And, I think from a donor's perspective, goodness, it's very good to be associated with a project that everybody says is successful and which other donors want to fund because it is working so much better than many of their other projects. And so, the productive uses here have been very helpful in that respect. It was just an impression that kept coming back to me. It wasn't so much that the Chairman of the REB knew personally exactly what productive uses there were, but rather that there were going to be productive uses made of rural electrification and that the system was going to maximize the opportunities that existed in local situations. It was a sensitivity to what the local opportunities were and the determination to make it work that stood out with me.

SAM BUNKER: Sort of the "spread effect" in a sense of the program. The question is whether, while it may have been targeted towards a particular type of activity and others came out and sprang up, this was a spontaneous kind of reaction. Is that what you are saying?

WILLIAM JOSLYN: Well, the opportunities were there, but it was a central decision to make opportunities, if you will, a determination that they were going to find opportunities. They just didn't wait for them to happen and string up the lines and wait for productive uses to just spontaneously develop, but rather followed through on a central decision to go out and find opportunities which were there.

SAM BUNKER: So there was an external, in a sense, catalyst that was involved in this.

WILLIAM JOSLYN: There was an external catalyst to make that part of the program work.

SAM BUNKER: Which is the important part of the program.

WILLIAM JOSLYN: Yes, which is the important part of the program.

SAM BUNKER: Well, I think that's an important observation, and I think it, perhaps, puts into a little better perspective the observations of Dr. Denton about The Philippines' program.

I would like now to turn briefly to Mr. Jay Carter, who is with us here representing AID from Pakistan, and ask Jay to talk just a little bit about what AID's views are these days in Pakistan on productive uses and, of course, the Pakistani Government's view as well. Jay . . .

CLOSING REMARKS

Jay Carter
USAID
Pakistan

As a representative of USAID/Pakistan, I should like to bring to you the greetings of the Mission Director, Donor Lion, and those from Charles Moseley, the Chief of the Office of Energy and Engineering. Mr. Moseley planned on being here with you, but at the last moment the Director found that he had urgent business for him. So, I am pinch-hitting for him, and it has been a real pleasure for me to be here with you.

I would like to pass on just a few points that come to mind in light of the work that is going on in Pakistan.

The productive uses of electricity in the rural setting is really an integral part of the AID program, which is only a small part of the Government's overall economic program. In Pakistan, the Mission and its participation is developing a rural electrification program with the Water and Power Development Authority, of which my colleague here, Mr. Majid, is the Chief of the Rural Electrification Office. And, as a result of work that has been accomplished in the last 6 months--concentrated in the last 6 months (I think people have been working on it for a year or two before that time)--we have put together a rural electrification project of $155 million which will be initiated in the coming months. This is being supported by an additional $15 million in AID money for providing transformers and line extensions for tubewells in the agricultural areas. The Mission is in the process of carrying out an energy planning and development program which would be $20 million, a forestry project for $20-25 million, and a rural road project. There is also the on-farm water management project and tribal development--all of which are going to be integrally tied in with the rural electrification work.

No one of the projects will be standing alone, and we have to have success in each of them in order to make it work. I think that the success of these will improve the living standards in the villages and will slow down the migration to the cities, and this is a very important part of the Pakistani program.

I would like to draw on some of the comments by Mr. Majid yesterday that, in the Pakistani scene, they have already gotten to the point where there are more than 300,000 applications for service laying on their desks. They are more than a year behind in trying to serve these new applicants. And we are at a point where technical assistance in the villages needs to stress more the efficient use of electricity, and this carries over directly into the economic program. Actually, we want to get the tube wells working, water on the farm, and better, more economic crops. We want agro-industries where these crops can be processed and passed on and be competitive on the local market and, hopefully, in the international market to better the overall economic situation.

I think we need to start at an early point to safeguard the energy and to make more efficient use of it. In too many of our countries there is a real energy shortage, and we end up struggling to provide the electricity out into the rural areas, and that, in the end, in Pakistan at the present time, is a very, very serious problem.

I appreciate being here with you during this Conference, and, again, best wishes from the AID Mission in Pakistan.

Thank you.

FURTHER CLOSING REMARKS
William Joslyn
USAID
Bangladesh

You know, as I was listening to Jay's comments, it struck me that we have a tendency to compartmentalize what we are doing. We are having a seminar on the productive uses of rural electrification, and so we think of it as a rural electrification concern. But, you know, in a different sense, it's much broader than that and, I think, it is useful to just note that, while the USAID Mission in Dhaka has a rural industries program, productive uses of rural electrification are, indeed, a rural industries program. Productive uses of electricity in rural electrification areas by electrifying pumps and providing electric motors for tubewells are, indeed, an agricultural program. Some studies suggest (and we are tailoring our own evaluation and data collection to be able to try to answer this question once and for all) that rural electrification is, indeed, a population program. And, certainly, it is a rural employment program. It's many things. So, when you make productive use of electricity, you have a much broader constituency for rural electrification because you are doing all of these other things that are in themselves projects in many countries.

Now, we all recognize that reliable power is the ultimate need. But I know, for myself, and I think for our Mission here, one solution, I suppose, is not to electrify--and that is not an acceptable solution because we want to bring the 20th Century into these villages. We need to if we are going to succeed in our development goals. So, rural electrification has been a high priority project in our USAID Mission here and is going to continue to be. It's one that we point to as one our most successful programs and one that we are going to continue to stay involved with and one that we are going to encourage other donors to increase the commitment to. The fact that the ADB was here last night and has been indicating that they are going to come into this project is a very positive sign and something that we at USAID very strongly support.

Thank you.

COMMENTS

DR. PABANEY: On the subject of future orientation, I wonder if we might look at the question of the effect of rural electrification in villages over a period of time. In our own area, we are trying to have in-depth 5-year monitoring. We are suggesting that there might be an economist who might look into some of the questions that you yourself raised on the problems in the growth of productive use, growth of employment or not. And the other aspect we are looking into is to have a cultural anthropologist attached to the program. It is not a periodic need; in a sense, it is a continuous one. Now, the kind of strategy we are trying to use is maybe to select three or four of what you would call sample villages which would be more or less representative and, over a period of time, take a look at what really happens both on the economic as well as on the cultural side. What I would like to suggest, if it is acceptable here, is to have a kind of cross-cultural one. Let's say, something in Bangladesh, something in Thailand, something in India--in terms of what really happens to these rural areas when electricity is introduced. Thank you.

SAM BUNKER: Well, that sounds like an interesting subject to discuss, and, operationally, I think, we would need to consider that when you talk about a cross-cultural kind of examination--economic and social examination--that's quite a large order. I think it could be extremely useful if it could somehow be mobilized. No doubt it would take a tremendous amount of coordination--agreement and coordination and organization. But, I think it is the kind of thing that needs to be considered quite seriously. I understand that the Rural Electrification Board Evaluation Unit is thinking, along with AID, about attempting to get some demographic data out of their evaluation efforts to begin to understand what the effect is of rural electrification on fertility levels in the rural areas of Bangladesh, comparative study on electrified/nonelectrified villages and such. Some of this has already been done in The Philippines. I think Bangladesh is probably a much better country at this stage in which to attempt to begin to develop that kind of data and information. And I think it is important. I think what you are saying, Dr. Pabaney, is important also in order to understand what is going on in this process. I think not to understand or to proceed with the process with a lack of understanding is not the right thing to do. So, I think this is a good suggestion. I see it as a tremendously difficult task. But, you wanted a cross-cultural comparison, which means a sort of international effort along this line.

SAM BUNKER: All right. The delegate from Sri Lanka has the floor. Please use this microphone up front.

C. RATNAYAKE: Thank you, Mr. Chairman. I would like to associate myself with the comments that this

Workshop has, indeed, been a successful one and also that some form of follow-up action by the reviewers or other conferences is necessary. But, I would like to bring out one aspect--make a humble suggestion. In this type of conference we have the problem of, I think, a fairly large number of papers, and an inability to discuss particular topics in more intensity. So, I would suggest that in any kind of future follow-up conference, we would have, let us say, one lead speech or one lead paper on a particular subject, and then a more intensive discussion so that all of us could get the benefits of the different problems that various countries have faced and solutions that they have come up with and so on. I think one of the most important aspects of a conference of this nature is the exchange of ideas and news and to draw from other people's experiences. And, in that context, I think if you could arrange the organization of the conference itself in such a way--I think one suggestion was already made by the delegate from Bangladesh that we could distribute the papers beforehand so that delegates could be informed of what is being discussed and we would restrict the time for the lead paper or for the number of papers on each topic--my whole object is to intensify the discussion and the exchange of views on each particular aspect so that, on the various fields we are trying to discuss, we could gain very much more knowledge and information.

Thank you very much.

SUMMARY OF WORKSHOP ACHIEVEMENTS

Edward Gaither

I think the Conference, the Workshop, has been well summarized. I'd like to share a few things with you first as background. Through the planning process of the Conference, a great deal of excitement and enthusiasm developed among the various financial institutions that have an interest in and have been participating in the funding of rural electrification. There seems to have been an increasing concern that here's a broad program where there seems to be an increasing demand throughout the developing world that requires tremendous front-end capital investments. And, in too many instances, as has been brought out by some of the presentations--the example that Jim Lay gave yesterday of the Peruvian system that had been operational for 10 years and almost static as far as vertical growth is concerned--there are too many situations like that throughout the world which have caused increasing concern. As a result, AID/Washington requested us at NRECA to organize three regional productive uses of electricity workshops throughout the world. For many reasons, which have been indicated throughout the Conference, we proposed Asia as the first one. The content, the participation, and, certainly, the conference proceedings, I am sure, will be viewed and reviewed very closely by these institutions and, we think--I think, at least--my conclusion is at this point that it certainly is going to have a positive impact on their interest in assisting them in whatever way possible, to do what they can to accelerate the interest and the overall implementation of productive uses programs by the various power entities throughout the areas which are engaging in rural electrification programs.

The interest and the participation here has certainly been most gratifying. You came, as has been indicated, well prepared with country assessments, and with useful and interesting case studies, but as has been repeatedly noted, the Workshop agenda just did not permit sufficient time to discuss and ask questions of the presenters about detailed aspects of their presentations.

I am not going to try to summarize the evaluations, but we do appreciate the participation and the cooperation of each of you who have dutifully filled out, at the end of each day, the evaluation forms and turned them in. They are going to be most valuable in planning follow-on workshops. I would like to share with you some of the highlights.

First, we asked you to rate from "poor" to "excellent" each major subject covered by the Workshop. We are gratified that there were no poor ratings. A majority of the ratings were from "good" to "excellent." I'd like to share with you the most popular aspects--and this is simply a consensus of the evaluations that you turned in and will be recorded in the conference proceedings, but in no particular order, except one--by far, the field trip was, I think, the most popular one and rated consistently the highest by all of the participants. There were five others that had significant mention and proved to be the most popular subjects overall. They were the presentation on the productive uses and load growth; the slide presentation (the first day on productive uses); the presentation on cottage and rural industries; a productive uses division as part of a consumer services department; and the design of the action plans.

There were several interesting and beneficial general comments that have been reiterated here this morning by those of you who have approached the microphones that the subject matter has been timely. But we tried to crowd too many subjects into the conference proceedings overall, thereby not allowing sufficient time for the interaction that can be so beneficial in questions and answers and discussion concerning the relevant papers. And, as has been brought out by virtually every speaker who has commented this morning, it would have been beneficial to distribute the papers in advance. Certainly, we are most appreciative of the comments; the evaluation papers will be studied in detail, but a summary of the consensus of the evaluation papers will be an important part of the conference proceedings.

Now, to attempt to conclude. Just where do we go from here? The suggestion has been made that, on some kind of basis, we get together annually. There are a lot of possibilities in that. My boss, Sam Bunker, has graciously volunteered our network, and that, I think, is a logical role, under the circumstances, for us to play. And if you desire us to do that, certainly, we are more than willing to play that role. We hope we have the concurrence of the presenters--the people who have developed the papers--to do some editing and, in some instances, to synthesize the papers in the interest of brevity but, certainly, maintain the high points so that each of the delegates has a permanent record of the proceedings of this Conference which all of us can use as a guide for planning future conferences.

Then, the last item in concluding would be an attempt to institutionalize the coordination of our efforts to evaluate our respective programs. I don't think we can over-emphasize that aspect. It's very important to everyone in this room who is interested in rural electrification and who is going to be putting together packages to expand their existing programs to serve more people to try to upgrade and maximize the use of electric energy provided to existing connections for economic and social gain and to make evaluation a continuing, very important aspect of our overall planning and implementation efforts. Because when you can put together a proposal to a prospective donor or lender, if you can document a track record that these are the benefits that we have been able to document that have occurred as a result of our program thus far, you are at least half-way there in securing their attention, their interest, and their response to your request.

Thank you.

WORKSHOP CLOSING

Remarks by Ambassador Jane A. Coon at Closing Session of International Workshop on Productive Uses of Rural Electricity

Adjournment
Yusuf Hossaid

REMARKS BY AMBASSADOR JANE A. COON AT CLOSING SESSION OF INTERNATIONAL WORKSHOP ON PRODUCTIVE USES OF RURAL ELECTRICITY

It's a cliche to say that I am honored to speak to this Workshop. In fact, I volunteered to speak because of m deep personal interest in the Rural Electrification Program. And as United States Ambassador to Bangladesh, I share with my Bangladeshi colleagues the feeling of pride that this Workshop has been held in Dhaka, where you can see real accomplishments in rura electrification.

In the past year, I have participated in the opening of three Palli Bidyut Samitis -- Rural Electrification Societies. Having seen the impact on rural areas, I am an enthusiastic supporter of this project.

What makes possible this impact, of course, is meticulous planning, careful management, absolute insistence on high standards, training, and many other less obvious elements which make the program a success.

You have been discussing this week an essential aspect, namely how to increase the productive uses of electricity. I have seen the electrified irrigation pump, the oil mill, the rice husking machine, which contribute to rural productivity and generate income. While it is essential to build into the rural electrification plans a program for productive uses, it is equally important that other government policies and programs create an environment which encourages farmers and small entrepreneurs to utilize the power.

While your emphasis has been on productive uses, I would suggest that we not lose sight of some less measurable, perhaps intangible, benefits. At the last project I visited, I was struck by the importance of light in the village tea house, where people can now gather after dark. The school could show film strips and students could do their homework in the evening. I am also impressed with the potential benefits of the cooperative system, which has been carefully structured. The users do have an input into decisionmaking and a shared responsibility for the system. This provides a form of grass roots democracy and provides sound experience in community action.

Nothing succeeds like success, and the Bangladesh Rural Electrification Program provides the evidence. My government has contributed so far about $90 million.

The World Bank, the Kuwait Fund, and the Government of Finland are making substantial contributions for an expanded program.

I wish I had been able to attend some of the sessions this week. I understand there have been lively and constructive discussions and that you have been able to share frustrations as well as examples of success. This kind of practical exchange of information and experience can be enormously useful. I would like to thank our hosts, the Rural Electrification Board of Bangladesh, for their gracious hospitality. And thanks are also due to the National Rural Electric Cooperative Association for making available provocative speakers and bringing together the delegates.

May you return home safely to turn on the lights, the pumps, and the engines in thousands of villages in Asia.

* * *

ADJOURNMENT
Yusuf Hossaid

Distinguished delegates, panelist participants, members of the REB, Her Excellency the Ambassador of the United States, ladies and gentlemen, everything which has a beginning has an end. The end is always painful and gloomy. It has been, I can assure you, a great honor and pleasure for me and all the officers and staff of the REB to be able to play the role of hosts to such an august gathering.

Ladies and gentlemen, as you all know, Bangladesh is one of the so-called members of the least developed countries. With a lot of constraints on resources, you should appreciate that, in spite of all these limitations, we are succeeding in implementing a rural electrification program. However, you must have already noticed that Bangladesh may have resource limitations due to overpopulation and almost total lack of "lucky list" resources like petrol and other mineral resources, etc., but we stand almost parallel to most of our Asian brothers when it comes to organization and management capability.

Distinguished delegates, I do not know how well we have been able to achieve playing the role of a host, but I can only assure you that all the officers and staff of the REB served in that role with pride and extended their hospitality from the core of their hearts. I hope you will forgive and forget any lapses that may have occurred during your stay here. I would like to thank

Mr. Sam Bunker and Mr. Edward Gaither of NRECA, and Mr. Jim Norris of USAID, and, in particular, the Ambassador of the United States, Mrs. Jane A. Coon, for making possible all that has happened here.

Lastly, my friend-delegates, I thank you for the cooperation you extended and all the hard work you have put into making this Workshop a success. Thank you.

The distribution phase of S
Bangladesh's "Total Electrifica-
tion Programme" will take both
time and large investment be
fore it has major impact in the
rural areas. If, sustained rural
development is to be attained
It is essential to create enough
rural employment. In Bangla-
desh putting to work at least
some of the enormous surplus
of unemployed rural poor, is a
prerequisite to any concept of
rural growth. The failure to do
so will leopardise the success
of even the best of rural deve-
lopment efforts.

IMPORTANCE OF AN EFFECTIVE PRODUCTIVE USES PROGRAMME

THOMAS NIBLOCK

Few of us would be here if we
not already believe
tification to be on
nomic, ne

Early in 1976, USAID made
project studies grant to the
Government of Bangladesh to
conduct an Rural Electrification
Feasibility Study. Two US firms
the National Rural Electric Co
operative Association and Com
monwealth Associates, Inc
were selected to combine their
efforts and carry out the study.
The purpose of the study was
to ascertain whether area cov-
erage Rural Electrification could
be financially viable in a poor
determine if it was
the rural poor
what contri-
ke to im-
nd social
y. The

k 12.30 cr for Khulna drought hit areas

From Our Correspondent

JESSORE, Nov. 15: The Gov
rnment has sanctioned a loan
of Taka 12.30 crore for distribu-
tion among the drought affect-
ed cultivators in six pol-
tions of the dist
tion Prom

tilling land in a village near Matlab thana after recent show

no loans would be sanctioned
in IRDP Project areas. Through-
out th
19

to refuse funds for expanding
rural electrification. Successful
rural d consumer task is to
utility financ ojects and
ances needed by
consumers.

Develop information/educational
aterials to include:

Potential products or activi-
ies in newly electrified areas
otential

Mrs Jane A. Coon, US Ambassador to Bangladesh, addressing the closing session of the five-day International workshop on Productive Use of Rural Electricity organized by the Bangladesh Rural Electrification Board (BEB) in cooperation with United States Agency for International Development (USAID) and National Rural Electric Cooperative Association (NRECA) USA at a local Hotel in Dhaka on Friday The closing ssion. was also addressed by the REB Chairman Brig. Sabihuddin Ahmed.

area coverage rural electrification

EDWARD GAITHER

HOLIDAY 7

and other uses of
electricity
omic-book-style educational
phlets on safety and ra-
onal use of energy
Radio announcements for
eventual use in project areas
Posters and devices for de-
monstration purposes
- Typical wiring diagrams for
lighting, pumps, motors,
shop and other equipment
for agricultural and other
rural enterprises

The Bangladesh Times

Concept of Electric Distribution in Rural Areas of Bangladesh

NAJIBUR RAHMAN, Chief Engineer, REB

Poles and Structure

MOHAMMAD IMAM BUKSH
Director, Equipment and Materials Rural Electrification Board Dhaka

World workshop on rural electricity Nov

By A Staff Reporter

An international workshop
productive use of rural elec
city will be held at Ho
Sonargaon at 9 a.m. on Nove
ber 15.

The workshop arranged
the National Rural Electric C
operative Association of Ame
ca with financial assistance fro
USAID and Bangladesh Go
ernment with Rural Electrifica
tion Board as host

About 34 representatives fro
USA, Pakistan, India, Sri Lan
ka, Thailand, Malaysia, Philip
pines and Nepal will take part
in the workshop.

Latin Americ

Economic growth; whe
urban or rural; whether
in the developing or developed
countries of the world, is large-
ly dependent on the availability
of steadily increasing supplies
of energy in one form or ano-
ther. In many parts of the ru-
ral areas of the developing
world; newer forms of energy
supply systems are just beg
ning to be develop d. B
in terms of availabl
sources; the investm
ed to bring these
areas where th
before can be
important
effort b
maxim
be

Mr Philip Costas, Assistant Administrator, Economic Analysis and Evaluation, National Rural Electric Cooperative Association (NRECA) speaking as chairman of the panel discussion on Financing Productive Use Activities and Programmes on Tuesday on the second day of International Workshop on Productive Uses of Rural Electricity at a local hotel. The other participants in the discussion were Mr Claude Reece of Neth, Deputy Mission Director, World Bank, Dr Shyam Rungta, USAID Bangladesh, Mr A.K. Bank (ADB), Mr Ashamullah of Bangladesh Krishi Bank and Rural Electrification Board of Bangladesh (B

Electricity in rural areas is
only a social amenity but
more importantly so—an econo-
mic
cate-yes
rural economy
marily agr

installation of three phase line
extensively as they are scatter
ed and separated by long dis-
ances. REB is therefore using
phase converters, which
convert single phase output
to

plan and supported with vol-
tage drop and sectional'zing
studies. The design has been
called prelim nary because it
is meant for selecting best
lines. Sizing and locating sub-
stations sizing conductors and
equipment etc. Exact and
to pole design is
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A brief on Bangladesh Rural Electrification Programme

Compiled by Directorate of Programme

Bangladesh is located in the
Eastern part of Indo-Bangla
Subcontinent. The approx area
of the country is 143,998 sq km.
The total population is about
8000 million.

Agriculture is the main occu-
pation of the people employing
80% of the labour force and
directly contributes 53% to the
GDP. Bangladesh has a per ca
pita generation of 35 KWH
(1992) as compared to Indi
Pakistan-195, Sri Lanka-1
Philippines-373 in 1990
gy statistics by
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unit of th

ductive power use programme
a vital part of the Rural Elec-
trification Programme. Mere
electric service connection is
not the objective of REB. Eco-
nomic well being of the consu-
mer and productive power uses
are also important consider-
tions of REB.

In order to
productive p
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IV Motor through 10 Hp
V Utilization of Electric Ser
vice in Irrigation
V Utilization of E
vice in

Productive use of electricity

e accomplished by the field
taff in each project area under
he direction, support and su-
pervision of the central office
taff. During this period, the
Productive Uses Advisers will

nomic evaluations of rural pro-
ject areas, maps, distribution
design guidelines, equipment
and supplies catalogues, etc.

Develop guidelines for con-
ducting production and market-
ing surveys of the proposed

an ongoing constant activity).

Enter into discussions with
firms from the private sector
for mutual promotional cam-
paigns, including equipment dis-
counts, information exchanges,
lists of clients, etc. (Constant
Activity).

Schedule and conduct train-
ing programme for local utility
staff personnel.

Schedule training program-
mes for local and area leaders
and hold them.

APPROXIMATE TIME: C+6—
(Three Months)

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THE BANGLADESH OBSERVER

DA. 5. 34th Year No. 241 Dhaka Wednesday November 17 1982 Agrahayan 1 1389 (B.S.) Moharram 30 1403 (H.) 12 Pages : P.

Women's Role in Productive uses of Electricity

AKHTARI BEGUM, Director, BSCIC

making (43 per cent), and silk weaving (39 per cent), etc. 63.1 ent of the total women employed in the (BISP report

also reveals that women activities crafts and these d in far flung

also wo- e and tivi- ne, ng of n

Rehabilitation and Welfare Foundation (BWRWP) serves Bangladesh Jatio Mohila Sangsa and trains destitute women tha (BIMS) runs centres to train women in handicraft etc. Swanirvar Cell under the Mi-

of Agriculture are al d in women

ductivity will depend on expansion if these support facilities to use small machi ries.

Electricity is required for production process of th lowing products in wh men are predominan ved —

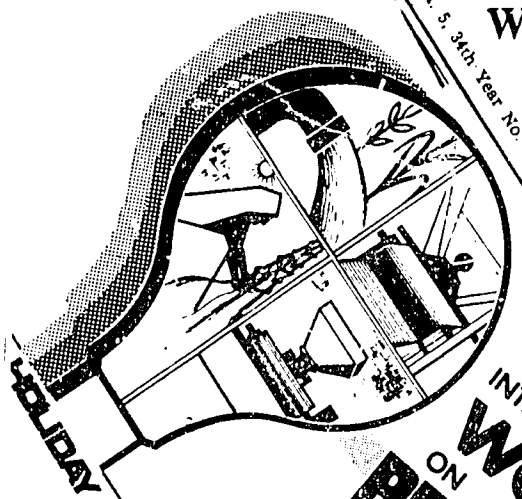
— Coirrope and
— Jute Yarn m
— Oil making.
— Silk weavi
— Food proc
— Agricultu ceasing

Rural more thr servic sonal the a

21, 1982

Productive uses A Model Proj

JAMES D. LAY, Regional Admi
the Caribbean National Rural Electric Co-ope
rural Electric Co

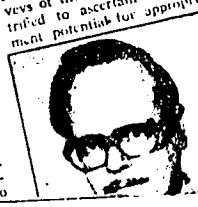


HOLIDAY

INTERNATIONAL WORKSHOP ON PRODUCTIVE USES OF RURAL ELECTRICITY

Date: November 15—19, 1982.
Dhaka, P

which
uses of energy.
— Production and marketing sur vevs of the areas to be elec trified to ascertain develop ment potential for appropri



CO USE USES
Nearly programm pletion of have as on purposes the ral areas. Hi only lip servic to the planning mentation of a w well-supported a ed power use/pro programme which the

Bangladesh-Total Commitment to Area Coverage Rural Electrification

EDWARD GAITHER
Regional Administrator Asia and the Pacific
National Rural Electric Co-operative Association, Washington, D.C.

Many countries have been making various types of assistance programmes available to Bangladesh since they estab-

lished their

study was divided into two phases. Phase, I, Economic, Financial Feasibility and, — Phase II, a detailed Planning and design study to determine the magnitude and cost of the necessary physical facilities,

Perhaps we should pause here to clarify what we mean by Area Coverage Rural Electrification. It is a concept developed in the United States in the early 1940s. Th States

rowers 1/2 of 1 per cent above the cost of borrowing of the US Treasury. In the initial years the REA adopted a policy that a borrower must be to demonstrate a density connections per mil In the sparsely pop ern US, this densi ssible to achieve

As

and, in cooperation with ind try, developed high conductors which ber of

Financing productive use activities in rural electrification programme of Bangladesh

SYED YUSUF HOSSAIN, Member (Finance), REB

asonable in co possibl

Participating countries:
BANGLADESH, INDIA
MALAYASIA, NEPAL
SRILANKA
ONESIA
KISTAN
AILAND
MERICA

HOLIDAY