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EVALUATION OF THE
INDONESIA RURAL ELECTRIFICATION PROJECT

Results of 1984 Surveys
of Households, Businesses and Public Facilities

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EXECUTIVE SUMMARY

1. BACKGROUND

The Perusahaan Umum Listrik Negara (PLN), Indonesia's National Electric Company, is conducting an evaluation of their Rural Electrification Project, which was funded by the United States Agency for International Development (USAID). The evaluation, also supported by USAID, is designed to measure the social and economic effects of providing electricity to villages in Central Java. The evaluation will describe the characteristics of households, businesses, and other facilities using PLN electricity, what the electricity is used for and extent of use. It also will measure changes in patterns of energy use, consumption and expenditures and assess changes in household and community life styles, employment and income, educational and health care opportunities, entertainment and security. Finally, it will describe the quality of PLN service to customers and the demand for and affordability of electricity among the village households and businesses.

This is the second evaluation report issued by the PLN and their technical advisor, the United States Bureau of the Census. An earlier report (August 1981) described the conditions existing immediately after the introduction of PLN electricity to three demonstration area villages in the Klaten region of Central Java.[1] This report documents "baseline" measures in six villages in two of the seven USAID-funded project areas in Central Java--Klaten and Banyumas.

All households, businesses and public facilities in these six villages were included in the data collection with interviews taking place in January through March 1984. In three of these villages, PLN electrification began in 1983. This report describes the initial uses of electricity and the resultant changes in these villages. In the other three villages, electrification was scheduled to begin in 1984, that is, after the surveys were conducted. The PLN plans to conduct followup surveys in all six villages to monitor the changes due to electrification.

2. SUMMARY OF BASELINE SURVEY FINDINGS--HOUSEHOLD SECTOR

The survey investigated the uses of electricity and other energy sources among all households. A summary of these findings is presented below.

2.1 Socioeconomic Status of Villages and Households

The socioeconomic status of the three Banyumas villages, whose economic base is predominantly agricultural, can be described as "average" when compared to the rest of Indonesia. The three Klaten villages, located in an industrial area, are somewhat more affluent than average.

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[1] Klaten Area Surveys on Costs, Uses, Affordability and Quality of Service of Electricity, International Statistical Programs Center, U.S. Bureau of the Census, August 1981.

At the time the surveys were conducted, approximately 20 percent of the households and 50 percent of the businesses in the villages had electricity. In general, the households with PLN connections are better off economically than the households without electricity. Almost 60 percent of the highest income households compared to less than 10 percent of the lowest income households, have PLN electricity.[2] The electrified households in the highestincome quartile consume an average of 57 KWH of electricity per month while the lower income electrified households consume an average of 33 KWH per month. In 1980, the lower income electrified households in the three Klaten demonstration areas consumed an average of only 23 KWH per month. The higher income households in these areas consumed about the same amount of electricity as the comparable households in the 1984 survey villages.

2.2 Use of Electricity by Households

All the electrified households use the electricity for lighting, and between 30 and 42 percent use electricity to run radios, televisions, phonographs and irons. Although the ownership of these appliances is income related, they are used even by the lowest income group. Seventy percent of the households report that the major benefit of electricity is improved lighting.

2.3 Use of Electricity in Home Businesses

Twenty-four percent of the households in these villages have home businesses, but only eight percent of these have electricity. Among the electrified businesses, most of which sell retail products or process agricultural goods, 72 percent use electric lighting for an average of 4 hours per day to accomplish more work, 50 percent use electric for security lights, 10 percent use electricity for tools and equipment, and 4 percent for refrigeration. Forty-four percent of these electrified home businesses report that electricity has extended working hours. The average number of employees among the electrified businesses is also higher (2 persons) than in the nonelectrified home businesses (1 to 2 persons).

2.4 Use of Alternate Energy Sources by Households

While all the electrified households use electricity for lighting, all the nonelectrified households use kerosene for lighting. No household reported using electricity for cooking. Ninety percent of all the households use firewood as their major energy source for cooking, with most of the others using kerosene. These results differ substantially from the 1980 Klaten study, where only 34 percent of the households used firewood as their major energy source for cooking and boiling water. Although the use of kerosene for cooking predominates among the higher income households, more of the electrified households use kerosene rather than firewood for cooking at all levels of income. It appears that as households switch from kerosene to electricity for lighting, some then continue to use kerosene (which they are accustomed to purchasing) for cooking and boiling water, and reduce or eliminate their use of firewood for these purposes.

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[2]Households were divided into four income groups of approximately 1250 households each.

2.5 Household Energy Expenditures and Consumption

The average expenditure for energy by households is Rp. 6221 (approximately U.S. $6.00) per month. After adjusting for inflation, this is 1.5 times greater than the expenditure reported in the 1980 study. The electrified households spend approximately the same percentage of income as the nonelectrified households for all energy sources when controlling for income level with one exception: the lowest income group. In the group of lowest income households, electrified households spend 25 percent of their income on energy (15 percent on electricity) and nonelectrified households spend only 18 percent of their income on energy. Among the highest income group, both electrified and nonelectrified households spend 12 percent of their income on all energy sources. The electrified households in this group spend 4 percent of their income on electricity.

Comparing the results of the 1984 survey to the 1980 survey shows that the figures for average consumption of electricity and firewood have increased while average kerosene consumption has decreased. This is not surprising, as the price of both electricity and firewood has increased by a factor of approximately 1.6 during this time, while the cost of kerosene has increased by a factor of 3.75.

2.6 Gathering of Firewood and Agricultural Wastes

Households can purchase or gather firewood, while agricultural wastes are usually gathered. At all levels of income, approximately the same percentage of electrified and nonelectrified households purchase firewood, while more of the nonelectrified households gather firewood. In addition, this study concludes that after controlling for the effects of differing income levels, size of agricultural landholdings, and household size, electrified households spend significantly less time gathering energy sources than the nonelectrified households. The major beneficiaries of these time savings realized by the electrified households are the adult men.

2.7 Energy Using Household Activities

Most households members listen to radios, with little difference between electrified and nonelectrified households. However, 83 percent of the electrified households watch television while only 50 percent of the nonelectrified households do so; there are available battery powered or village televisions.

Households use lighting in the evening for a variety of purposes: security (51 percent), studying (57 percent), pleasure reading (25 percent), religious reading (15 percent), social activities (12 percent), doing chores (5 percent), and producing handicrafts (2 percent). At all levels of income, a greater percentage of the electrified households, compared to nonelectrified households, use lighting for security and for religious reading. At the highest level of income, a greater percentage of electrified households use lighting for pleasure reading.

3. SUMMARY OF BASELINE SURVEY FINDINGS--BUSINESS SECTOR

3.1 Characteristics of Businesses

In the Klaten villages, where the majority of the businesses are manufacturing establishments (factories), 21 out of the 111 businesses have PLN electricity, and most received their connection in the year prior to the interviews. In Banyumas, most of the businesses are small retail stores or restaurants. The vast majority of these 90 businesses are electrified, having obtained connections over several years. The average number of employees is higher in both Banyumas and Klaten in electrified businesses. The electrified businesses also operate more hours per month than the nonelectrified businesses.

3.2 Use of Electricity by Businesses

The businesses, just as the households in both areas, use PLN electricity primarily for lighting. Approximately 75 percent of the electrified businesses in both areas use electricity for security lighting and for lighting work areas. A smaller percentage of businesses also use electricity for water pumps, fans, and sound systems. In Banyumas, a small percent of the businesses also use electricity for cooking. Most of the businesses that operate machinery (primarily in Klaten) still use diesel generators as their power source.

3.3 Energy Expenditures and Consumption by Businesses

The factories in Klaten consume considerably more energy than the Banyumas retail stores. However, the average electric bill in Klaten of Rp. 5445 (for 71 KWH) is only 6 percent of total expenditures for energy for electrified businesses while the average bill in Banyumas (Rp. 9216 for 87 KWH) is more than 60 percent of total expenditures energy. The Klaten businesses also consume large quantities of kerosene, diesel fuel and lubrication oil.

3.4 Effects of Electrification on Businesses

While the Klaten businesses have had electricity for a considerably shorter time than the Banyumas businesses, a greater percentage report positive benefits from PLN electricity. In Klaten, 71 percent report an increase in profits, 43 percent report an increase in production, sales or service, 24 percent report an increase in working hours, and 14 percent report an increase in the number of employees. The respective percentages for Banyumas electrified businesses are 26 (profits), 19 (production/sales/service), 15 (longer hours) and 2 (more employees).

4. QUALITY OF PLN SERVICE AND DEMAND FOR CONNECTIONS

4.1 Quality of Service

Sixteen percent of the electrified households reported a "high" degree of satisfaction with PLN service, 81 percent reported a "fair" degree and

3 percent a "low" degree. These households as well as businesses experienced an average of three electric interruptions in the month prior to the interviews, lasting an average of 3-4 hours each. Approximately 25 percent of the businesses also reported voltage fluctuations.

4.2 Demand for PLN Electricity

Overall, 78 percent of the nonelectrified households reported that they want PLN electricity. The amount that they would be willing to pay for electricity varies greatly. Subscription could be a problem in the Banyumas area, where more than 50 percent of the households report that they would not be willing to pay a monthly bill of even Rp. 1500 ($1.50) for electricity; also, 50 percent report that they cannot afford to pay the Rp. 55,000 ($55.00) connection fee, even if granted credit.

Of the businesses who answered the question on demand of electricity, 71 of the 84 nonelectrified businesses in Klaten and 5 of the 11 in Banyumas said they wanted PLN electricity. A majority of these businesses plan to use the electricity for lighting, and more than half of the Klaten businesses intend to use it to run equipment. In addition, almost 20 percent of the currently electrified businesses desire a larger connection, and 8 of the 13 businesses using diesel generators for machinery plan to switch to PLN electricity in the future.

TABLE OF CONTENTS

	Page
Executive Summary	iii
I. Description of the Project and Evaluation Study	
1. Background Information Concerning the Program	1
2. Status of PLN Electrification in the Villages Studied	1
3. Description of the Evaluation Study	3
3.1 Purpose	3
3.2 Study Design	3
3.3 Analytical Plan	6
II. Detailed Survey Results--Household Sector	
1. Socioeconomic Characteristics	7
2. Use of Energy by Households: Sources Used, Consumption, Expenditures	10
2.1 Kinds of Energy Sources Used	11
2.2 Lighting	14
2.3 Cooking	14
2.4 Effect of Electrification on Use of Other Energy Sources	21
2.5 General Conclusions	22
3. Cost of Energy Sources	22
4. Consumption of Electricity and Kerosene	22
5. Expenditures for Energy by Households	25
6. Fetching and Gathering of Energy Sources	31
6.1 Time Spent	31
6.2 Firewood	31
6.3 Agricultural Wastes	32
6.4 Time Savings	32

7. Use of PLN Electricity 36

7.1 Use of Applicances 36
7.2 Perceived Benefits of Electrification 37

8. Use of PLN Eelctricity in Home Businesses 43

8.1 Types of Businesses 43
8.2 Uses of Electricity 43
8.3 Perceived Benefits 43
8.4 Impact on Number of Employees 46

9. Quality of PLN Service to Households 47

10. Desire and Affordability for Electricity 50

11. Potential Direct Impacts of Electricity 53

11.1 Use of Lighting in the Evening 53
11.2 Use of Battery Appliances 58
11.3 Extent of Use of Televisions and Radios and Types of Programs Preferred 58

12. Potential Indirect Impacts on Household Life - Use of Energy and Electricity in Public Utilities 61

III. Detailed Survey Results - Business Sector

1. Characteristics of Businesses 63

2. Use of Energy Sources by Businesses: Sources Used, Expenditures, Consumption 66

2.1 Use of Energy Sources 66
2.2 Energy Expenditures and Consumption 68

3. Use of PLN Electricity by Businesses 71

4. Quality of PLN Service to Businesses 74

5. Costs and Uses of Diesel Generators by Businesses 75

6. Demand for PLN Electricity Among Businesses 77

Appendix A. Analytical Models and Specific Questions Formulated During Study Design 80

Appendix B. Survey Procedures and Implementation 91

1. Field Materials 91
2. Survey Fieldwork 92
3. Quality Control Procedures 93
4. Data Processing 93

Bibliography 96

CHAPTER 1. DESCRIPTION OF THE PROJECT AND THE EVALUATION STUDY

1. Background Information Concerning the Program

The AID-supported Rural Electrification I Project (497-0267) began in FY 1977 and concluded in December, 1984. The budget consisted of an AID loan of $30 million and a grant of $11 million to the Government of the Republic of Indonesia (GOI). The recipient agencies in GOI were the National Electric Company (PLN), and the Directorate General of Cooperatives (DGC). The total GOI direct contribution was approximately $30 million.

The overall goal of the Rural Electrification Project was to improve the standard of living and increase productivity of the rural population in the project areas. The major purpose of the project was to demonstrate that electricity can be provided to the rural areas of Indonesia at a price which the majority of the people can afford through systems which are technically sound and financially viable. A subsidiary purpose was to train a cadre of Indonesian experts in all phases of rural electrification in order to manage and expand their rural electric systems.

Through this project, it is estimated that 676 villages in Indonesia eventually will be electrified. Approximately 486 of these villages are in Central Java and will be served from the existing PLN power grid, while approximately 190 villages in the Outer Island districts of Central Lampung, East Lombok and Luwu will be served by member owned and managed electric cooperatives under the DGC.

A combined population of over two million people live in these 676 villages. The Rural Electrification I Project was designed to introduce electric power to these areas for household, commercial, and public uses. It was intended that this power be provided at an affordable price and be available to a majority of area residents.

During the project, ten separate electric distribution systems will be constructed and put into operation--seven by the PLN and three by the DGC. Originally these were all planned to be completed by May, 1983, but delays occurred during implementation. As of July 1984, five of the seven PLN systems and one of the three DGC systems were operating. The remaining systems are scheduled to be completed during 1985.

2. Status of PLN Electrification in the Villages Studied

Before the baseline surveys were conducted in early 1984, three of the six villages were electrified under the Rural Electrification I Project, with 882 of the 5,024 households and 101 of the 203 businesses connected to the system (see table 1). Although there were some longer-term users of earlier PLN systems, most of these households and businesses were connected to the electrical system for the first time just prior to the surveys (see table 2). Thus, this report focuses primarily on the initial uses of electricity in three of the areas and on describing the potential users in all six areas.

Table 1. Electrification Status of Households and Businesses by Area, 1984

	Number					
	Households			Businesses		
	Total	Electrified	Non-Electrified	Total	Electrified	Non-Electrified
Klaten Region						
Village 1	333	0	333	25	0	25
Village 2	561	8	553	52	0	52
Village 3	778	515	263	34	21	13
Banyumas Region						
Village 1	1,527	264	1,263	91	79	12
Village 2	1,137	103	1,034	1	1	0
Village 3	685	0	685	0	0	0

Table 2. Year Received Electric Connection By Area

	Number			
	Banyumas		Klaten	
Year	Households	Businesses	Households	Businesses
1978 or earlier	36	4	-	-
1979	27	4	-	-
1980	41	36	-	-
1981	43	11	-	-
1982	66	6	13	3
1983	142	16	226	15
1984*	6	1	215	3
Missing	6	1	67**	

*January or February of 1984 only--surveys were conducted January-March 1984
**Many of the "missing" households also received their connection in 1984, just prior to the surveys.

3. Description of the Evaluation Study

3.1 Purpose of the evaluation

This study is designed to measure the social and economic impacts of providing electricity to households, businesses and public facilities in seven areas of Central Java. It will focus on measuring changes in energy usage and the resultant monetary and time savings; changes in commercial activities; food production; changes in provision of health care; changes in security measures; and opportunities for social activities such as, entertainment, religious activities and education to the extent possible. The study will attempt to assess which of these changes can be are attributed to the provision of electricity.

Another purpose of the evaluation is to identify the beneficiaries of this project by describing the socioeconomic characteristics of both the households who obtain PLN connections and those that do not. The reasons why households and businesses choose to subscribe to the system, affordability of electricity and opinions on PLN service will also be explored.

A final purpose of the evaluation is to build the capacity within the PLN for conducting this type of research.

3.2 Study design

The study is based on the Analytical Model shown on the following page (Figure 1). This model traces the hypothetical causal linkage of the project inputs and outputs to the ultimate impacts on the population in the project areas. Appendix A of this report provides a more detailed explanation of how this model was used in designing the data collection system that provides the information for conducting the evaluation study. For clearer understanding, the Analytical Model is separated into smaller sub-models, and for each of the sub-models the specific questions that were formulated during the study design and the appropriate sources from which the data were obtained are listed.

Originally, this study was designed to incorporate baseline and followup surveys both in areas that would and areas that would not be electrified during the project. This design would allow the measurement of changes in many variables over a period of time, thus, changes that occurred to a greater degree in electrified as opposed to nonelectrified areas could be deemed attributable to the project. For a variety of reasons, this design was abandoned in favor of one that studies only areas to be electrified under the project. This study attempts to determine impacts of the project by comparing changes in electrified and nonelectrified households in these areas while controlling for differences in socioeconomic status and other factors.[3]

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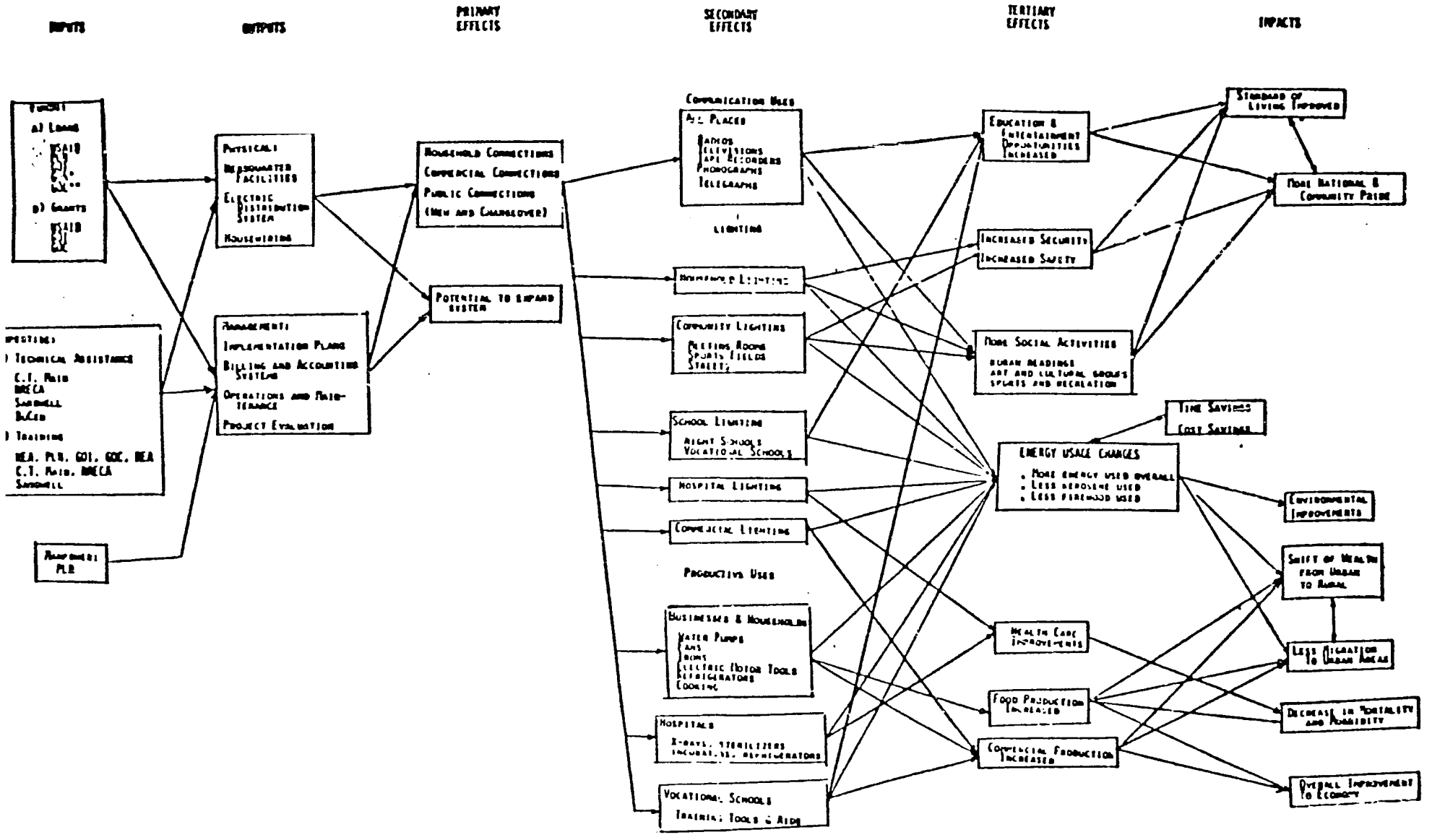
[3] See Philippines Provincial Water Project Evaluation, Final Report, U.S. Bureau of the Census, International Statistical Programs Center, pp 159-161 for a discussion of the advantages of this approach.

Figure 1

INDONESIAN RURAL ELECTRIFICATION PROJECT EVALUATION

ANALYTICAL MODEL DRAFT #2 NOVEMBER 13, 1981



This study still includes the baseline/followup approach, so that these changes can be assessed over a period of time. The evaluation plan developed included three rounds of surveys, but it is possible that PLN will conduct only two surveys.

Another feature of the original study design was a sample design that would permit inferences from the data gathered to be made to the entire project area. The study would have included sample surveys in over 30 villages. Because of funding limitations, the design team decided that it was not necessary to make inferences to the entire project area. Instead, they selected six "typical" villages--three predominantly agricultural and three predominately industrial--that would be electrified under the project. Although these villages might not strictly be representative of all the villages that will be electrified under the project, the design team felt that many of the changes occurring in the study villages could be expected to occur in the other villages as well.

The evaluation team decided to do censuses of all households and establishments in the six villages rather than sample surveys. This decision was made for several reasons:

a. The census will provide data from enough units (households and businesses) to allow for a thorough analysis; for example, this would permit controlling for several variables at once when necessary.

b. The censuses will actually cost <u>less</u> than sample surveys. In countries such as Indonesia, where labor is inexpensive, the costs of the additional field interviewers and supervisors and editing staff is outweighed by the savings from neither designing a sampling frame (none is necessary for the census) nor developing the computer software to provide the estimates of sampling errors and sampling weights, necessary for data analysis of survey results.

c. The repeated censuses of the same households, businesses and facilities form a longitudinal study design. It will not be strictly longitudinal, however, as some migration will certainly occur. Nevertheless, the design will provide a better measure of actual changes occurring in these villages over a longer period of time than would a cross- sectional design.

d. If the PLN decides to conduct case studies between the baseline and followup surveys, the census results from the baseline studies allows them to select a representative sample of units from <u>all</u> units, so that any phenomena can be knowledgeably researched.

In order to address all the hypotheses implicit in Figure 1 and answer all the evaluation questions, data would be obtained form a variety of sources. Data would be collected on households, businesses, hospitals, schools, village heads (lurahs), mosques, public facilities, PLN sub-offices through direct interviews and possibly in-depth case studies. In addition, village-level data collected by the Indonesian Bureau of Statistics (BPS) could be utilized.

3.3 Analytical plan

The purpose of the evaluation is to measure overall electricity-related changes in each of six villages over several years. The resulting analytical design is shown below.

	1984 Measures		1986 Measures		1988 Measures
		compared to		compared to	
Village 1		----------		----------	
2		----------		----------	
3		----------		----------	
4		----------		----------	
5		----------		----------	
6		----------		----------	

Each village is viewed as a separate case study where the effects of electrification will be investigated. The data for each of the six villages will be analyzed separately, for the most part, because the villages differ, and were selected to be representative of the various types of villages that will be electrified by the project throughout Java. It is also expected that the extraneous factors that affect households and busineses will differ somewhat in each villages over the study period. Thus, the thrust of the analysis will be done at the village level.

Some of the analysis will simply focus on exploring changes over time in the entire village, some will involve comparisons between electrified and non-electrified households or businesses and some will involve a more complex investigation of which of the observed differences are attributable to electricity as opposed to other factors.

In general, the analysis will focus on comparing tables produced from the data from subsequent surveys to the data in this report. Much of the analysis will involve comparisons of electrified and nonelectrified households while controlling for income level. This was accomplished by dividing the households into four groups of equal size (same number of households) by household income, and comparing electrified and nonelectrified households within each of these groups.

CHAPTER 2. DETAILED SURVEY RESULTS--HOUSEHOLD SECTOR

1. Socioeconomic Characteristics

In order to provide a base to study the immediate and future impact of electrification on the quality of life, data for several socioeconomic variables were collected of all households in the six study villages. Other reasons for collecting these data were to describe the initial users of the electricity provided by the project and how they differed from the non-users. Tables 3 and 4 present summaries of these data.

One of the measures that was considered as possibly having a great impact on use or non-use of the electricity was income or affluence. If we compare the per capita income data collected by the survey and shown in table 3 to similar data derived from the Indonesian Central Bureau of Statistics for rural Indonesia, which indicate an average per capita income of 9,997 rupiah (Rp.) per month (approximately U.S. $9.75),[4] it appears that the villages in the Banyumas region are "average" communities while the Klaten villages are somewhat more affluent than average.

The other indicators in table 3 tend to support this conclusion. When electrified and nonelectrified households are compared in newly electrified areas such as shown in table 4, it can be seen that the first households to obtain electrical connections were generally better-off economically.

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[4]The Indonesian Central Bureau of Statistics (BPS) reported that per capita income for persons in rural areas of Indonesia was 3,909 rupiah during 1976. Adjusting this figure for inflation based upon the Consumer Price Index from the International Monetary Fund, the adjusted per capita income for January 1984 was 9,997 rupiah (US $1 = Rp. 1,023).

Table 3. Socioeconomic Characteristics of Households by Area, 1984

Subject	Klaten Region			Banyumas Region		
	Village 1	Village 2	Village 3	Village 1	Village 2	Village 3
1. Per Capita Income Level (Percent)	100.0	100.0	100.0	100.0	100.0	100.0
Lowest (Rp. 6300 or less per month)	12.6	17.7	18.3	32.6	29.7	22.9
Second Group (Rp. 6301-9000)	20.2	23.7	23.6	23.3	31.3	31.0
Third Group (Rp. 9001-13000)	27.8	28.5	27.8	21.8	22.8	27.0
Highest (Rp. 13001 or more)	39.4	30.0	30.3	22.4	15.7	19.1
2. Mean Monthly Per Capita Income (Rp.)	15,617	12,278	11,846	11,115	9,711	9,917
3. Mean Number of Rooms in House	3.8	3.9	3.5	3.4	3.6	3.5
4. Percent Owning Land	72.1	60.1	50.1	59.7	66.9	73.3
5. Percent Owning House	93.1	92.5	93.6	93.7	96.9	99.4
6. House Construction - Strong Materials (Percents)	83.2	86.6	84.4	15.6	11.2	14.6
7. House Construction - Dirt Floors (Percents)	36.3	39.8	51.2	76.7	85.3	80.1

Table 4. Socioeconomic Characteristics of Households by Electrification Status, 1984*

Subject	Electrified	Non-Electrified
1. Per capita Income Level (Percent)		
Lowest (Rp. 6300 or less per month)	11.0	34.4
Second Group (Rp. 6301-9000)	18.7	28.7
Third Group (Rp. 9001-13000)	27.3	22.2
Highest (Rp. 13001 or more)	43.0	14.8
2. Mean Per Capita Income (Rp. monthly)	15,418	9,231
3. Mean Number of Room Per House	4.2	3.2
4. Percent Owning House	93.0	95.4
5. Percent Owning Land	64.3	58.4
6. House Construction - Strong Materials (Percent)	79.4	12.6
7. House Construction - Dirt Floors (Percent)	31.6	88.3

*This table includes all households in the three villages electrified prior to the baseline surveys.

To provide a more detailed analysis of the effect of income, the households of the more recently electrified Banyumas villages were categorized into four income groups. As table 5 shows, the households in the highest income group had the highest percentage of initial users. This occurs primarily because the PLN charges a connection fee of Rp. 55,000 ($55) and many more of the households at the highest income level can afford to pay that amount in cash. Table 6 shows the distribution of responses to questions on affordability for the connection charge at each income level.

Table 5. Percent of Households in Each Income Group Electrified, 1984*

Income Group	Percent
Lowest	7.2
Second	14.7
Third	27.1
Highest	57.0

*Includes households in the three villages with PLN electricity. Also, this table uses household rather than per capita income, as in table 4. The percentages differ because higher income households are generally larger (see also table 26).

Table 6. Percent of Households Which Can Afford Connection Charge in Cash or If Granted Credit Over a 4 Year Period 1984*

Income Group	Cash	Credit**
Lowest	3.0	41.4
Second	3.1	54.9
Third	4.3	75.3
Highest	19.8	89.1

*This table includes households in the three villages that were not electrified as of January 1984.

**The question on affordability, given credit, was only asked to households who reported that they could not pay the fee in cash.

If we compare this distribution to the electrification experience in the Klaten villages which have been electrified longer, it is reasonable to assume that a larger percentage of the lower income households will eventually connect to the system. Table 7 shows the subscription at each income level in Klaten after the system was in place for 16 months. The data clearly shows that most of the lower income households are connected to the system. This could mean that income has less impact on whether a household becomes connected to the system over time. As will be discussed later, income may have more influence on how a household uses electricity once connected.

Table 7. Percent Electrified by Income Level, Klaten, 1980

Income Group	Percent
Lowest	70
Second	83
Third	93
Highest	98

2. Use of Energy by Households: Sources Used, Consumption, Expenditures

This section examines the use of various types of energy for lighting, cooking and boiling water and the effect of income and electrification on the uses of other energy sources.

2.1 Kinds of energy sources used

The various energy sources used by households in the six villages are listed in table 8. Nearly all households use kerosene and firewood. In the village in Klaten where electrification has progressed to the greatest extent, only 75 percent of the households use kerosene, but in the other areas, 95 percent or more use kerosene. At least 85 percent of the households in all the areas use firewood.

The use of the accumulators (large wet-cell batteries, similar to automobile batteries), charcoal, agricultural wastes, sawdust, and ricehulls varies more among the villages. Variation in the use of agricultural wastes, sawdust and ricehulls is probably a result of the availability of these sources in each village, while the use of the other sources depends more on the household's income level. Table 9 shows that the use of charcoal and accumulators increase as income increases. Another income effect is evident among the highest income level households, where fewer use kerosene and firewood.

The energy sources used by electrified versus nonelectrified households are shown in table 10. Only two-thirds of the electrified households use kerosene, while practically all the nonelectrified households do. Fewer, compared to the nonelectrified households, use accumulators and firewood.

Table 11 shows the major energy source used by electrified and nonelectrified households for lighting, cooking and boiling water. These are discussed in greater detail in the following sections.

Table 8. Use of Energy Sources by Area All Villages, 1984
(Percent)

Energy Source	Klaten Region Village 1	Klaten Region Village 2	Klaten Region Village 3	Banyumas Region Village 1	Banyumas Region Village 2	Banyumas Region Village 3
Electricity	2.7	0.3	59.0	28.4	11.4	0
Kerosene	100.0	99.8	75.3	95.5	94.5	100.0
Accumulators	25.8	29.4	4.0	9.2	7.1	8.9
Charcoal	40.8	40.6	21.2	16.5	9.9	11.5
Firewood	88.6	93.4	88.7	84.9	97.2	98.7
Agricultural Wastes	15.3	30.1	31.7	5.0	12.6	23.5
Sawdust/Ricehulls	1.5	2.0	10.2	0.9	1.1	1.6
Other	72.7	71.8	55.4	19.4	48.	43.1

Table 9. Use of Energy Sources by Income Level All Villages, 1984
(Percent)

Energy Source	Income Level: Lowest	Second Group	Third Group	Highest
Electricity	7.2	12.1	19.5	37.5
Kerosene	97.1	94.9	92.5	89.8
Accumulators	4.3	7.3	12.2	21.1
Charcoal	4.9	10.6	23.4	38.2
Firewood	95.4	94.8	92.5	82.9
Agricultural Wastes	19.5	18.4	17.4	12.4
Sawdust/Ricehulls	1.1	2.4	4.3	2.8
Other Source	25.5	39.8	52.0	59.1

Table 10. Use of Energy Sources by Electrification Status All Villages, 198
(Percent)

Energy Source	Electrified Households	Nonelectrified Households
Kerosene	67.5	99.2
Accumulators	3.0	13.0
Charcoal	18.9	19.4
Firewood	77.4	94.4
Agricultural Wastes	17.2	16.8
Sawdust/Ricehulls	6.2	1.9

Table 11. Major Energy Source for Household Purposes by Electrification Status, 1984

Purpose and Energy Source	(Percents) Electrified	Non-Electrified*
A. Lighting		
Electricity	99.8	3.2
Kerosene	0.2	96.7
Other	0	0.1
B. Cooking		
Electricity	0.1	0
Kerosene	26.1	6.3
Charcoal	0.1	2
Firewood	71.7	92.6
Agricultural Wastes	0.6	0.6
Other	1.5	0.4
C. Boiling Water		
Electricity	0.2	Z
Kerosene	27.3	6.7
Charcoal	0	Z
Firewood	70.5	92.3
Agricultural Wastes	0.8	0.7
Other	0.2	0.2

Z = less than 0.05 percent

*Approximately 130 households included in this group use electricity but do no report having a PLN connection. Most tap into neighbors' connections.

2.2 Lighting

Electricity is used as the major source for lighting by nearly all electrified households, while the nonelectrified households use kerosene as their major source for lighting (table 11). In the six villages, 20 percent of all households use electricity for lighting, with 80 percent using it for lighting in the village where electrification has proceeded to the greatest extent (table 12).

Table 12. Major Energy Source for Lighting, 1984
(Percent)

		Klaten Region			Banyumas Region		
Energy Source	All Villages	Village 1	Village 2	Village 3	Village 1	Village 2	Village 3
Electricity	20.3	2.4	1.2	80.1	17.9	9.6	0
Kerosene	79.6	97.3	98.8	19.9	81.9	90.4	100.0
Other	0.1	0.3	0	0	0.2	0	0

2.3 Cooking

Nearly 90 percent of the households use firewood as their major energy source for cooking and boiling water. Most of the other households use kerosene for these purposes (table 13). This result is somewhat surprising because a similar survey conducted in 4 villages in Klaten in 1980 found tnat 38 percent of the households used agricultural wastes as the major source for cooking, 25 percent used kerosene and only 34 percent used firewood.[5]

In general, more of the electrified households (than nonelectrified households) use kerosene for cooking (table 11). The data in table 15 indicate that tne use of kerosene rather than firewood for cooking is income related, and the substitution of kerosene for firewood takes place predominantly among the highest income households. However, as table 16 shows, more electrified housenolds use kerosene for cooking at every level of income.

Further, similar tabulations produced for households within each separate village result in the same conclusion.

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[5]Op. Cit. International Statistical Programs Center, U.S. Bureau of the Census, August 1981.

The uses of kerosene versus firewood for cooking among the electrified and nonelectrified households was investigated further to substantiate this finding. The amount of kerosene and purchased firewood that households use for cooking was derived from the data and converted to usable kilocalories.[6]

An attempt to similarly convert gathered firewood and agricultural wastes used for cooking to kilocalories was not made. (The gathering of energy sources is discussed later in this chapter.)

The average amount of purchased fuels that households in the study areas used for cooking is 9.6 liters of kerosene per month and 80.9 kilograms of firewood per month (for a total of 127 kilogram equivalents per household per month). These provided approximately 35,000 usable kilocalories from purchased wood and 20,000 from kerosene for cooking to the average household.[7]

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[6] These calculations used figures for caloric value (CV) and relative stove efficiencies (SE) for kerosene and wood from the Environmental Assessment of the Rural Electrification I Project (Weatherly, December 1980), p. 28. The basic formulas used were:

kcal kerosene = liters x 8900 (CV) x 0.24 (SE)
kcal firewood = kilograms x 3500 (CV) x 0.125 (SE)

The amount of purchased firewood used for cooking was determined by subtracting derived values for kerosene used for lighting from total kerosene consumption. These values were derived by subtracting the average kerosene consumption of households with electric lighting and firewood cooking (for each of four separate income groups) from the average consumption of households with kerosene lighting and firewood cooking (for the same four income groups). These values, ranging from 1.5 liters per week for the lowest income group to 4.5 liters per week for the highest income group, were consistent when various sub-groups within the data file were similarly explored.

[7] This does not consider gathered wood. An estimate of total cooking energy was obtained by looking at households who do not gather energy sources. These households used an average of 289 kilogram equivalents per month, providing 37,000 kilocalories from kerosene and 92,000 from firewood. However, since these households have higher than average income (Rp. 14127 per capita monthly compared to Rp. 10317 for all households in the study), and energy consumption is certainly income related, this figure is probably somewhat higher than average. The small amount of charcoal that households use in cooking special foods was not considered.

The data for electrified and nonelectrified households, controlled for household income level, are shown in table 17. They show that the electrified households at the two higher levels of income actually do use more kerosene energy for cooking than the nonelectrified households. Similarly, the nonelectrified households use more firewood energy for cooking, but only among the households at the highest level of income.

Because the difference between electrified and nonelectrified households in the use of firewood might be understated at the lower income levels, a similar tabulation was produced for households who reported that they do not gather energy sources; therefore, all of their cooking fuel is kerosene and/or purchased firewood[8]. These data (table 18) show that the nonelectrified households use more firewood energy for cooking than electrified households at all levels of income.

Table 13. Major Energy Source for Cooking, 1984
(Percent)

Energy Source	All Villages	Klaten Region Village 1	Klaten Region Village 2	Klaten Region Village 3	Banyumas Region Village 1	Banyumas Region Village 2	Banyumas Region Village 3
Electricity	Z	0	0	0.1	0	0	0
Kerosene	9.8	16.5	7.3	11.2	17.3	3.0	1.8
Charcoal	Z	0.3	0	0.1	0	0	0
Firewood	88.9	82.0	91.4	84.7	82.2	96.5	97.4
Agricultural Wastes	0.6	0.7	2.2	0.1	0.4	0.4	0.6
Other	0.6	0.6	0.5	1.7	0.5	0.2	0.4

Z = less than 0.05 percent

[8]This small amount of charcoal that households use in cooking special foods was not considered.

Table 14. Major Energy Source for Boiling Water, 1984
(Percent)

Energy Source	All Villages	Klaten Region			Banyumas Region		
		Village 1	Village 2	Village 3	Village 1	Village 2	Village 3
Electricity	0.1	0	0	0.3	0.1	0	0
Kerosene	10.3	16.5	8.4	12.2	17.7	3.0	2.5
Charcoal	Z	0.3	0	0	0	0	0
Firewood	88.3	82.3	89.5	83.9	81.7	96.4	96.9
Agricultural Wastes	0.7	0.6	1.2	2.3	0.1	0.4	0.4
Other	0.4	0.3	0.4	1.3	0.3	0.2	0.1

Table 15. Major Energy Source for Household Purposes by Income Level All Villages, 1984

Purpose and Energy Source	Income Level Lowest	Second Group	Third Group	Highest
A. Lighting				
Electricity	7.9	13.0	21.4	38.7
Kerosene	91.9	87.0	78.6	61.2
Other	0.2	0	0	Z
B. Cooking				
Electricity	0	0	0	0.1
Kerosene	3.5	5.4	8.7	21.5
Charcoal	0	0	0.2	0
Firewood	94.5	93.4	90.5	77.5
Agricultural Wastes	1.1	1.1	0.2	0.2
Other	1.0	0.1	0.5	0.6
C. Boiling Water				
Electricity	0	0.1	0	0.2
Kerosene	3.5	5.3	9.6	22.7
Charcoal	0	0	0.1	0
Firewood	94.4	93.5	89.8	76.4
Agricultural Wastes	1.4	1.1	0.2	0.3
Other	0.7	0	0.1	0.1

Z = less than 0.5 percent

Table 16. Major Energy Source for Cooking by Income Level and Electrification Status All Villages, 1984
(Percent)

Income Level and Electrification Status	Energy Source		
	Kerosene	Firewood	Other
Lowest Income			
Electrified	16	83	.
Nonelectrified	3	95	2
Second Group			
Electrified	11	86	2
Nonelectrified	5	94	1
Third Group			
Electrified	16	82	2
Nonelectrified	7	93	Z
Highest Income			
Electrified	37	61	2
Nonelectrified	13	87	Z

Z = less than 0.5 percent

Table 17. Delivered Heat Energy for Cooking From Kerosene and Purchased Firewood by Income Level and Electrification Status, 1984
(Thousands of kilocalories)

Income Level and Electrification Status	Total	Kerosene	Firewood
Lowest Income			
Electrified	32	15	16
Nonelectrified	25	12	13
Second Group			
Electrified	34	14	19
Nonelectrified	34	14	20
Third Group			
Electrified	63	23	40
Nonelectrified	58	17	40
Highest Income			
Electrified	106	50	56
Nonelectrified	103	30	72

Table 18. Households Using No Gathered Energy Sources: Delivered Heat Energy for Cooking from Kerosene and Purchased Firewood by Income Level and Electrification Status; 1984

(Thousands of kilocalories)

Income Level and Electrification Status	Total	Kerosene	Firewood
Lowest Income			
Electrified	75	30	44
Nonelectrified	77	20	57
Second Group			
Electrified	60	22	40
Nonelectrified	108	27	82
Third Group			
Electrified	102	33	70
Nonelectrified	127	28	99
Highest Income			
Electrified	145	65	82
Nonelectrified	174	54	130

2.4 Effect of electrification on use of other energy sources

In previous sections, the effects of a household's income level and electrification status on energy usage have been discussed. Table 19 explores the income and electrification interaction in their effect on energy usage. The data lead to the following conclusions:

1. Fewer electrified households at every income level use kerosene then nonelectrified households. As mentioned earlier, this is a result of substitution of electricity for kerosene for household lighting. At the highest income level, however, a greater percentage of the electrified households use kerosene for cooking. Thus, the use of kerosene is influenced to the greatest extent by the presence of electricity, but an income relationship is also evident.

2. Fewer electrified households use accumulators at every income level. This is more pronounced at the highest income level because the use of accumulators is more prominent among the nonelectrified households in the upper quartile of income.

3. While fewer electrified households, at all income levels, use firewood, lower income households also show a greater use of agricultural wastes then nonelectrified households. A plausible hypothesis is that as these lower income electrified households switch from firewood to kerosene as their major source for cooking (as shown in table 16), some also gather agriculture wastes as a secondary source for cooking (instead of the firewood).

d. For nonelectrified households, charcoal use appears to be most affected by income level.

Table 19. Use of Energy Sources by Electrification Status and Income Level
All Villages, 1984

Income Level	Energy Source					
	Kerosene	Accumu-lators	Charcoal	Firewood	Agricultural Wastes	Sawdust/ Ricehulls
Lowest						
Electrified	62.3	1.4	13.0	84.1	27.5	2.9
Nonelectrified	99.0	4.5	4.5	96.1	19.1	1.0
Second Group						
Electrified	57.3	1.7	15.0	86.3	29.9	6.8
Nonelectrified	99.2	7.9	10.1	95.7	17.0	1.9
Third Group						
Electrified	63.4	2.1	23.0	85.6	21.4	10.3
Nonelectrified	99.2	14.5	23.4	94.1	16.5	2.9
Highest						
Electrified	73.2	4.1	18.5	69.9	10.2	4.4
Nonelectrified	99.4	30.9	49.6	90.4	13.6	1.9

2.5 General conclusions

Households that obtain electric connections switch from kerosene to electricity for lighting. Some of these electrified households also switch to kerosene for cooking and boiling, and reduce or eliminate their consumption of firewood for these purposes. This substitution is most prominent among households at the higher levels of income.

3. Cost of Energy Sources

In order to fully understand changes in the consumption of various energy sources, changes in the costs of the sources must be taken into consideration. The major purchased energy sources are electricity, kerosene and firewood. The cost of these fuels has increased at different rates over the past few years, as subsidies for kerosene were largely reduced in 1983 while subsidies for electricity continued. The table below shows the price changes from 1980 to 1984 in Central Java.

Table 20. Average Prices of Energy Sources in Central Java, 1980 and 1984

(rupiah per quantity)

	1980	1984
Electricity	50/KWH	81/KWH
Kerosene	50/liter	188/liter
Firewood	12/kg.	19.75/kg.

The average cost of electricity is 81 Rp. per KWH. A particular household's electrical consumption affects its actual cost. Lower consumers pay more per KWH, as shown in table 21. This is because the price is the sum of a fixed cost plus a charge for the electricity actually consumed.

Table 21. Cost of Electricity Per KWH By Level of Consumption, 1984

KWH Consumption	Cost Per KWH (rupiah)
1-10	489
11-20	108
21-40	78
41-80	70
81-200	69

4. Consumption of Electricity and Kerosene

The survey obtained data on monthly kilowatt hour (KWH) consumption of electricity from the electrified households and liters of kerosene and kilograms of purchased firewood consumed by all households. This section presents these results for the six villages, and investigates the income and electrification effects on kerosene consumption.

Before discussing the consumption of electricity and kerosene in detail, it is interesting to look at changes in consumption of the various sources as reported in the 1980 and 1984 surveys. Table 22 shows the average monthly consumption of electricity, kerosene and, purchased firewood for electrified and nonelectrified households surveyed in 1980 and 1984. Since these were not the same households (in fact, not even the same villages), the changes do not reflect actual energy use changes (because habits between these villages undoubtedly differ) but are shown for illustrative purposes only. They also do not take into account changes or differences in income between electrified and nonelectrified households interviewed in each survey.

In general, the results show that in 1984, consumption of electricity and firewood has increased while kerosene consumption has decreased. Given the price changes shown in table 20, these results are not surprising. The remainder of this section focuses on the 1984 data.

Table 22. Average Monthly Consumption of Energy Sources by Electrification Status, 1980 and 1984*

Energy Source	1980		1984	
	Electrified	Nonelectrified	Electrified	Nonelectrified
Electricity (KWH)	31	-	46	-
Kerosene (liters)	15	26	16	18
Firewood (kilograms)	31	27	103	77

*1980 and 1984 consumption averages are not based on the same households.

1. Electricity

Table 23 presents the average consumption figures for the villages. The KWH consumption varied among the villages from an average of 32 KWH to 57 KWH. In Banyumas, the village with the highest consumption is also the one with highest average income (see table 3). The average KWH consumption for all electrified households is 46 KWH.

Table 24 shows that only the highest income quartile consumes significantly more electricity than the other income groups. This implies that only this group (which accounts for 43 percent of the electrified households) can afford to use electricity for anything beyond basic purposes. It is interesting to note, though, that the households in these six villages consume more electricity than the households surveyed in Klaten in 1980 (except at the highest income level).

2. Kerosene

The kerosene consumption also varies among the villages, with the wealthier villages consuming more per household (table 23). Table 24 clarifies the income effects, showing that consumption increases with income, with the largest percentage increase in consumption occurring from the medium to highest level income households. This must be considered when comparing the kerosene

consumption between the electrified and nonelectrified households, as a much greater percentage of the electrified households are among the highest income group. It is not surprising, then, that electrified households consume only slightly less kerosene, on the average, than nonelectrified households (table 25). When electrified households that use no kerosene are removed from the comparison, electrified households actually use more than nonelectrified ones.

Another factor to consider in evaluating consumption is household size. Although the number of household members does not correlate strongly with actual consumption (for example, r = .24 for kerosene consumption and household size), it does correlate to a greater degree with household income (r = .50). As shown in table 26, the median household size increases as income increases and actually doubles from the lowest to highest income groups. Since the electrified households are generally higher income households than nonelectrified households and therefore somewhat larger in size, it is interesting to compare the per capita kerosene consumption between these groups. Table 27 shows that on this basis, electrified households consume less kerosene per capita than nonelectrified households at all levels of income.

Table 23. Average Household Electric and Kerosene Consumption by Area, 1984*

Area	KWH Consumption per month	Kerosene Consumption (liters/week)
Klaten Region		
Village 1	-	5.8
Village 2	49.0**	5.7
Village 3	41.7	3.2
Banyumas Region		
Village 1	57.1	5.5
Village 2	32.2	3.4
Village 3	-	3.2

*Calculations exclude households not using electricity or kerosene
**Three cases only

Table 24. Average Electric and Kerosene Consumption by Income Level, 1984*

Income Level	KWH Consumption Per Month		Kerosene Consumption (liters/week)
	1984	1980	
Lowest	35	23	2.7
Second Group	32	23	3.4
Third Group	35	29	4.7
Highest	54	50	7.3

*Calculations exclude households not using electricity or kerosene; Results for electricity show comparable figures from 1980 Klaten Area Surveys

Table 25. Average Kerosene Consumption by Electrified Status, 1984*

	All Households		Households Using Kerosene	
	Electrified	Nonelectrified	Electrified	Nonelectrified
Liters/Week	3.8	4.0	5.6	4.1

*This table includes households in the three villages with PLN electricity.

Table 26. Median Household Size by Income Level

Income Level	Median Household Size
Lowest Income	3
Second Group	4
Third Group	5
Highest Income	6

Table 27. Average Per Capita Kerosene Consumption in Liters by Electrification Status and Income Level, 1984

Income Level	Electrified	Nonelectrified
Lowest Income	0.9	1.0
Second Group	0.4	0.9
Third Group	0.6	1.1
Highest Income	1.0	1.3

5. Expenditures for Energy by Households

Total expenditures for energy for household activities vary among the villages from Rp. 3,754 to Rp. 7,486. These differences are due mainly to variations in expenditures for firewood and kerosene (table 28). The overall average expenditures for energy in all six villages is Rp. 6,221. In the Klaten studies conducted in 1980, the average energy expenditures were Rp. 2,750 per household (Rp. 4,032 in 1984 rupiah, if adjusted by the Consumer Price Index).

The electrified households spend only slightly more for energy in total than nonelectrified households (table 29). Controlling for income level, it can be shown that electrified households spend more than nonelectrified households at all income levels, but only substantially more at the lowest income level (table 30).

The data in table 30 show that households in the lower three income groups have similar patterns of expenditures for the energy sources, while more differences between electrified and nonelectrified households are evident in the highest income group. Comparing electrified and nonelectrified households in the lowest three income groups, we find that:

a. all the electrified households spend approximately Rp. 2000 for electricity (probably the minimum amount for lighting),

b. electrified households spend about the same amount for firewood as nonelectrified households, and

c. electrified households spend about one half as much as nonelectrified households for kerosene.

At the highest income level, we find that:

a. electrified households spend more than Rp. 4000 per month for electricity,

b. electrified households spend less for firewood than nonelectrified households, and

c. electrified households spend about three-quarters as much as nonelectrified households for kerosene.

Figure 2 displays the percentage of total energy expenditures that electrified and nonelectrified households spend on each energy source. It shows that overall, the electrified households substitute electricity for kerosene.

In terms of the percentage of income spent on energy, households at the highest level of income spend approximately 12 percent of their income while the lowest income households spend 18 to 25 percent (table 31). Electrified and nonelectrified households spend about the same proportion of their income on energy except at the lowest level of income. Table 31 also shows that this is primarily a result of the expenditure for electricity.

Table 28. Average Monthly Expenditures for Energy by Type and Area in Rupiah, 1984*

Energy Source	Klaten Region			Banyumas Region		
	Village 1	Village 2	Village 3	Village 1	Village 2	Village 3
Electricity	-	-	1700	758	252	-
Kerosene	4567	4467	2047	4152	2676	2756
Accumulators	216	280	29	73	52	66
Charcoal	200	177	99	66	37	47
Firewood	1437	1390	896	2634	1509	464
Agricultural Wastes	54	0	7	14	2	7
Sawdust/Ricehulls	3	1	243	2	0	0
All sources	7486	7134	5543	7951	5044	3754

*Rupiah; Rp. 1023 = $1.00

Table 29. Average Monthly Expenditures for Energy By Type and Electrification Status in Rupiah, 1984*

Energy Source	Electrified	Nonelectrified
Electricity	3233	0
Kerosene	3085	3425
Accumulators	22	108
Charcoal	94	80
Firewood	2040	1516
Agricultural Wastes	4	12
Sawdust/Ricehulls	121	17
Total	9275	5637

*(Rupiah; Rp. 1023 = $1.00)

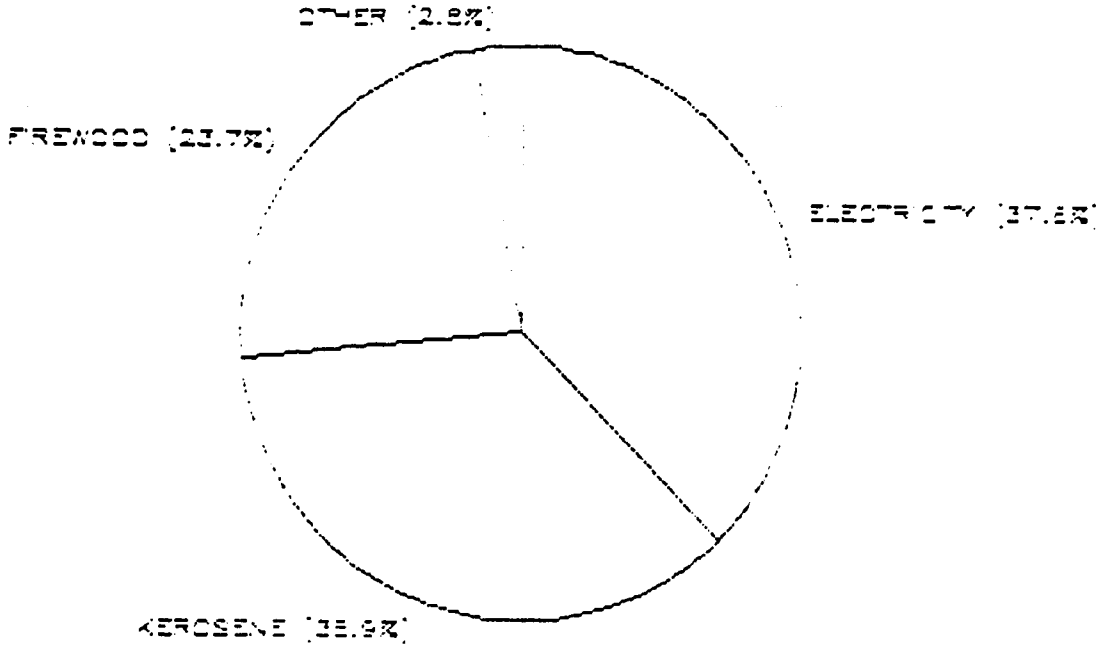
Table 30. Average Monthly Expenditures for Energy by Type, Electrification Status and Income Level in Rupiah, 1984*

Energy Source	Income Level: Lowest		Second Group		Third Group		Highest	
	Electrified	Non-electrified	Electrified	Non-electrified	Electrified	Non-electrified	Electrified	Non-electrified
Total	4241	3023	4777	4175	6867	6394	12010	10526
Electricity	2001	0	2093	0	2323	0	4068	0
Kerosene	1392	2152	1392	2784	2009	3812	4274	5746
Accumulators	28	27	8	57	10	107	31	302
Charcoal	69	16	119	39	89	92	95	220
Firewood	752	600	851	903	1819	1837	2529	3275
Agricultural Wastes	0	7	0	21	2	8	6	14
Sawdust/ Ricehulls	57	0	123	5	105	12	138	65

*Rupiah; Rp. 1023 = $1.00

TOTAL ENERGY EXPENDITURES

ELECTRIFIED HOUSEHOLDS



TOTAL ENERGY EXPENDITURES

NONELECTRIFIED HOUSEHOLDS

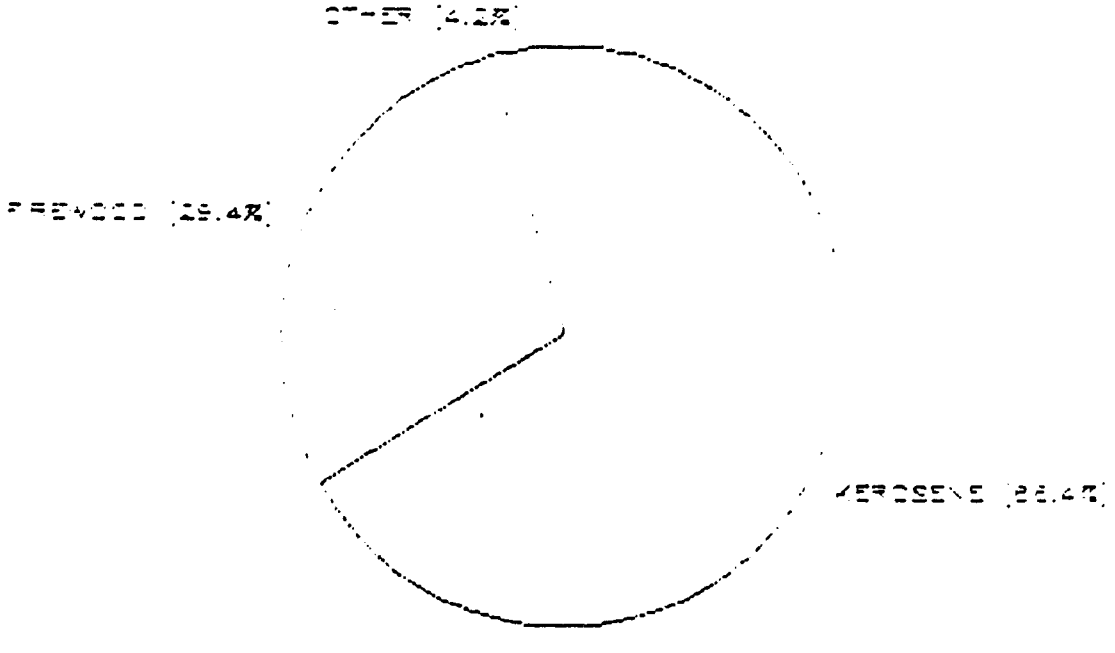


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Table 31. Percent of Income Spent On All Energy Sources, Electricity, by Income Level and Electrification Status, 1984

Energy Source	Income Level: Lowest		Second Group		Third Group		Highest	
	Electrified	Non-electrified	Electrified	Non-electrified	Electrified	Non-electrified	Electrified	Non-electrified
a. Percent of Income Spent on Energy	24.7	17.7	14.6	12.6	14.2	13.6	11.5	12.0
b. Percent of Income Spent on Electricity	15.1	-	8.0	-	5.8	-	4.2	-

6. Fetching and Gathering of Energy Sources

This section focuses on the extent to which household members gather energy sources. The most commonly gathered energy sources are firewood and agricultural wastes. Previous studies indicate that several factors can affect the amount of time households spend gathering these sources. These include proximity to wooded areas, income, size of agricultural landholdings and number of household members. This study examined the effects of all these factors, except proximity, and included electrification status as an additional factor to consider.

6.1 Time spent

Table 32 shows the effects that each of these variables taken alone has on the number of hours the household spends gathering energy sources. The following is evident:

a. Higher income households, especially those at the highest level of income, spend less time gathering energy sources;

b. One person households spend less time gathering, but otherwise, household size does not affect gathering practices;

c. The time households spend gathering energy sources is greater among those with larger agricultural landholdings. Households who own no land spend significantly less time gathering energy sources.

d. Electrified households spend less time than nonelectrified households gathering energy sources.

Tables 33 and 34 examine the effect of electrification on time spent gathering energy sources controlling for the effects of income and size of agricultural landholdings. It is quite evident that even after considering these factors jointly, electrified households spend significantly less time gathering than nonelectrified households.

The remainder of this section examines gathering of firewood and agricultural wastes separately, as firewood can be either bought or gathered, while agricultural wastes are nearly always gathered. It also investigates who benefits from the time savings realized by the electrified households.

6.2 Firewood

Table 35 shows that more of the households at the lower levels of income gather firewood rather than buy it. As income increases, a higher proportion of the households buy firewood. Approximately the same percentage of electrified and nonelectrified households buy firewood at each level of income. A higher proportion of the nonelectrified households gather firewood at all income levels. In addition, among the households who do gather firewood, nonelectrified households spend more time gathering (table 36). This is also evident at all levels of income.

6.3 Agricultural wastes

Overall, few households gather agricultural wastes. Table 35 shows that the percentage who does gather wastes declines slightly as income increases. Also, more of the lower income electrified households of the same income levels gather wastes. Table 36 shows, however, that the nonelectrified households, which do gather agricultural wastes, spend more time doing so then the electrified households at all income levels.

6.4 Time savings

Generally, the data indicate that the major benefit that the electrified households enjoy is time savings rather than money savings. These time savings relate mostly to gathering firewood. Tables 37 and 38 examine more closely which household members actually gather the energy sources, and which, therefore, may benefit from these time savings.

In most cases, men gather the firewood (table 37). Between 45 and 63 percent of men living in electrified households and 62 and 80 percent of men in nonelectrified houses gather wood. At all income levels, a lesser percentage of the men in electrified households (than those in nonelectrified households) gather wood. Conversely, slightly more of the women in electrified households gather wood although fewer people do so overall. Only a small percentage of the children are engaged in these gathering activities. The percentage of men gathering agricultural wastes does not vary by income level or between electrified and nonelectrified households, but, slightly more of the women in electrified households in the lower income groups gather agricultural wastes.

It appears, then, that the adult men are the beneficiaries of the energy substitution resulting from electrification, while women may actually realize a small additional burden. Table 38 shows that on the average, however, men who gather firewood and agricultural wastes spend more time doing so than women.

Table 32. Average Hours Per Week Gathering Energy Sources by Selected Factors--Bivariate Relationships, 1984

	Hours Per Week
A. Income Level	
Lowest Group	5.5
Second	6.1
Third	4.9
Highest Group	3.3
B. Household Size	
1	4.0
2	5.0
3	5.3
4	6.4
5	6.1
6	6.4
7	6.2
8	7.7
9	5.4
10	5.5
11 or more	6.4
C. Size of Agricultural Landholdings	
None	4.4
Small	5.4
Medium	6.1
Large	5.7
D. Electrification Status	
Electrified	2.7
Nonelectrified	5.4

Table 33. Average Hours Per Week Gathering Energy Sources by Income Level and Electrification Status, 1984

Income Level	Electrified	Nonelectrified
All Households	2.7	5.4
Lowest Income	3.6	5.6
Second Group	3.7	6.3
Third Group	3.3	5.2
Highest Income	2.0	4.1

Table 34. Average Hours Per Week Gathering Energy Sources by Size of Agricultural Landholdings and Electrification Status, 1984

Size of Agricultural Landholdings	Electrified	Nonelectrified
None	2.4	4.8
Small	1.3	5.9
Medium	4.5	6.4
Large	3.5	6.3

Table 35. Percent Buying and Gathering Firewood and Agricultural Wastes by Income Level and Electrification Status

Income and Electrification Status	Firewood		Agricultural Wastes	
	Buying	Gathering	Buying	Gathering
Lowest Income				
Electrified	14	62	0	28
Nonelectrified	14	78	Z	18
Second Group				
Electrified	21	59	0	30
Nonelectrified	16	75	Z	17
Third Group				
Electrified	33	48	1	20
Nonelectrified	27	59	Z	17
Highest Income				
Electrified	34	32	Z	10
Nonelectrified	39	44	Z	14

Z = less than 1/2 percent

Table 36. Average Hours Per Week Gathering Firewood and Agricultural Wastes By Income Level and Electrification Status, 1984*

Income Level	Firewood		Agricultural Wastes	
	Electrified	Nonelectrified	Electrified	Nonelectrified
Lowest Income	4.2	5.9	2.7	3.8
Second Group	4.4	7.0	2.8	4.3
Third Group	5.3	6.9	2.2	3.6
Highest Income	4.8	6.9	2.5	3.9

*This table includes only those households who do gather firewood and/or agricultural wastes.

Table 37. Percent of Men, Women and Children Gathering Energy Sources by Electrification Status and Income Level, 1984

Income and Electrification Status	Firewood			Agricultural Wastes		
	Men	Women	Children	Men	Women	Children
Lowest Income						
Electrified	45	35	3	12	15	1
Nonelectrified	62	28	6	10	6	1
Second Group						
Electrified	47	28	10	11	17	2
Nonelectrified	80	11	5	11	5	2
Third Group						
Electrified	63	15	7	11	8	7
Nonelectrified	78	9	7	11	4	2
Highest Income						
Electrified	57	8	4	6	3	1
Nonelectrified	76	7	7	9	3	2

Table 38. Average Hours Men and Women Spend Gathering Firewood and Agricultural Wastes, 1984

	All Households	Electrified Households Only
Firewood		
Men	6.8	5.2
Women	4.9	3.5
Agricultural Wastes		
Men	4.1	2.9
Women	2.9	1.9

7. Use of PLN Electricity

This section examines the uses of PLN electricity in more detail, including the size of the connections, reasons why households obtained electricity and opinions on the major benefits of electricity.

As mentioned, households with electricity nearly always use it as their major source for lighting, while only a few use it for cooking. A majority of households reported that the reason they do not use electricity for cooking is that they cannot afford an electric stove (table 39). Only in the electrified village with the lowest average income (Banyamas, Village 2) did a substantial number (35 percent) report that they could not afford the cost of additional electricity for cooking.

In the three villages where PLN electrification is already underway, 100 percent, 96 percent and 80 percent of the households, respectively, obtain their electricity directly from PLN. The other households generally use a neighbor's connection (table 40). Most of the PLN electrified households have a 450 Volt Ampere (VA) connection.[9] Only in the village with the highest average income do some households (9 percent) have the larger connections (table 41).

7.1 Use of appliances

The major uses of electricity, other than for lighting, are for electric radios, television, irons and phonographs or cassette players. From 30 to 43 percent of the households use electricity for these appliances (table 42). The two Banyumas area electrified villages utilize these appliances to a greater extent than the Klaten electrified village, with more of the households in the higher income village using the appliances.

Table 42 also shows that less than 7 percent of the electrified households use refrigerators, fans, electric sewing machines, stoves, water pumps, power tools, hair dryers or other appliances. In the higher income village, however, 9 percent use refrigerators, 14 percent use fans, 12 percent use electric water pumps, and 8 percent use power tools. Table 43 shows that the greater use of these appliances in that village is obviously income related. The vast majority of households using them are in the highest income group.

Use of radios, television, phonographs and irons is also income related; as income increases, more households use them. However, many of the lower income households do use these appliances. Even among the lowest income group, 16 percent use radios, 25 percent use televisions, 17 percent use phonographs and 16 percent use irons.

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[9] These households are equipped with a 10 ampere fuse and actually have up to 2000 VA of electricity available; the 450 VA is a pricing classification.

Households that own these appliances use their radio for an average of 2.8 hours per day, their television for 4.1 hours, their phonograph for 1.8 hours and their iron for 1.3 hours. The average times of use do not vary much between the electrified villages (table 42).

7.2 Perceived benefits of electrification

Nearly 70 percent of the electrified households expressed the opinion that better lighting is the major benefit of electricity (table 44). This ranged from 53 percent in the higher income Banyumas village to 78 percent in the Klaten village. Other opinions on the major benefit included that it is more practical/efficient (14 percent overall) and that it saves money (10 percent overall). Only 4 percent reported that the major benefit of electricity is that it allows the use of appliances.

Table 39. Reason Not Using Electricity for Cooking, 1984
(Percents)

Reason	All Villages	Klaten Region			Banyumas Region		
		Village 1	Village 2	Village 3	Village 1	Village 2	Village 3
Cannot Afford Electric Stove	60.3	71.4	42.9	64.9	57.4	44.0	NA
Cannot Afford Monthly Charge For Electricity to Operate Stove	18.3	0	0	19.6	9.6	34.9	
Other	21.4	28.6	57.1	15.8	33.0	21.1	

Table 40. Source of Household Electricity, 1984
(Percent)

Source	All Villages	Klaten Region			Banyumas Region		
		Village 1	Village 2	Village 3	Village 1	Village 2	Village 3
Private generator	0.2	22.2*		0	0	0	NA
PLN	85.5	0	100.0*	80.2	95.6	94.5	
Other (generally a neighbor's PLN connection)	14.3	77.8*		19.8	4.4	5.5	

*Less than 10 cases

Table 41. Size of Electric Connection Charge, 1984

Size	All Villages	Klaten Region			Banyumas Region		
		Village 1	Village 2	Village 3	Village 1	Village 2	Village 3
450 VA	90.7	NA	(only 8 cases)	97.2	76.5	100.0	NA
900 VA	2.4			0	7.3	0	
1300 VA	0.3			0	0.8	0	
2200 VA	0.3			0.2	0.4	0	
Other (usually 250 VA)	6.4			2.5			

Table 42. Percent of Electrified Households Using Specific Appliances by Type and Average Hours of Use for Each, 1984

Percent Using Appliance and Average Hours	All Villages	Klaten Region			Banyumas Region		
		Village 1	Village 2	Village 3	Village 1	Village 2	Village 3
Electric Radio	30.4	NA	(only 8 cases)	22.3	42.0	41.7	NA
Hours	2.8			3.0	2.3	3.3	
Television	39.8			29.9	63.3	28.2	
Hours	4.1			3.8	4.3	4.6	
Phonograph/Cassette	40.7			29.9	58.6	47.6	
Hours	1.8			1.9	1.7	1.7	
Electric Iron	42.2			22.9	73.1	63.1	
Hours	1.3			1.2	1.4	1.3	
Refrigerator	3.0			0.4	9.1	1.0	
Hours	17.7			4.0	18.5	24.0	
Electric Fan	5.8			1.6	14.4	5.8	
Hours	1.2			1.1	1.2	1.0	
Electric Sewing Machine	1.8			0.6	4.9	0	
Hours	3.1			8.0	1.9		
Electric Stove	0.3			0.4	0	0	
Hours	1.5			1.5			
Electric Water Pump	6.4			4.5	12.0	1.9	
Hours	2.7			2.5	3.0	1.0	
Power Tools	2.7			0.6	7.5	1.0	
Hours	1.5			1.3	1.5	1.0	
Hair Dryer	0.8			0.4	1.9	0	
Hours	1.1			1.5	1.0		
Other Uses	1.2			0.6	2.6	1.0	

Table 43. Use of Electric Applicances by Income Level, 1984*
(Percents)

Electric Appliance	Lowest Income	Second Group	Third Group	Highest Income
Radio	16	23	30	38
Television	25	19	36	55
Phonograph/Cassette	17	29	38	54
Iron	16	21	40	60
Refrigerator	1	1	2	5
Fan	1	2	2	12
Sewing Machine	1	0	1	4
Stove	1	0	0	1
Water Pump	2	0	3	13
Power Tools	0	0	1	5
Hair Dryer	0	0	z	2

z = less than 1/2 of 1 percent

Table 44. Opinion on Major Benefit of Electricity to Household, 1984

	All Villages	Klaten Region			Banyumas Region		
		Village 1	Village 2	Village 3	Village 1	Village 2	Village 3
Better Lighting	68.2	NA	(only 8	77.6	53.2	60.2	NA
Saves Money	9.7		cases)	6.5	15.6	10.7	
More Practical, Efficient	13.5			9.7	20.5	12.6	
Allows Use of Appliances	4.1			2.8	5.7	6.8	
Other	4.6			3.4			

8. Use of PLN Electricity in Home Businesses

Approximately 24 percent of the households in the 6 villages have home businesses.[10] Of these, 8 percent were electricified as of 1984. This section examines the use of electricity in these home businesses.

8.1 Types of businesses

The most common home businesses in all the households surveyed involve sales and processing of agricultural goods. In the Banyumas area, a majority of the home businesses are agricultural and food processing ventures; although in Village 1, the most urbanized of the three, there were more sales related businesses. In the Klaten area, most of the home businesses involve sales (table 45). Of all home businesses, 11 percent of these sales-related and 4 percent of the agricultural were electrified (table 46).

8.2 Uses of electricity

Among the electrified home businesses, 50 percent use electricity for security lighting, 72 percent use it for lighting to accomplish more work, 10 percent use it to power equipment or tools, and 4 percent for refrigeration (table 47). The security lights are used for an average of 10 hours per night and the inside lights are used for an average of 4 hours per day/evening.

8.3 Perceived benefits

Two-thirds of the electrified home businesses report that electricity has been used to accomplish more work. Nearly half (44 percent) report that electricity has resulted in more income to the business. Twenty-five percent of the businesses extended their hours of operation by an average of 2.1 hours per day (table 48).

[10] A home business was defined as an enterprise at the location of a house (structure) operated by household members.

Table 45. Types of Home Businesses in the Study Villages, 1984
(Percents)

Types	All Villages	Klaten Region			Banyumas Region		
		Village 1	Village 2	Village 3	Village 1	Village 2	Village 3
Sales	32	56	49	35	51	13	14
Agricultural/Food Processing	48	6	5	20	34	80	80
Tailor	5	4	7	13	7	1	3
Other	14	33	40	32	8	6	3

All Households with Home Businesses:

Table 46. Home Business Types by Electrification Status, 1984

Type of Home Business	Percent Electrified
Sales	11
Agricultural/Food Processing	4
Tailor	18
Other	15

Table 47. Purposes and Extent to Which Electricity is Used in Home Business, 1984

Purpose	Percent of Electrified Home Busineses Using Electricity for Purpose	Average Hours Per Day
Lighting for Security	50	10
Lighting for Doing Work	72	4
Equipment/Tools	10	-
Refrigeration	4	-

Table 48. Impacts of Electricity in Home Businesses, 1984*

Impact	Percent	Hours
1. More work is accomplished	67	
2. More income	44	
3. More Hours of Operation	25	
- Average Hours Per Day More		2.1
4. Less Hours of Operation	2	
- Average Hours Per Day Less		2.0

* Opinions of owners of home businesses

8.4 Impact on number of employees

Home businesses, on the average, employ 1.62 family members -- 0.57 on a full-time basis and 1.05 on a part-time basis. There are an equal number of men and women working in the home business full time, while more women than men on the average, work in the business on a part time basis. Few children work in the home business. A complete profile of employment in the various types of home businesses is shown in table 49.

Approximately 1.5 times the number of household members work in electrified home businesses than in the nonelectrified businesses. This difference is accounted for mostly by additional full time workers. Table 50 displays these results.

Table 49. Employment in Home Businesses By Type, 1984
Type of Home Business

verage Number of Workers*	Sales	Agricultural	Tailor		Other
A. Total	1.48	1.62	1.11	2.50	1.20
Full Time	.65	0.45	0.20	1.27	0.32
11-39 hrs/wk	.52	0.93	0.58	0.95	0.41
10 or less hrs/wk	.32	0.24	0.33	0.28	0.45
B. Male Adults					
Total	.39	0.56	0.32	1.50	0.96
Full Time	.15	0.17	0.06	0.86	0.28
11-39 hrs/wk	.14	0.29	0.16	0.52	0.30
10 or less hrs/wk	.12	0.10	0.09	0.12	0.38
C. Female Adults					
Total	1.00	1.00	0.80	0.85	0.23
Full Time	.47	0.27	0.13	0.42	0.05
11-39	.39	0.63	0.43	0.34	0.11
10 or less hrs/wk	.16	0.12	0.24	0.10	0.07

*Children are not included in this table because of the small number working in home businesses. For this reason, the sum of "male" workers and "females" workers is slightly less than "total" workers.

Table 50. Employment in Home Businesses By Electrification Status, 1984

Average Number of Workers	Electrified	Nonelectrified
Total - All Workers	2.15	1.48
Full Time	1.05	0.45
Part Time	1.10	1.03
Male Adults - Total	0.89	0.54
Full Time	0.50	0.16
Part Time	0.39	0.38
Female Adults - Total	1.14	0.89
Full Time	0.52	0.28
Part Time	0.62	0.61

9. Quality of PLN Service to Households

This section provides information on electricity interruptions and customers' level of satisfaction with PLN. Most of the electrified households experienced a least one electric interruption in the month prior to the interview (87 percent). Overall, they experienced an average of approximately three interruptions per month that lasted an average of 3.6 hours each. In the two Banyumas villages, there was only an average of 2.1 and 1.8 interruptions, which lasted an average of 5.4 and 8.9 hours, respectively. In the Klaten village, there were 3.6 interruptions, lasting an average of 1.6 hours (tables 51 and 52). Customers in all three villages almost never were warned of the interruptions in advance (table 53).

In the three villages, 16 percent of the customers reported a "high" degree of satisfaction with the PLN service, 81 percent reported a "fair" degree of satisfaction, and 3 percent a "low" degree (table 54).

Table 51. Number of Electric Interruptions in Previous Month, 1984
(Percents)

Number	All Villages	Klaten Region			Banyumas Region		
		Village 1	Village 2	Village 3	Village 1	Village 2	Village 3
1	23	NA	NA	10	34	52	NA
2	21			27	29	20	
3	29			31	30	16	
4 or more	27			42	6	7	
Average	2.9			3.6	2.1	1.8	

Table 52. Average Length of Electric Interruptions, 1984
(Percents)

	All Villages	Klaten Region			Banyumas Region		
		Village 1	Village 2	Village 3	Village 1	Village 2	Village 3
Average Length (Hours)	3.6	NA	NA	1.6	5.4	8.9	NA

Table 53. Frequency of Warning by PLN Prior to Electric Interruption, 1984
(Percents)

Frequency	All Villages	Klaten Region			Banyumas Region		
		Village 1	Village 2	Village 3	Village 1	Village 2	Village 3
All of the time	1	NA	NA	1	1	1	NA
Sometimes	4			2	8	3	NA
Never	95			98	91	96	

Table 54. Degree of Satisfaction With Performance of PLN, 1984
(Percents)

Degree	All Villages	Klaten Region			Banyumas Region		
		Village 1	Village 2	Village 3	Village 1	Village 2	Village 3
High	16	NA	NA	13	21	15	NA
Fair	81			84	77	83	
Low	3			4	2	2	

10. Desire and Affordability for Electricity

This section examines the desire for PLN electricity and the amount that the households are willing to pay for it. In three of the six villages studied (Klaten 1 and 2 and Banyumas 3), there were no PLN connections at the time of the survey and the summary information includes all households. In the other three villages, the remaining nonelectrified households were surveyed.

Overall, 78 percent of the nonelectrified households desire a PLN connection (table 55). The amount that these households are willing to pay per month for the electricity, shown in table 56, varies greatly between the villages. In the two higher income villages in the Klaten area, nearly 50 percent of the households are willing to pay Rp. 2500 or more per month, with only 14 percent not willing to pay at least Rp. 1500 per month. In the other Klaten village, which is largely electrified already, only 23 percent are willing to pay Rp. 2500 or more and 30 percent are not willing to pay even Rp. 1500. These differences are due in part to the fact that many of the higher income households in Village 3, who would (presumably) be willing to pay more, already have connections.

In the three Banyumas villages, more than 50 percent of the households reported that they are not willing to pay even Rp. 1500 per month and only 10 percent are willing to pay Rp. 2500 or more. An additional 12 percent are willing to pay Rp. 2000 per month. Since Rp. 2000 is the average electric bill for all but the highest income level households, subscription in these villages might be a problem. It is possible that these villagers do not know how much the electricity costs, however, and when they do know they might be willing to pay more for it. It is also possible that they were not addressing their actual affordability when answering these questions, but instead were "bargaining" with the interviewer for the price they will have to pay.

Nearly all the households in the six villages reported that the reason they are not willing to pay more for electricity is that they cannot afford to pay more (table 57).

In addition to the monthly charge for the electricity consumed, households must pay a fee to PLN in order to obtain a connection. Households were asked if they could afford to pay this connection fee of Rp. 55,000 in cash or in 48 monthly installments of Rp. 1400 (or not at all). Again, the results for the six villages differed. Table 58 shows that in the two nonelectrified Klaten villages, 15 percent can pay the fee in cash and the remainder can pay it if granted credit. In the other Klaten village only four percent can pay the fee in cash and 26 percent cannot pay it at all. In the Banyumas villages, approximately 50 percent cannot pay it at all and only 2 percent can pay the connection charge in cash.

Table 55. Percent of Nonelectrified Households Desiring Electric Connection, 1984

	All Villages	Klaten Region			Banyumas Region			
		Village 1	Village 2	Village 3	Village 1	Village 2	Village 3	
Percent	78	78	88	86	60	79	80	68

Table 56. Amount Nonelectrified Households Willing to Pay for Electricity, 1984
(Percents)

	Klaten Region			Banyumas Region		
	Village 1	Village 2	Village 3	Village 1	Village 2	Village 3
Less than Rp. 1500	13	14	30	51	61	55
Rp. 1500	16	21	26	24	19	24
Rp. 2000	22	22	19	14	12	12
Rp. 2500	11	8	5	6	4	4
Rp. 2500 or more	38	37	20	5	3	5

Table 57. Reason Why Households Not Willing to Pay More For Electricity, 1984

	All Villages	Klaten Region			Banyumas Region		
		Village 1	Village 2	Village 3	Village 1	Village 2	Village 3
Cannot Afford	97	97	96	99	96	97	96
Other	3	3	4	1	4	3	4

Table 58. Affordability of Connection Charge, 1984

	All Villages	Klaten Region			Banyumas Region		
		Village 1	Village 2	Village 3	Village 1	Village 2	Village 3
Can Afford to Pay in Cash	5	15	14	4	2	1	2
Can Afford if Granted Credit	56	85	84	70	53	4;	47
Cannot Afford at all	39	0	1	26	45	58	51

11. Potential Direct Impacts of Electricity on Household Life

This section examines the life-styles and habits of the villagers in order to identify how electricity might affect them. Specifically, possible changes in education, entertainment, security and employment that could result in the household from electrification are described. Changes in energy use are discussed in an earlier chapter. Indirect effects on households are examined in the following section by looking at energy use in community facilities (rather than households).

With the 1984 data it is possible to compare electrified and nonelectrified households with regard to their habits, but actual impacts due to electrification would be difficult to establish even after controlling for income level. Nevertheless, these tables are presented in this section. It will be more appropriate to compare these "baseline" survey results to similar data from the subsequent surveys to measure actual changes in habits of the households. This report concentrates on the baseline measures, and therefore the potential impacts of electricity on household life.

11.1 Use of lighting in the evening

The first set of tabulations deal with the use of lighting in the evening for various activities - reading, studying, religious reading (the Qur'an), doing chores, making handicrafts, sewing, social activities, and security lighting. Table 59 shows that the most common use of lighting is for security purposes, and it is much more prevalent in the Klaten area than in Banyumas (approximately 80 percent and 35 percent of the respective households). Fifty-seven percent of the households in all villages use lighting for studying with only minor variation among the villages. The third most common purpose is pleasure reading, with 25 percent of the households using evening lighting for reading books, newspapers, and magazines. In one of the villages, many of the households (34 percent) using lighting for reading the Qur'an in the evenings, but overall, only 15 percent of the households use the light for this purpose. Five percent or fewer of the households use the lighting for "productive" purposes - chores, handicraft production, or sewing as a business.

Table 60 shows that the average number of hours per day that households use lighting for these activities does not vary much between the villages. Households having security lights use them for an average of 10.9 hours per night. Those using lighting for reading, studying or chores do so for approximately 1.5 hours per evening. Lighting for Qur'an reading is used for an average of 4 hours per week and lighting for social activities is used 3 hours per month.

In comparing the electrified and nonelectrified households, controlling for income level (table 61), the major difference evident is the use of security lighting. At all levels of income, especially among the lower income groups, a greater proportion of the electrified households use security lights. At the highest level of income, more of the electrified households use lighting for pleasure reading. The third and final difference appears to involve the use of lighting for Qur'an reading. At all levels of income, the greater percentage of the electrified households use lighting for reading the Qur'an. This finding is consistent for all three electrified villages.

Table 62 shows the average length of time that electric and kerosene lighting is used for the evening activities. There are no significant differences. Thus, we conclude that a greater percentage of these earliest electrified households do use lighting for selected evening activities--security, pleasure reading (high income only), Qur'an reading--but they do not do so for longer periods of time than the households using kerosene for these purposes.

Table 59. Percent of Households Using Light for Various Evening Activities, 1984

Activity	All Villages	Klaten Region			Banyumas Region		
		Village 1	Village 2	Village 3	Village 1	Village 2	Village 3
Reading	25	32	27	22	33	22	14
Studying	57	59	64	58	55	58	53
Reading qur'an	15	14	15	34	13	8	7
Doing chores	5	7	6	6	8	4	2
Handicrafts/ sewing	2	2	2	4	1	1	1
Social activities	12	5	11	12	13	19	5
Security	51	83	75	80	38	38	31

Table 60. Average Hours Using Light for Various Evening Activities, 1984

Activity	All Villages	Klaten Region			Banyumas Region		
		Village 1	Village 2	Village 3	Village 1	Village 2	Village 3
reading*	1.3	1.3	1.2	1.2	1.3	1.2	1.2
studying*	1.4	1.7	1.6	1.5	1.3	1.3	1.3
reading qur'an**	4.0	3.2	2.4	3.3	5.3	4.8	4.8
handicrafts/ sewing*	2.0	.25	1.8	2.1	1.5	2.3	2.3
social activities***	3.2	2.5	2.8	3.2	2.7	3.5	4.5
security*	10.9	11.3	11.3	11.4	10.5	10.4	10.5
reading	25	32	27	22	33	22	14
studying	57	59	64	58	55	58	53
reading qur'an	15	14	15	34	13	8	7
doing chores	5	7	6	6	8	4	2
handicrafts (sewing)	2	2	2	4	1	1	1
social activities	12	5	11	12	13	19	5
security	51	83	75	80	38	38	31

*hours per night
**hours per week
***hours per month

Table 61. Percent of Households Using Light for Various Evening Activities by Electrification Status and Income Level, 1984

Activity	Income Level							
	Lowest		Second Group		Third Group		Highest	
	elec.	nonelec.	elec.	nonelec.	elec.	nonelec.	elec.	nonelec.
pleasure reading	13	11	21	12	28	25	60	42
studying	30	29	50	50	63	67	81	81
reading qur'an	28	7	25	8	34	12	36	17
doing chores	1	2	8	3	7	4	16	8
handicrafts/ sewing	1	1	3	1	4	2	4	3
social activities	7	6	12	9	16	13	24	20
security	84	28	85	38	89	47	91	64

Table 62. Average Hours Using Light in the Evening by Activity and Type of Lighting, 1984

Activity		Type of Lighting	
		Electric	Kerosene
pleasure reading	(hours/night)	1.3	1.2
studying	(hours/night)	1.6	1.4
reading qur'an/praying	(hours/week)	3.5	4.4
doing chores	(hours/night)	1.3	1.6
handicrafts/sewing	(hours/night)	1.9	2.1
social activities	(hours/month)	3.3	3.1
security	(hours/night)	11.3	10.7

11.2 Use of battery appliances

Overall, 49 percent of the households use battery powered radios, 11 percent use battery cassette players, 5 percent use battery televisions, and 12 percent use battery tools (table 63). More of the households in the higher income Klaten villages (both nonelectrified) use these appliances than in the other villages (approximately 71 percent have battery radios and 20 percent each of the other appliances). Table 64 shows that the use of the battery radios is overwhelmingly among nonelectrified households in all the villages. It also shows that the other battery appliances are used to the same extent by electrified and nonelectrified households.

11.3 Extent of use of televisions and radio and types of programs preferred

In all the villages, 84 percent of the households listen to a radio and 55 percent watch television. Approximately the same percentage of electrified and nonelectrified households listen to the radio, while more of the electrified households watch television (electrified - 82 percent, nonelectrified - 50 percent). Thus, television use has greater potential for change because of electrification than does radio.

The two types of television shows most commonly watched are entertainment and news programs. Table 65 shows that 91 percent of the households who have televisions watch entertainment shows and 65 percent watch the news.[11] The most popular radio shows are also the entertainment programs (table 66).

[11]Households were asked to name up to three types of shows they watched.

Table 63. Percent of Households Using Various Battery Appliances, 1984

Type	All Villages	Klaten Region			Banyumas Region		
		Village 1	Village 2	Village 3	Village 1	Village 2	Village 3
radio	49	74	68	48	43	47	41
cassette player	11	21	21	6	12	8	9
television	5	17	20	3	2	1	1
tools	12	21	26	14	7	7	11

Table 64. Use of Battery Appliances by Electrification Status, 1984 (percents)

Type	Electrified Households	Nonelectrified Households
Radio	17	83
Cassette player	8	12
Television	4	5
Tools	16	11

Table 65. Types of Television Programs Household Members Watch, 1984

	All Villages
Entertainment	91
News	65
Village program	20
Educational	13
Religious	14
Music	29
sports	19

Table 66. Types of Radio Programs Household Members Listen to, 1984

	All Villages
Entertainment	86
News	17
Village program	11
Educational	15
Religious	16
Music	32
Sports	4

12. Potential Indirect Impacts of Electricity on Household Life - Use of Energy and Electricity in Public Utilities

The section examines the characteristics and use of energy in public facilities - schools, hospitals, offices, recreation centers, and religious institutions - and the prevalence of streetlights in the villages. The use of electricity in these places offers the villagers increased educational opportunities and security, better health care, more entertainment and possibly more jobs. After the next survey is conducted, changes in the facilities within each village will be addressed. In this report, the facilities in the six villages are discussed together.

All of the villages have schools and mosques, four have village televisions and government offices, three have public meeting places, two have streetlights and one has a clinic. There are no radio stations, movie houses, or recreation facilities. Some of the existing facilities already have PLN electricity. The remainder of this section describes the characteristics of these facilities in more detail.

Altogether, there are 30 schools - 15 in Banyumas and 15 in Klaten. More than half of them (17) are government schools, while 8 are private, 3 are religious and 2 are other kinds of schools. More than half are primary schools, with at least 2 in each village. There are only 4 junior high schools and one high school. Most (24) of the schools existed prior to 1980.

Approximately half of the schools conduct 6 to 10 classes per day; 13 conduct 1 to 5 classes and 3 conduct 11-15 classes. Most of these are morning classes; only 5 schools conduct afternoon classes and 7 schools conduct evening classes (usually 1 to 5 classes per evening).

The median number of students per school is approximately 150, with 8 having less than 100 students and 4 schools having more than 400. Nineteen of the schools have less than 10 teachers, 8 have 11-20 teachers and 2 have more than 30.

Twenty-two of the schools use kerosene, mostly for heating and cooking. Ten schools use accumulators to power tape recorders and/or loudspeakers. Expenditures for these energy sources are low. No schools use diesel fuel, gasoline, or electric generators.

Six of the schools have PLN connections, and 16 of the others desire a connection. Most of these nonelectrified schools want electricity for lighting and approximately one-third of them desire it for alarms/security purposes, tape recorders and/or loudspeakers.

Five of the electrified schools have a 450 VA connection and the other has a 2250 VA connection; four of the schools feel that their connection is not sufficient for their needs. Electric consumption varied greatly in the month prior to the interview, with three schools using less than 15 KWH and two schools consuming more than 100 KWH. Five of the schools use electricity for lighting classes, security lights and/or sound systems, radios, or television. Four schools use other equipment as well, including amplifiers (two schools), a fan, and a mixer. No schools use electric refrigerators or water pumps.

Four of the electrified schools rate PLN's service as "good" and the other two rate it as "fair.

The other public facilities include 7 government offices and 27 mosques (16 in one village). One third of these use kerosene. Unlike the schools, however most (10) use it for lighting and only 2 use it for heating/cooking. Seven of the facilities use accumulators to power sound systems (3), loudspeakers (2), a tape recorder, and a calculator. Expenditures by these facilities for these energy sources are low.

More than half (18) of these facilities have PLN connections. Most of these (12) have a 450 VA connection and use less than 100 KWH of electricity per month. Five (4 with larger connections) use more than 100 KWH per month. One of the other facilities has its own electric generator that provides 4,000 VA of electricity.

Most (12) of these facilities reported that they obtained electricity for economic or practical uses. All use the electricity for lighting, usually for 9 to 12 hours per day. Twelve of the facilities use electricity for sound systems, radios or televisions, usually for 1 to 4 hours per day. None of them use electricity to operate equipment. The electricity enables 15 of the facilities to operate during evening or night hours, and 7 to operate some electric appliances.

There is only one clinic in the 6 villages, a Public Health Center that opened in 1974. In the month before the interview, 2,115 in-patients and 100 out-patients were treated. The clinic has 20 beds and 26 employees, including 2 doctors, 2 midwives, 1 nurse and 2 technicians. The clinic uses kerosene for cooking and sterilization, PLN electricity for a variety of purposes, and no other energy sources.

The 1,300 VA PLN connection was obtained in 1981. In the month before the interview, the hospital used 448 KWH of electricity for lighting (it is open 24 hours, 4 days per week), security (10 hours per night), refrigeration, a water pump, a fan, and an iron. The clinic rates PLN service as "good."

The village leaders (lurahs) were also interviewed. They provided the information on the location of the public facilities and streetlights. One of the three electrified villages uses streetlights (120 fluorescent lights) and one of the nonelectrified villages uses them (60 kerosene lamps). The lurahs all report that there is a high demand for PLN electricity. The only problem reported by one of the lurahs in an electrified village was that connection service is slow - at the time of the interview some households had paid the connection fee and not received the electric connection. Electricity was described by the lurahs as being useful, saving energy, providing greater village security, and allowing more working hours. Table 82, shown later in this report, shows that many of the businesses in both Klaten and Banyumas also use lighting to operate evening hours. The potential benefit to the Klaten villagers is additional employment (most are factories) while in Banyumas, it is additional shopping opportunities (most are retail stores).

CHAPTER 3. DETAILED SURVEY RESULTS -- BUSINESS SECTOR

1. Characteristics of Businesses

In the Klaten areas, there are 111 businesses in the 3 villages, of which the vast majority are factories or industries. These 111 also include 5 agricultural processing businesses, 6 commercial stores, 3 service businesses and 1 commercial farm. In Banyumas, all but one of the 90 businesses are located in 1 village, and the majority are small retail stores or restaurants. There are also 8 service businesses, 2 agricultural processing businesses, 1 factory and 1 hotel (table 67).

Twenty-one of the Klaten businesses in the village with electricity have PLN connections. More than 80 percent of these obtained their connection within 6 months of the interview. Eighteen of these electrified businesses are factories. In contrast, most (80 of 92) Banyumas businesses have PLN electricity, and obtained their connections over the previous several years (average connection time is 35 months). Most of the small retail stores are electrified (63 of 73), as are the hotel and all the restaurants, 7 of the 8 service businesses and both the agricultural processing businesses (tables 68-70).

Most of the businesses in both Klaten and Banyumas existed prior to 1980, but several did start in the year prior to the interview - 7 in Klaten (3 electrified) and 12 in Banyumas (10 electrified). (See table 71).

Because of the many differences between the kinds of business establishments in Klaten and Banyumas, this report compares electrified and nonelectrified businesses only within each area. Table 72 shows the comparisons between the electrified and nonelectrified businesses in these areas in average employment and average working hours per week. The electrified businesses in both areas employ more workers (8.8 electrified, 4.2 nonelectrified in Klaten; 1.3 electrified, 0.4 nonelectrified in Banyumas). The electrified businesses also operate more hours, especially in Klaten (32 more hours per month).

Table 67. Types of Businesses by Area, 1984

	Klaten Area			Banyumas Area
	Village 1	Village 2	Village 3	All Businesses
Industry or Factory	19	49	28	1
Commercial Farm	0	0	1	0
Agricultural Processing	2	1	2	2
Hotel	0	0	0	1
Restaurant	0	0	0	7
Other Trade or Commercial	3	1	2	73
Service	1	1	1	8

Table 68. Number of Businesses Per Area by Electrification Status, 1984

	Klaten Area			Banyumas Area
	Village 1	Village 2	Village 3	All Businesses*
Total Number	25	52	34	92
Electrified	0	0	21	80
Nonelectrified	25	52	13	12

Table 69. Length of Time With PLN Connection - Businesses, 1984

Percents	Klaten	Banyumas
1-6 months	81	9
7-12 months	5	15
13-18 months	5	1
19 or more months	10	75
Missing		
Mean Length of Time (months)	6.0	34.8

Table 70. Types of Businesses by Electrification Status, 1984

	Klaten Area		Banyumas Area	
	Electrified	Non-electrified	Electrified	Non-electrified
Industry/Factory	18	78	-	1
Commercial Farm	-	1	-	-
Agricultural Processing	1	4	2	-
Hotel	-	-	1	-
Restaurant	-	-	1	-
Other Trade/Commercial	2	4	63	10
Service	-	3	7	1

Table 71. Types of Businesses by Electrification Status, 1984 (Number)

	Klaten Area		Banyumas Area	
	Electrified	Non-electrified	Electrified	Non-electrified
1983-1984	3	4	10	2
1980-1982	1	9	16	3
1970-1979	12	46	36	6
1960-1969	3	22	9	1
1959 or earlier	2	9	9	0

Table 72. Characteristics of Businesses by Electrification Status, 1984

Characteristic	Klaten Area		Banyumas Area	
	Electrified	Non-electrified	Electrified	Non-electrified
1. Median Number of Full Time Employees	8.8	4.2	1.3	0.4
2. Average Number of Working Hours Per Month	297	265	310	303

2. Use of Energy by Businesses; Sources Used, Expenditures, Consumption

This section examines the use of various energy surves by business establishments and describes the difference between electrified and non-electrified businesses in energy use.

2.1 Use of energy sources

Tables 73 and 74 show that 62 percent of the electrified businesses in Klaten use energy for lighting (all use electricity) compared to 13 percent of the nonelectrified businesses (most use kerosene). In Banyumas, 89 percent of the electrified businesses use energy for lighting (all use electricity) compared to 25 percent of the nonelectrified businesses (all use kerosene).

One-third of the electrified businesses in Klaten and 14 percent in Banyumas use energy for operating equipment while only 12 percent of the nonelectrified businesses in Klaten and none in Banyumas use energy for that purpose. More than half of the electrified businesses in Klaten and some of those in Banyumas use electricity from their own diesel generators rather than PLN to operate equipment. Most of these businesses plan to switch to PLN electricity in the future.

Many of the businesses in both areas use energy for cooking and/or heating. Although most use kerosene, firewood, or charcoal, a few of the businesses in Banyumas use electricity for these purposes.

Table 75 shows the types of businesses that use energy for lighting, cooking, and operating equipment. The majority of the businesses (except for agricultural processing businesses and industries) use energy for lighting. Most of the restaurants and the hotels use energy for cooking. More than half of the agricultural processing businesses and service businesses use energy for operating equipment, as do 10 of the industries (only 10 percent of all industries) and 7 of the commercial businesses (9 percent).

Table 73. Business Use of Energy by Electrification Status, 1984

Percent Using Energy For:	Klaten Area		Banyumas Area	
	Electrified	Non-electrified	Electrified	Non-electrified
1. Lighting	62	13	89	25
2. Cooking	67	83	11	25
3. Heating/Cooling	67	52	13	17
4. Operating Machinery	33*	12	14*	0

*Some of the electricity used for machinery is provided by diesel generators.

Table 74. Types of Energy Sources Used by Businesses by Electrification Status, 1984

(Percents)

Energy Source	Klaten Area		Banyumas Area	
	Electrified	Non-electrified	Electrified	Non-electrified
For Lighting				
Electricity	100	17*	100	-
Kerosene	-	75	-	100
Other	-	8	-	-
2. For Cooking				
Electricity	-	-	22	-
Kerosene	57	35	67	67
Charcoal	-	23	-	33
Firewood	21	35	11	-
Other	21	8	-	-
3. For Heating/Cooling				
Electricity	-	-	10	-
Kerosene	57	47	80	100
Charcoal	-	2	-	-
Firewood	21	49	10	-
Other	21	2	-	-
4. For Operating Machinery				
PLN Electricity	43	-	82	NA
Kerosene	-	9	-	
Firewood	-	9	-	
Diesel Fuel	57	82	18	

*Two cases only; perhaps using neighbor's diesel generator

Table 75. Types of Businesses Using Energy for Lighting, Cooking and Operating Equipment, 1984

	Lighting		Cooking		Operating Equipment	
	Number	Percent	Number	Percent	Number	Percent
Industries/Factories	18	19	84	87	10	10
Commercial Farms	1	100	0	0	0	0
Agricultural Processing	3	43	2	29	71	5
Hotel	1	100	1	100	0	0
Restaurants	7	100	5	72	14	1
Commercial Business	60	76	7	9	9	7
Service	9	82	2	18	54	6

2.2 Energy expenditures and consumption

In the Klaten area, the electrified businesses spend an average of only seven percent of their total energy expenditures on PLN electricity, with an average electric bill of Rp. 5445. The Klaten businesses, both electrified and nonelectrified, spend large amounts for kerosene. The electrified businesses in Klaten also spend a significant amount for diesel fuel and lubrication oil, while the nonelectrified businesses spend much more for charcoal and firewood. It is highly unlikely that these differences have anything to do with PLN electricity (table 76).

In contrast, the electrified businesses in Banyumas spend well over 50 percent of their energy expenditures on electricity, with an average electric bill of Rp. 9216. Other expenditures are low. Electrified businesses spend less than the nonelectrified businesses for kerosene. This may result in part from a substitution of electricity for kerosene for lighting.

Tables 77 and 78 show the average energy consumption figures for businesses, with table 77 including all businesses and table 78 including only the businesses that use each energy surce. The electrified businesses in Klaten consumed an average of 71 KWH of electricity in the month before the interview, and the Banyumas electrified businesses consumed an average of 87 KWH.

Table 76. Previous Month's Expenditure for Energy By Businesses, Averages for All Businesses, 1984

(Rupiah)

Energy Source	Klaten Area Electrified	Klaten Area Non-electrified	Banyumas Area Electrified	Banyumas Area Non-electrified
PLN Electricity	5,445	0	9,216	0
Kerosene	44,590	36,374	1,832	2,833
Diesel Fuel	14,827	1,640	1,950	0
Oil (for Lubrication)	8,410	757	246	0
Charcoal	0	14,041	15*	1,750*
Firewood	5,381	37,579	1,128	0
Accumulators	0	9	0	0

*Based on expenditures by one business only.

Table 77. Previous Month's Energy Consumption By Businesses, Averages for All Business, 1984

Energy Source	Klaten Area Electrified	Klaten Area Non-electrified	Banyumas Area Electrified	Banyumas Area Non-electrified
Electricity (KWH)	71	-	87	-
Kerosene (liters)	253	205	14	23
Diesel Fuel (liters)	66	7	8*	-
Oil (liters)	7	0.9	0.4	-
Charcoal (kilograms)	-	18.3	0.3	25*
Firewood (bundles)	5	53	1.3	-

Table 78. Previous Month's Energy Consumption By Businesses, Averages for Businesses Using Each Energy Source, 1984*

Energy Source	Klaten Area		Banyumas Area	
	Electrified	Non-electrified	Electrified	Non-electrified
Electricity (KWH)	71	-	87	-
Kerosene (liters)	442	616	88	91
Diesel Fuel (liters)	198	98	600**	-
Oil (liters)	20	7	9	-
Charcoal (kilograms)	-	822	25*	300**
Firewood (bundles)	14	183	25	-

*This table does not include businesses that do not use the energy source in the calculation of averages

**One case only

3. Use Of PLN Electricity By Businesses

This section describes the purposes and extent to which businesses use PLN electricity, the size of the connections they use, the reason why they obtained electricity, and the owners' opinions on the main benefits of electricity and its impact in their business.

All but one of the businesses in Klaten use a 450 VA connection, while over 25 percent of the Banyumas businesses have larger connections (table 79). The size of the connection, as well as the type (household, commercial, industrial, etc.) determine the price per KWH, which explains why the average cost in Banyumas (Rp. 106/KWH) is higher than in Klaten (Rp. 76/KWH).[12]

Although the major use of electricity in the businesses is for lighting (table 82), the majority of the businesses in both areas initially obtained electricity for other reasons. Forty-three percent in Klaten and 36 percent in Banyumas reported that they obtained the connection "to make work easier" or "more efficient" and 10 percent in Klaten and 32 percent in Banyumas thought that it would decrease costs or increase net income (table 80). After having the connection for some time, the same percentage of Klaten businesses reported that lighting was the major benefit of electricity (43 percent) while considerably more of the Banyumas businesses (66 percent) cited lighting as the major benefit. Table 81 shows the distribution of these responses. It is evident that more of the Klaten factories consider productive applications of electricity as the major benefit than do the Banyumas businesses.

Table 82 shows that, in fact, the factories in Klaten use electricity for operating equipment to a greater extent than the Banyumas retail stores (although much of the equipment is powered by diesel generators). In both areas, the majority of the businesses use PLN electricity for security lighting and for lighting working areas (for more than 1 hour per day and more than 4 hours per evening, respectively). Other uses of electricity include powering water pumps, an electric fan, and communication appliances (sound systems/radio/television). Approximately 5 percent of the Klaten businesses and 16 percent of the Banyumas businesses use PLN electricity for one or more of these purposes.

Table 83 shows the perceived impacts of PLN electricity in businesses by the owners. Although the Klaten businesses have had electricity for a shorter time, the perceived benefits are greater there than in Banyumas. Seventy-one percent of the Klaten businesses report an increase in profits (average of Rp. 23,269 per month). In Klaten, 43 percent report an increase in production, sales or service (average 16 percent increase); 24 percent report an increase in working hours (average 2.2 hours per day); and 14 percent report an increase in the number of full time employees (average 4.7 persons). In Banyumas, only 19 percent report an increase in production, sales or service (average 19 percent increase); 15 percent report an increase in working hours (average 2 hours per day); and 2 percent report an increase in the number of employees (average 3.5 full time persons).

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[12] Derived from tables 76 and 77; there was a 30 percent price increase in Klaten in 1984 after the surveys were completed.

Table 79. Size of Electric Connection - Businesses, 1984

(Percents)

Size (VA)	Klaten	Banyumas
250	-	11
450	95	65
900	-	14
1300	-	9
2200	-	1
4400	-	-
More than 4400	5	-

Table 80. Reason Obtained PLN Connection - Businesses, 1984

(Percents

Reason	Klaten	Banyumas
Make work easier, more practical, efficient	43	36
Less expensive, decreases costs, increases income	10	32
Lighting	43	26
Allows Use of Tools	0	1
Longer Hours	5	0
Other	0	5

Table 81. Opinion on Major Benefit of Electricity to Business, 1984.
(Percents)

Benefit	Klaten	Banyumas
Lighting	43	66
Make Work Easier	14	17
Less Expensive	5	3
Allows Use of Tools	24	8
Cleaner	-	3
Safer	-	4
Greater Production	14	-

Table 82. Purposes and Extent to Which Electricity is Used By Businesses, 1984

Region and Purpose	Percent of Electrified Businesses Using Electricity for Purpose	Average Hours Per Day	Average Hours Per Night
KLATEN			
Lighting for Security	76	NA	11.2
Lighting for Work	76	1.6	4.1
Operating Equipment (includes diesel)	33	6.7	0.3
Communication Uses*	5	NA	NA
Other purposes**	5	3.6	1.2
BANYUMAS			
Lighting for Security	88	NA	11.6
Lighting for Work	72	1.2	4.4
Operating Equipment (includes diesel)			
Communication Uses*	16	NA	NA
Other Purposes***	16	5.6	1.2

*Includes sound systems, radio, television, etc.
**Includes water pump
***Includes fan, water pump

Table 83. Impacts of Electricity in Businesses, 1984

	Klaten	Banyumas
A. Percent With Increase in Working Hours	24	15
Average Additional Hours/Day	2.2	2.0
B. Percent With Increase in Number of Employees	14	2
Average Additional Workers:		
Full-Time	4.7	3.5
Part-Time	0	2.0
C. Percent With Increase in Production, Sales or Service	43	19
Average Percent Increase	16.0	18.5
D. Percent With Increase in Profits	71	26
Average Increase (rupiah) Per Month	23,269	12,187

4. Quality Of PLN Service To Businesses

Most of the businesses feel that their electric bill is "fair." However, 29 percent of the Banyumas businesses reported that it is too expensive, while 28 percent of the Klaten businesses reported that it is inexpensive (table 84). These differences may be explained in part to the lower cost to Klaten businesses at the time of the surveys.

The Klaten businesses experienced an average of 4.0 electric interruptions in the month prior to the interview that lasted an average of 1.1 hours. In Banyumas, the businesses averaged 2.4 interruptions that lasted 4.5 hours (tables 85 and 86). All but one business in both areas were never warned prior to the interruptions (table 87). These results are nearly the same as the results for electrified households.

Businesses were also asked if they experienced voltage fluctuations, and 29 percent in Klaten and 17 percent in Banyumas reported that they did. Most of these businesses (all in Klaten and 82 percent in Banyumas) experienced "up and down" fluctuations, and a few of Banyumas businesses reported that it was "too low" (table 88).

Table 84. Opinion of Electric Bill - Businesses, 1984*
(Percents)

Opinion	Klaten	Banyumas
Too Expensive	0	29
Fair	72	65
Inexpensive	28	6

Table 85. Number of Electric Interruptions in Previous Month - Businesses, 1984
(Percents)

Number	Klaten	Banyumas
1	0	27
2	19	32
3	29	25
4 or more	52	16
Average	4.0	2.4

Table 86. Average Length of Electric Interruptions - Businesses, 1984

	Klaten	Banyumas
Average Length (Hours)	1.1	4.5

Table 87. Frequency of Warning by PLN Prior to Electric Interruption - Businesses, 1984 (Percents)

Number	Klaten	Banyumas
All of the Time	0	0
Sometimes	0	1
Never	100	99

Table 88. Voltage Fluctuations in Businesses, 1984

	Klaten	Banyumas
Percent With Voltage Fluctuation	29	17
Type of Fluctuation:		
Up and Down	100	82
Too Low	0	18

5. Costs And Uses Of Diesel Generators By Businesses

There are thirteen businesses in Klaten and one in Banyumas that use diesel generators. Four of the eight agricultural businesses use diesel generators. Nine of the 97 factories and 1 of the 79 commercial businesses are the other users of generators. The cost per month for operating and maintaining these generators is high - an average of Rp. 59,462 for the Klaten users and Rp. 181,333 for the Banyumas user. A breakdown of these costs is shown in table 89. Most of these businesses use the generators to operate equipment or water pumps. All use the generator for approximately 6 hours per day, and two of the businesses use it for operating equipment during the night (table 90). Only two of the businesses use their generators for lighting.

Table 89. Businesses Using Diesel Generators - Costs 1984

	Klaten	Banyumas
Number of Diesel Users	13	1
Average Cost of Diesel Fuel Previous Month (Rp.)	32,542	156,000
Average Cost of Oil for Diesel Previous Month (Rp.)	16,792	12,000
Average Number of Full Time Workers to Operate Diesel	0	1
Average Monthly Salary of Worker (Rp.)	NA	10,000
Average Cost of Maintenance Previous Three Months	30,385	10,000
Average Total Diesel Costs Per Month (Rp.)	59,462	181,333

Table 90. Businesses Using Diesel Generators - Purpose and Extent to Which Electricity is Used, 1984

Region and Purpose	Number of Businesses Using Electricity for Purpose	Average Hours Per Day	Average Hours Per Night
A. Klaten: 13 businesses			
Security Lighting	2	NA	4-
Lighting for Work	2	0	4
Operating Equipment	6	6.3	0.5*
Cooking (Elec. Equip)	0	-	-
Communication Uses**	0	-	-
Water Pump	4	6.0	0
B. Banyumas: 1 business			
Security Lighting	0	-	-
Lighting for Work	0	-	-
Operating Equipment	1	6	8
Cooking	0	-	-
Communication Uses**	0	-	-
Other Purposes	0	-	-

*One business uses it for 3 hours
**Includes radio, television, advertising

6. Demand For PLN ELectricity Among Businesses

Tables 91-93 show the demand for electric connections or power increases among business who currently have PLN connections, those with diesel generators, and those with no electricity.

A. Businesses With PLN Electricity - Nineteen percent in Klaten and 16 percent in Banyumas desire larger size connections. The median size desired is 900 VA in Banyumas and 1350 VA in Klaten, but varies greatly. The remaining businesses, who do not want power increases, feel that they have a large enough connection already (table 91).

B. Users of Diesel Generators - Seven of these thirteen businesses also have PLN electricity. Eight of the thirteen plan to switch their use of generators to PLN electricity - five in 1984 (for 1350 VA,3000 VA and 4400 VA connections) and three after their diesel equipment stops working (table 92).

C. Nonelectrified Businesses - Seventy-one of the 84 Klaten business without electricity and five of the eleven in Banyumas desire PLN connections. Thirty-two of these businesses in Klaten and three in Banyumas want 450 VA connections and the remainder (a majority in Klaten) desire larger connections. All of these Banyumas businesses and 64 of 71 in Klaten plan to use the electricity for security lighting and all in Banyumas and 46 in Klaten plan to use it to light working areas. More than sixty percent (45) of the Klaten businesses (and one of the five Banyumas businesses) plan to use the electricity to power equipment or tools for production. Fourteen of these Klaten businesses and two Banyumas intend to use it for cooking or refrigeration, and several others plan to use it for other purposes (Table 93).

Table 91. Whether Businesses with PLN Electricity Plan to Increase Power of Electric Connection and Amount of Power Needed, 1984

	Klaten	Banyumas
A. Percent Desiring Power Increase	19	16
Power Needed (VA)	(percents)	
450	-	13
500	-	6
900	33	50
1350	33	-
2000	-	13
2200	-	6
2500	-	6
3000	-	6
4400	33	-
Average	2217 VA	1268 VA
B. Percent Not Desiring Power Increase	81	84
Reason	(percents)	
Has Enough Already	94	89
Cannot Afford	0	6
Other	6	5

Table 92. Businesses Using Diesel Generators - Future Plans, 1984

	Klaten	Banyumas
1. Number of Diesel Users (seven also have PLN electricity)	13	1
2. Number With Plans to Increase Diesel Power	1	0
3. Number With Plans to Change Uses to PLN Electricity	8	0
4. Size of Connection Needed		
1350 VA	2	NA
3000 VA	2	-
4400 VA	1	
Don't Know	3*	

*These businesses reported that they will probably use PLN electricity instead of diesel after their diesel equipment ceases to function.

Table 93. Desire Among Nonelectrified Businesses for PLN Electricity and Planned Uses, 1984

	Klaten	Banyumas
Number of Nonelectrified Businesses	84*	11**
Number Planning to Connect to PLN	71	5
Planned Uses (Number of Businesses):		
Lighting for Security	64	5
Lighting for Working	46	5
Tools for Production	45	1
Cooking or Refrigeration	14	2
Other	30	1
Size of Connection Desired		
450 VA	32	3
750 VA	1	
900 VA	25	1
1000 VA	1	
1300 VA	8	
2200 VA	1	
3000 VA	1	
Missing Data	2	1

*90, but 6 missing information
**12, but 1 with missing information

APPENDIX A. ANALYTICAL MODELS AND SPECIFIC QUESTIONS FORMULATED DURING STUDY DESIGN

This appendix documents the specific sub-models extracted from the overall analytical model in Chapter 1 that were used in designing the study. The sub-models cover 5 areas - project implementation, the household sector, the business sector, the agricultural sector, and the public sector. Following the models are the list of specific questions that the design team formulated. The number listed with each group of questions matches a corresponding number on the appropriate sub-model. There are also capital letters in parentheses following each question. These refer to what the design team felt were the most appropriate source of data to address the question. The letters refer to the following data sources:

A: 1. Existing data and data collection agencies including:

a. Kecamatan Office
b. Regional Government Office
c. BPS (National Statistical Office)
d. Department of Internal Affairs
e. Public Works
f. Department of Mines and Energy
g. Universities

2. Administrative records:

B: a. PLN, DGC and Coop records
C: b. Schools
D: c. Hospitals or Clinics
E: d. Lurah

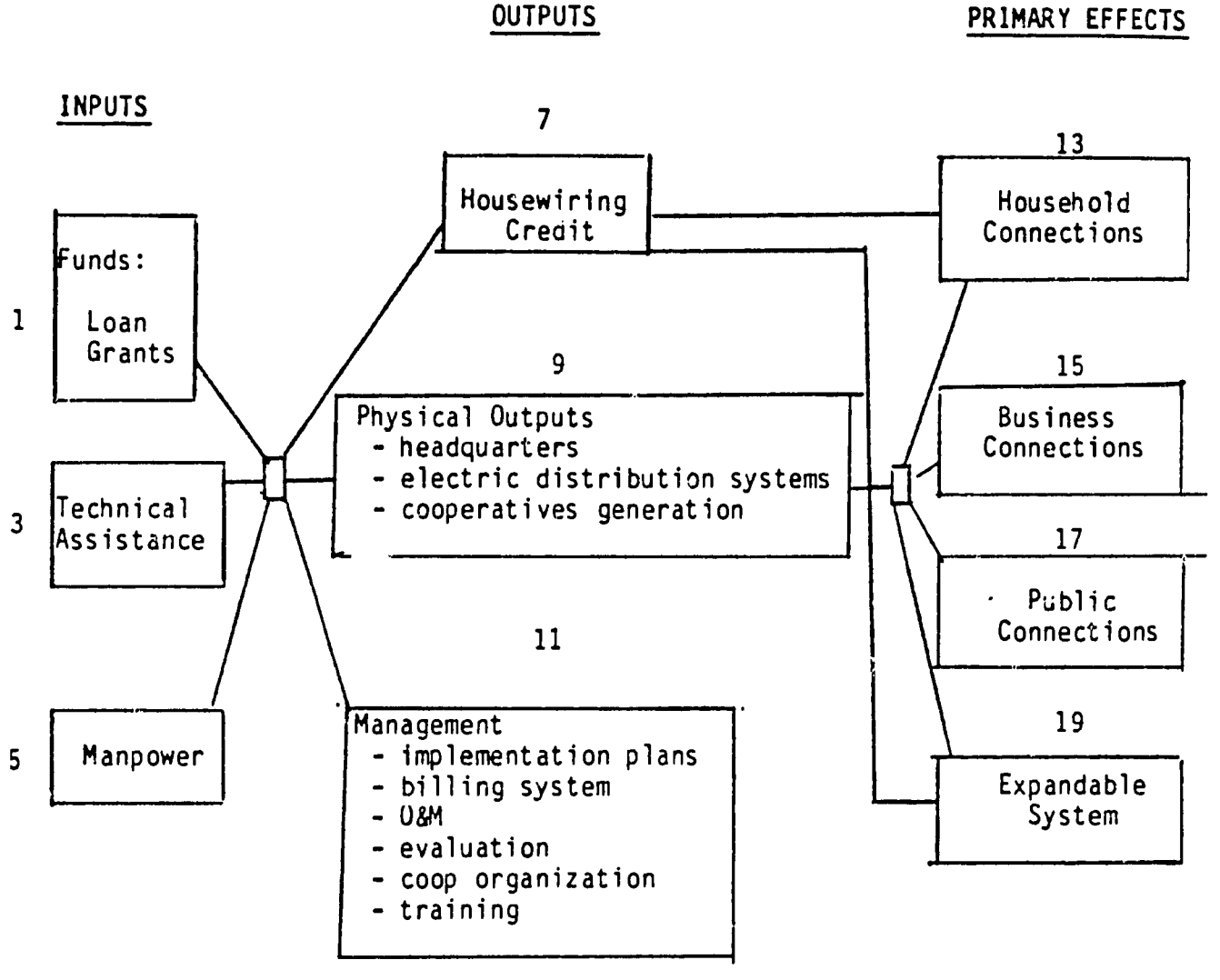
F: 3. Rapid observation - quick answers

G: 4. Case studies - detailed answers on behavior

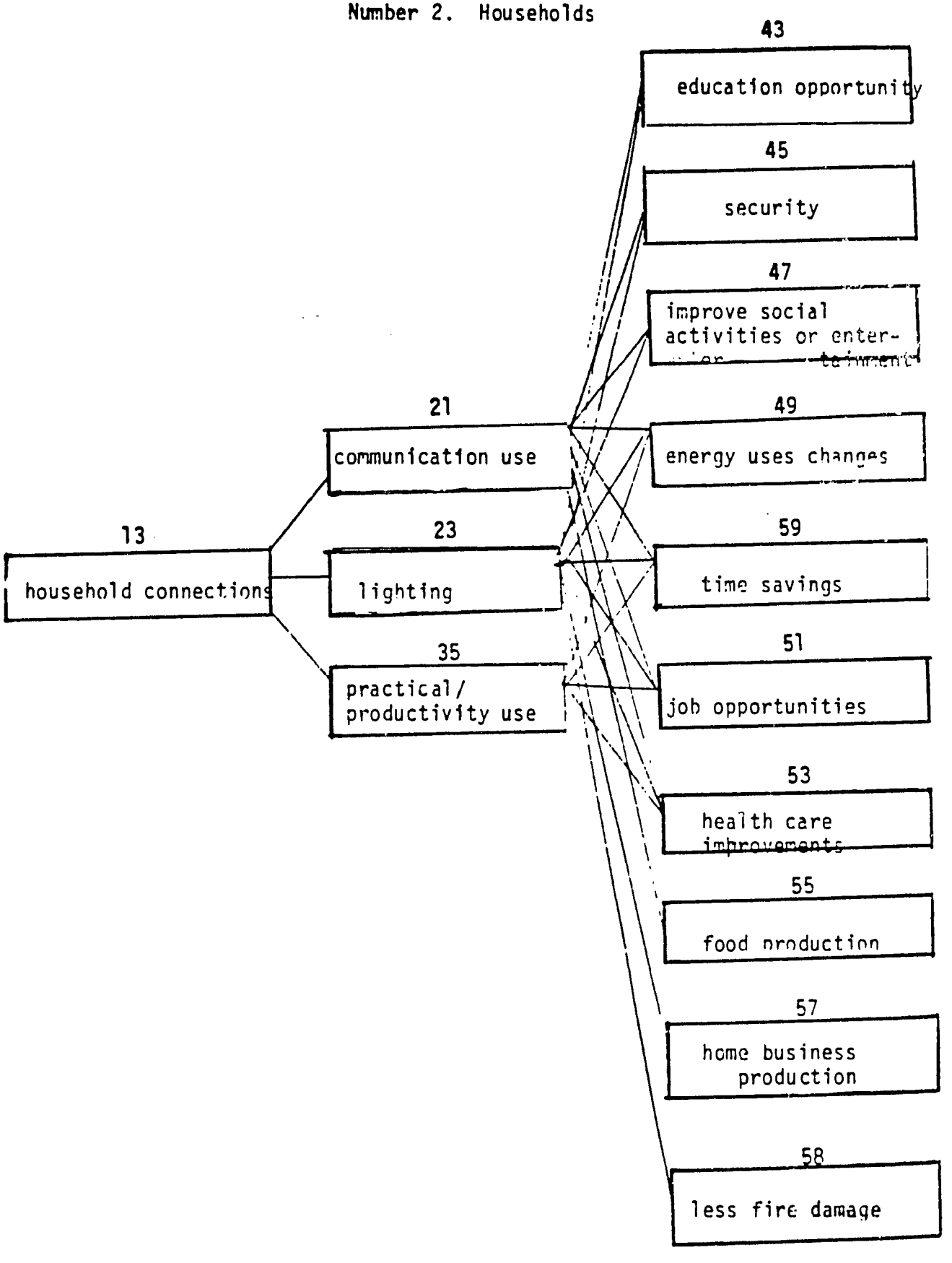
5. Sample surveys

H: a. Households
J: b. Business
K: c. Agricultural business
L: d. Users of irrigation pumps

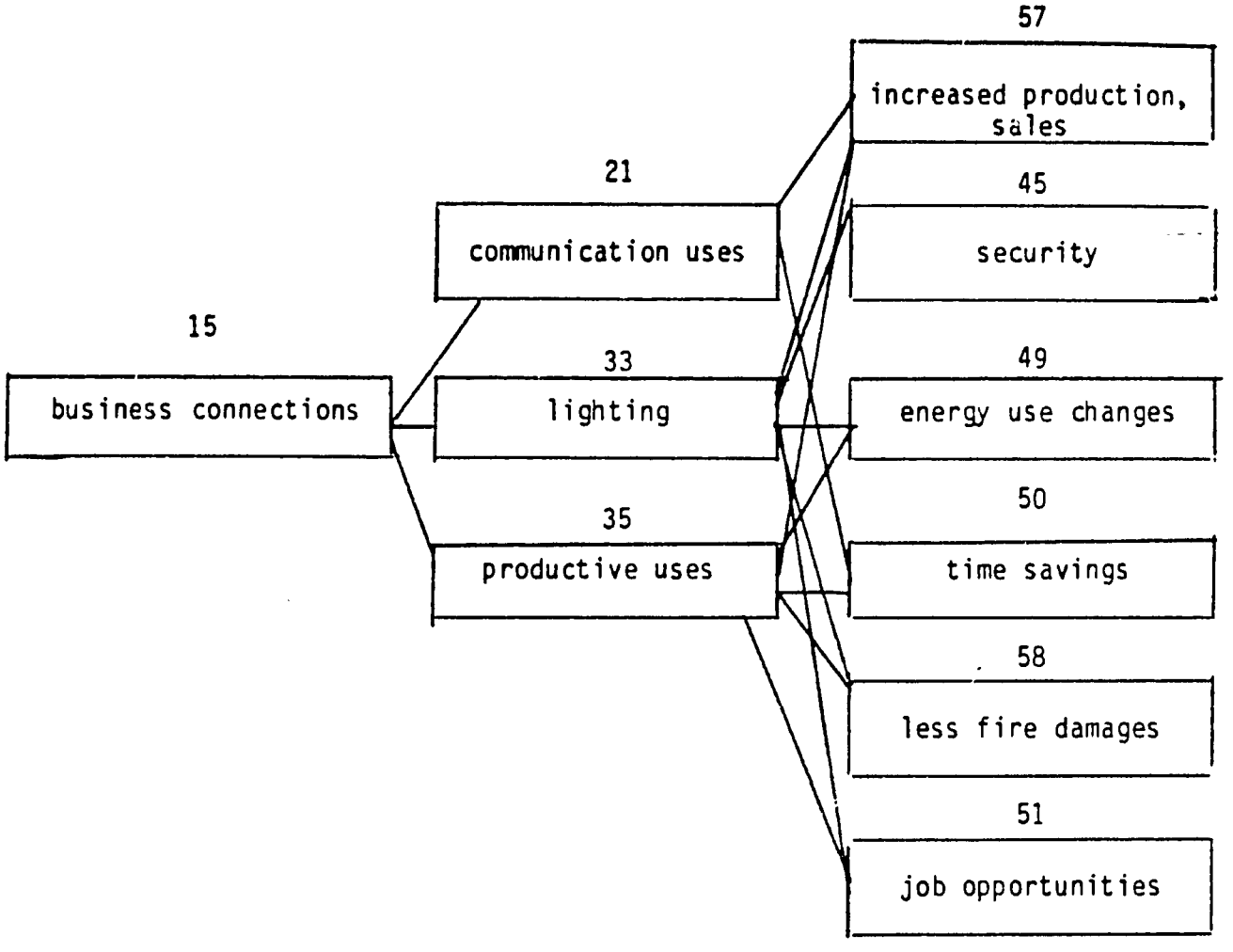
Number 1
Project Implementation



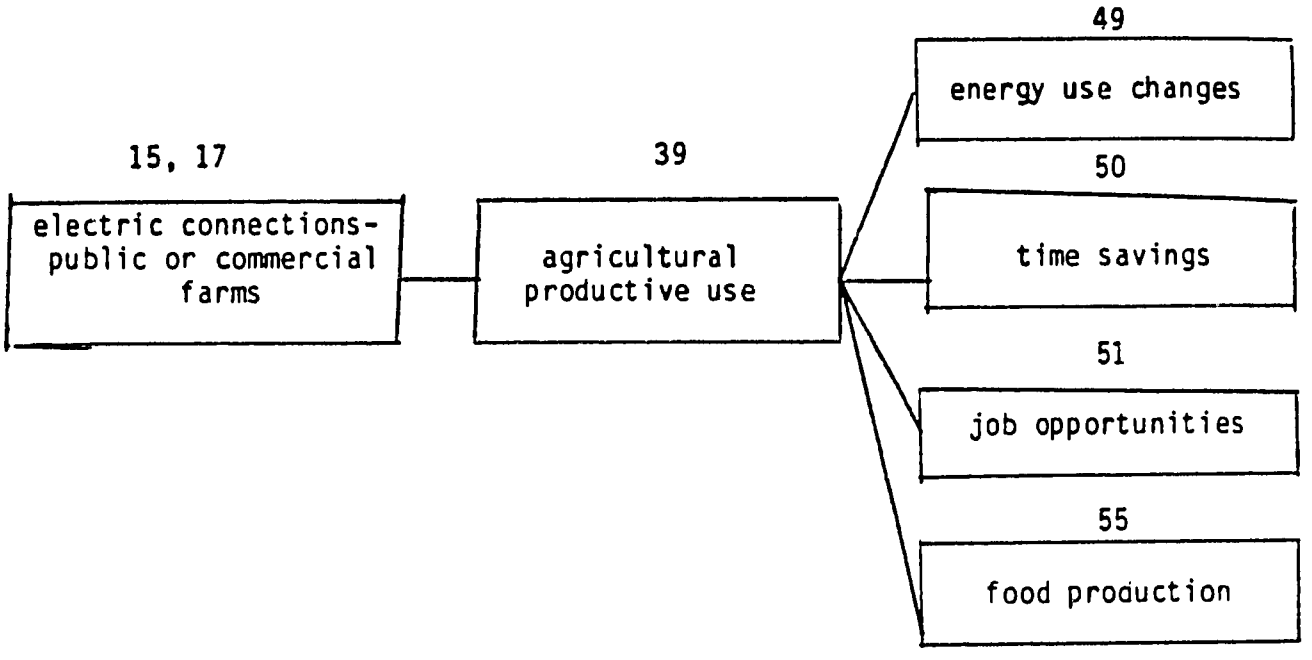
Number 2. Households



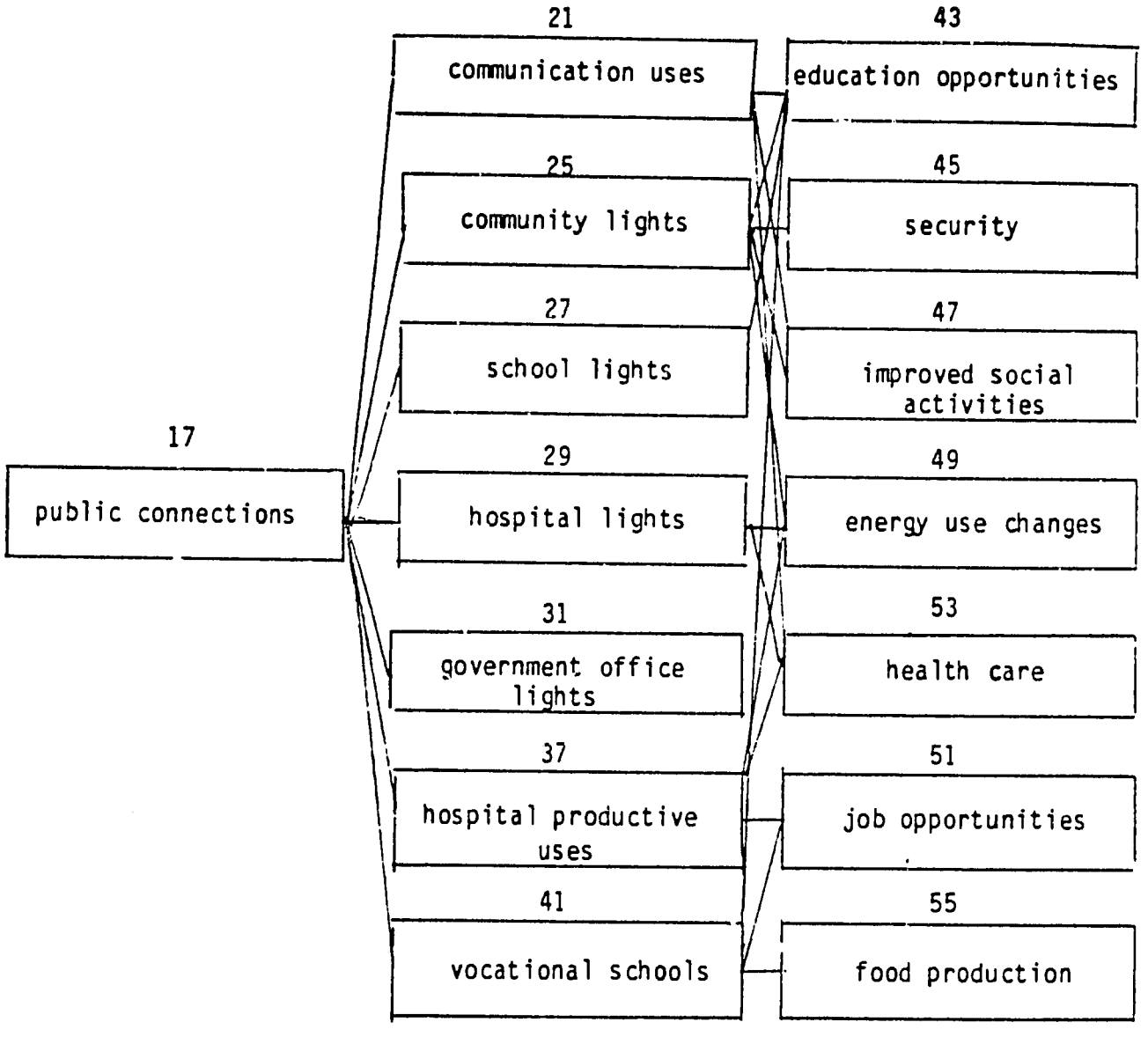
Number 3. Businesses



Number 4. Agriculture



Number 5. Public Sector



SPECIFIC QUESTIONS

HOUSEHOLDS

13. Household connections

How many households are connecting? (B)

Which households are connected (by socioeconomic characteristics)? (H)

What size power connections do households have? How many households are using each type? (B, H)

21. Communication uses:

What electric equipment, e.g., televisions and phonographs, are households using? (H)

How often do they use the equipment? Are households using similar equipment powered by batteries? (H)

What percentage of households are using electricity for each communication use? (H)

What programs are households watching or listening to: educational, entertainment, information, news, sports, etc.?

23. Lighting

What percentage of households are using electric lights? (H)

How many bulbs, watts per bulb? What kind? (H)

What are electric lights used for and to what extent? (G,H)

- reading or studying at night?
- socializing at night?
- security?
- chores or handicraft production?

35. Practical/Productive Uses

What percentage of households are using electricity in their home businesses? What types of home businesses, types of equipment? (F,H)

- Do they employ more people? (G,H)
- Does electricity increase the functional activity in the home business? (G,H)
- Does the home business operate longer hours? (G,H)

What percentage of households are using electric equipment such as irons, fans, water pumps, refrigerators, heating coils and cooking equipment? (H)

Does the use of electricity replace the use of other fuels? Which fuels, and how much? Does it result in less fire damage? (G,H)

Does the use of electricity for equipment result in time savings? If so, which household members benefit and what do they use that time for? (G)

Will traditional home businesses disappear because electrified businesses take over the market for a product or service? (E,G)

BUSINESSES

15. Business connections:

Which business are using electricity and/or diesel generators? Why? (A,B,J)

For the businesses' current productive uses, is diesel or PLN electricity preferable (not considering connection cost)? (J)

How many and what type of new businesses will connect? (A,B,J)

What percentage of business are using electricity? Diesel? (A,B)

What size connections are being used? (B)

Is the connection charge affordable? (G,J)

Is the power itself reliable? (B,J)

21. Communication Uses

Are business using radios or television for advertising? (J)

Is electricity being used to communicate with workers or between locations? Are they using sound systems or radios? (J)

How many businesses use electricity for these communication uses? (J)

How many businesses use electricity in advertising? (J)

33. Lighting

What percentage of businesses are using electric lighting? (J)

Which businesses? (J)

What kind of lighting does it replace? (J)

What percentage of electrical consumption is used for lighting? (J)

What kind of bulbs are they using? How many? Wattage? (J)

Are lights being used for security? (J)

Is lighting being used for work during day-light and non-day light hours? (J)

To what extent? (G)

Has this resulted in additional jobs?

What fire damage is caused by electric or kerosene lighting? (A,F)

35. Productive Uses

What percentage of business are using electricity for productive uses? (A,B,J)

What kinds of businesses? (A,B,J)

What hours of the day or night do businesses use power for uses other than lighting? (J)

What uses are being made - equipment? motors? tools? machines? (J)

For the businesses current productive uses, is diesel or PLN electricity preferred? (F,J)

What equipment changes would be needed to change from diesel to PLN electricity? (F)

Has the use of electricity for productive purposes resulted in improved efficiency? More profit? More or less jobs? (G,J)

Has the use of electricity replaced the use of other fuels? Which fuels? How much? (G,J)

AGRICULTURE

15, 17. Electric Connections

What kinds of electric connections are used for agricultural purposes? Private commercial farms? Public irrigation systems? New commercial farms? (A,B,K,L)

Are agricultural businesses changing from diesel to PLN electricity? Why or why not? (F,K)

Is the connection charge/tariff structure appropriate? (B,K)

What size connections are being used? (B)

During what time of day is it used? Does this vary by season? Which months? (L,K)

PUBLIC SECTOR

17. Public Connections

What kinds of public facilities or services are utilizing electricity? (B)

What size connections do they have? (E,B)

How much power do they use? (E,B)

21. Communication Uses

What kind of communication facilities are using electricity: village television, radio, movies, public sound system? How many? (E)

Are people in the project areas using these facilities? Were they utilizing these facilities (with the use of batteries) as much before electricity? (H)

What kinds of programs do the people watch/list to: educational, health care, agricultural, news, entertainment? (H)

25. Community Lighting

What electric lights are used by the community: street lights, meeting places, religious institutions, sports facilities, parks? (B,E)

Are these electric lights maintained? (B,E)

Are these electrified facilities new or did they exist before electricity? (B,E)

If they existed before electricity, did they have lighting (kerosene)? (B,E)

Are more people using publicly lighted meeting places or religious institutions for educational purposes? social purposes? (G,H)

Are more people using publicly lighted sports facilities, parks? (G,H)

Do street lights provide more people in the community with a sense of security than before electricity?

27. School Lights

Do any schools use electric lights? What proportion of all schools? (B,E)

Are these new schools? (B,E)

Are these previously existing schools that used no lights before? (B,E)

How many people are attending schools in the evening? (C,G)

Are more people attending school in the evenings than before they switched to electricity? (C,G)

29. Hospital Lights

Do any hospitals use electric lights? What proportion of all hospitals? (B,E)

Are these new hospitals or expanded parts of existing hospitals? (D,E)

Are these previously existing hospitals that used no lights before? (D,E)

Are these previously existing hospitals that used kerosene lights before? (D,E)

Do these hospitals serve more patients than before electrification? (D)

31. Government Office Lights

Are any government offices using electric lights? How many? (B,E)

Were these offices using kerosene lights before electricity? (E)

For what purposes do they use the lights? (E)

37. Hospital Productive Uses

What uses (other than lighting) are made of electricity in hospitals: medical equipment, refrigeration? (D)

To what extent were these uses made before (battery or small generators)? (D)

Do these hospitals serve more people than before electricity? (D)

Do these hospitals employ more people? (G,D)

41. Vocational Schools

What kinds of vocational schools are there in the community? (G,E)

For what purposes do they use electricity: lighting, video equipment, machinery, etc.? (C)

What courses of study do these schools offer that were not offered before electricity? (C)

How many people are attending these courses? (C)

APPENDIX B. SURVEY PROCEDURES AND IMPLEMENTATION

1. Field Materials

After the specific questions for the study were formulated, analytical table plans were constructed containing data in a format that would allow the evaluators to address each question during the analysis. Questionnaires were then designed to obtain the necessary data from households, businesses and community facilities to produce these tables. Copies of all questionnaires are available upon request from PLN or the Bureau of the Census.

Some of the key variables of the study required operational definitions. A summary of these operational definitions follows.

a. For purposes of the surveys, a household was defined as a group of persons that occupy the same dwelling unit and share living expenses.

b. A home business was defined as an enterprise at the location of a house (structure) operated by household members. This definition includes small-scale businesses that manufacture, provide services, or sell items.

c. A commercial establishment (business) was defined as an enterprise operated in a structure other than a dwelling unit for the purpose of manufacturing, selling products, or providing a service.

d. Income - The income figures in this report are derived from summing several categories of household expenditures plus the value of farm and garden consumption. The intent of the income data was to allow separation of the households into four groups, so that comparisons between electrified and nonelectrified households can be "controlled by" income.

   Data on average income are collected by the Biro Pusat Statistik (BPS-the Indonesian Census Bureau), which administers a questionnaire that covers income, expenditures, and consumption. Because the BPS household interview takes three hours to complete (which was well beyond the budget for this survey) a different method was used for this study. During the design of the 1980 study, the BPS advised the evaluators that the best indicator for household income in rural areas, such as Klaten and Banyumas, is the sum of total cash expenditures and home consumption from the farm and garden. It was decided to use a short series of questions on household level expenditure and consumption that would contain the same basic elements as the BPS questionnaires, but in less detail. (See questionnaire in Appendix C.)

e. Affordability (households) - In addition to the questions used to obtain income data, questions regarding the willingness of nonelectrified households to pay monthly bills of $2.00 (Rp. 2000), $2.50 (Rp. 2500), and $3.00 (Rp. 3000) were included. Questions of this

kind are susceptible to response distortion resulting from the order in which the monetary categories are presented. This is because respondents tend to choose the first category presented to them. Based on a study of the effect of question form on gathering information of this kind,* the questions were designed and ordered in an attempt to minimize the effects of this bias.

Questions regarding households' perceived ability to afford the current PLN connection charge $55.00 (Rp. 55,000) were also included in the household questionnaire.

An interviewer's manual for household and business surveys was developed for interviewer training and fieldwork. The manual contained sections on general interviewing techniques (how to ask questions, record answers, etc.), how to list households and businesses, specific instructions for each item on the questionnaires, and guidelines on how to check and edit the questionnaires. Definitions of all concepts in the questionnaires are contained in the manual. Copies of the manual (in Indonesian) are available from PLN on request.

Other materials developed for the surveys include a verbatim training guide on general interviewing procedures and editing, and a manual covering procedures for supervising survey fieldwork and coding and editing questionnaires after the fieldwork.

2. Survey Fieldwork

a. Training was accomplished in 6 days. Three of the PLN staff took turns training the 30 interviewers provided by Gadja Mada University under a contract with PLN. Towards the end of the training, the supervisory staff conducted practice interviews with the trainees until all procedures were understood. The Bureau of the Census advisor conducted the training of the Gadja Mada supervisors.

b. Fieldwork - Interviewing was accomplished over a 6-week period. The male household head was most often the respondent, although in some cases a woman was interviewed. In cases where more than one family resided together, one household head was usually able to answer all the questions, because a household in this study was defined to include more than one family only when living expenses were shared.

During the fieldwork, meetings of the interviewers and supervisors were held during the mornings and afternoons to prepare interviewer assignments and discuss any problems that occurred in the field. In

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*William B. Locander and John P. Burton, "The Effect of Question Form on Gathering Income Data by Telephone," Journal of Marketing Research, Vol. XIII (May 1976), pp. 189-192.

ıe supervisors pointed out errors they found while reviewing completed questionnaires. Interviewers were required to return to households or businesses, as necessary, to verify responses to any questionnaires that were not completed satisfactorily.

One of the concerns prior to fieldwork had been how well the procedures for establishing "work areas" for the interviewers would work. The supervisory staff wanted to be certain that each interviewer would be responsible for a specific area of the village that had easily identifiable borders, so that households and businesses would not be either excluded from the survey of interviewed more than once. They found that the administrative subdivisions in the village provided ideal work areas. The villages are divided into several neighborhoods called Rukun Keluargas (RK's), each of which has an average of five Rukun Tentanggas (RT's). The RT's consist of approximately 20-50 households.

They first met with the lurah (captain) to obtain permission to conduct the survey and to obtain detailed maps of the village. The lurah then called meetings, first with the RK captains, then with the RT captains, to explain the purpose of the survey. The interviewers then accompanied each RT captain to his RT, where he showed them the borders of the RT and provided them or helped them make maps that showed the location of all the houses and the names of the household heads. Thus, the work areas were very clear. Because of this, quality control procedures that were designed to ensure that all households were included in the survey were modified, as supervisors could easily ascertain if entire RT's were covered.

3. Quality Control Procedures

Quality control procedures were implemented at every stage of the surveys.

First, a pretest was held to test the adequacy of the questionnaire and interviewer procedures. Revisions were then made to the materials before the actual survey fieldwork was begun.

During the first days of fieldwork, interviews were observed and procedures that were not being followed uniformly were reviewed during the daily sessions with the supervisors.

Both interviewers and supervisors reviewed the completed questionnaires for completeness and accuracy and households and businesses were revisited as necessary. After the fieldwork, additional editing and coding was accomplished by PLN central office staff. Finally, range and consistency checks were accomplished by computer prior to the production of tables.

4. Data Processing

After data entry of household and business questionnaires and before SPSS files were created, four programs were run: file generation, range edit, consistency edit, and recode. Each of these is discussed below.

a. File Generation (GENBQF)

Approximately 150 household questionnaires had not been keyed and another 50 needed to be keyed over again because there were too many duplicate cell values. The keying process took two weeks. During these two weeks, the staff proceeded with the range and consistency editing of the remainder of the file, merged and rekeyed questionnaires and repeated the editing for the entire file.

Several duplicate questionnaire identification numbers were discovered. These were resolved by referring back to questionnaires. Eventually four unresolvable cases were deleted from the household file.

The file generation of the business questionnaires produced only a few problems, and these were easily resolved. However, the staff discovered that more than half of the business questionnaires (approximately 100) were lost after the keying.

b. Range Edit - Household File

Five rounds of range editing were completed - three with 4,800 cases and two with 5,000 cases (after the files were merged). The expenditures section of the questionnaire contained the most errors. A special program was written to change blank cells to "zeros." All other problems were resolved by using the UPDATE program (to change the values of cells), or by modifying the range limits in the range program.

c. Range Edit - Business File

Most errors were resolved in the same way as the household file. The staff found one major problem resulting from the lost questionnaires. In many of these cases, the business income had not been computed during the office edit conducted prior to data entry. Since they could not refer back to the questionnaires, that information was coded as "missing."

d. Consistency Edit - Household File

As with the range edit, five rounds of consistency editing were performed. Most errors were resolvable--mostly interview error and some keying errors. The program itself required some modifications during the editing.

The only significant problem encountered was that in 107 cases, no electric bill information (KWH consumption and amount paid) was recorded because the households had just received their electric connection during the month the interviews were conducted.

e. Consistency Edit - Business File

During three rounds of editing, most problems were resolved. Minor changes to the program were again required.

f. Recodes

After these programs were run, the staff manually examined the household and business listings to compute the recoded values. In a few cases, they discovered that modifications to the program were required - mainly to distinguish between "blanks" and "zeros." All problems were resolved.

g. Tabulations

After all editing was completed, all the tabulations contained in this report were produced by utilizing the Statistical Package for the Social Sciences (SPSS-X). Additional recoding of the data was performed using SPSS-X in many of the tables.

REFERENCES

Barnes, Douglas F. and Binswanger, Hans P. 1984. "The Impact of Rural Electrification and Infrastructure on Agricultural Changes in India, 1966-1980." Discussion Paper, World Bank Report No. ARV 29.

Berndt, E.R., Darrough, M.N., and Diewert, W.E. 1977. "Flexible Functional Forms and Expenditure Distributions: An Application to Canadian Consumer Demand Functions." International Economic Review 18 (3): 651-674.

Biro Pusat Statistik. Government of Indonesia. 1979. Indonesia Survei Sosial Ekonomi Nasional. Jakarta, Indonesia: Biro Pusat Statistik.

Biro Pusat Statistik. Government of Indonesia. 1984. Statistik Energi 1982. Jakarta, Indonesia: Biro Pusat Statistik.

Biro Pusat Statistik. Government of Indonesia. 1982. "Statistik Kecamatan-Tahun 1980." Reports for the following villages: Ketandan, Karanganom, Wangon.

Brodman, Janice. 1981. "Impacts of Rural Electrification in Klaten Villages: A Preliminary Report." Unpublished paper.

Crystal, Eric. 1980. "Social Soundness Analysis, Rural Electrification II, Indonesia." Jakarta, Indonesia: Prepared for the U.S. Agency for International Development.

Directorate General of Cooperatives, Project Development Office. Government of Indonesia. 1979. "Rural Electrification Project - Plan of Implementation." Jakarta, Indonesia: Prepared for the U.S. Agency for International Development.

Directorate General for Power, Ministry of Mines and Energy, Government of Indonesia. 1981. "Energy Planning for Development in Indonesia." Jakarta, Indonesia: Report prepared for U.S. Agency for International Development.

Chatlerjee, Romir. 1981. "Energy Planning for Development in Indonesia - Appendix D: Domestic Energy Consumption in Rural Areas of Indonesia." Jakarta, Indonesia: Prepared for Energy/Development International.

Gellerson, Mark. 1980. "Economic Analysis, Rural Electrification II, Indonesia." Jakorta, Indonesia: Paper prepared for the U.S. Agency for International Develt.

Harbison, Sarah F., and Robinson, Warren C. 1984. "Rural Electrification and Fertility Changes." Discussion paper prepared for NRECA conference, Washington, D.C.

Manser, Marilyn E. 1976. "Elasticites of Demand for Food: An Analysis Using Non-Additive Utility Functions Allowing for Habit Formation." Southern Economic Journal 43 (1): 879-891.

National Electrification Administration. Government of Philippines. 1978. "Nationwide Survey on Socioeconomic Impact of Rural Electrification." Manila, Philippines: Prepared in conjunction with U.S. Bureau of the Census, International Statistical Programs Center.

National Rural Electric Cooperative Association. 1977. "Rural Electrification Preliminary Engineering and Feasibility Study Report." Jakarta, Indonesia: Prepared for the U.S. Agency for Intenational Development.

National Rural Electrification Cooperative Association. 1980. "Rural Electrification Feasibility Study II for PLN in Central Java, Indonesia. Jakarta, Indonesia: Prepared for U.S. Agency for International Development.

Perusahaan Umum Listrik Negara. Government of Indonesia. 1979. "Rural Electrification Project - Plan of Implementation." Jakarta, Indonesia: Prepared for the U.S. Agency for International Development.

Pollack, Robert A. and Wales, Terence J. 1980. "Comparison of the Quadrati Expenditure System and Translog Demand System with Alternative Specifications of Demographic Effects." Econometrica 48 (3): 595-612.

Sadli, Mohammed. "Socio-Economic Problems of Rural Electrification." Jakarta, Indonesia: Paper prepared for University of Indonesia.

Soemardjan, Prof. Selo. 1980. "Rural Electrification." Jakarta, Indonesia.

Tebodin. 1981. "Study on Rural Electrification Plan - Criteria for the Assessment of Benefits." Jakarta, Indonesia: Report prepared for Indonesia National Electric Company (PLN).

Tendler, Judith. 1978. "Rural Infrastructure Projects: Electrification." Washington, D.C.: Paper prepared for the U.S. Agency for International Development.

Weatherly, W. Paul. 1980. "Environmental Assessment of the Rural Electrification I Project in Indonesia." Jakarta, Indonesia: Report prepared for the U.S. Agency for International Development.

World Bank. 1983. Indonesia, Selected Issues of Energy Pricing Policies. Washington, D.C.: World Bank.

U.S. Agency for International Development. 1977. "Indonesia - Rural Electrification I." Jakarta, Indonesia: Project Paper AID-DLC/P-2244.

U.S. Agency for International Development. 1980. "Project Evaluation Summary - Rural Electrification I." Jakarta, Indonesia.

U.S. Agency for International Development. 1979. "Project Evaluation Summary - Rural Electrification I." Jakarta, Indonesia.

U.S. Bureau of the Census, International Statistical Programs Center. "Report on the Results and Methodology - Klaten Area Surveys." Washington, D.C.: Prepared for the U.S. Agency for International Development.