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# RURAL ELECTRIFICATION PRELIMINARY ENGINEERING

## AND

# FEASIBILITY STUDY REPORT

## NORTH CENTRAL KLATEN

## Central Java, Indonesia

NRECA International Consulting Services

August 1977

PREPARED UNDER

TASK ORDER NO. 5

CONTRACT NO. AID/pha - 1090

PROJECT NO. 498-11-995-249

BETWEEN THE

UNITED STATES OF AMERICA

AGENCY FOR INTERNATIONAL DEVELOPMENT

AND THE

NATIONAL RURAL ELECTRIC COOPERATIVE ASSOCIATION

WASHINGTON, D.C.

March 1, 1977

PIO/T 498-249-3-60279 and 498-249-3-6478013

March 2, 1977

TABLE OF CONTENTS


| | Page |
|---|---|
| Preface and Acknowledgements | 6 |
| Technical Assistance Team | 8 |
| Indonesian Terms Used in this Report - Currency and Measurement Equivalents - Abbreviations | 11 |
| PART I. PROJECT BACKGROUND | |
| A. Introduction | 14 |
| B. Summary Findings | |
| 1. Financial and Economic | 17 |
| 2. Social Aspects | 18 |
| 3. Load Expectations | 19 |
| 4. Pricing - Estimating Cost of Distribution System Materials | 20 |
| 5. Institutional Development | 24 |
| PART II. PROJECT ANALYSIS | |
| A. Site Selection | 26 |
| B. IPB Survey | 30 |
| C. Load and Energy Forecast | 30 |
| D. Distribution System Engineering | 37 |
| E. Materials and Equipment for Distribution Systems | 40 |
| F. Estimated Construction Costs for Distribution Systems | 50 |
| G. General Plant | 54 |

H. Power Supply 60

I. Retail Rate Formulation and Schedules 62

J. Financial Analysis 66

PART III. PROJECT IMPLEMENTATION RECOMMENDATIONS AND REQUIREMENTS

A. Institutional and System Development 71

B. Construction Technical Assistance 73

C. Operations Technical Assistance 73

D. Training 75

E. Power Use Development 75

F. Housewiring Program 77

G. Project Financial Plans 81

PART IV. ANNEXES

A. Basic Distribution System Criteria 82

B. Labor Costs 96

C. Unit Cost Assemblies 107

D. Financial Forecast 147

E. Map of Klaten Project Area 155

LIST OF TABLES, CHARTS, MAPS


| Title | | | Part | Page |
|---|---|---|---|---|
| Figure | 1. | Klaten Feasibility Study Analysis Organizational Input | | 10 |
| Figure | 2. | Location of Project Sites | II | 28 |
| Figure | 3. | Central Java Sites | II | 29 |
| Figure | 4. | Household Kerosene and Battery Expenditure, and per Capita Income | II | 31 |
| Table | 1. | Klaten Domestic Usage Estimates | II | 34 |
| Table | 2. | Klaten Diesel Survey Summary | II | 36 |
| Figure | 5. | Circuit Diagram | II | 41 |
| Table | 3. | Voltage Drop Calculations | II | 42 |
| Table | 4. | Klaten Loan Fund Summary | II | 52 |
| Table | 5. | Distribution System Plant Increments | II | 53 |
| Table | 6. | General Plant Increments | II | 57 |
| Table | 7. | General Plant Costs | II | 58 |
| Table | 8. | Distribution Plant Operating Expense Assumptions as Percent of Total Plant | II | 67 |
| Table | 9. | Ratio Comparisons - Klaten System, REA Distribution Cooperatives, U.S. Class A & B Electric Utilities | II | 69 |
| Table | 10. | Alternative System Financial Analysis | II | 70 |
| Figure | 6. | Typical Housewiring Plan | III | 79 |
| Table | 11. | Materials for Basic Housewiring Installation | III | 80 |

| | | | | |
|---|---|---|---|---|
| Table | 12. | Manpower Needs for System Operation | Annex B | 100 |
| Table | 13. | Composite Man-hour Rates - Construction | Annex B | 101 |
| Table | 14. | Unit Cost Assemblies | Annex C | 107 |
| Table | 15. | Distribution System Cost | Annex C | 113 |
| Table | 16. | Distribution System Cost - Operating Year | Annex C | 131 |
| Table | 17 | Project Assumptions | Annex D | 147 |
| Table | 18. | Consumer, Usage, Sales and Power Requirements | Annex D | 148 |
| Table | 19. | Statement of Operations | Annex D | 149 |
| Table | 20. | Balance Sheet and System Ratio Analysis | Annex D | 150 |
| Table | 21. | Operating Revenues | Annex D | 151 |
| Table | 22. | Plant Investment, Depreciation, and Cost of Power | Annex D | 152 |
| Table | 23. | General Funds and Expenditure Summary | Annex D | 153 |
| Table | 24. | Distribution Plant Loan Funds, Interest and Repayments | Annex D | 154 |
| Figure | 7. | Map of Klaten Project Area | Annex D | 155 |

## PREFACE AND ACKNOWLEDGEMENTS

This report is one of a series to be prepared by the NRECA Technical Assistance Team under Basic Ordering Agreement No. AID/PHA/BOA/1090, Task Order No. 5, dated March 2, 1977, which required the preparation of detailed feasibility studies of proposed new electric distribution power systems for rural areas of PLN which lack electric service. The proposed system would be built to reach all potential consumers in the service area, under an "area coverage" concept.

This first project study area located in Klaten, Central Java, was selected for Team analysis under direction of PLN and USAID/J, in coordination with the office of the Provincial Governor of Central Java. Selection was based on social, economic, political, and technical considerations. The project area consists of 96 desa centered about the kecamatan of Ketandan, Kebonarum, Pedan, Jatino, ~~Karanguorgko~~, and Polaharjo.
Karangnongko

The report is divided into three parts. Part I consists basically of study findings. Part II consists of power load, engineering, power supply, rates, and financial project analysis. This part also includes summary findings of project economic analysis. Separate from this report, but in association with its preparation, studies covering the soundness of the project area were prepared by Dr. Mark Gellerson and Dr. Ferdinand Okada under personal service contract with USAID. Part III is the Team's description and listing of recommendations and requirements necessary for successful project implementation. Annexed to the report are various feasibility study data and analyses which embody the essence of the report.

Special acknowledgement is made to the people and organizations indicated in the "Feasibility Study Analysis Organization Inputs" chart which follows. The study commenced with project area site selection during June 1977, proceeded through study analysis during July with draft report preparation completed on August 1, 1977. Special appreciation for assistance is extended to Professor Suryono of PLN and his staff including Ing. Soepangkat, Johannes J. Rumondor, and Ir. Moeljadi Oetji. Bibl.

The cooperation of many individuals on the staff of USAID/J under Director Thomas C. Niblock, was especially important in producing this report in its present form and on schedule. Valuable input also was made by Peter T. McNeill and Raymond Shoff of the NRECA Advisory Team working with the National Electrification Administration

in the Philippines, and by James Taylor, REA pole and timber specialist.

It is the hope of the Team that the development of the Klaten Rural Electric Distribution System will serve as a model for similar development in other PLN areas. Data in this report, refined by actual construction and operating statistics, will be useful to other projects. Success here will be an incentive for others to seek similar remedy for electric power deficiencies in their respective areas. We believe that this report presents a reasonable and practical yet ambitious plan to bring benefits of electric service to a large number of rural people never before within reach of the opportunity.

For lack of information and operating experience in the proposed service area (an area hitherto without service), the demand, revenue, and cost forecasting involved a greater degree of uncertainity than would be the case in an PLN area already having some service. Forecasting therefore required a good deal of estimating on the basis of a Team judgement. This points to the importance of studying the assumptions of this report in detail, and utilizing prudent judgement in final project design and investment planning.

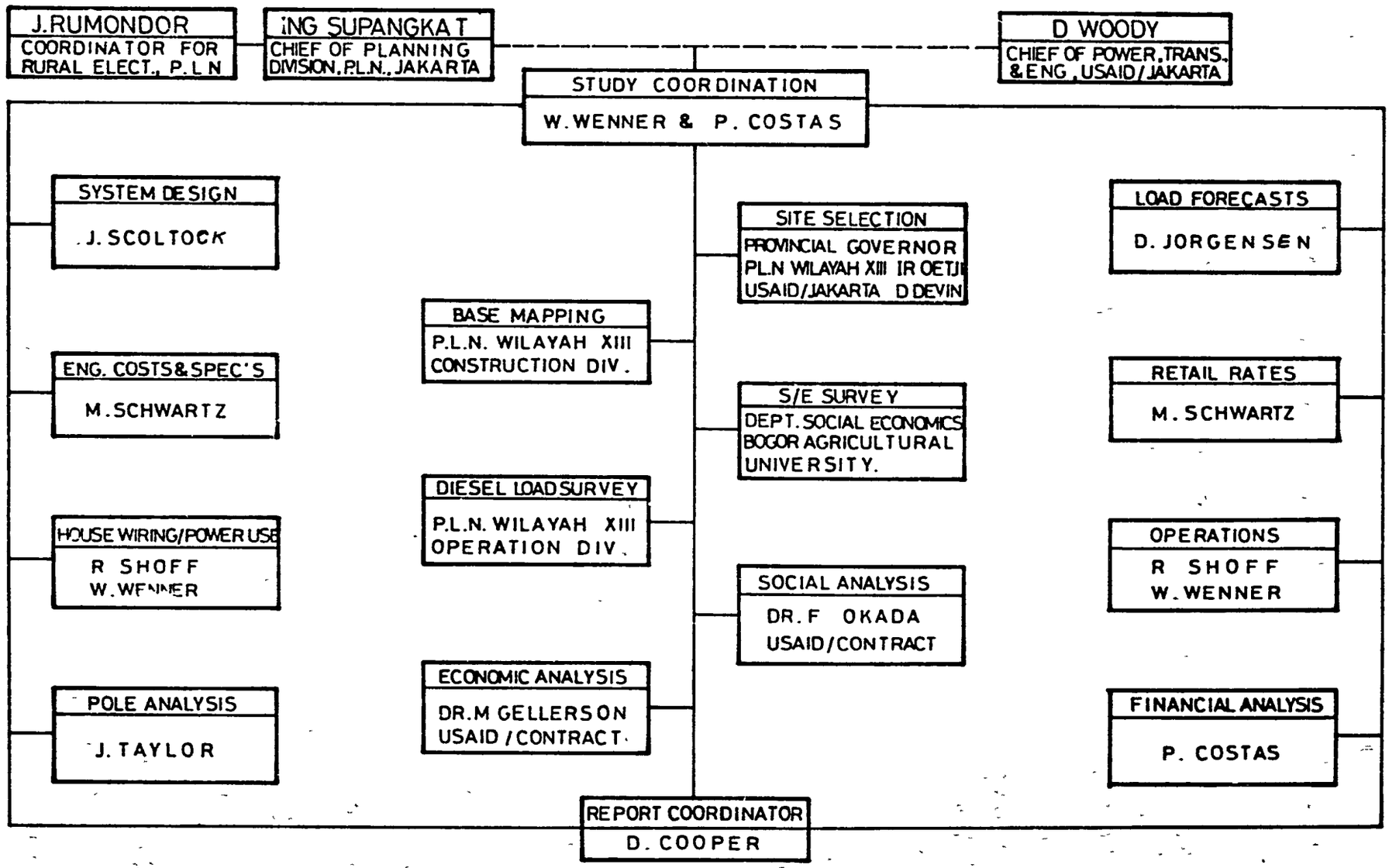
## TECHNICAL ASSISTANCE TEAM

The NRECA Team selected for the preparation of this first series of project feasibility studies included the following individuals:

| | |
|---|---|
| William C. Wenner | Team Leader and agricultural engineer, with 42 years in rural electrification. (4 years as REA operations field engineer; 30 years as general manager of an electric cooperative; service on NRECA Board of Directors and U.S. National Farm Electrification Council; consultant for USAID in Brazil; 3 years as NRECA Advisory Team Leader in the Philippines). |
| Phil Costas | Economist. (2 years as program analyst at REA; 3 years as financial and organizational advisor to National Electrification Administration, Philippines; 5 years with Borrowers Operations Department, NRUCFC; presently on assignment from NRECA, Washington, D.C.). |
| John Scoltock | Electrical engineer. (3 years as general manager of Humbolt County Rural Electric Cooperative; 37 years with REA as head of regional engineering, borrower operations, and area director of REA program). |
| Marion W. Schwartz | Electrical engineer and power consultant.(49 years of electrical engineering, including 10 years with Mississippi Power Company, 2 years as project engineer with a rural electric co-operative, 2 years with REA, 11 years as president of Powerline Construction Company and associate of other construction companies and 20 years as an electric power consultant to various public utility companies and engineering firms world-wide). |
| Hobard C. Adams | Distribution layout engineer. (40 years as general manager of three rural electric cooperatives, and service on the NRECA Board of Directors). |
| David Jorgensen | Distribution layout engineer. (8 years in distribution engineering with R.W. Beck and Associates; 1 year with Arizona Public Service Company). |

| | |
|---|---|
| Donald H. Cooper | Report coordinator. (17 years in REA as management specialist and rural electrification information specialist; 6 years in NRECA as cooperative and rural electrification specialist; 3 years in Philippines as organization and management consultant to National Electrification Administration). |

FIGURE 1.
"KLATEN FEASIBILITY STUDY ANALYSIS ORGANIZATIONAL INPUTS"



## INDONESIAN TERMS USED IN THIS REPORT

| | |
|---|---|
| Bupati | Head of a kabupaten. |
| Camat | Head of a kecamatan. |
| Desa | Village or town. |
| Kabupaten | Administrative district below province level. |
| Kampung | Local district within a desa or town. |
| Kecamatan | Administrative district below kabupaten level. |
| Lurah | Official in charge of a desa or town. |
| Pusat | District center or headquarters. |

## CURRENCY AND MEASUREMENT EQUIVALENTS

| | | |
|---|---|---|
| US$1 | = | 415 Indonesian rupiah |
| Rp 1 | = | US$.00241 |
| 1 mill | = | US$.001 |
| 1 kilometer | = | .6214 mile (about 5/8 mile) |
| 1 mile | = | 1.61 kilometers |

## ABBREVIATIONS

| | |
|---|---|
| ADB | Asian Development Bank |
| BAPPENAS | National Economic Development Planning Board |
| BRI | Bank Rakyat Indonesia |
| CFC | National Rural Utilities Cooperative Finance Corporation (U.S.A.) |
| DGC | Directorate General for Cooperatives (GOI) |
| GOI | Government of Indonesia |
| IBRD | International Bank for Rural Development |
| IPB | Institut Pertanian Bogor |
| NEA | National Electrification Administration (Philippines) |
| NRECA | National Rural Electric Cooperative Association (U.S.A.) |
| PDO | Project Development Office (GOI) |
| PLN | Perusahaan Umum Listrik Negara (State Electricity Enterprise, GOI) |
| REA | Rural Electrification Administration (in U.S. Department of Agriculture) |
| USAID | United States Agency for International Development |
| A&E | architecture and engineering |
| amp | ampere |
| HP | horsepower |
| km. | kilometer (5/8 mile) |
| KV | kilovolt |

| | |
|---|---|
| KVA | kilovolt-ampere |
| KW | kilowatt |
| kwh | kilowatt-hour |
| TIER | "times interest earned ratio" (interest expense plus net margins divided by interest expense) |
| V | volt |
| W | watt |

# PART I

# PART I. PROJECT BACKGROUND

## A. INTRODUCTION.

The Government of Indonesia has determined that electric service shall be an integral part of its development program for all the people on its 3,000-and-more islands. Rural electrification is to be one of the essential elements in the implementation of this policy.

Assistance in this undertaking has been requested of the United States Agency for International Development, and USAID has expressed interest in such a project. Patterns and experience for full rural electrification are available in the USAID-assisted program in the Philippines as well as in the 42-year-old success of the Rural Electrification Administration and nearly 1,000 rural electric cooperatives in the United States.

USAID contracted with the National Rural Electrification Cooperative Association (NRECA) to make a pre-feasibility study to determine what potential existed for establishment of government-assisted consumer-owned electric distribution systems in Indonesia. The report of the NRECA Study Team, published in May 1976 as RURAL ELECTRIFICATION FOR INDONESIA, concluded that there were many densely populated rural areas beyond the reach of the national power grid system which could support nonprofit, consumer-owned electric utilities.

The findings and recommendations of that study were based on the premise that such systems would be economically constructed and operated and upon the determination that the topography, concentrations of population, and natural resources of Indonesia offer a satisfactory basis for such an undertaking. It was recognized that if adequate capital financing and administrative capabilities were provided, then the principle requirements would exist for a rural electrification program which could bring better living conditions for millions of the Nation's poor people as well as benefits to the country at large.

The islands of Indonesia stretch 3,300 miles from east to west and 1,000 miles from north to south, covering an area which makes this the sixth largest nation in the world. The population of 140,000,000 makes Indonesia the fifth most populous among the nations. The natural wealth of forests and agricultural land, of minerals and water resources is still largely untouched.

Indonesia's people have not yet, as a whole, been able to benefit from this wealth of resources. It has been demonstrated that rural electrification is essential in opening the country's wealth to development and in spreading its benefits to the great percentage of the population which is impoverished.

More than three-fourths of the families on these islands depend on farming and other rural endeavors, and yet it is in these rural areas where poverty is most widespread. It is interesting to note that fewer than one out of a hundred rural families have electricity, in contrast to Jakarta where it is used by 24 out of 100.

The State Electricity Enterprise, Perusahaan Umum Listrik Negara (PLN), has been making good use of the considerable water power potential on Java, Sumatra, and other islands. Petroleum is both abundant and cheap as an energy source for electricity in Indonesia. As the world demand for petroleum continues to grow and known reserves decrease, this fuel will soon have to give way to alternative sources of energy. Gas has not been fully exploited but this, too, has finite limitations. Fortunately, resource exploration indicates ample supplies of coal which can be developed to fuel new large generating stations in coordination with the country's hydro generating plants.

The generation of electricity is not seen, therefore, as so much of a problem as rural distribution systems in developmental planning for the people of Indonesia.

As a result of the encouraging pre-feasibility report in 1976, the Government of Indonesia has expressed continuing interest in USAID assistance for rural electrification and asked that feasibility studies be prepared for six distribution systems which could be observed as pilot projects in anticipation of an expanding program for service to rural areas. Financial assistance in terms of low-interest, long-term financing is being sought from USAID for this initial stage, depending upon a finding of satisfactory feasibility.

It was requested by the Government of Indonesia that sites studied for cooperative-type electric systems be on islands other than Java. It was determined, then, that feasibility studies would be prepared for seven possible non-cooperative projects in Java which could be tied into the PLN grid. Three other sites, at Central Lampung, on Lombok, and at Luwu on Sulawesi were selected for feasibility studies as non-profit, member-owned cooperatives.

USAID contracted with NRECA to field a team of rural electrification specialists with many years of experience in engineering, economics, and rural life to prepare feasibility studies to provide a basis for a project proposal for a rural electrification loan. A six-member team arrived in Jakarta in mid-March and began immediate field study of possible sites proposed by PLN and by the Directorate General for Cooperatives in the Ministry for Transmigration, Manpower, and Cooperatives.

Their investigation and analysis has depended heavily on information supplied by Indonesian sources and upon guidelines from both the Government of Indonesia and USAID. Preparation of the feasibility studies is predicated on the experience of these rural electrification specialists in various countries of the world in addition to the Philippines and the United States.

This report is one of 10 complete studies being prepared by the NRECA Team. Three of these are for consideration by the DGC and seven are for PLN. Field notes, basic data, and maps have been prepared for all areas, and this information is being placed in USAID files for future use.

There are many, many other areas in Indonesia where similar projects could be undertaken with excellent prospects for success. It is recommended that the Directorate General for Cooperatives and PLN collaborate on a joint national power survey to determine the most feasible approach to a program of total nation-wide rural electrification. Enormous resources of manpower and money will be required to electrify Indonesia. It is essential, therefore, that before such heavy commitments are made for rural electrification, the very best plan of action be agreed upon and adopted.

## B. SUMMARY FINDINGS.

### 1. Financial and Economic.

A 15 - year financial forecast was prepared for the proposed project. The forecast passes commonly accepted tests for financial viability. However, sensitivity tests made, changing key assumptions of the forecast, indicate that the financial viability of the Klaten project will largely depend on what the final power rate charge will be. If a drastic increase is made in the Rp. 22 kwh rate assumed in the forecast, financial viability will be difficult to achieve. If only a moderate increase (say 15%) is necessitated to meet PLN's cost of service to the project, project financial viability still should be maintained.

Major assumptions made in the forecast include:

a. The connection of 25,000 residential customers by the end of the third year of system operation.

b. An extensive housewiring loan program to assist the economically poor to partake immediately in the benefits of electric service.

c. Soft project loan terms.

The system forecasted is quite unique, and will be operationally different from REA rural electric systems now operating in the United States. Consumer density is predicted to be 40 times those of REA-financed systems, and revenue density is predicted to be 10 times as great. Return on investment of the project at the end of the forecast period is predicted to be three and one-half times that of REA rural distribution systems today.

Much of this can be explained by describing the system under design. It should be kept in mind that a rather finite system is under analysis here - a system with geographic growth and potential load compressed within the time framework of study analysis.

In addition, an economic rate of return was calculated for Klaten. In order to do this, surplus benefits resulting from resource savings and increased economic activity were first estimated for each of the categories of consumers and then added to the estimated revenues taken from the financial forecast in order to obtain a measure of the total economic benefits derived from rural electrification over the relevant 15 - year period. By comparing this estimate of benefits with the estimate of costs over the same period, the economic rate of return for this project was estimated to be 27%.

2. Social Aspects.

Of the 98 villages (desa) designated for electrification in the Regency (kabupaten) of Klaten in Central Java, 10 were surveyed in order to identify the beneficiaries and for socio-cultural data. Information was collected on their 5,410 households and, by primary occupation of the heads-of-household, they were classified as the following:

| Primary Occupation of Household Head | Number of Households | % of Households | |
|---|---|---|---|
| Farmer, cultivating | | | |
| less than 0.5 ha | 1,314 | 24.3 | |
| 0.5 - 0.9 ha | 510 | 9.4 | |
| 1.0 - 1.9 ha | 186 | 3.4 | |
| 2.0 ha and over | 24 | 0.4 | |
| Sub Total | 2,034 | | 37.5 |
| Wage Laborer: | | | |
| Agricultural | 992 | 18.3 | |
| Non-agricultural | 1,554 | 28.7 | |
| Sub Total | 2,546 | | 47.0 |
| Tradesman/Businessman | | | |
| With 0 - 2 employees | 111 | 2.1 | |
| With 3 or more employees | 151 | 2.8 | |
| Sub Total | 262 | | 4.9 |
| Salaried/Professional/ Public Servant | 568 | 10.5 | |
| Grand Total: | 5,410 | 99.9 | |

The principal beneficiaries in Klaten are therefore small farmers (1,824 or 33.7%) cultivating less than one hectare of land, a figure chosen because the national average for land holding is 0.98 ha; wage laborers (2,546 or 47.8%); and small tradesmen/businessmen with no employees or a maximum of two employees (111 or 2.1%). Together they form an aggregate of 83% of the total population of these sample villages.

An important aspect, however, is that of the informal sector of the economy. Most farmers, because their land is too small to sustain their households, have secondary and tertiary means of livelihood. A small farmer, between planting and harvesting seasons, may weave palm-leaf hats for sale, drive a pedicab, or

work as a construction laborer. Thus it is hard to draw the line between the small farmer and the wage laborer or small tradesman (who is not necessarily landless) except in terms of how he defines himself.

Even more important is the role of the village wpman. But for the combined efforts of herself and her husband (and adult children, if any), a village household would often collapse economically. Though she is not the head-of-household (unless widowed or, rarely, divorced), she plays a crucial role as a wage laborer (usually agricultural) or as an entrepreneur in her own right: a food stall or small retail shop keeper, a manufacturer of soy-bean products, a weaver of cloth, or a breeder of poultry - in Klaten, principally ducks. It is expected that, proportionately, the provision of electricity will benefit her more, and enhance her role in the household and in village society vis-a-vis her husband.

Javanese society is based on traditional concepts of cooperation and concord, expressed not only as traditional activities which maintain both village social cohesion and physical condition, but as modern institutions such as the Government system of cooperatives, community halls, village soccer teams, and Boy Scouts. Not the least is the village political organization with a dependable elected village leadership. Thus, there is a durable framework for the acceptance and utilization of innovations without disruption to society, the more so because of the pragmatic attitude of the villager (as evidenced in his economic enterprises) towards work and towards things that work.

3. Load Expectations.

The proposed service area designated for this electric system is farm oriented with unusual potential for small commercial and industrial power loads. Population is in dense clusters. Almost all households depend on kerosene lamps or candles for lighting at the present time and lack electricity for even the simplest home needs. Some farm crop processing plants and other small enterprises operate on power from very small diesel generators. Most cottage industry is by hand. Low-cost electric service will be a welcome alternative for these people according to the Team's findings. Additional electric load for a rural electric system will come from street and security lighting, community water pumps, and public buildings, as indicated from surveys conducted in the area and from experience with rural electrification elsewhere.

Even a casual visit points to good load expectations. The system should climb rapidly from zero to satisfactory load levels within a relatively short number of years. Factors determining rate of load growth will be:

a. Availability of an adequate supply of power, delivered over the distribution system at satisfactory voltage levels with

24-hour service and a minimum of outages (blackouts).

b. A retail rate which encourages use of electricity for productive purposes.

c. An energetic consumer information and power use development program.

Experience in other countries where electric service has been brought into rural areas shows that the availability of dependable electric service in itself attracts additional economic activity. As new small industrial and commercial enterprises start, they create more jobs. This results in higher family income and in turn makes possible additional use of electricity in households. Studies made in the Philippines, for instance, reveal that where ample power supply is available, as in the service area of the Misamis Oriental Rural Electric Service Cooperative, the rate of new construction has increased substantially along the electric lines. Improved community services such as medical clinics, schools, local water systems, and children's playgrounds for evening use also follow the electric lines.

The present feasibility study uses initial connection rate expectations that were pre-determined, but the projected load growth which is based on the assumptions for household and other connections is conservative and should be attainable with good system management.

4. Pricing -- Estimating Cost of Distribution System Materials.

Material costs have been developed, delivered to warehouses in Indonesia, by determining the costs in currencies expended, U.S. dollars and Indonesian Rupiah. Procedures and methods used are briefly described.

While it is known that Code 941 countries may furnish materials, only United States manufacturers' prices have been used. The use of these prices for estimates is considered logical as no published prices are available from Code 941 country suppliers. Further, recent bid openings in Indonesia indicate that while Code 941 suppliers have expressed interest, no bids were received. It can be shown in other areas that prices quoted from Code 941 suppliers vary with the "time" of bidding and are often 30 - 40% below other bidders. It is not known whether such offers, if accepted, were delivered and if the material quality delivered is as specified. While quality materials at lower prices are highly desirable, it is not felt that experience in Indonesia on electrical materials procurement, using USAID regulations and procedures, warrants use of these lower prices for cost estimates.

Material prices used are published list prices of suppliers adjusted by their current (spring 1977) discount sheets. It is

to be expected at time of bidding that there will be some additional reduction in base price (FOB factory) depending on quantity required, manufacturing plant, load, shipping schedules, etc. These "reductions", if they are made, cannot be reduced to concrete terms and therefore are not considered in estimating material costs. Prices used are from these manufacturers:

| Product | Suppliers |
|---|---|
| Line hardware insulators | A. B. Chance Company |
| Conductor fittings, etc. | Joslyn Mfg. & Supply Co.<br>McGraw-Edison Co. |
| Transformers, meters, meter-sockets, instrument transformers, regulators, street lighting fixtures | General Electric Co.<br>Westinghouse Electric Corp. |
| Non-NEMA standard watthour meters | Ta-Tung Engr. Co., Taipeh, Taiwan |
| Bypass switches | Kearney-National |
| Airbreak switches | Kearney-National<br>Westinghouse Electric Corp. |
| Reclosers, sectionalizers | McGraw-Edison Co. |
| Arresters | General Electric<br>Westinghouse Electric Corp. |
| Connectors and splices | Burndy Corp. |
| Conductors and service drop cables | Alcoa Conductor Products Co.<br>Southwire Co. |
| Cross arms | local producers |
| Poles and anchor logs | local producers |

Costs for export packing and delivery to port were added where appropriate to obtain an FOB port price. Most materials are quoted with an Eastern and Western Zone price with freight allowed to destination within those zones. Since Eastern Zone prices are the lower priced and conference ocean freight rates to Indonesia from Atlantic-Gulf ports are roughly the same as from West Coast ports, Eastern Zone pricing is used. Export packing is quoted at approximately 5% of factory cost on many items and this adder is used where appropriate.

Cost to export (a U.S. dollar cost) consists of these expenses--spring 1977 average rates shown are used:

a. ~~port broker~~ Import's fee - 1/4 of 1% of commodity cost FOB Port.

b. Port handling costs, stevedoring - US$7 per cubic foot measurement of shipment. This does not include heavy lifts which are not anticipated for these materials.

c. Ocean freight - US$125 per shipping unit, 2,000 pounds or 40 cubic feet, whichever produces most revenue for carrier.

d. Marine insurance - 1-1/4% of C & F price for insulators, transformers, meters, regulators, etc.
3/4 of 1% of C & F price for hardware, conductors, etc.

e. Demurrage charges are not anticipated or used since 15 days at port are "no charge".

Cost to import (an Indonesian rupiah cost) consists of these expenses, gathered from local Indonesian sources and believed valid for this estimate:

a. ~~Port broker~~ Import's fee - Estimated at Rp 15,000/MT which includes all documentation and clearance as duty free merchandise.

b. Port handling costs, stevedoring - From shipside to warehouse and inspection area, Rp 4,000/MT.

c. Heavy lifts - Charges are made for use of port cranes, etc. at varying rates, according to character or size of lifting equipment. No costs are anticipated for heavy lifts on material to be imported.

d. Warehouse charges -

| | |
|---|---|
| Outdoor | Rp 70/$M^3$/day. |
| Indoor (roof covered) | Rp 100/$M^3$/day. |
| Bonded | Rp 175/$M^3$/day. |

Above rates apply for 12 days. After 12 days rates are increased 100% as a penalty, which we understand does not apply on USAID materials. Most materials (except corrugated packed material) will use outdoor rate for 12 days only or Rp 840/$M^3$. For corrugated packed material indoor material rate will be used for 12 days only or Rp 1,200/$M^3$.

e. Loading for inland transport from port - After clearance from port (customs or warehouse area) stevedores load merchandise to owner's trucks, with rent of fork lifts, etc. To load a 5 to 6 ton truck, use Rp 3,000/MT as an average cost.

These import costs assume no customs duties, per se, but various stamp charges will no doubt accrue with each shipment. No definite value can be assessed to these charges and they are not included in the estimated material costs used in this report.

Materials will be imported through several different ports on different islands of Indonesia. For material pricing at any warehouse, average import costs have been applied for any Indonesian port.

To transport materials from port to a central warehouse a price of Rp 6,000 per metric ton has been used. This cost is based on utilizing large open-bodied 5 to 6 ton trucks. An average of 50 km is used as the distance between port and central warehouse.

Cost of distributing materials to individual projects from central warehouses will be estimated as a job cost for the individual project.

To illustrate costing methods used and described above:

INSULATOR, PIN TYPE, ANSI 56-1, RADIO FREED, BROWN PORCELAIN

Material cost:

| | |
|---|---|
| Unit | 100 pieces |
| Shipping weight, export packed | 875 pounds (0.4375 tons) |
| Volume, export packed | 32 cu. ft. (0.8 shipping cube) |
| List price, Eastern zone delivery | US$587 |
| Discount | none |
| Export packing 5% of net price | US$ 29.35 |
| Cost FOB U.S. port | US$616.35 |

Export Cost:

| | |
|---|---|
| ~~Port broker~~ Import's fees, 1/4 or 1% of FOB cost | US$ 1.54 |
| Stevedoring US$7 per 40 cu. ft. (shipping cube) | US$ 5.60 |
| Ocean freight, US$125 per 40 cu. ft. (shipping cube) | US$100.00 |
| Marine insurance, 1-1/4% of C&F cost (616.35 + 107.14) | US$ 9.04 |
| | US$116.18 |

Import Cost:

| | |
|---|---|
| ~~Port broker~~ Importer's fees, Rp 15,000/MT | Rp 5,955 |
| Stevedoring Rp 4,000/MT | Rp 1,588 |
| Warehousing at port, Rp 1,200/$M^3$ | Rp 1,088 |
| Loading on truck at port, Rp 3,000/MT | Rp 1,191 |
| Total import cost | Rp 9,822 |

Inland freight:

| | |
|---|---|
| Port to warehouse, Rp 6,000/MT | Rp 2,382 |

Total cost for insulators, pin type, FOB Indonesian warehouse:

| | Rupiah | US$ | US$ Equivalent |
|---|---|---|---|
| Material cost | - | 616.35 | 616.35 |
| Export cost | - | 116.18 | 116.18 |
| Import cost | 9,822 | - | 23.67 |
| Inland transport | 2,382 | - | 5.74 |
| Total cost per 100 pieces | 12,204 | 732.53 | 761.94 |

Due to the mass of the calculation sheets used they are retained in the files at USAID/Jakarta. Costs shown are brought forward to the"Unit Cost" sheets for various construction assemblies.

5. Institutional Development.

The Report of the NRECA Study Team, May 1976, recommended and anticipated a single rural electrification administration for Indonesia somewhat along the lines which developed in the Philippines or in the U.S.A. As of July 1977, this recommendation has not been followed, but USAID/J remains optimistic that as these initial projects develop, a single agency responsible for rural electrification, with its special characteristics and requirements, will be established.

Following a seminar on rural electrification in Jakarta in December 1976, it was determined that both PLN and DGC should establish separate but somewhat similar programs.

The Minister of Public Works and Power has established a new sub-Directorate for Rural Electrification within PLN to implement the projects for those areas within reach of the PLN transmission grid - - initially seven rural electric distribution systems on the island of Java. These will be construc-

ted and operated as individual entities under PLN supervision and responsibility.

The proposed electric distribution system at Klaten would be one of these seven pilot projects.

During January and February of 1977, PLN sent key officials from its staff to the Philippines for training and an inspection tour of established rural electric systems there. This included elements of feasibility and general orientation for project implementation and supervision. It is anticipated that further training will be provided for officers and key employees of the new PLN Sub-Directorate.

# PART II

# PART II. PROJECT ANALYSIS

## A. SITE SELECTION.

When the NRECA Team was requested by PLN and USAID/JAKARTA during mid-May 1977 to assist PLN in the preparation of six preliminary engineering and feasibility studies for rural power districts, PLN and USAID/J jointly had decided to locate these six systems in Central Java. The NRECA Team supports this initial decision for project implementation for the technical considerations involved, which included spare capacity in the PLN Wilayah XIII system, and compatibility in system design integration.

Shortly after project identification was made on a regional basis, NRECA Team members were requested during early June 1977 to assist PLN and USAID/J in field reconnaissance study of the selected areas to geographically determine priorities in the six project sites for project evaluation. Based on local and technical considerations, first priority for project study was given to the Klaten site.

In short, the NRECA Team supports this initial decision for project investment, for during this process of site location it did consider area and location where a reasonbly strong and growing demand for electric service can be expected, and where the resulting benefits of electrification can justify the costs. This can be supported by selecting a location where (in accordance with site selection criteria listed by the World Bank, Rural Electrification, A World Bank Paper; October 1975, page 49) the area meets the following criteria:

" *the quality of infrastructure, particularly of roads, is reasonably good;
*incomes and living standards are improving;
*there are plans for developing the region;
*the region is close to the main grid;
*spare capacity existed; and
*there are a number of large villages, not too widely scattered."

Klaten, selected for one of the first pilot rural service districts by PLN, is a rich agricultural area spread out at the base of Mt. Merapi. It has an economy based on rice, sugar, tobacco, coconuts, and cassava, with some cloves, peanuts, and coffee. About half of the farmlands are irrigated rice paddies and sugarcane fields. Most of the irrigation is by gravity

flow but there are some pumps. Two or three crops a year are produced on the irrigated land.

The designated service area is north of the city of Klaten, and located between the two old sultanates of Surakarta and Yogyakarta. This is reported to be one of the most densely populated rural sections of Java and perhaps in the world. About 51,000 families live in an adjoining 98 villages. Of the whole population, 87% are reported to be farm families or farm laborers. Others own or work in cottage industries or are construction laborers. More than two-thirds of the small industries or businesses engage in processing agricultural produce.

FIGURE 2.

# LOCATIONS OF PROJECT SITES

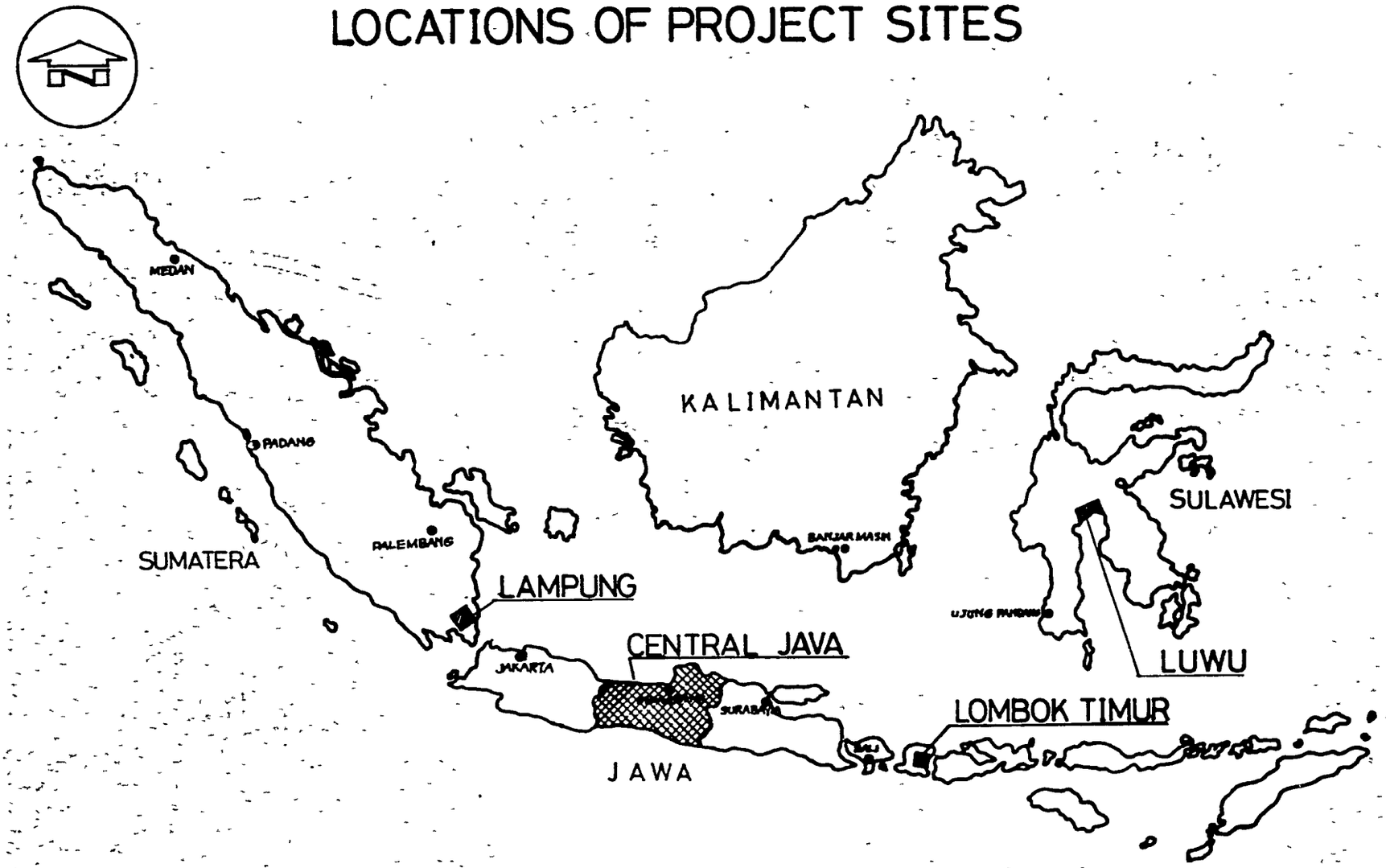
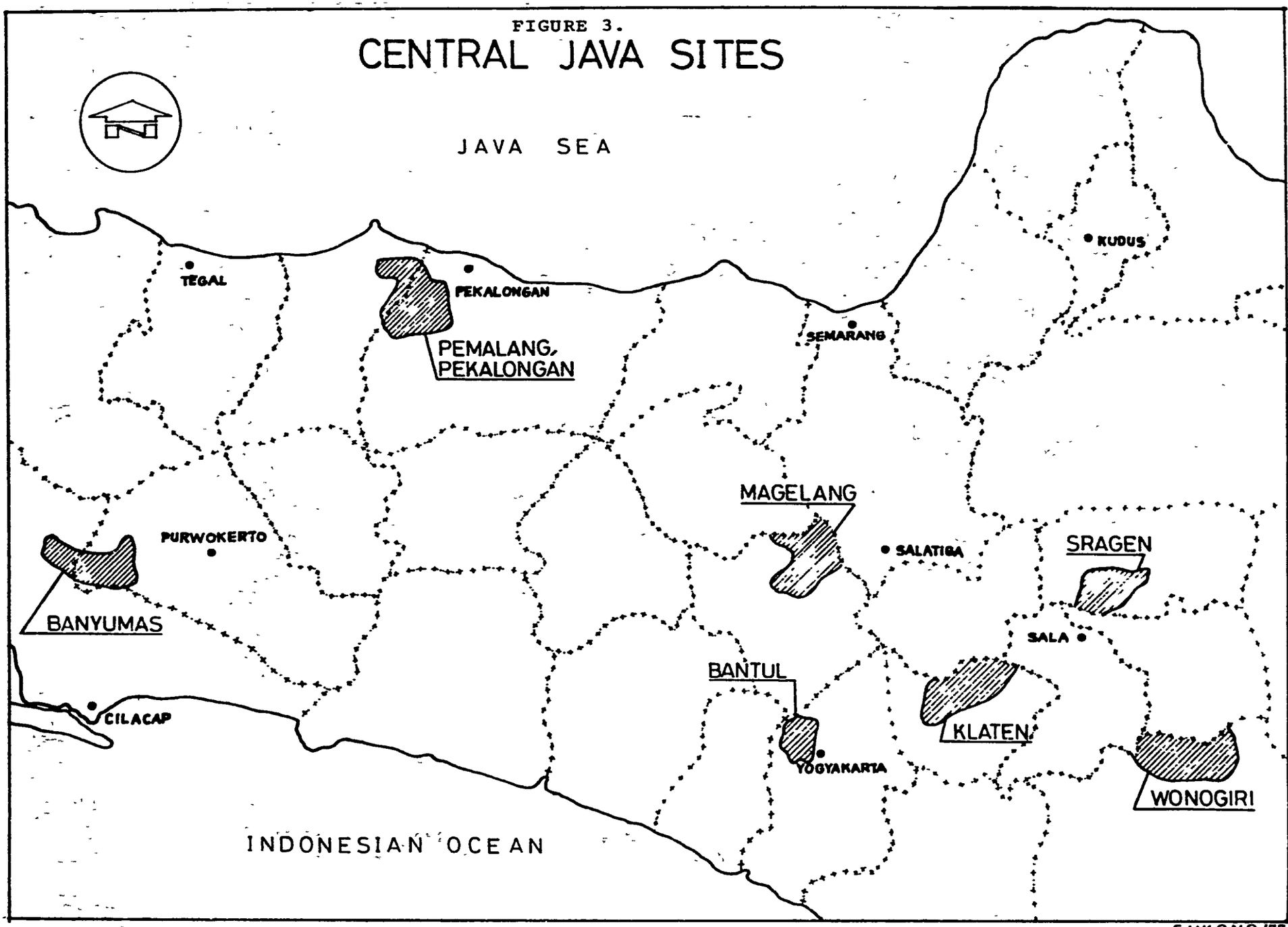


FIGURE 3.

# CENTRAL JAVA SITES




SUKONO '77

## B. IPB SURVEY.

The main thrust of this report is to evaluate the technical and engineering soundness, as well as the financial soundness of the project. To augment this evaluation, and to independently evaluate the social and economic soundness of the project, a separate USAID project grant was given to Dr. F. Okada and Mr. Philip Costas (of the NRECA Study Team) to undertake during June and July of 1977 a field survey study covering the salient social and economic factors relating to the establishment of rural electric systems in three outer island locations in Indonesia and seven locations in Central Java. In implementing this study the consultants were assisted by a faculty task team from the Department of Social Economics, Bogar Agricultural University (IPB), Bogar, Indonesia. The IPB team also included 16 field interviewers.

During the survey, four structured and unstructured interview models were used. In each study site 10 selected lurah and 50 kampung chiefs were interviewed. Also, 30 selected heads of households were interviewed. Unstructured interviews, moreover, were made with leading educators in the project study site. The objectives of the study analysis were to determine:

1. Who would be the target beneficiaries of the proposed rural electric development project.

2. Would these beneficiaries be able to afford, and would they be willing to pay for full cost electric service.

3. What are the expected benefits of bringing electric service to the proposed site, and how do these benefits correlate with other projects and development needs in the project area.

4. What are the anticipated social constraints and costs of project development.

In addition, the research was structured to gather "site specific" data and information and was kept flexible to incorporate data useful for the NRECA Feasibility Study Team in making project study load and energy assumptions. For detailed information concerning the IPB study, refer to the "Social Soundness Analysis" study prepared by Dr. Okada.

Of particular interest to the NRECA Team was the IPB data collected concerning household energy expenditures. Briefly, the responses of lurah and kampung chiefs indicated that over one-half of the households in their areas could afford and would immediately take central station electric service if the monthly minimum minimum and housewiring payment, taken together, would not exceed 1,250 rupiah. The household expenditure data for kerosene and battery purchases at the site support these estimates (see Figure 4 ). Moreover, from this figure, note it is imputed that approximately one-half of the households that would take electric service (based on present kerosene and expenditure patterns) would come from households with per capita income levels less than US$200 annually.

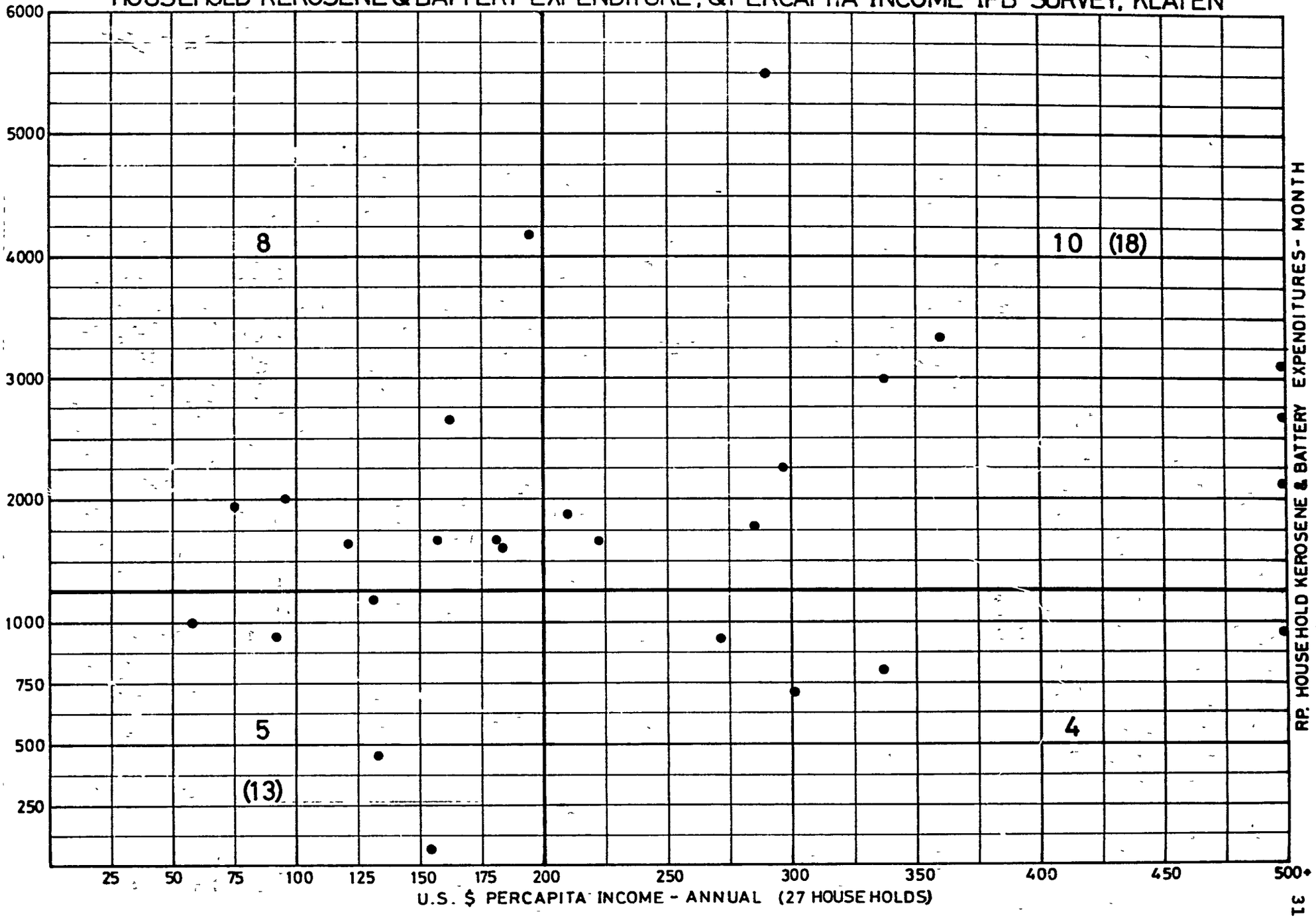
## C. LOAD AND ENERGY FORECAST.

### 1. Methodology.

Survey data used for this forecast of load and energy requirements included

FIGURE 4.

"HOUSEHOLD KEROSENE & BATTERY EXPENDITURE, & PERCAPITA INCOME- IPB SURVEY, KLATEN"



the following:

a. Number of current houses existing per desa in the proposed project area (source: PLN Survey).

b. Number and operating characteristics of all privately owned diesel installations over 10 HP in the project area (source: PLN Survey).

c. Energy expenditure patterns for selected households in the project area (source: IPB Survey).

d. Expected electric usage patterns of selected desa in the proposed project area (source: IPB Survey).

e. Number of small commercial establishments existing in selected desa and kampung of the project area (source: IPB Survey).

f. Presently existing electric usage patterns in the Klaten PLN district (source: PLN billing data).

g. Typical existing electric usage patterns of selected small commercial users in PLN Wilayah XIII service area (source: PLN billing data).

h. Desa data profile sheets provided to USAID/J by PLN.

Unfortunately, due to other study requirements at hand, time was not available for Team members to make a full field reconnaissance of the project area, and the Team's load forecast was dependent on the source data available. Moreover, a prime design objective--- that of connecting 50% of the households existing in the project area by the end of the third operating year---subscribed to by PLN and USAID/J became a part of the study forecast. Also, two other goals subscribed to by PLN and USAID/J became a part of the forecast. These included wholesale power cost and retail rate structure assumptions. In general, these prescribed goals dictated the basic parameters of the load and energy forecast.

2. Connection Level Estimates.

As stated above, the forecast was predicated on a given level of household consumers -- that of serving 50% of present day households during the third year of system operations. For forecast

purposes it was further assumed that 85% of present day households would be served by the end of the fifteenth year. Based on the IPB data on hand, and assuming that the technical chore of connecting 25,000 houses by the third year of operation can be mastered, the Team believes that this level of domestic connections may be achieved. As indicated in the IPB data, potential demand for domestic electric service exists in the project area, and most probably this demand will be in excess of the demand assumed in the forecast. Further, household additions in the project area (based on IPB data) increased at an annual 2.24% growth rate from 1972 through 1977. This indicates that the estimates made for household connections could prove to be too conservative, over the forecast period of 15 years. Other consumer class connection level estimates were made as follows:

a. Small commercial. Based on Team field trips made throughout Central Java, and data made available through the IPB and PLN surveys, it appears that a fairly constant relationship of small commercial establishments (i.e. public buildings, service shops, restaurants, cottage industries, stores, hotels, etc.) and houses exists in the project area, with the ratio being 6 : 100. Consequently, this ratio was used to estimate the number of small commercials existing in the entire project area. It was further assumed that 90% of such establishments would become consumers by the third year of service and that small commercial connections would increase at an annual 1% compound growth rate. It should be noted that this study area includes an inordinately large number of handicraft shops. More exist here than in any other area surveyed by the IPB Team.

b. Other consumer classes. Connection level estimates of other consumer classes are listed in "Project Assumptions" (see ANNEX D). Briefly, 7 street or security lights per desa are estimated for year one of the forecast and 23 per desa for the fifteenth year of the forecast. In all sites surveyed by the IPB Team a very strong desire was expressed for security lighting and this Klaten area was no exception.

No pump irrigation, as such, was forecast because the source data indicated only a negligible demand for this use. It was estimated that in every other year of the forecast period each desa would develop a demand for one small community water system to provide pure water from deep wells.

TABLE [1]. KLATEN DOMESTIC USAGE ESTIMATES

| | Lights | Iron | Radio | T.V. | Rice Cooker | Refrig-erator | Hot Plate | Hair Dryer | Total/ Day | Total/ Mo. | Ave./ Mo. |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Initial Year** | | | | | | | | | | | |
| Watts/item | 150 | 660 | 10 | 35 | 660 | 300 | 660 | 500 | | | |
| % connected | 100 | 15 | 15 | 5 | 10 | 1 | 5 | 1 | | | |
| Average watts connected | 150 | 99 | 1.5 | 1.75 | 66 | 3 | 33 | 5 | | | |
| Hours usage | 4 | .5 | 6 | 3 | .5 | 5 | .5 | .25 | | | |
| Watt-hours | 600 | 50 | 9 | 5 | 33 | 15 | 16 | 1 | 729 | 21,870 | 21,870 |
| **15th Year** | | | | | | | | | | | |
| Watts/item | 250 | 660 | 10 | 35 | 660 | 300 | 660 | 500 | | | |
| % connected | 100 | 60 | 75 | 60 | 60 | 8 | 15 | 10 | | | |
| Average watts connected | 250 | 396 | 7 | 21 | 396 | 24 | 99 | 50 | | | |
| Hours usage | 5 | .5 | 7 | 5 | .5 | 5 | 1 | .25 | | | |
| Watt-hours | 1,250 | 198 | 49 | 105 | 198 | 120 | 99 | 13 | 2,032 | 60,960 | 60,960 |

Based on the PLN "existing small diesel installation" survey (see Table 2 ) it was estimated that 50% of existing grain mills would come on line by the fourth year of operations and that the remainder of these mills would convert to electric power by the end of the forecast period. Moreover, it was estimated that half of these mills will install grain drying equipment by the end of the period.

The PLN survey also indicated the existence of two small textile mills and one tobacco factory using diesel power. The forecast estimates that these loads will come on line early in the forecast period, and that other miscellaneous power loads will come on line at an average rate of three new power consumers per year. Such loads might include sawmills, furniture factories, and medium-size repair, crop drying, food processing, and refrigeration facilities.

3. Usage Estimates.

The Table above indicates the Team's estimate of average domestic usage of 22 kwh per month during the first year of operation and of 61 kwh per month during the fifteenth year. Coincidentally, 61 kwh per month is the current median usage for domestic customers in PLN's Klaten district. Domestic usage is estimated to remain constant at 22 kwh per month during the first 4 years in order to accommodate the large number of new, low-usage connections coming on line through that period. Small commercial usage is estimated at six times domestic usage. This results in a fifteenth year average of about 360 kwh per month for commercial users, again nearly equal to present median usage by PLN small commercial customers in the Klaten district.

Average street lighting usage is estimated at 45 kwh per month, based on 125 watt luminaires and 365 hours use per month. Miscellaneous power consumer usage is based on an average load of 25 KW and 250 hours use per month.

Grain mill and water system usage estimates are listed in "Project Assumptions" (see ANNEX D of the report). It should be noted that average KW demand used to estimate miscellaneous power and grain mill usage was derived from existing diesel units in operation within the project area, as indicated on the PLN survey.

4. Load Magnitudes.

Briefly, here is a summary of the information incorporated in "Consumer, Usage, and Power Requirements", ANNEX D of this report.

TABLE 2 . KLATEN DIESEL SURVEY SUMMARY (JULY 1977)

| Diesel HP Size Grouping for Rice Mills | No. of Mills | Median Year, Diesel Installation | Estimated Run Time Hrs./Mo. | Av. No. Liters Fuel/Mo. | Average Fuel Cost /Liter (Rp.) | Average Fuel Cost /Mo. (Rp.) | Average Maintenace Cost /Mo. (Rp.) | Average Variable Cost /Mo. (Rp.) | Estimated Equivalent Av. KW * | Estimated Equivalent Kwh/Mo. | Estimated Equivalent Kwh Cost-fuel + Maintenance (Rp.) | Interest in Conversion ** |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 10 to 14 HP | 7 | 1973 | 120 | 300 | 26.6 | 7,980 | 11,429 | 19,409 | 7 | 840 | 23.1 | 100% |
| 15 to 19 HP | 16 | 1972 | 100 | 310 | 26.7 | 8,277 | 10,293 | 18,571 | 10 | 1,000 | 18.6 | 100% |
| 20 to 24 HP | 11 | 1972 | 120 | 413 | 27.5 | 11,358 | 15,477 | 26,835 | 13 | 1,560 | 17.1 | 100% |
| 25 to 29 HP | 5 | 1973 | 120 | 455 | 30.6 | 14,229 | 12,950 | 27,179 | 16 | 1,920 | 14.2 | 100% |
| 30 to 39 HP | 5 | 1973 | 200 | 1,500 | 29.0 | 43,500 | 12,000 | 55,500 | 20 | 4,000 | 13.9 | 100% |
| 40 to 49 HP | 2 | 1972 | 100 | 510 | 28.2 | 14,382 | 17,500 | 31,882 | 26 | 2,600 | 12.3 | 100% |
| Total | 46 | | | | | | | | | | | |

* Av. HP x .746 x 0.8, rounded to nearest 0.5 Kw.
** Based on survey.

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Textile factory Kasauganon Kecamatan | 1969 | 400 | 3,155 | 27.5 | 86,751 | 10,000 | 96,751 | 15 | 6,000 | 16.1 | Yes |
| Textile factory Polanharto Kecamatan | 1977 | 240 | 1,600 | 32.8 | 52,500 | 25,000 | 77,500 | 23 | 5,520 | 14.0 | Yes |
| Tobacco factory, Kebun Asum Kecamatan | 1968 | 300 | 2,100 | 25.0 | 52,500 | 180,000 | 232,500 | 34 | 10,200 | 22.8 | Possible |

During year 5 of the forecast period 62.7% of the estimated total system load should be derived from household usage. During year 10 this percentage should increase to 65.5%, due to the large number of these connections, and during the last year of the forecast household usage is expected to decrease again, to 63.1%. This fairly constant relationship between domestic and non-domestic usage indicates that the prime benefit of the project will be experienced by the domestic consumer, and that a significant portion of the system energy will be used for commercial and productive industrial purposes.

Finally, project peak demand is expected to increase from 3.12 MW during year one to 20.85 MW during the fifteenth year of operation.

5. Summary.

Based on the consumer connection level objectives prescribed by PLN and USAID/J for the project design, and the other assumptions used in the forecast, an extremely rapidly developing rural electric system has been forecasted -- a system where "horizontal" and "vertical" growth may even be more extensive than forecasted if the prescribed consumer connection goals are reached.

## D. DISTRIBUTION SYSTEM ENGINEERING.

### 1. General.

Implementation of rural electrification projects must be based on lowest feasible system investment to obtain maximum benefits. This means that general system guidelines should be followed to assure adequate voltage and reliable service as economically as possible.

Further, many of the older distribution system design and construction criteria now used in Indonesia should not be considered in designing and constructing these new rural distribution systems.

Conditions in Indonesia affecting the design and construction of rural lines are similar to those encountered in other countries, therefore standards and criteria used in like areas of those countries can be safely used in Indonesia. In Java and some other locations rural population

density is unusually high, but in general the clustering appears to be in villages. This may cause right-of-way clearing and staking problems, but the high density is an advantage rather than a problem in system design.

With high consumer density, but small demand per consumer and initial low revenue anticipated, it becomes the responsibility of the project engineer to utilize every tool and method at his command to build low-cost, safe systems, with a lifespan and reliability commensurate with the need for good rural service and moderate rates.

2. Type of System.

Elements of distribution systems should be serviceable for long periods of time. Therefore, they should be designed with much thought given for future requirements. Since customers and additional loads will not develop on any fixed pattern, as much flexibility as possible must be considered so that if loads "shift" the distributing system can also "shift" with least expenditure.

Systems should also be built simple and straightforward, without operating restrictions, so that operational errors will be minimal. Present-day system components (transformers, poles, insulators, conductors, sectionalizing equipment, etc.) are very reliable and when properly utilized obviate the necessity of duplicate distributing facilities. Emergency capacity in various parts of the system should be provided by short-time overloads (as defined in Annex A) on a single contingency basis, without redundancy.

Radial feeder systems should be used, preferably fed from a regulated bus. However, existing feeders suitably protected to isolate faults on the new system may be used to feed it, provided satisfactory regulation and capacity are available on the existing feeders.

Three-phase or "V" phase feeders and laterals should be built from bulk power buses to points where it is feasible to divide the loads beyond. From these points, single-phase lines should be constructed along with single-phase taps from the three-phase system to serve consumer loads. Three-phase and "V" phase construction should be held to a minimum consistent to load growth and voltage drop.

The existing systems in Indonesia are 50 hertz, and this usage is too extensive to consider a change. Voltage standards for the Indonesian Archipelago were set by the Director General for Power and Electricity, Ministry of Public Works and Power, by Decrees Nos. 08/K/70 and 09/K/70. Primary voltage of 20 KV (nominal) with a maximum of 24 KV is now being used extensively and does not require introduction of another class or size of equipment and materials.

Secondary voltages are being changed from 127/220 V to 220/380 V (nominal). Use of this new standard voltage is almost mandatory for any new rural construction, because motors, appliances, lighting equipment and bulbs are being marketed for 220/380 V service. The new voltage also reduces consumers' wiring costs.

For residential and small commercial loads, 10 KVA and below, the service voltage should be 220 V, two-wire, single-phase. For loads of 50 KVA and below, 220/440 V. three-wire, single-phase should be used with individual motor size limited to 10 HP. However, for miscellaneous, commercial and industrial loads, 25 KVA and above, 220/380 V, four-wire, three-phase should be used, if individual motors 15 HP minimum or other three-phase equipment, 25 KVA or more are to be installed.

All new rural distribution systems should be overhead wood pole line, with bare aluminum conductors, standard fittings, pole-type transformers, overhead services, and meters. The system should be four-wire wye, with multi-grounded common meutral. There must be effective grounding as defined by the National Electrical Safety Code, ANSI C2-1977.

3. System Design Criteria.

Complete and detailed design criteria which would apply to rural distribution systems suitable for Indonesia were developed and will be found in Annex A.

4. Implementing the Engineering and Construction.

Large outlays of money for system design can be avoided by using already available standard design/criteria, construction specifications and drawings, and approved materials. All of these have been thoroughly field-tested in close to a thousand rural electric cooperatives, and are available from the Rural Electrification Administration in the U.S.A.

With feasibility study maps showing prospective consumers and suggested routing of lines it is believed that minimal electrical design engineering will be needed. In fact only a voltage drop diagram (REA Bulletin 45-1) to determine phasing and wire size with a sectionalizing diagram (REA Bulletin 62-1) to determine location, size and type of automatic sectionalizing devices, appear to be necessary. However, a great amount of skilled field (survey) engineering will be required to properly stake lines and designate construction units with due regard to economy and safety.

In implementing distribution and transmission construction projects for PLN, many Indonesians have been trained and instructed both in Indonesia and abroad by foreign engineering and construction firms handling these projects. Using some of this personnel, it would appear that adequate engineering skills to handle rural system work, described above is available. Further, with some supervision from out-of-country sources in the initial years, these locally trained personnel should be able to perform the required service.

Since all the work will be done in Indonesia, the major portion on job site, it is believed two foreign advisors who are experienced design engineers for supervising general system design, and material procurement, along with one experienced field engineer for each rural system under construction will be adequate to handle the work, along with Indonesian personnel.

Presently, in certain areas, local contractors or owner's personnel are constructing overhead electric lines, under foreign engineers' supervision.

It is reasonable to assume if all materials are furnished, that local contractors or owner's personnel could construct strong, safe systems in approximately 50 km. segments per contract. The supervising field engineer assigned to each rural system along with his Indonesian fieldmen could supervise and manage such contract construction.

It is recommended that local contractors or owner's personnel should construct lines, as described above, and that the systems own service crews should run service lines and install meters since this phase of the work involves consumer contact, etc.

These suggested methods would make maximum use of local personnel, construct quality systems at minimum cost, and would in some 3 to 5 years enable local personnel to construct system without assistance from foreign advisors.

## E. MATERIALS AND EQUIPMENT.

### 1. Source, Type, Procurement, and Handling.

Adequate supply of proper materials and equipment is essential to timely and low-cost construction. All materials and equipment must conform to predetermined standards and specifications to assure high quality and safe construction, compatibility of components, and lowest pricing through large orders.

A detailed "List of Approved Materials" has been developed over a period of many years by the Rural Electrification Administration, in Washington, D.C., for the rural electric systems in the U.S.A. With very few changes, to accomodate differences in Indonesian frequencies and required transformer ratings, these standards should be used. The publication is REA Bulletin 43-5.

Standard identification of items facilitates the use of standard invitation-to-bid forms and simplifies price comparison on bidding by suppliers, stocking, handling, etc.

Warehousing the quantity of materials to be used in this electrification program promises to be a monumental task, so careful scheduling of deliveries is worth consideration.

Certain materials must be obtained from overseas sources. However, investigation has determined that limited amounts of other materials of sufficient size and quality may be obtained locally. One objective for an extended rural electrification program would be the creation of a market to utilize new lines of production in Indonesia. This would provide additional job opportunities.

Analysis, comments, and suggested source and type of some materials and equipment are detailed below.

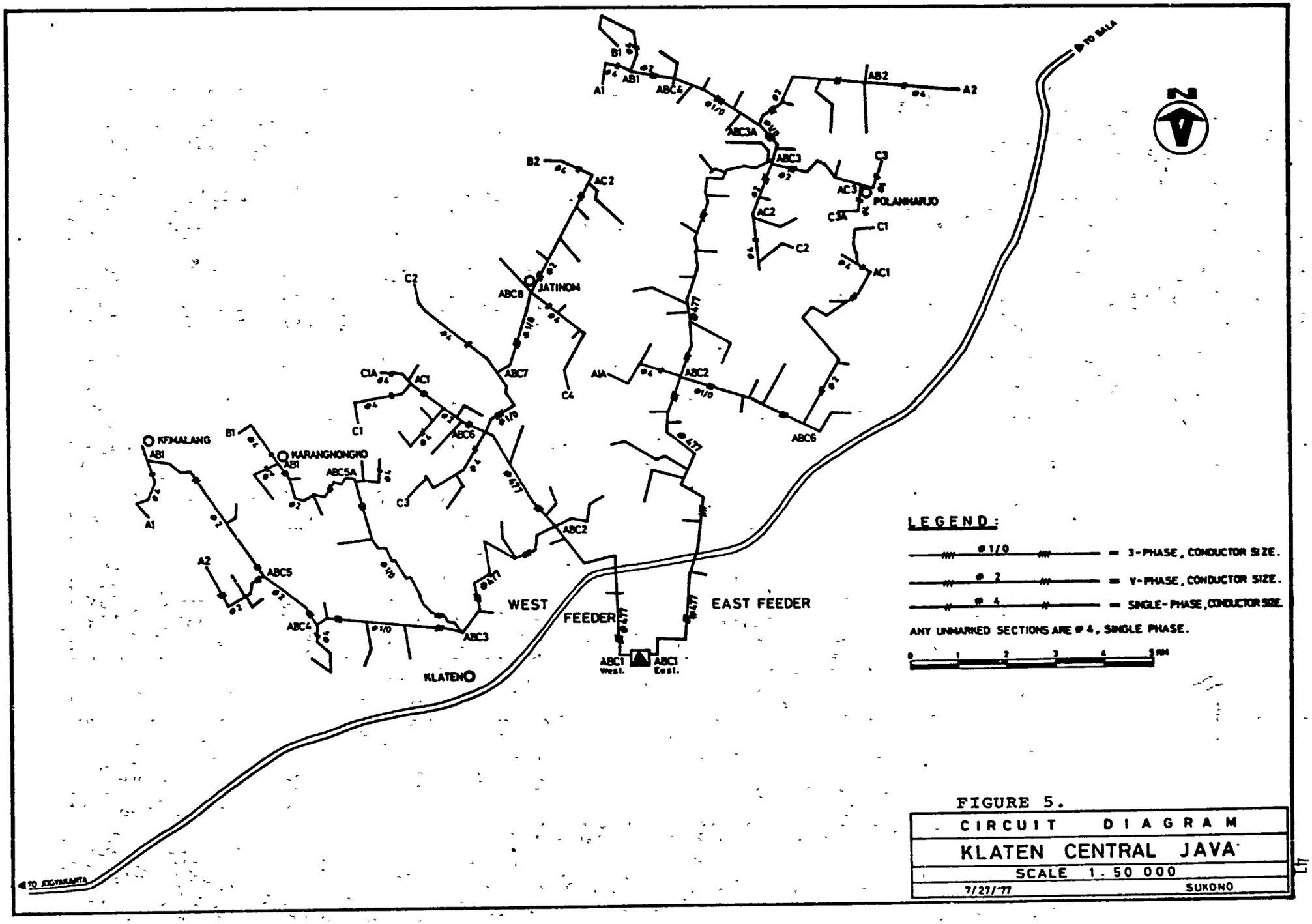



FIGURE 5.

| CIRCUIT DIAGRAM | |
|---|---|
| KLATEN CENTRAL JAVA | |
| SCALE 1 : 50 000 | |
| 7/27/77 | SUKONO |

TABLE 3.

# VOLTAGE DROP CALCULATIONS

AREA: CENTRAL JAVA

SUBSTATION: KLATEN CIRCUIT : E A S T

| SECTION | | LOAD KW | | | LINE | | | | | KW KMS | VOLTAGE DROP | | AT POINT |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| SOURCE END | LOAD END | WITHIN THIS SECTION | BEYOND THIS SECTION | TOTAL KW | CONDUCTOR SIZE | Ø | KV | VOLTAGE DROP FACTOR | LENGTH OF SECTION IN KM | | THIS SECTION | TOTAL | |
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 |
| AB1 | A1 | 199 | 0 | 199 | 4 | 1 | | 1.992 | 1.0 | 199. | .396 | 12.587 | A1 |
| AB1 | B1 | 213 | 0 | 213 | 4 | 1 | | 1.992 | 2.4 | 511.2 | 1.018 | 13.209 | B1 |
| ABC4 | AB1 | 205 | 412 | 617 | 2 | 2 | | .694 | 0.8 | 493.6 | .343 | 12.191 | AB1 |
| ABC3A | ABC4 | 681 | 617 | 1298 | 1/0 | 3 | | .280 | 2.0 | 2596 | .727 | 11.848 | ABC4 |
| AB2 | A2 | 249 | 0 | 249 | 4 | 1 | | 1.992 | 1.9 | 473.1 | .942 | 14.265 | A2 |
| ABC3A | AB2 | 884 | 249 | 1133 | 2 | 2 | | .694 | 2.8 | 3172.4 | 2.202 | 13.323 | AB2 |
| ABC3 | ABC3A | 170 | 2431 | 2601 | 1/0 | 3 | | .280 | 0.8 | 2080.8 | .583 | 11.121 | ABC3A |
| AC3 | C3 | 201 | 0 | 201 | 4 | 1 | | 1.992 | 0.7 | 140.7 | .280 | 11.613 | C3 |
| AC3 | C3A | 216 | 0 | 216 | 4 | 1 | | 1.992 | 1.0 | 216. | .430 | 11.763 | C3A |
| ABC3 | AC3 | 130 | 417 | 547 | 2 | 2 | | .694 | 2.0 | 1094. | .795 | 11.333 | AC3 |
| AC2 | C2 | 357 | 0 | 357 | 4 | 1 | | 1.992 | 1.9 | 678.3 | 1.351 | 12.29 | C2 |
| ABC3 | AC2 | 124 | 357 | 481 | 2 | 2 | | .694 | 1.2 | 577.2 | .401 | 10.939 | AC2 |
| ABC2 | ABC3 | 1597 | 3082 | 5679 | 477 | 3 | | .109 | 6.0 | 34074. | 3.714 | 10.538 | ABC3 |
| AC1 | C1 | 357 | 0 | 300 | 4 | 1 | | 1.992 | 1.5 | 450. | .896 | 11.827 | C1 |
| ABC6 | AC1 | 366 | 500 | 866 | 2 | 2 | | 0.694 | 4.8 | 4156.8 | 2.885 | 10.931 | AC1 |
| ABC2 | ABC6 | 813 | 866 | 1679 | 1/0 | 3 | | 0.280 | 2.6 | 4365.4 | 1.222 | 8.046 | ABC6 |
| ABC2 | A1A | 328 | 0 | 328 | 4 | 1 | | 1.992 | 1.8 | 590.4 | 1.176 | 8.0 | A1A |
| ABC1 | ABC2 | 1490 | 6748 | 8238 | 447 | 3 | | .109 | 7.6 | 62608.8 | 6.824 | 6.824 | ABC2 |

# VOLTAGE DROP CALCULATIONS

AREA: CENTRAL JAVA

SUBSTATION: KLATEN CIRCUIT : W E S T #1 OF 2 PAGES

| SECTION | | LOAD KW | | | LINE | | | | | KW KMS | VOLTAGE DROP | | AT POINT |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| SOURCE END | LOAD END | WITHIN THIS SECTION | BEYOND THIS SECTION | TOTAL KW | CONDUCTOR SIZE | Ø | KV | VOLTAGE DROP FACTOR | LENGTH OF SECTION IN KM | | THIS SECTION | TOTAL | |
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 |
| AB1 | A1 | 200 | 0 | 200 | 4 | 1 | | 1.992 | 1.5 | 300.0 | .598 | 9.272 | A1 |
| ABC5 | AB1 | 443 | 200 | 643 | 2 | 2 | | .694 | 3.6 | 2314.8 | 3.213 | 8.674 | AB1 |
| ABC5 | A2 | 477 | 0 | 477 | 2 | 2 | | .694 | 1.5 | 715.5 | .993 | 6.454 | A2 |
| ABC4 | ABC5 | 0 | 643 | 643 | 2 | 3 | | .280 | 2.3 | 1478.9 | .602 | 5.461 | ABC5 |
| ABC3 | ABC4 | 740 | 643 | 1383 | 1/0 | 3 | | .280 | 3.1 | 4287.3 | 1.20 | 4.859 | ABC4 |
| AB1 | B1 | 163 | 0 | 163 | 4. | 1 | | 1.992 | 1.2 | 195.6 | .389 | 11.22 | B1 |
| ABC5A | AB1 | 301 | 163 | 464 | 2 | 2 | | .694 | 2.5 | 1160.0 | .805 | 10.831 | AB1 |
| ABC3 | ABC5A | 635 | 464 | 1099 | 1/0 | 3 | | .280 | 4.4 | 4835.6 | 1.354 | 5.013 | ABC5A |
| ABC2 | ABC3 | 665 | 1099 | 1764 | 477 | 3 | | .109 | 4.5 | 7938.0 | .865 | 3.659 | ABC3 |
| AC1 | C1 | 160 | 0 | 160 | 4 | 1 | | 1.992 | 1.6 | 256.0 | .509 | 6.311 | C1 |
| AC1 | C1A | 609 | 0 | 609 | 4 | 1 | | 1.992 | 0.6 | 365.4 | .728 | 6.53 | C1A |
| ABC6 | AC1 | 770 | 609 | 1379 | 2 | 2 | | .694 | 1.7 | 2344.3 | 1.627 | 5.802 | AC1 |
| ABC6 | C3 | 289 | 0 | 289 | 4 | 1 | | 1.992 | 2.5 | 722.5 | 1.439 | 5.614 | C3 |
| AC2 | B2 | 223 | 0 | 223 | 4 | 1 | | 1.992 | 1.1 | 245.3 | .487 | 8.817 | B2 |
| ABC8 | AC2 | 930 | 223 | 1153 | 2 | 2 | | .694 | 2.4 | 2767.2 | 1.92 | 8. 33 | AC2 |
| ABC8 | C4 | 352 | 0 | 352 | 4 | 1 | | 1.992 | 2.6 | 915.2 | 1.823 | 8.223 | C4 |
| ABC7 | ABC8 | 494 | 1505 | 1999 | 1/0 | 3 | | .173 | 2.0 | 3998. | 1.119 | 6.41 | ABC8 |

# VOLTAGE DROP CALCULATIONS

AREA: CENTRAL JAVA

SUBSTATION: KLATEN

CIRCUIT : WEST

#2 OF 2 PAGES

| SECTION | | LOAD KW | | | LINE | | | | | KW KMS | VOLTAGE DROP | | AT POINT |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| SOURCE END | LOAD END | WITHIN THIS SECTION | BEYOND THIS SECTION | TOTAL KW | CONDUCTOR SIZE | Ø | KV | VOLTAGE DROP FACTOR | LENGTH OF SECTION IN KM | | THIS SECTION | TOTAL | |
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 |
| ABC7 | C2 | 491 | 0 | 491 | 4 | 1 | | 1.992 | 2.5 | 1227.5 | 2.445 | 8.036 | C2 |
| ABC6 | ABC7 | 0 | 2490 | 2490 | 1/0 | 3 | | .173 | 1.6 | 3984.0 | 1.116 | 5.59 | ABC7 |
| ABC2 | ABC6 | 909 | 4158 | 5067 | 477 | 3 | | .109 | 2.5 | 12667.5 | 1.381 | 4.175 | ABC6 |
| ABC1 | ABC2 | 485 | 5922 | 6407 | 477 | 3 | | .109 | 4.0 | 25628 | 2.794 | 2.794 | ABC2 |

2. Poles.

A survey of the wood pole potential available in Indonesia was made to determine the feasibility of using wood poles for supports for the rural electric lines. Conventionally, steel poles have been used for this purpose in the majority of the Indonesian construction. However, steel poles represent a total import of the basic material with only a small percentage of value added by local manufacture. Wood poles, on the other hand, represent utilization of a domestic renewable resource of Indonesia which requires only about 20 percent imported commodity (wood preservative) to convert it into a long-lasting wood pole. Further, the production of wood poles is a rural industry. Poles are grown in rural areas and their manufacture and treatment can be accomplished in the same areas. Thus, the production of wood poles would increase the gross income of rural people and in turn enable these people to have more cash available to spend in equipping their homes to use electric service.

Indonesia has a transmigration program in operation. One of the first problems of transmigration is to provide employment for the moved citizens. By establishing a new industry in these areas, these people could be self-sufficient. This would hopefully be an incentive to transmigration. With these factors, the survey of the wood pole concept was explored.

One of the other prime factors to be considered was the cost savings which could be accomplished. Steel poles cost in the neighborhood of US$150 to US$200. Wood poles hopefully could be produced for 1/3 to 1/4 this amount. Steel poles require periodic maintenance to prolong their useful life. They should be heavily painted prior to installation and repainted on a 3-to-5-year cycle. The painting of steel poles is conventionally an external protection. However, corrosion inside the steel pole should not be ignored. To achieve the maximum life from a steel pole, it should be painted internally with an epoxy-type paint to prevent this internal corrosion.

In a similar fashion, wood poles must be properly treated initially and given periodic supplemental treatments at the ground line to extend this useful life. These concepts are amply proven in the U.S.A.

The factors to be considered are:

a. Types of wood available.

b. The strength of these wood species when converted into poles.

c. The harvesting capability available.

d. The treatability of the wood.

e. Treating and manufacturing capability available.

f. Anticipated production capability.

g. Cost data.

Many species of wood are available in Indonesia in the natural ecosystem. However, in natural situation the density of a specific species population is low and several different species are usually mixed considerably per hectare. This presents sorting and handling problems. Unless a demand exists for the majority of the species, the harvesting and sorting of unusable species or selective cutting of species is costly per pole and complicates the selection process.

The alternative is to use plantation-grown trees where a specific tree species has been planted and grown as a crop. This narrows the selection process providing the species is suitable in other respects. It should be remembered that in a plantation system, poles are cut from immature trees. The plantations are usually managed to grow much larger trees for lumber, veneer logs, pulp, etc. In some cases, regulations have been written to restrict the cutting of these young trees for poles. Therefore, the concurrence of the forestry department must be obtained.

Of the woods available, the best prospect is rasamala (altingia excelsa). The average breaking strength is 9,000 psi. This is a plantation-grown tree in West Java. Many of the plantations have grown past the pole stage, but quantities of pole-sized timber are available. Harvesting is by manual means, and transportation to the road site is by manpower or by animal power. Harvesting will be limited to the dry season and will not be available during rice harvests.

This wood, when dried, is conventionally treated to 2.5 cm penetration. In our opinion, this is a marginal treatment for poles in the tropics. There are two plants which we visited in West Java, which are now treating rasamala using a cold penta chlorophenol solution. In order to treat with cold pcp the poles must be air dried to fiber saturation. This drying therefore limits the production time to the dry season.

One treating plant in Cikampek, West Java, has two cylinders -- a 15 m. x 2 m. cylinder for pcp and a 12 m. x 2 m. cylinder for cca. Usually they treat poles in their 15 m. cylinder at the rate of about 50 poles per charge. They can treat one charge per shift. Presumably they can run 3 shifts per day and average 4 days per week. The maximum production will therefore be 600 poles per week for 6 months out of the year or 15,600 poles per year. This is the total maximum production and does not provide for any major breakdowns or delays caused by harvesting or force majeure. While they have not done so to date, they can treat poles in the 12 m. cylinder with cca.

The other treating plant is located at Cipatat, West Java. This plant also treats rasamala with pcp in a 24 m. x 1.9 m. cylinder. Many of the comments on the Cikampet plant are applicable here. Their capacity is 60-80 poles per charge. The maximum capacity for this plant would be:

70 poles average per charge.
3 charges per day.
4 days per week.
26 weeks per year.
21,340 maximum pole capacity.

In the case of both plants, about 33 to 50 percent of the maximum capacity should be anticipated as realistic.

In Medan, Sumatra, three species are available:

a. damar laut - shorea ellipitica - av. breaking strenght 15,000 psi.

b. keruing - diptocarpus warburgi - av. breaking strength 13,000 psi.

c. tusam - pinus meskusii - av. breaking strength 8,000 psi.

Damar laut and keruing are natural species while tusam is plantation grown. Damar laut and keruing are harvested and produced into poles by a company with a treating plant at Medan, Sumatra.

This company is regularly producing poles at the rate of about 40 poles per charge in their 1.5 m. x 15 m. cylinder. Using the factor applied to the West Java plants, the maximum anticipated production would be 12,500 poles with a realistic production of 1/3 or 1/2 this quantity.

Tusam is not regularly produced into poles but is available from the area around Lake Toba. Harvesting of tusam poles will be selective as the shape is not always good, the trees are often on slopes, and heavy cutting is not allowed as erosion must be avoided.

In Kalimantan, three species are available for consideration:

a. anthocephalus cabamba - fiber stress - 7,000 psi.

b. eucalyptus deglupta - fiber stress - 10,000 psi.

c. ulim eusideozyton zwagesi - av. breaking strength 10,000 psi.

Anthocephalus grows naturally and in plantations. Eucalyptus is grown in plantations. Both species will grow from seed to pole size in 3-5 years. The outer 2.5 to 4 c. of eucalyptus is treatable and will make a good pole if properly handled. Anthocephalus is fully treatable and has a pith center which will dry and fall out. This will facilitate drying and treatment. The wood is not as strong as other woods suggested but can be compensated for by slightly larger circumferences. The wood is light, which is a positive factor in road transportation and construction.

Ulin is a restricted species and can be cut only as a native industry. The wood is heavy and naturally durable. It cannot be treated successfully but the natural durability appears adequate. The supply is limited and the quantities and availability may be difficult to predict and schedule.

Eucalyptus and anthocephalus are grown by a large timber corporation. The production facilities appear to be excellent and could be considered as a most dependable source of supply. Logging facilities operate year around and are modern and heavily mechanized. Shipment of poles can be arranged by water to ports in the areas where construction is being done. A treating plant would be required. This could be fabricated, shipped, and installed in 6-8 months. The installation of an automated cca treating plant capable of treating 5 charges of poles per day could more than supply the estimated needs of projects under consideration. A plant capable of supplying 40 to 50,000 poles per year should be encouraged.

The forestry service and treating plants both report that prices for green poles on the stump have decreased markedly in the last few months. Recent orders filled by existing treating plants confirm these reports. We have used such pricing in our material estimates. Competitive bidding with more suppliers offering, will no doubt further lower prices. We therefore recommend that wood pole production should be encouraged. Further, to supply quantities required for the rural and other programs we recommend expansion of treating facilities. It is our belief that sufficient interest has been generated among companies with timber concessions to install treating plants and enter the treated pole business.

We concluded that when procurement of treated poles is initiated, price will be reasonable and timely deliveries of required quantities can be accomplished. Poles should be procured locally according to AWPA and ANSI specifications, using local woods discussed above.

3. Cross Arms and Anchor Logs.

Treated cross arms and anchor logs should be procured locally according to REA standards, using local woods.

4. Line Conductors and Service Cables.

As described elsewhere, bare all-aluminum cable and aluminum alloy (6201) should be used for line conductors. Likewise, twisted, self-supporting service cable, all-aluminum, with bare ACSR neutrals should be used.

A large local well designed wire and cable fabricating plant with two separate units, one for copper and one for aluminum, is presently operating in Jakarta. The aluminum section has a capability of producing concentrically stranded conductors through medium circular mil sizes from imported standard rod sizes and core wire. Size capability is well above any requirement for this rural program. Both ACSR and all aluminum types of cable have been produced in limited quantities for local customers. Presently 40 tons of all-aluminum cable is being fabricated for PLN. Oxlip (AWG 4/0) all-aluminum cable was being stranded during our visit.

One final cabling machine, working one 8-hour shift, can produce some 2,000 tons of cable per year. Dependent upon orders, this fabricator is willing to work additional shifts and even install additional cabling machines in existing factory space, providing business warrants such installations. It appears with present equipment and proper supply of raw material the plant could fabricate some 5,000 - 6,000 tons of aluminum conductors and cable per year.

Aluminum alloy conductor (6201-T81) is being produced on a trial basis, to ascertain if a quality product can be fabricated. Final determination on ability to produce this type of conductor has not been made.

Multiplex service cable up to AWG 4/0 size using bare ACSR neutral and convential black polyethylene insulated solid or stranded aluminum power conductors has been sucessfully fabricated in this plant. No XLP insulated multiplex service cable has been manufactured.

The managing director was of the opinion that he could be competitive with the world market on ACSR and all-aluminum cable, provided needed raw materials could be imported "duty free". He further stated he felt for this rural program, since foreign currency is available, that raw materials (rod and core wire) might be furnished in bond to his plant for fabricating into cable of various sizes and types. He was of the opinion that converting rupiah to procure raw materials could result in higher finished product costs.

This plant is the only one in Indonesia presently producing aluminum conductors.

It is suggested that procurement of conductors and service cable should be attempted using two methods, viz:

a. Advertise and receive bids for complete conductor and service cable requirements, CIF Indonesian ports, from foreign sources (Code 941 countries).

b. Simultaneously advertise and receive bids (CIF Indonesian ports) for necessary raw materials (rod, core wire, and insulation) to produce the amount of conductor and cable required in a. above. At same time receive bid(s) from local fabricators for handling raw materials, fabricating, and packing the amount of conductor and cable required in a. above.

This will obtain the cheapest price for the material and could well help establish a local industry.

5. **Revenue Meters.**

Watthour meters manufactured according to American National Standards Institute (ANSI) publications have ratings and characteristics far in excess of most Indonesian rural consumers' needs. Meter requirements for some 97% of the services in this program would be single-phase, two-wire 220 volt, 10 ampere, 50 hertz. The meters specified should be those using less stringent overload, thermal, and power factor characteristics than required by ANSI. It is believed adequate meters manufactured to other than ANSI standards, which will have characteristics compatable with the intended service, can be procured for some 50% of the cost of an ANSI meter. Meters for large loads and all power meters should be purchased according to ANSI publication for 50 hertz. To conform with principles stated elsewhere in this report, no load limiters should be purchased or installed.

6. Other Materials.

All other materials and equipment should be purchased using standard GOI and foreign source procurement procedures. No local industries were found producing acceptable materials, with the possible exception of transformers. A transformer plant producing three-phase distribution units was visited and found to be producing quality products using modern and adequate production equipment. This plant has no engineering staff per se, and is producing equipment according to "borrowed" designs. At present this plant cannot produce suitable single-phase transformers due to lack of competent designs. However, this plant has the capability of becoming a source for

distribution transformers in future years.

## F. ESTIMATED CONSTRUCTION COSTS FOR DISTRIBUTION SYSTEMS.

A "standard unit" or "standard kilometer" approach was taken to arrive at estimated system construction costs.

Average quantities for a "standard" kilometer were based on design criteria (described elsewhere), number of consumers, and terrain.

In estimating total prices for these standard units, several steps were taken to accurately cost these units. The method used to build-up this pricing was as follows:

1. Material prices F.O.B. Indonesian warehouse (see Part I, Section B-5) were applied to each distribution construction assembly, i.e. poles, pole top assemblies, service assemblies, transformer assemblies. This resulted in material costs per assembly as shown in columns (3), (4), and (5) of sheets titled "Unit Costs-Mid 1977."(Annex C).

2. Labor man-hours for installation, column (6) of "Unit Costs-Mid 1977" are derived from standard hours commonly used in the construction industry in the U.S.A. Labor rates columns (7) and (8) of "Unit Costs-Mid 1977", are calculated using composite man-hour rates for various type of crews needed to install the different assemblies. Composite rates are based on labor rates in Annex B. Included in the composite man-hour rates are costs, including operating and maintenance for equipment required by each crew. Since actual productive man-hours are used, allowances have been made in man-hour rates for non-productive time (travel time, weather, etc.). and a productivity factor is added.

   This productivity factor adjusts the man-hours required in Indonesia to the standard man-hours used. "Composite Man-hour Rates-Construction" are calculated for different types of crews and are included in Annex B.

3. Job expense, column (9) of "Unit Costs-Mid 1977" includes provision for these and other incidential expenses not covered by material and labor costs. These expenses include office expenses, general overhead, small tools, insurance, etc.

4. Total installed cost of assemblies, columns (10), (11), and (12) of "Unit Costs-Mid 1977" are used to determine "Standard Kilometer" and "Standard Unit" prices. Assembly costs are extended on price sheets entitled "Distribution System Cost" and are included in Annex C.

5. From the "Distribution System Cost" sheets standard kilometer or standard unit prices are used in calculating distribution system costs for various operating years. Each year shows value of system <u>added</u> and is not cumulative. (see Annex C).

Quantities used for deriving system yearly costs are taken from "Distribution Plant Increments" sheets prepared from distribution system designs and load data. Distribution system cost sheets subtotals are "adjusted to location" in certain construction areas. This item cares for additional expense for handling material,

mostly local furnished, to job warehouse. Suitable adjustments are made in labor rates for the additional compensation required at remote locations. Engineering costs for local engineering services, only, are included in "Distribution System Costs". Foreign engineering services and training are, according to USAID/J, a grant and should not be included in costs.

Costs shown will adequately construct the systems delineated for the ensuing 2-year period, without escalation, provided all materials are contracted prior to March 1978.

Attached Table 4, delineates the estimated loan fund requirements for Klaten's 15 year study period.

TABLE 4.

KLATEN LOAN FUND SUMMARY

| Description | REQUIREMENTS X 1000 | | | | | | |
|---|---|---|---|---|---|---|---|
| | Distribution System | | | General Plant | | | Totals |
| | (Rupiah) | (US$) | (US$ Equiv.) | (Rupiah) | (US$) | (US$ Equiv.) | US$Equiv. |
| **Construction Period** | | | | | | | |
| 1st Year | 204,262 | 1,726 | 2,218 | 68,270 | 258 | 423 | 2,641 |
| 2nd Year | 379,345 | - | 914 | - | 164 | 164 | 1,078 |
| TOTAL | 583,607 | 1,726 | 3,132 | 68,270 | 422 | 587 | 3,719 |
| **Operating Period** | | | | | | | |
| 1st Year | 82,276 | 298 | 496 | | | | 496 |
| 2nd Year | 78,810 | 283 | 473 | | | | 473 |
| 3rd Year | 70,441 | 257 | 427 | | | | 427 |
| 4th Year | 54,665 | 226 | 358 | | | | 358 |
| 5th Year | 44,088 | 178 | 284 | 44,820 | - | 108 | 392 |
| 6th Year | 28,340 | 118 | 186 | | | | 186 |
| 7th Year | 22,691 | 93 | 148 | | | | 148 |
| 8th Year | 16,086 | 68 | 107 | | | | 107 |
| 9th Year | 15,430 | 63 | 100 | | | | 100 |
| 10th Year | 12,273 | 53 | 82 | 111,635 | - | 269 | 351 |
| 11th Year | 12,207 | 49 | 78 | | | | 78 |
| 12th Year | 8,609 | 37 | 58 | | | | 58 |
| 13th Year | 7,641 | 32 | 50 | | | | 50 |
| 14th Year | 7,613 | 32 | 50 | | | | 50 |
| 15th Year | 6,157 | 26 | 41 | 89,660 | - | 204 | 245 |
| TOTAL | 467,327 | 1,813 | 2,939 | 241,115 | - | 581 | 3,520 |
| Grand Total | 1,050,934 | 3,539 | 6,071 | 309,385 | 422 | 1,168 | 7,239 * |

US$ Equivalent = $\frac{\text{Rupiah}}{415}$ + US$

*Short-term loans for working capital and for financing housewiring are not included.

TABLE 5. DISTRIBUTION SYSTEM PLANT INCREMENTS LOCATION - KLATEN-CENTRAL JAVA

| | DESCRIPTION | INITIAL PROJECT | YEAR OF OPERATION 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | PRIMARY LINES - KMS | 449.64 | 1.0 | | 1.0 | | 1.0 | | 1.0 | | 1.0 | 1.0 | 1.0 | 1.0 | 1.0 | 1.0 | 1.0 |
| 2 | a) 3Ø,477,AAC | 25.83 | | | | | | | | | | | | | | | |
| 3 | b) 3Ø,1/0,AAAC | 19.64 | | | | | | | | | | | | | | | |
| 4 | c) 3Ø,#2,AAAC | 2.42 | | | | | | | | | | | | | | | |
| 5 | d) VØ,#2,AAAC | 18.2 | | | | | | | | | | | | | | | |
| 6 | e) 1Ø,#2,AAAC | 5.36 | | | | | | | | | | | | | | | |
| 7 | f) 1Ø,#4,AAAC | 378.19 | 1.0 | | 1.0 | | 1.0 | | 1.0 | | 1.0 | 1.0 | 1.0 | 1.0 | 1.0 | 1.0 | 1.0 |
| 8 | g) | | | | | | | | | | | | | | | | |
| 9 | h) | | | | | | | | | | | | | | | | |
| 10 | SECONDARY LINES - KMS | 105.00 | 2.0 | 1.0 | 2.0 | | 2.0 | | 1.0 | 1.0 | 1.0 | | 2.0 | | 1.0 | 2.0 | 1.0 |
| 11 | a) 3-wire, #2 AAAC | 26.25 | 1.0 | | 1.0 | | 1.0 | | | 1.0 | | | 1.0 | | | 1.0 | |
| 12 | b) 3-wire, #1/0AAAC | 78.75 | 1.0 | 1.0 | 1.0 | | 1.0 | | 1.0 | | 1.0 | | 1.0 | | 1.0 | 1.0 | 1.0 |
| 13 | SECONDARY UNDERBUILD-KMS | 385.85 | 2.0 | | 2.0 | | 1.0 | 1.0 | 1.0 | | 2.0 | | 1.0 | 1.0 | 1.0 | | 2.0 |
| 14 | a) 2-wire, #2 AAAC | 96.2 | 1.0 | | 1.0 | | | 1.0 | | | 1.0 | | | 1.0 | | | 1.0 |
| 15 | b) 2-wire #1/0,AAAC | 289.65 | 1.0 | | 1.0 | | 1.0 | | 1.0 | | 1.0 | | 1.0 | | 1.0 | | 1.0 |
| 16 | SERVICES & METERS - EACH | 2155 | 8503 | 8407 | 7304 | 5702 | 4301 | 2801 | 2092 | 1492 | 1492 | 1092 | 882 | 682 | 477 | 377 | 277 |
| 17 | a) 1Ø-2WIRE | 2070 | 8300 | 8250 | 7200 | 5650 | 4270 | 2770 | 2060 | 1470 | 1270 | 1060 | 860 | 650 | 450 | 350 | 220 |
| 18 | b) 1Ø-3WIRE | 180 | 200 | 150 | 100 | 50 | 30 | 30 | 30 | 20 | 20 | 30 | 20 | 30 | 25 | 25 | 55 |
| 19 | c) 3Ø-4WIRE | 5 | 3 | 7 | 4 | 2 | 1 | 1 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 |
| 20 | | | | | | | | | | | | | | | | | |
| 21 | TRANSFORMERS - KVA | 7060 | 375 | 125 | 330 | 1535 | 1175 | 755 | 590 | 435 | 380 | 305 | 270 | 195 | 165 | 105 | 100 |
| 22 | | | | | | | | | | | | | | | | | |
| 23 | SECURITY LIGHTS - EACH | 480 | 192 | 192 | 192 | 96 | 96 | 96 | 96 | 96 | 96 | 96 | 96 | 96 | 96 | 96 | 96 |
| 24 | | | | | | | | | | | | | | | | | |
| 25 | VOLTAGE REGULATORS-EACH | | | | | | | | | | | | | | | | |
| 26 | a) 1Ø | | | | | | | | | | | | | | | | |
| 27 | b) 3Ø | | | | | | | | | | | | | | | | |
| 28 | | | | | | | | | | | | | | | | | |
| 29 | SECTIONALIZING - EA. | | | | | | | | | | | | | | | | |
| 30 | a) 1Ø FUSED C.O. | 16 | | | | | | | | | | | | | | | |
| 31 | b) 1Ø OCR | 14 | | | 1 | | | 1 | | | | 1 | | | | 1 | |
| 32 | c) 3X1Ø OCR | 17 | | | | | | | | | | | | | | | |
| 33 | d) 3Ø ABS | 3 | | | | | | | | | | | | | | | |
| 34 | | | | | | | | | | | | | | | | | |
| 35 | R/W CLEARING - KMS | 212 | | | 1.0 | | 1.0 | | 1.0 | | 1.0 | | 1.0 | | 1.0 | | 1.0 |

## G. GENERAL PLANT.

This item of capital cost includes buildings, vehicles, tools, machines and equipment required for construction and operation of the electric plant as well as the handling of office work. Cost estimates were obtained from PLN, DGC, and other local sources, and quantities were based on the experience of competent electrification advisors in Indonesia and elsewhere.

### 1. Headquarters Facilities.

The general office and headquarters support facilities should be located near the operational center of the service area. No less than 3 hectares of land should be obtained. It should be situated where future expansion is possible, should additional space be required in the future.

Consideration must be given to access by road, to adequate supply of water for use by the staff, and to selection of a site not subject to flooding or drainage problems.

The administration building should contain approximately 900 square meters of floor space in order to provide the staff with both adequate and efficient work space. A meeting room capable of seating 100 persons is desirable. Staff meetings may be held in this room. Community service and public relations require a facility of this type.

Funds have been provided in the capital budget estimates for improvements to the headquarters site. It is anticipated that the architectural and supervisory work will be done by the A&E firm provided by USAID.

In addition to the office building, funds have been budgeted for a warehouse with 500 square meters of enclosed floor space. Provision is made for a pole yard and outdoor storage space for bulk items such as wire reels and transformers, and for a small vehicle maintenance facility with gasoline storage. The entire compound should be surrounded by a security fence.

### 2. Office Equipment and Furniture.

This included both office furniture and office machines for billing, typing, mimeographing, etc. A large staff will be required to handle the work involved in accepting applications for service and service deposits, processing a large number of wiring loans, billing the members for electric usage and loan repayment, and reporting reports to PLN. Funds have been budgeted for all required office machines to match the size of the enterprise.

### 3. Tools and Work Equipment.

In order to perform construction, operations, and maintenance work on the power lines in a safe and efficient manner, good tools are a necessity. Funds have been budgeted in sufficient

quantities to purchase tools as required. It is assumed that they will be properly stored and cared for.

4. Test and Laboratory Equipment.

If good electric service is to be delivered to the consumers, voltage must be checked and regulated. Loads on various lines must be measured and balanced. Power delivered must be measured by accurate meters. All of these functions, and more, must be checked by use of sophisticated and precisely accurate test devices. This work begins before the first meter is removed from the meter shop to be installed. Funds are provided for purchase of these devices.

5. Transportation Equipment.

Transportation of men and materials is a major cost item during the construction and operational phases of an electric distribution system. Funds have been budgeted for the following initial fleet:

1 heavy truck for hauling equipment and supplies.

1 line truck, equipped with "A-Frame" and winch for pole line work.

4 service trucks, 3/4 ton, for use during the housewiring program and later on for operation and maintenance work on the system.

2 light vans for personnel.

10 motorcycles for patrolling lines, reading meters and collecting bills.

6. Communications Equipment.

Good communications between the headquarters office and personnel in the field are essential to efficiency in delivering quality service to all consumers. It is especially desirable where telephone service is lacking, as it is at this proposed project site. One base radio station near the office and eight mobile units have been budgeted.

7. Staff Housing.

The headquarters will be located near the operational center of the service area where rental housing may not be available. It is anticipated that management and technical employees will be recruited generally from outside the service area. Therefore, funds have been budgeted for 9 staff houses at or near the office

8. Materials Inventory.

The PLN will order all construction materials required for connecting 25,000 services during the first 3 years of operation under the USAID loan. Therefore, funds have not been budgeted for a normal inventory. This will be an item for future financing if a stock of material is not on hand when contract construction comes to an end.

9. Contingencies.

Experience indicates that in developing such an extensive enterprise unforseen needs will arise. Therefore, U.S.$57,416 or Rp. 23,827,640 for contingencies is budgeted.

Attached is a schedule of all general plant items. Total cost is U.S. $586,510. or Rp. 243,342,000, for the initial project. (Tables 6 & 7).

TABLE 6.

# GENERAL PLANT INCREMENTS

(US $)

(US $ - add "000")

| | DESCRIPTION | INITIAL PROJECT | YEAR OF OPERATION 5 | 10 | 15 | |
|---|---|---|---|---|---|---|
| 1. | LAND | 108,434 | | | | |
| 2. | (A) | | | | | |
| 3. | (B) | | | | | |
| 4. | (C) | | | | | |
| 5 | (D) | | | | | |
| 6 | | | | | | |
| 7 | SITE IMPROVEMENTS (GRADING, FENCING, ROADS, ETC.) | 10,000 | 4 | | 4 | |
| 8. | (A) | | | | | |
| 9. | (B) | | | | | |
| 10 | (C) | | | | | |
| 11 | (D) | | | | | |
| 12 | | | | | | |
| 13 | BUILDINGS | | | | | |
| 14. | (A) HEADQUARTERS | 75,000 | | 70 | | |
| 15 | (B) WAREHOUSE | 30,000 | | 25 | | |
| 16 | (C) MAINTENANCE | 7,000 | 5 | | 5 | |
| 17. | (D) Staff Housing | 43,660 | | | | |
| 18. | | | | | | |
| 19 | MATERIAL INVENTORY | | | | | |
| 20. | | | | | | |
| 21. | FUEL STOCK | | | | | |
| 22 | | | | | | |
| 23. | OUTDOOR STORAGE FACILITIES | 12,000 | 4 | | 4 | |
| 24. | | | | | | |
| 25 | WORKING CAPITAL | | | | | |
| 26 | | | | | | |
| 27. | COMMUNICATIONS EQUIPMENT | | | | | |
| 28 | (A) BASE STATION | 15,000 | | 16 | | |
| 29 | (B) MOBILE UNITS | 15,000 | 6 | 6 | 6 | |
| 30. | | | | | | |
| 31 | TRANSPORTATION EQUIPMENT | 154,000 | 70 | 120 | 160 | |
| 32 | | | | | | |
| 33 | TOOLS & EQUIPMENT | 15,000 | 10 | 12 | 15 | |
| 34 | Test and Lab. Equipment | 15,000 | | 10 | | |
| 35 | OFFICE EQUIPMENT | 29,000 | 10 | 10 | 10 | |
| 36 | Contingency | 57,416 | | | | |
| 37 | TOTAL | 586,510 | 108 | 269 | 204 | |

TABLE 7.

# GENERAL PLANT COSTS
## OPERATING YEAR -2

| | DESCRIPTIONS | TOTAL COSTS RUPIAH | U.S. $ | US $ EQUIVALENT |
|---|---|---|---|---|
| 1. | LAND | 45,000,000 | | 108,434 |
| 2. | (A) | | | |
| 3. | (B) | | | |
| 4. | (C) | | | |
| 5. | (D) | | | |
| 6. | | | | |
| 7. | SITE IMPROVEMENTS (GRADING, FENCING, ROADS, ETC) | | | |
| 8. | (A) | 4,150,000 | | 10,000 |
| 9 | (B) | | | |
| 10. | (C) | | | |
| 11. | (D) | | | |
| 12. | | | | |
| 13 | BUILDINGS | | | |
| 14 | (A) HEAD QUARTERS | 31,125,000 | | 75,000 |
| 15. | (B) WAREHOUSE | 12,450,000 | | 30,000 |
| 16 | (C) MAINTENANCE | 2,905,000 | | 7,000 |
| 17. | (D) Staff Housing | 18,120,000 | | 43,660 |
| 18 | | | | |
| 19 | MATERIAL INVENTORY | | | |
| 20 | | | | |
| 21. | FUEL STOCK | | | |
| 22 | | | | |
| 23 | OUTDOOR STORAGE FACILITIES | 4,980,000 | | 12,000 |
| 24 | | | | |
| 25 | WORKING CAPITAL | | | |
| 26 | | | | |
| 27. | COMMUNICATIONS EQUIPMENT | | | |
| 28 | (A) BASE STATION | | | |
| 29 | (B) MOBILE UNITS | | | |
| 30 | | | | |
| 31 | TRANSPORTATION EQUIPMENT | 5,810,000 | 40,000 | 54,000 |
| 32. | | | | |
| 33 | TOOLS & EQUIPMENT | | | |
| 34 | | | | |
| 35 | OFFICE EQUIPMENT | 8,300,000 | 5,000 | 25,000 |
| 36. | Contingency | 23,827,640 | | 57,416 |
| 37. | TOTAL FOR GENERAL PLANT | 156,667,640 | 45,000 | 422,510 |

# GENERAL PLANT COSTS
## OPERATING YEAR -1

| | DESCRIPTIONS | TOTAL COSTS | | |
|---|---|---|---|---|
| | | RUPIAH | U.S. $ | U.S. $ EQUIVALENT |
| 1. | LAND | | | |
| 2. | (A) | | | |
| 3. | (B) | | | |
| 4. | (C) | | | |
| 5. | (D) | | | |
| 6. | | | | |
| 7. | SITE IMPROVEMENTS (GRADING, FENCING, ROADS, ETC.) | | | |
| 8. | (A) | | | |
| 9 | (B) | | | |
| 10 | (C) | | | |
| 11 | (D) | | | |
| 12. | | | | |
| 13 | BUILDINGS | | | |
| 14 | (A) HEAD QUARTERS | | | |
| 15. | (B) WARE HOUSE | | | |
| 16 | (C) MAINTENANCE | | | |
| 17. | (D) | | | |
| 18 | | | | |
| 19 | MATERIAL INVENTORY | | | |
| 20 | | | | |
| 21. | FUEL STOCK | | | |
| 22 | | | | |
| 23 | OUTDOOR STORAGE FACILITIES | | | |
| 24. | | | | |
| 25 | WORKING CAPITAL | | | |
| 26 | | | | |
| 27. | COMMUNICATIONS EQUIPMENT | | | |
| 28. | (A) BASE STATION | | 15,000 | 15,000 |
| 29. | (B) MOBILE UNITS | | 15,000 | 15,000 |
| 30 | | | | |
| 31 | TRANSPORTATION EQUIPMENT | | ~~100,000~~ | 100,000 |
| 32. | | | | |
| 33 | TOOLS & EQUIPMENT | | 15,000 | 15,000 |
| 34 | TEST AND LAB. EQUIPMENT | | 15,000 | 15,000 |
| 35 | OFFICE EQUIPMENT | | 4,000 | 4,000 |
| 36 | | | | |
| 37. | TOTAL FOR GENERAL PLANT | | 164,000 | 164,000 |

## H. POWER SUPPLY.

The Klaten rural power system is located adjacent to PLN's 150KV transmission system, specifically the Klaten 16 MVA 150-11.55/20 KV substation. This station and the 150 KV steel tower line between Solo and Jogjakarta are under construction and will be completed in mid-1978. This construction, when finished, will complete a 150KV network tying Semarang, Magelang, Solo, and Jogjakarta systems to the new Semarang steam station (2 X 50 MW).

In mid-1978, the major loads in Central Java will be interconnected on the 150KV system. The capacity and capability of this interconnected system and the isolated systems will be the following:

| | MW Installed | | MW Capability | |
|---|---|---|---|---|
| Hydro- | | | | |
| Tuntang | 32.48 | | 24.80 | |
| Ketenger | 7.04 | | 4.00 | |
| Total Hydro: | | 39.52 | | 28.80 |
| Gas Turbines - Tungtang | 55.90 | | 51.00 | |
| Total Gas Turbines | | 55.90 | | 51.00 |
| Diesels - | | | | |
| Tungtang | 19.97 | | 13.80 | |
| Ketenger | 17.15 | | 13.00 | |
| Total Diesels | | 37.12 | | 26.80 |
| Steam - Tungtang | 100.00 | | 100.00 | |
| Total Steam | | 100.00 | | 100.00 |
| Total Generation, Central Java Grid | | 232.54 | | 206.60 |
| Isolated Systems - | | | | |
| Small Diesels | 6.0822 | | 4.988 | |
| Large Diesels | 4.9280 | | 4.000 | |
| Total Isolated Systems | | 11.0102 | | 8.988 |

The highest system peaks occurred in January 1977 and are:

| | |
|---|---|
| Tungtang | 51.40 MW |
| Ketenger | 11.85 MW |
| Isolated | 4.43 MW |

System peaks have not varied appreciably since January 1977. The latest available data (for April 1977) is:

| | |
|---|---|
| Tungtang | 50.6 MW |
| Ketenger | 11.8 MW |
| Isolated | 4.3 MW |

The interconnected system (Tungtang plus Ketenger) will probably have a peak on the order of 70 MW in mid-1978 when Tungtang and Ketenger are interconnected.

System additions in the near future for improving power supply to meet demands are:

1. 150 KV double circuit steel tower line, Solo to Madiun, will tie together the East and Central Java systems, providing back-up for both systems. This line is financed and will be under construction very soon. Completion is expected in late 1979.

2. 150 KV double circuit steel tower line, Tegal to near Bandung. Will tie West and Central Java systems providing back-up for both systems. Bids for materials to construct this line have been received. Completion is expected in mid-1979.

3. Two X 100 MW steam units to be installed at Semarang. Financing is arranged and specifications to procure equipment are being prepared. The loan is expected to be consummated in late 1977, with the probable in-service date on both units in late 1982.

We conclude from the above data that ample firm, regulated power is available at the Klaten substation 20KV bus for adequately serving the Klaten rural system. Of course, as loads grow, additional transformer capacity must be provided at Klaten substation. Since Klaten substation is not for the exclusive use of the rural system, it is expected that PLN will provide such capacity as needed.

Long-term studies and plans made for expansion of PLN's generation and transmission facilities, which the feasibility team reviewed, provide for load increases on existing distribution systems and for new loads in presently unserved areas. It is believed that PLN will be able to provide necessary firm regulated power to the Klaten rural project as it grows, provided financing for additional generation capacity is available. With no additions other than those described above, PLN's Central Java System with projected load growth probably would reach its capability in 1988 - 1990.

In discussions between AID/JAKARTA and PLN, it was determined that cost of power at the Klaten 20KV bus for this study would be Rp. 22/kwh. PLN's system has hydro-gas turbine-steam-diesel generating plants making actual cost of power difficult to forecast. To make the situation more complex, the largest units (Semarang Steam ) which will be base loaded are not presently on stream and have no historical costs in conjunction with other units. The Team believes, however, an approach using the new units to calculate power costs for new load is valid. This approach assumes existing generation has all been "sold" and new loads must "buy" from new generation.

Calculating cost of power using anticipated per unit costs of Semarang steam units, gives the following figures:

| | |
|---|---|
| Investment/KW | |
| Semarang Steam Plant | Rp 246,000 |
| Transmission System Semarang Plant to Klaten 20 KV bus | Rp 80,000 |

| | |
|---|---|
| Annual Carrying Charges as % of Investment | |
| Steam Plant | 9.15% |
| Transmission Systems (based on concessional interest rates) | 7.95% |
| System Losses - % of Generation | 3% |
| Fuel Cost | Rp 22/liter |
| Specific Gravity (average) | 0.955 |
| Heat Value | 9,500 KCAL/kg. |
| Net Heat Rate of Semarang Units | 2,350 KCAL/kwh. |

Annual Demand Cost/KW

Plant - Rp 246,000 X .0915 = Rp 22,509

Transmission - Rp 80,000 X .0795 = 6,360

TOTAL: Rp 28,869

Annual Demand Cost/KW = 28,869 X 1.03 = Rp 29,735

$$\text{Demand Cost/kwh} = \frac{\text{Annual Demand Cost/KW}}{8{,}760 \text{ X Load Factor}}$$

$$\text{(For 20\% Load Factor)} = \frac{29{,}735}{8{,}760 \text{ X } 0.2} = \text{Rp } 16.97$$

$$\text{Energy Cost/kwh} = \frac{\text{Fuel Cost/Liter X Net Heat Rate}}{\text{Specific Gravity X Heat Value}} \text{ X } 1.03$$

$$= \frac{22 \text{ X } 2{,}350}{0.955 \text{ X } 9{,}500} \text{ X } 1.03 = \text{Rp } 5.87$$

Cost/kwh at Klaten 20KV bus = Demand Cost & Energy Cost
= 16.97 + 5.87 = Rp 22.84/kwh.

The 20% load factor used here is considered reasonable on the basis of experience elsewhere and on calculated characteristics for this system.

While PLN's system load factor will be much higher, the addition of Klaten rural loads will lessen the existing PLN system load factor. If a load factor of 25% is assumed for the Klaten rural system, then cost/kwh at Klaten 20KV bus would be Rp 19.44.

PLN has proposed the Rp 22/kwh at Klaten 20 KV bus for calculating costs in this study and simple analysis shows this price to be reasonable based on concessional interest rates. Therefore, this proposed cost will be used for the Klaten Rural System financial analysis.

## I. RETAIL RATE FORMULATION AND SCHEDULES.

PLN, which will operate Klaten and other rural power projects in Central Java, has existing rate structures, and service rules and regulations which can be expanded for use on the proposed new rural systems.

Basic tariffs for electricity utilized by various types of consumers were promulgated by the Minister of Public Works and Electric Power

on June 12, 1973 (Regulation No. 03/PRT/1973). These tariffs provide charges for unmetered and metered consumers. The metered schedules are two-part rates, i.e. a charge for contracted capacity (demand charge) and a charge for kwh used (energy charge). The unmetered schedule, for residential use only, has a fixed charge based on connected or contracted capacity. All consumers both metered and unmetered are equipped with limiters, a device preset to interrupt power supply if contracted capacity is exceeded. Regulation No. 03/PRT/1973 also provides for adjustment in the basis tariffs due to increase or decrease in cost of operating the enterprise, after 1973. This adjustment is based on cost of fuel as fired, cost of system improvements, operating and maintenance expenses and other considerations. The most recent adjustment,an increase over basic tariffs, was promulgated April 1, 1976, and is presently effective. Article 4, Paragraph 1, of Regulation No. 03/PRT/1973 provides for a connection charge to be collected for new connections which require additional investment in the power system.

The above statements show, in general, the philosophy of the present PLN charges for electric service. The particular schedules and policies needed for initial use on the rural systems are being studied and suggestions for tariff implementations are discussed below.

The purpose of these rural projects is to provide electricity to the rural poor. Therefore charges must be tied to the economic limitations of these people.

According to information provided by USAID/J for providing full service (24 hours, unrestricted load), the following principles are to be observed for each consumer:

1. Kilowatt-hour meters shall be installed on each service (security or street lights excepted).

2. No limiters or other devices other than measuring equipment shall be installed.

3. Based on investment in service drop and meter, a connection charge not to exceed Rp 1,800 shall be made. Payment of this charge may be made monthly, over a period of 60 months, with interest on the unpaid balance at the rate of 6% per annum. This payment will be added to the monthly bill for service rendered.

Rate Schedules (Reg. No. 03/PRT/1973) applicable to the initial operation of these rural systems are:

B1 - Residential Service:

| | |
|---|---|
| For each 25 VOLTAMP of contracted capacity | Rp 12 |
| For each kwh used up to 200 hours use of contracted capacity | Rp 13 |
| For each kwh used in excess of 200 hours use of contracted capacity | Rp 6 |

Minimum charge - contracted capacity but not less than 250 VOLTAMP.

B2 - Commercial Service:

| | |
|---|---|
| For each 25 VOLTAMP of contracted capacity | Rp 27.50 |
| For each kwh used up to 200 hours use of contracted capacity | Rp 20 |
| For each kwh used in excess of 200 hours use of contracted capacity | Rp 8 |

Minimum charge - contracted capacity but not less than 250 VOLTAMP

D - Public Road Illumination:

| | |
|---|---|
| For each kwh used | Rp 10 |

To cover replacement of bulbs, a monthly charge of 1/3 the cost of incandescent bulbs, and a monthly charge of 1/12 the cost of tubes or mercury lamps is made.

Formulae used for calculating the kwh consumption is based on 0.375 times the VA rating of the lamp. (incandescent 1VA = 1W. Mercury 2VA = 1W).

By decree of April 1, 1976, these schedules have been adjusted for the Central Java Area (Wilayah XIII - Semarang).

| | |
|---|---|
| B1 - Each kwh used | Add Rp 14 |
| B2 - Each kwh used | Add Rp 14 |
| D - Each kwh used | Add Rp 7.50 |

It has been learned from AID/Jakarta, that PLN, in order to comply with the "full service" concept and endeavoring to meet the economic limitations of rural consumers, has agreed to furnish residential and commercial service (B1 and B2 Rates) on this basis:

Contracted capacity - 350 VA (Regardless of connected load)

For each kwh used up to 200 hours use of contracted capacity, base rate plus adjustment for special rural areas - Rp 36

Minimum charge - total billing for 15 kwh

These two schedules, according to this understanding, will be:

B1 - Residential Service:

| | |
|---|---|
| Contracted capacity charge | Rp 168 |
| First 70 kwh consumed | Rp 49/kwh |
| Excess over 70 kwh consumed | Rp 42/kwh |
| Minimum (15 kwh billing) | Rp 903 |

B2 - Commercial Service:

| | |
|---|---|
| Contracted capacity charge | Rp 385 |
| First 70 kwh consumed | Rp 56/kwh |
| Excess over 70 kwh consumed | Rp 44/kwh |
| Minimum (15 kwh billing) | Rp 1,225 |

Other rates for power, C1(13.5 to 99 KVA) and E (100-2000 KVA) should be utilized on PLN's regular basis with a nominal connection charge based on cost of service conductors and metering.

These rates, which it is understood have been agreed upon by PLN, are used to estimate the revenues for Klaten in this report and for all Central Java systems.

## J. FINANCIAL ANALYSIS.

Financial feasibility for a rural electric system is based on a variety of factors which are measurable or which can be extended from base data. A study of the geography, economy, and social patterns for the proposed service area plus a competent engineering study can support acceptable forecasts of costs and revenues. It should be noted, however, that such factors as unexpected changes in rate of inflation or political developments or the quality of institutional or local system management cannot be structured into a financial analysis.

In the United States the successful program of nearly 100 percent rural electrification far exceeded the early financial expectations. This was due in part to a long period of years with a very low rate of inflation, to a long period of years with strong political support at top government levels, and to sound management both at the REA institutional level and in the cooperatives themselves.

In some other countries these variables have had sometimes a favorable and sometimes an unfavorable effect on financial feasibility of the program and individual projects.

This present feasibility study is predicated on certain assumptions about the interest rate on the loans for the rural electric systems, and exemptions from import duties and taxes for materials and equipment, as these are nonprofit service systems for servicing all the people in the designated areas including those with low incomes.

First, an analysis is made using prescribed assumptions concerning power costs and consumer connection levels given to the Team. And second, an analysis is made using alternative assumptions concerning these forecast parameters.

The following criteria, partially based on World Bank suggested guidelines for such analysis, are used to evaluate financial viability in the report.

1. Utility operating margins during the third to fifth year of system operations.

2. Net operating margins including debt amortization payments by the tenth year of operation.

3. Appreciable equity accumulation after the tenth year of operation.

Summarizing the assumptions made in the forecast, it should be noted that a highly ambitious level of domestic consumer connections is predicted and that in all probability a conservative level for non-domestic load is predicted.

Briefly, also, plant costs were based on current expected prices for on-site construction. Operating costs were based on estimated manpower, inventory, and overhead needs to operate a system of

scale required by the load and energy forecast. For reference, the table below indicates the operating expense assumptions used in the forecast.

TABLE 8. DISTRIBUTION PLANT OPERATING EXPENSE ASSUMPTIONS* AS PERCENT OF TOTAL PLANT

| Years | Operations and Maintenance | Consumer Accounting | Administrative and General | Sales | Total |
|---|---|---|---|---|---|
| 1 to 3 | 1.35 | 1.80 | 1.125 | 0.225 | 4.5 |
| 4 to 6 | 1.65 | 2.20 | 1.375 | 0.275 | 5.5 |
| 7 to 9 | 1.95 | 2.60 | 1.625 | 0.325 | 6.5 |
| 10 to 12 | 2.25 | 3.00 | 1.875 | 0.375 | 7.5 |
| 13 to 15 | 2.55 | 3.40 | 2.125 | 0.425 | 8.5 |

*Based on prior year total distribution plant.

It should be mentioned that the housewiring loan proposed for the project was not considered in the forecast, for this loan should be self-liquidating over the terms of the loan.

Loan terms, both for U.S. dollar and rupiah components, used in the forecast reflect USAID development loan terms proposed for the project. Differential interest rates and non-coterminous loan terms by the host country were not considered. Moreover, interest during construction and capitalized expenses were calculated using a 2% annual equivalent loan interest rate. However, operating loans made to the project were considered interest-free.

As mentioned in other parts of this report, prescribed retail rate tariffs and wholesale power rate levels were given to the Team for use in the forecast. This included the current PLN "B-1" rate tariff for domestic consumers, at an average service capacity of 350 VA, and using a PLN wholesale power rate of Rp 22/kwh. In addition, the forecast assumes that this rate will increase 1% annually from date of energization.

Finally, it should be mentioned, that earnings reserves generated through project operations were assumed to be invested with PLN at original value.

In respect to the financial viability tests set forth above, the project financial forecast should be given high marks for:

1. Utility operating margins are predicted during the third year of project operations.

2. Net operating margins including accelerated debt amortization

is predicted to be met during the sixth year of operation.

3. Appreciable equity accumulation is predicted to start during the sixth year of project operation.

Forecast operating ratios are compared with similar ratios derived from REA (U.S.A.) data in Table 9 . "Ratio Comparisons". As indicated, the proposed project differs dramatically. Many factors create this difference, above all the consumer and revenue density. As indicated on the table, the proposed project is predicted to reach a consumer density level 40 times the magnitude of REA systems today, and a revenue density level 10 times the magnitude in REA-financed systems. Such factors help to explain the favorable return on investment predicted for the project.

A table on "Alternative System Financial Analysis", which will be found below, presents the expected impact on forecast operating margins as certain key assumptions of the forecast are altered. The impact of a shift in the timing schedule for the project, or a change in rates or power cost can be summarized as follows:

1. Under unchanged forecast assumption (most likely), the project could absorb slight retail rate reduction or power cost increases during the initial years of project operation, but such reductions or increases require reversal in later years in order to cover increased capital and capital costs.

2. Under assumption of delayed project implementation (most likely), the project could maintain financial viability, but without a power cost increase or a retail rate decrease.

3. Under either set of assumptions (most likely) a substantial power cost increase would not be absorbed without significant retail rate adjustment.

It is evident from these findings that project financial viability will depend largely on PLN furnishing power to the project at the expected charge of Rp 22/kwh. In the event, however, of a slight power cost increase being necessitated, project viability still should be maintained since, fortunately, favorable retail rate elasticity appears to exist in the project area.

TABLE 9. RATIO COMPARISONS —
KLATEN SYSTEM, REA DISTRIBUTION COOPERATIVES,
U. S. CLASS A&B ELECTRIC UTILITIES

| | | Klaten Planning Year (5) | (10) | (15) | REA Co-ops (1975) 1/ | A & B Utilities (1975) 2/ |
|---|---|---|---|---|---|---|
| 1. | Rate of return on 1.1 x net plant (%) | 4.66 | 12.19 | 13.15 | 3.72 | - |
| 2. | TIER | 2.41 | 4.29 | 4.49 | 2.55 | - |
| 3. | Distribution investment per consumer (US $) | 172. | 152. | 147. | 1,120. | - |
| 4. | Consumers per pole-line km. | 61.7 | 79.3 | 83.4 | 2.73 | 21.3 |
| 5. | Revenue per pole-line km. (US$) | 3,344. | 7,013. | 9,250. | 992. | 14,477. |
| 6. | Revenue per kwh sold (US$) | 11.6 | 11.2 | 10.7 | 2.80 | - |
| 7. | Power cost per kwh purchased (US$) | 5.70 | 6.30 | 7.00 | 1.52 | - |
| 8. | Revenue less power cost (Spread) per kwh sold (US$) | 4.60 | 3.53 | 2.84 | 1.28 | - |
| 9. | Operating & Maintenance expenses as % of distr. plant | 1.60 | 2.19 | 2.55 | 2.97 | - |
| 10. | Administrative & General sales expense per consumer (US$ per year) | 2.66 | 4.07 | 3.74 | 33.84 | - |
| 11. | Consumer account expense per consumer (US$ per year) | 3.53 | 4.32 | 4.98 | 12.67 | - |
| 12. | Investment per kwh sold (US$) | 35.60 | 18.60 | 13.60 | 9.28 | - |

1/ Derived from NRUCFC's 1975 Key Ration Trend Analysis, and Annual Statistical Report, REA.

2/ Derived from Statistics of Privately Owned Electric Utilities in the United States, 1975, Federal Power Commission

TABLE 10. ALTERNATIVE SYSTEM FINANCIAL ANALYSIS (KLATEN)

A. Planning years as indicated on forecast:

| | Year 5 | Year 10 | Year 15 |
|---|---|---|---|
| 1. Forecast operating margins | US$156,000 | US$527,000 | US$517,000 |
| 2. Revised operating margins: | | | |
| (a) with 10% rate decrease | (33,000) | 127,000 | (43,000) |
| (b) with extra 1% per year power cost increase | 98,000 | 277,000 | (193,000) |
| (c) with extra 2% per year power cost increase | (30,000) | (48,000) | (906,000) |

B. Planning years shifted 3 years in future:

| | Year 5 | Year 10 |
|---|---|---|
| 1. Revised Forecast operating margins | US$(4,000) | US$334,000 |
| 2. Revised operating margins: | | |
| (a) with 10% rate decrease | (118,000) | 52,000 |
| (b) with extra 1% per year power cost increase | (39,000) | 146,000 |
| (c) with extra 2% per year power cost increase | (75,000) | (58,000) |

# PART III

# PART III. PROJECT IMPLEMENTATION RECOMMENDATIONS AND REQUIREMENTS

## A. INSTITUTION AND SYSTEM DEVELOPMENT.

Electric utility service is unique in the business world for several reasons.

Usually there is only one electric service entity in a given locality and this means that it is a business monopoly. This puts great responsibility on the electric supplier to deal with every individual consumer and with all classes of consumers on a fair and equitable basis.

Utilities must obtain rights of way over every property along every road and sometimes across fields. This poses many problems, especially if trees must be cut. Because of the great value of the electric service to the area, rights-of-way should be furnished without payment of compensation.

Large sums of money are required for construction. Therefore almost all potential consumers must be persuaded to do business with the utility or financial viability may be impaired. Operating an electric utility is a very complex business and a very dangerous undertaking if not handled properly. This means that skilled management is required at every step in the construction and operating of an electric system. Competent, trained personnel are required in every position. This means higher payroll costs than for most other businesses.

These facts are cited to point up the extent of the responsibility placed on the PLN by the Government of Indonesia as it embarks on this massive program of rural electrification.

To gear up to manage the size program planned for the new system within the larger PLN plant will require, first, the hiring of an experienced manager. He must be responsible for all system activities, subject only to guidelines, policies and budgets approved by the PLN Division office.

Competent and dedicated people must be hired for every position on the rural electric system staff and they must be given intensive training in program requirements, policies and objectives and in their own specific duties.

Since there are few people skilled in the construction and operation of such a large utility system available for hire in the proposed service area the PLN will need to assist the new rural system in recruiting personnel and in training them.

It is recommended that PLN detail one experienced officer to each rural electric system, to live on the site of the project and to be the liaison between the PLN, the system and the technical advisors. This person can be the contact man for the A&E consultants, the construction contractor and such other technical advisors as may be working for the system, in all matters related to PLN general policy.

The general manager of the system will be very busy with duties related to guidance of his staff as they learn to operate the system. He will need much advise and support from the PLN officer.

One management advisor with specific rural electrification experience should be made available to each new rural system. Specialists in accounting, consumer services, power use and safety training should be made available on a part-time basis as needed. Each advisor from outside Indonesia should have a full-time counterpart at PLN who will remain on the permanent rural electrification department staff. These people would be invaluable to the advisor in interpreting the Indonesian situation. At the same time they will be absorbing the expertise of the advisor and will eventually take over as his replacement in the expanding rural electrification program of PLN.

Indonesia is a great agricultural country with the majority of all workers engaged in farming or farm-related industry, which is sometimes described as agri-business. Rural electrification, with its special emphasis on service to farms and agri-business requires a specialized approach. It is suggested that PLN consider the establishment of an agri-business section within the new rural electrification department.

Recommendations and suggestions for system operations in this section are based on each rural distribution system being a self-contained autonomous unit. Should PLN, with USAID/J approval, operate these rural systems integrated with their other operations then certain recommendations made in this study as well as manpower requirements will be changed. However, it must be remembered that integrated operation must provide for discrete system analysis and reporting.

See Table 12 page 100 for Manpower Needs for System Operating.

B. CONSTRUCTION TECHNICAL ASSISTANCE.

USAID will finance the services of an A & E team of consultants from the United States to oversee the bidding and ordering of off-shore construction materials and equipment, and to assist with the design and construction supervision of the proposed rural electric system. It is anticipated that the American A & E team will work with PLN engineers in performing the actual field work of line staking, as well as the supervision and inspection of the construction work. Construction will be done by Indonesian contractors or PLN forces, as work schedules permit. Both PLN and the new rural electric service system will be involved in the selection of the A&E firm and any contractors who may be needed.

The A & E team from the U.S. will train the PLN and rural system engineers in the USAID-prescribed methods of project design and construction.

The PLN rural electric service system will engineer the service drops and install them along with the meters and meter grounds. Although the service drops are small items of construction, cumulatively they represent a great amount of engineering time,mapping, construction, inspection, record keeping and accounting. The A & E consultants will train the counterparts at the rural electric service system to lay out services, prepare staking sheets, inspect completed jobs, and verify field reports of labor and materials, preparatory to submission to the accounting department.

The schedule of work and training by the A&E will be programmed so that by the time they leave the project the engineers on the staff of the system will be able to perform all engineering and construction supervision.

The A&E consultants will assist with training of new linemen who will be hired to install the service drops, build minor line extensions, and operate the system. Safety training will be an important element in this activity.

C. OPERATIONS TECHNICAL ASSISTANCE.

Efficient operation of any rural electric distribution system is of critical importance if financial viability and low cost service to consumers are to be achieved. Administrative and operating expenses will always exceed interest and amortization expense, in spite of the large sums that must be invested in the electric plant. An efficient system will require from 8 to 10 percent of plant investment for these purposes each year. An inefficient system may need from 12 to 15 percent to accomplish the same result. Low-cost, efficient operation is just as essential to the success of a rural power system as low-cost capital.

It is readily apparent, therefore, that all of the basic management principles of planning, organizing, directing, coordinating, and controlling must have constant attention from those responsible for

the management of a rural electric system.

The A&E consultants will prepare a detailed and comprehensive plan for construction of the physical plant. A "work plan" for operations and administration should be prepared with the same care. The new electric plant will give good economical service only when operated by dedicated and competent people. And they must have a good sound work plan to follow. Design of such a plan must be supervised by persons experienced in efficient electric utility management. The new rural electric system will need assistance from experienced advisors from the date of organization through at least the first full year of operation. PLN management and technical specialists will be available to the new system.

It is expected that USAID will provide experienced rural electrification specialists who will be available to the new rural systems on a part-time basis. They will be knowledgeable in and experienced with the preparation of work plans and their implementation.

Among the first activities of the new organization will be the design of a total, integrated plan of action. From this will come a "system" which will coordinate the entire operation and see that it works according to plan.

An experienced general manager should be hired at a very early date. He must participate in all planning and budget making because he will have ultimate responsibility for the entire operation. He will work within guidelines and policies of the parent PLN and will report to the director of rural electrification in the PLN division office. The manager should hire all department heads in time for them to participate in the planning process. They will bring expertise to the planning exercise and they will need to learn exactly how their departments fit into the overall program.

This enterprise is starting off with a very large investment and a large number of employees. If program objectives are to be met, there will be little room for error and little time for on-the-job training. The great initial investment makes it important that thousands of houses are wired, with services installed, ready to connect at first energization. Assembling the resources of personnel and materials to accomplish this work will require management skill of a high order.

Specialty equipment sales companies provide people to install and demonstrate office equipment, tools, and other items of general plant. All purchase contracts should include service of the devices for an extended period of time. Such suppliers will be helpful in the design of forms and programs to make their equipment fit the needs of the rural electric system.

This is one of the largest rural electrification projects ever undertaken anywhere. Only experienced management, assisted by a staff of well-trained, dedicated employees can make it succeed. Once the basic primary distribution plant is in place, the burden is on the operating people to maintain it properly and to operate

it in such a way that the consumers will receive quality service at the lowest possible cost. If this is accomplished the construction loan repayment will present no serious problem.

All advisors must strive to instill this challenge in the minds of those who work for and direct the operation. Through strict attention to established management principles and careful attention to the needs of the consumers, this rural electrification project can meet the objectives assumed in this study, as required by the USAID/GOI loan agreement.

## D. TRAINING REQUIREMENTS.

PLN is a large national electric power enterprise. It has on its staff experts and specialists in every aspect of the electric service business. It is anticipated that from this wealth of talent will come the nucleus of the staffing for this new rural electric distribution system.

The extensive size of this special project and six other similar rural electrification projects will require PLN to expand its staff in Central Java by about 40% unless many employees are to be transferred from other work. The Klaten system alone will require a staff of about 90 employees when the first lines are energized. This may increase to 130 or more by the end of the third operating year, when 25,000 consumers will be connected and receiving service.

PLN has a training division that will be expanded to train personnel for the routine business of engineering, construction, and operating an electric distribution system. Some services such as purchasing, computerized record keeping, and consumer billing might be performed for the Klaten rural power sub-district by the PLN regional office in Semarang.

In the area of consumer education and power use, specialized training will be required. Management advisors, to be provided to the rural districts by grant-funded USAID contractors, will assist in this activity. Other specialists will be recruited by PLN and trained by PLN and USAID as needed.

Facilities of the International Rural Electrification Training Center in the Philippines may be used for training PLN employees. Trainers from the Philippines also are available to work in Indonesia. USAID may provide funds for training in the United States under the NRECA/REA international training program which has assisted hundreds of rural electrification personnel from about 35 different countries.

## E. POWER USE DEVELOPMENT.

The project which is covered by this study will be relatively large systems, with 25,000 connections projected for the end of the third year of operation.

If the project is to meet program objectives of social and economic

improvement for poor people and the economic development of the nation, a great amount of educational and power use promotional work must be planned and carried out by the sponsoring agency of the government and by the rural power district itself. Very few of the prospective consumers have ever had the opportunity to enjoy use of electric service.

Viability of the project depends on a hi[illegible] of connections and an increasing use of power over the years.

Achievement of these goals will require a positive policy decision on the part of system management along with a commitment to supply the resources of money and personnel needed to carry out the policy.

Actual implementation of the policy will be the responsibility of the Consumer Services Department within the organizational structure.

Community meetings should be held in order to reach the majority of the people with the least time and expense. At these meetings, the staff will explain the background of the program and outline the plan of action to achieve stated objectives for the Government institution, the rural power district, and the consumers. Communications and credibility must be established before any business can be transacted.

After the sign-up campaign has produced a list of consumers, the wiring campaign will begin. While most will be small users, it is important that each one be given every opportunity to make the most productive use of his new energy source. Training the staff for responding to the needs of the small users will be relatively easy and quickly accomplished.

For the larger users, including especially the commercial and industrial accounts, the task is much more technical and time consuming. Many of these already own and use mechanical power. They will have to be "sold" on using the new central station service before they will give up what they already have and in which they have confidence. To do this "selling", staff people familiar with the application of electric power to productive tasks will be needed. Industrial or mechanical engineers or technicians should be considered.

In the field of agriculture, electric power can perform many tasks. Irrigation, milling, processing, pumping, drying, freezing and refrigeration are areas of application. Better methods of handling, drying, and storing rice offer good potential for income improvement. Pure drinking water is needed in some areas and dependable electric power makes pumping from deep wells possible. Agricultural engineers could provide the expertise in these areas.

There are already cottage industries and craft shops in existence in the service area. These can be expanded and made much more efficient through the application of low-cost electric power.

Pure water, refrigeration, and water heating can improve the food handling and processing industry. Rural health clinics, schools, and security lighting are other needs that can be served with dependable 24-hour electric service.

In every home there are many potential uses for electricity. Consumers must be shown that the electric service is better and cheaper than alternatives.

The power use technicians will need to meter and monitor various installations to get accurate information to pass along to other consumers. An active power use program will produce profitable results for both the consumer and the power supplier. It will also be a satisfying career for a group of dedicated employees.

Training is very important to the power use staff. Assistance is available from the NEA staff in the Philippines. PLN staff specialists will be made available for consultation and training. The management advisors provided by the USAID grant will bring experience in power use work and can also assist in training and actual member service work.

F. HOUSEWIRING PROGRAM.

It is anticipated that many households in the poorer economic areas will fail to sign up for service in the new distribution system if they do not have cash savings on hand to pay for the cost of wiring their premises. Most prospective consumers are farm workers with very low income. They will require financial assistance if they are to prepare their houses with the safety switch, wiring, and outlets for using electricity.

It should be noted that the PLN distribution system is expected to pay for and own the service drop from the pole to the kilo-watt-hour meter, and including the meter and the ground. Wires to the safety switch and all wiring, outlets, connections, and switches beyond the meter are provided and owned by the consumer. All wiring and electrical appliances and equipment installed must meet standards set by PLN and be approved by PLN before the service is connected.

Because success of rural electrification is measured in part by the percentage of households which sign up to get electrical service, it is important to make sure houses are wired on schedule, and ready for connection.

It is recommended that PLN take two steps which will assist in obtaining a large sign-up when the electric system is getting under way.

1. The cost of wiring a house should be kept as low as possible. To assist in this, PLN should examine the possibility of:

   a. Bulk purchasing of standard housewiring materials.

b. Arranging to train housewiring electricians recruited locally in the service area, to individually contract for installing housewiring for consumers at a fixed price.

c. Adopting standard housewiring specifications.

To insure that all wiring installations are safe, there will have to be an inspection and certification made before the system will connect the service. This is an absolute requirement to prevent fires and loss of life. Competent inspection must not be disregarded. Any consumer who so desires may arrange to have his wiring done by private contractors other than those trained under PLN auspices, but it must be subject to the same inspection before the system will connect the service.

A sketch of a typical minimum housewiring installation, together with a list of m terials is provided below.

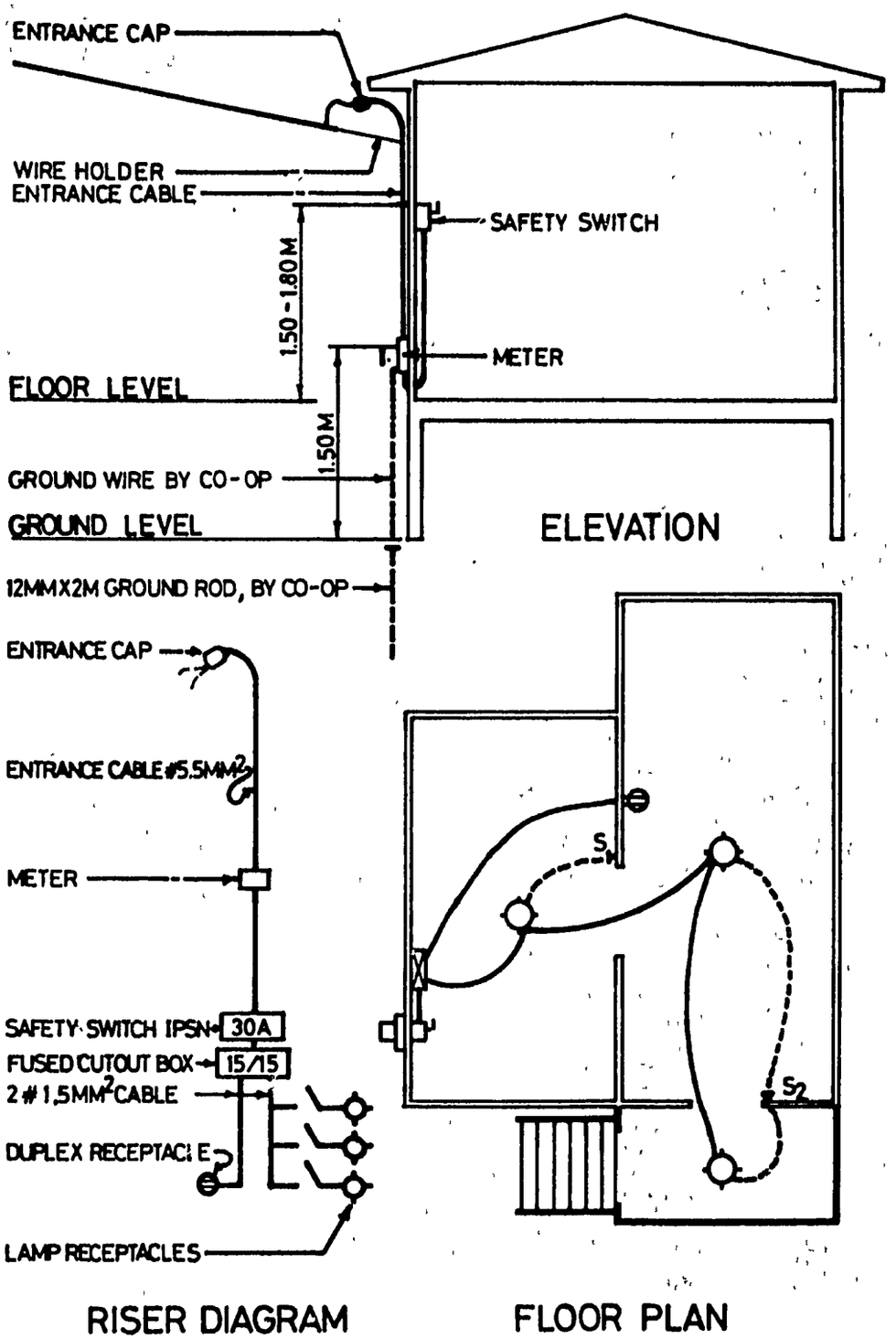
2. A program should be offered to provide low-interest loans for housewiring which the system can extend to the prospective consumers. Loans would be made for repayment within 5 years, with an arrangement for regular monthly payments at the same time collections are made for electricity used.

   The loans would be made only to those potential consumers who demonstrate a need for such assistance. Members would generally be encouraged to pay for housewiring from their own money in cash. Loans would cover only a basic installation with three ceiling lights and one convenience outlet. Consumers requiring larger installation should arrange their own financing for additional facilities.

   It is estimated in this feasibility study that the distribution system will need US $473,135 in capital for wiring loans to cover a 4-year period. By the fifth year, consumers' repayments of principal and interest will make possible a revolving fund for credit in subsequent years to take care of the needs of additional new consumers.

FIGURE 6.

# TYPICAL HOUSE WIRING PLAN




SUKONO '77.

TABLE 11. MATERIALS FOR BASIC HOUSEWIRING INSTALLATION

| | Item | Market Price (Rupiah) | Estimated Wholesale Price (Rupiah) | Quantity Required | Extended Cost (Rupiah) |
|---|---|---|---|---|---|
| 1. | Entrance wire, kwh meter to disconnect switch, 2 #5.5/mm$^2$ (30 amp) | 190/m. | 125/m. | 5.5 m. | 688 |
| 2. | Fused disconnect switch, 30 amp rating | 2,250 | 1,650 | 1 | 1,650 |
| 3. | Fuse holder | 200 | 150 | 1 | 150 |
| 4. | 15 amp fuse | 50 | 35 | 2 | 70 |
| 5. | Wire, from disconnect switch to fixtures and switches, 2 #1.5/mm (19 amp) | 140/m. | 90/m. | 55 m. | 4,950 |
| 6. | Ceiling mount, surface, incandecent lamp socket | 100 | 75 | 3 | 225 |
| 7. | Convenience outlet, surface mount | 550 | 400 | 1 | 400 |
| 8. | Snap switch, surface mount | 350 | 250 | 3 | 750 |
| 9. | Junction box, 2¾", PVC, with cover | 25 | 20 | 2 | 40 |
| 10. | Staples 3/8", metal with nails | 3 | 2 | 350 | 700 |
| 11. | Wood Screws, #6 3/4" | 1.5 | 1 | 12 | 12 |
| 12. | Electrician tape | 9/m. | 6/m. | 2 m. | 12 |
| | Total Price | (F.O.B. Jakarta 1977) | | | Rp 9,647 |
| | Total Estimated Price | (F.O.B. Central Java 1978) | | | Rp 11,500 |

## G. PROJECT FINANCIAL PLANS.

Upon receipt of this study, and the institution of the Klaten rural electric sub-district, PLN loan commitments should be made available in amounts sufficient to meet the five-year construction, housewiring and operating requirements as detailed in this report. Further, projected project loan needs for future years should be injected in PLN's long-range comprehensive electrification plan.

Loan fund commitments made to the Klaten project to be expended over the initial construction period and years 1, 2 and 3 of operation should be made for a period of 40 years at a 3% annual rate of interest, with a grace period of 10 years on loan amortization, during which time loan interest should be paid at a 2% annual rate. PLN must program its funds so that advances required by the Klaten project can be made in a timely manner.

Funds provided for salaries and expenses of project staff during the development period prior to energization should be capitalized. After energization such funds will come from project revenues. Experience should dictate whether the general fund levels proposed by the study are adequate to meet disbursement obligations, and revisions should be made if necessary. Further, project investments of general funds should be made, within the guidelines approved by PLN. Liquidity must be maintained to permit the project to meet its cash obligations when due.

Once trends are established through actual project operations, there should be a continuing review of project, rate policy, annual work plans, budgets, and financial forecasts. Corrective action can then be taken to maintain prudent financial management of system operations. In this connection, one of the first tasks that PLN should undertake is the establishment of a comprehensive reports management system for project implementation.

The financial interests of PLN as the nation's power company should also be protected. As such, PLN should set financial policy guidelines within which the project must operate. Such guidelines should call for PLN approval in such matters as project property sales, and purchases, project large load power sales contracts, project consultants' fees, and project retail rate levels.

Finally, comprehensive project financial and statistical operating reports should be submitted to PLN on a timely schedule, so that adverse project operating conditions can be detected and acted upon before project financial condition is gravely impaired.

# PART IV

# ANNEX A

# ANNEX A. BASIC DISTRIBUTION SYSTEM CRITERIA

## ELECTRICAL DESIGN CONSIDERATIONS

### 1. Frequency.

Any new rural distribution system in Indonesia should be 50 hertz, to conform with existing usage.

### 2. Distribution Voltage (Nominal).

a. By Decrees No. 08/K/70 and 09/K/70 of the Director General of Power and Electricity, Ministry of Public Works and Electric Power, voltage standards for distribution system in Indonesia have been established. The primary voltage of 20 KV (nominal) with a maximum of 24 KV is the most attractive voltage to be used for rural projects. This voltage is now being used extensively in Indonesia and does not require introduction of another class or size of equipment and materials. Further, the reduction in voltage drop and losses for the same loading, wire size, and line length more than offsets the slight additional costs of using this higher voltage over a 7.2/12.47 KV primary system. Voltage drop and losses at 11.55/20 KV are 0.3888 compared to 1.0 at 7.2/12.47 KV primary. Increase in capacity or line length using the same voltage drop and wire size are 2.572 at 11.55/20 KV compared to 1.0 at 7.2/12.47 KV primary.

The system may be safely operated near the maximum primary voltage (13.8/23.9 KV) since manufactured equipment and desined insulation levels are 125 KV BIL minimum. This higher level of voltage will increase system capability and capacity at no increase in cost.

b. Secondary voltages in all areas of Indonesia are being changed from 127/220 V, four-wire, three-phase to 220/380 V (nominal) four-wire, three-phase. Motors, appliances, equipment, lighting fixtures, and lamp bulbs are being marketed for the 220/380 V service making the use of this standard voltage attractive if not mandatory. Further, use of this voltage will reduce consumers' wiring costs. Single-phase systems should be two-wire 220 V, and three-wire 220/440 V. Three-phase systems should be four-wire 220/380 V.

### 3. Service Voltages (Nominal) with Use and Maximum Loadings.

a. 220 V, two-wire, single-phase should be used for miscellaneous residential and commercial loads, 10 KVA and below. Maximum individual motor size is 10 HP.

b. 220/440 V, three-wire, single-phase should be used for miscellaneous residential and commercial loads, 50 KVA and below. Maximum individual motor size is 10 HP.

c. 220/380 V, four-wire, three-phase should be used for miscellaneous commercial and industrial loads, 25 KVA and above, provided individual motors 15 HP minimum or other three-phase equipment, 25 KVA or more, are installed. Maximum load at this voltage is 500 KVA.

d. Industrial or commercial loads of 500 KVA or more should be given special consideration on a case by case basis. They may be served at primary voltage (11.55/20 KV, four-wire, three-phase) or 220/380 V, four-wire, three-phase, dependent of rate structure and availability of large transformers.

4. Insulation Level, Creepage Distance, Etc.

a. Insulation fro the primary system must withstand normal operating voltages and switching surge voltages without flashover or failure. Sufficient impulse insulation strength (BIL) must also be provided so that the system can be protected by suitable lightning arresters. Further, insulators and bushings, in air must have adequate creepage distance so that there will be practically no 50 hertz leakage current. At altitudes over 1,000 meters or in contamincated areas creepage should be provided.

b. Since standard equipment has been developed for this voltage class (14,400 V, line-to-ground) and has been in service and proven world-wide for many years, the system should be designed to meet these insulation parameters, using standards for material and equipment specified by the American National Standards Institute, New York City, U.S.A., and in REA Bulletin 43-5, Rural Electrification Administration, Washington, D.C., U.S.A.

(1) Basic insulation level (BIL) - distribution class, 125 KV.

(2) Switching surge voltage - three times normal line-to-ground voltage.

(3) Minimum creepage distance (approximately 1 inch/1000 volts) - 13 inches.

(4) Extra insulation to be provided at line angles and deadends to preclude flashover due to increased values of surge voltage caused by reflection.

(5) No increase in standard creepage distance for systems constructed below 1,000 meters in areas relatively free from contamination. Should it be determined that sections of the system require increased creepage distance they should be considered for each individual case.

(6) Equipment used will be according to the standards noted and meeting these insulation and creepage values:

(a) Line insulation, pin insulators - use ANSI Class 56-1 insulators.

| | |
|---|---|
| Leakage distance | 13 inches (33 cm.) |
| Wet flashover | 60 KV |
| Dry flashover | 95 KV |
| Critical impulse flashover | 150 KV |

(b) Line insulation, angles and deadends, suspension insulators - use two insulator units per deadend, ANSI Class 52-4.

| | |
|---|---|
| Wet flashover | 90 KV |
| Dry flashover | 155 KV |
| Critical impulse flashover | 255 KV |

(c) Equipment bushing insulation, distribution class - ANSI-C57.12 series.

| | |
|---|---|
| Bushing creepage distance | 17.75 inches ( 45 cm.) |
| Withstand voltages | |
| 10 seconds wet | 36 KV |
| 1 minute dry | 42 KV |
| Impulse withstand voltage (BIL) | 125 KV |

(d) Transformer winding insulation distribution class - ANSI-C57.12 series.

| | |
|---|---|
| Impulse withstand voltage (BIL), full wave | 125 KV |
| Impulse, chopped wave | 145 KV |
| Minimum flashover time 2.25 micro-seconds | |
| Low frequency dielectric | 40 KV |

(e) Secondary and service system will be designed using material and equipment for less than 300 V phase-to-ground, according to ANSI standards:

i. Insulators (spools) for secondary conductors will be ANSI class 53-2 and 53-4 with these electrical values:

| | | |
|---|---|---|
| Low-frequency dry flashover | | 25 KV |
| Low-frequency wet flashover, | vertical | 12 KV |
| | horizontal | 15 KV |

ii. Insulators ( spools) for service conductors will be ANSI class 53-1 with these electrical values:

| | | |
|---|---|---|
| Low-frequency dry flashover | | 20 KV |
| Low-frequency wet flashover, | vertical | 8 KV |
| | horizontal | 10 KV |

iii. Covering on phase conductors of multiplex service cables should be cross-linked polyethylene (XLP), with minimum thickness of covering:

| | |
|---|---|
| #2 AWG and smaller | 0.45 inches (1.15 mm) |
| #1/0 AWG through #4/0 AWG | 0.60 inches (1.52 mm) |

Covering shall be capable of withstanding continously, from conductor to ground, applied voltage of 1000 V at 50 hertz for 5 minutes.

5. Voltage Levels, Spreads, and Drops.

a. ANSI C84.1 presents standards for maintaining adequate voltage levels at service and utilization points. These points are defined as:

(1) "Service point" - the point at which systems of supplier and user are connected (kwh meter).

(2) "Utilization point" - the line terminal of the equipment using energy (lamp socket, convenience outlet, motor terminals, etc.).

b. Lighting and appliances can operate on a fairly broad spread of voltage above and below their rated voltages. Of course, when the spread is held closer to the rated or nominal voltage, better operation will be achieve. Accordingly the following voltage ranges have been selected as acceptable system voltage levels and spreads.

VOLTAGE RANGES (220 V base)

| | Minimum | Maximum |
|---|---|---|
| Utilization point | 198 | 231 |
| Service point | 203 | 231 |

c. Using the above acceptable service point range (203-231 V), the corresponding permissible voltage spreads at various points on the distribution system may be determined by using voltage drops indicated below for each segment of the system. The total drop permitted at point of service under maximum load conditions should be the maximum voltage delivered to the customer nearest the bulk power supply point (substation) and the minimum voltage delivered to the customer fartherest from the substation. Regulating equipment used on the system will have a voltage regulating relay with a bandwidth setting that can control feeder voltage to plus or minus 1.0 V (220 V base). Therefore, maximum voltage drop which may be allocated to the various parts of the distribution system will be (231-203) - (2 x 1.0) = 26.0 V. The following drops may allow some variations in regulator settings.

VOLTAGE DROPS - MAXIMUM LOAD CONDITIONS

| System Component | Maximum Voltage Drop (220 V base) | Percent Voltage Drop (approximate) |
|---|---|---|
| Substation or plant regulated bus (output) to primary terminals of last distribution transformer | 14.0 | 6.37 |
| Distribution transformer | 3.0 | 1.36 |
| Secondary and service | 6.5 | 2.95 |
| Total at consumer's meter | 23.5 | 10.68 |
| Consumer's interior wiring | 5.0 | 2.27 |
| Total at utilization point | 28.5 | 12.95 |

VOLTAGE LEVELS AND SPREADS - 220 V BASE

| Location | Voltage Levels (volts) Minimum | Voltage Levels (volts) Maximum | Voltage Spread (volts) |
|---|---|---|---|
| Substation transformer (unregulated) | 208 | 242 | 34 |
| Substation or plant bus (regulated) | 226.5 | 231 | 4.5 |
| Distribution transformer primary terminals (last transformer) | 214.5 | 231 | 16.5 |
| Service point (consumer's meter) | 203 | 231 | 28 |
| Point of utilization | 198 | 231 | 33 |

d. The above normal voltage levels, especially those at point of service and point of utilization, are the basis for system design; and the system should be operated within these limits so that the consumer's equipment will give satisfactory service. These levels are based on the following:

(1) Substation or plant outgoing bus voltage is regulated with a voltage bandwidth setting not exceeding 1 V on a 220 V base.

(2) Values used in above tables are center values of the regulator bandwidth.

(3) Only sustained voltages apply to table values. Variations of short duration (switching, motor starting, etc.) are not considered.

(4) Input voltages to bulk power supply point (subtation) are kept within prescribed limits so that regulating equipment can operate its prescribed limits, ± 10% of normal operating voltage.

6. Feeder Loading.

In determining feeder loadings, initial construction cost and quality of service desired are the most important factors to be considered. These considerations generally tend to oppose each other, in that lower construction costs will dictate heavily loaded feeders, while improved service requires more feeders lightly loaded. A compromise which allows initial costs, losses, and voltage regulation to determine the loading has proven to be an adequate solution.

In rural areas where initial load density on the order of 10 to 12 KVA per square kilometer with an annual load growth of 5%, it appears that feeder loading will be determined by voltage drop and desired reliability. Reliability will be determined by feeder length and number of sectionalizing points. Feeders, of course, would be voltage limited and with allowable voltage drops described above in Section 5. a 4/0 AWG-AAAC three-phase, four-wire feeder operating at 90% power factor and 13.8/23.9 KV with uniformly distributed load will have a capacity of 80925 KW-kilometers.

With a feeder rating of 6.0 MW the feeder would have a length of approximately 25 kilometers from source to last transformer. Assuming a rectangular feeder area with a main feeder 17 kilometers in length with laterals on each side of the main, 8 kilometers in length would make a feeder area of some 272 square kilometers. The load would be approximately22.06 KVA/square kilometer which would be satisfactory for 15 years based on 5% annual growth of an initial load of about 11 KVA per square kilometer.

The above loads are total loads per square kilometer and a coincidence factor should be applied when calculating definitive conductor sizes to feed an area.

Actual physical layout of a system, with bulk power points located outside the service area, could change feeder areas which in turn could change optimum wire size and feeder loading. However, for purpose of this study actual feeder areas and layouts are used. To provide for emergencies or short-time overload conditions, feeders or lines may be operated up to 90% of the thermal capability of the conductor, without loss of service life of the conductor.

7. Transformers and Secondary Systems.

The initial load density in KVA/square kilometers enumerated above may be also stated as being about 14 KVA/line kilometer. This initial load density may be used for design of the secondary system provided a growth factor and coincidence factor is applied. The optimum transformer spacing could then be determined by the maximum length of a given secondary conductor operating with the maximum permissible voltage drop (6.5 V). With an initial load density of 14 KVA/line kilometer and a coincidence factor of 0.90 and with an annual growth rate of 5%, the load density in 15 years would be $14 \times 0.9 \times (1 + 0.05)^{15} = 26.19$. KVA/line kilometer. A 25 KVA transformer may be adopted as a base size unit,

It may be assumed that a balanced uniform load on a three-wire secondary will be fed two ways from each transformer and that a peak rating of 150% of the individual transformer rating can be safely used for design. With this assumption and using a 25 KVA transformer (22.5 KW at 90% power factor), optimum transformer spacings with various size conductors may be:

UNIFORM DISTRIBUTED LOAD

| Wire Size | Voltage Drop Volts (220 V base) | KW-Meters 90% P.F. 3-wire, Single-phase | Load KW (1/2 the 150% rating of 25KVA transformer) | Optimum Length of Secondary (meters) | Optimum Transformer Spacing (meters) |
|---|---|---|---|---|---|
| # 4 AAAC | 5.5 | 3170 | 18.75 | 169 | 338 |
| # 2 AAAC | 5.5 | 4745 | 18.75 | 256 | 512 |
| #1/ 0 AAAC | 5.5 | 7116 | 18.75 | 380 | 760 |

To maintain a reasonable balance between number of transformers and secondary conductor size and to allow use of one size larger transformer (37.5 KVA) over base size (25 KVA), three-wire secondary system of #1/0 AAAC phase wires with neutral sized according to primary system requirements should be used. Maximum length of secondary system (transformer to last consumer) should not exceed 380 meters. Transformers should be located using the moment arm method to find a load center.

Along primary lines, effort should be made to place transformers on the optimum spacing of approximately 750 meters. In this way transformers may be changed out as the load develops to a maximum of 34.5 KVA units without relocating or respacing. When load increases beyond the 37.5 KVA capability another transformer may be installed between existing units cutting the secondary confuctors on intermediate poles. This will give additional capacity with minimum expense.

Transformer selection should be according to:

(a) Thermal capability (maximum load without damage to insulation),
(b) Voltage drop (adequate voltage under maximum load), and
(c) Economics (annual costs).

Single-phase transformer installations meeting this criteria should be sized according to this table:

| Rating 65°C (KVA) | Maximum Peak Load * Permitted (KVA) | Minimum Economic Loading (KVA) 30% Load Factor Annual Average Load | Minimum Economic Loading KVA (peak) |
|---|---|---|---|
| 10 | 15.8 | - | - |
| 15 | 23.7 | 4.9 | 16.3 |
| 25 | 39.5 | 5.4 | 18.0 |
| 37.5 | 59.25 | 10.3 | 34.3 |
| 50 | 79 | 11.8 | 39.3 |

* According to ASNI C57.92, with an ambient temperature of 40°C a peak of 1.58 rating is permitted for one hour following 50% equivalent load in percent of rated KVA every 24 hours with no loss of transformer life expectancy.

8. Services.

Services for residential and small commercial customers should be multiplex, self-supporting, service drop cable. Cable should have a bare ACSR neutral messenger, with stranded all-aluminum cross linked polyethylene insulated (600 V) phase conductors. Duplex cable should be sized 6 AWG and 4 AWG. Triplex and quadruplex cable should be sized 4, 2, 1/0, or 2/0 AWG.

Choice of number of service wires should follow maximum loadings given in Section 3 above, "Service Voltages (Nominal) with the Use and Maximum Loadings".

9. Voltage Regulation.

Bulk power source (substation bus) should be regulated by tap changing under load equipment, integrally a part of the step-down transformers. Generating plants will regulate their 20 KV buses by varying machine voltages. Step-up transformers will be furnished with off load high tension-taps. It is anticipated in the initial stage design of the rural system that no line type regulating equipment will be needed since line lengths and loads tend to keep the system within acceptable voltage limits.

When system loads and line lengths grow to the extent that acceptable voltage limits are exceeded, then line regulators generally applied with shunt capacitor banks should be installed. Single-phase, outdoor, step-type, platform mounted units should be used, banked for three-phase operation, with by-pass switches.

10. Capacitor Banks.

Line-type shunt capacitor banks, switched and unswitched, may be used to improve power factor thereby reducing losses. The initial system should be designed for growth, and while capacitors will improve voltage and increase line capacity, in the early years use of capacitor banks solely for this purpose appears to be unnecessary and the installation expense does not appear justified.

As load grows in future years, capacitor installation for voltage improvement and capacity release should be considered and compared with costs of additional feeder construction, or additional substation capacity.

Total capacity of fixed capacitor banks on a feeder or substation bus should not be more than required to correct power to a value approaching unity, at light load conditions.

Total capacity of switched capacitor banks on a feeder or substation bus should not be more than the additional quantity of capacitors required to correct power factor at peak load to a value approaching unity.

Capacitor banks should be group protected by expulsion fuse cut-outs, and lightning arresters, one per phase with co-ordinated fuse links. Fuses should have a continuous rating of not less than 1.35 times rated bank current, with a total clearing characteristic not exceeding zone 1 standard capacitor case rupture curves as shown in NEMA Std, CP-1. Fault currents at point of capacitor installation should be ascertained and fuse clearing times carefully checked with case rupture curves.

The application of capacity banks to the system should be made in conjunction with voltage regulating equipment, if such equipment is required.

11. Lightning Protection (Arresters).

Selection of arrester voltage ratings should be based on line-to-ground (not line-to-neutral) voltages existing on the system under fault conditions.

The system to be protected is solidly grounded with four-wire, multigrounded, common neutral lines. The voltage impressed across the unfaulted phases line-to-ground will, therefore, be only a percentage of the line-to-line voltages, under fault conditions.

Based on IEEE Transactions Paper 71TP-452, which details experience and practice for selecting arrestor ratings, an 18 KV arrester should be used on four-wire, multigrounded, common neutral distribution lines, maximum voltage 13.8/23.9 KV.

Use of 18 KV arresters commercially produced according to ANSI C62.1 will provide acceptable protection for 125 KV BIL distribution equipment.

In locating arresters on the distribution system, all line leads and ground leads connecting the arrester to the system and the protected equipment must be as short as possible to reduce the impedance paths of surge current during lightning discharge. Voltage across leads could completely nullify the protective characteristics of the arrester; therefore, precautions should be taken to keep leads short.

| Location | Remarks |
|---|---|
| Overhead transformers | Connect to each source high voltage phase wire. Ground lead solidly interconnected to common neutral, transformer tank and transformer secondary neutral. |
| Capacitor banks unswitched | Connect to each source high voltage phase wire of banks with 500 KVAR rating or less. Banks of higher capacity do not need protection since a surge of magnitude to charge the bank is unlikely. Ground leads solidly interconnected to common neutral, capacitor cases and bank ground. |
| Capacitor banks switched | Same as for capacitor banks unswitched, except install on all banks regardless of capacity. |

| | |
|---|---|
| Regulators, line type | Mount on regulators and connect to each high voltage phase, line and load side. Ground lead solidly connected to common neutral and equipment ground. |

It is believed that with high speed breakers set for an instantaneous reclosure that arresters placed along the lines for line protection are not required.

12. Fused Cut-outs and Fuses.

Open, drop-out expulsion type fused cut-outs should be used, rated 100 amps, minimum, 26 KV maximum, 125 KV BIL, 7000 amps. symmetrical and 6000 amps. assymetrical interrupting capacity (minimum).

Fused cut-outs should be used for capacitor bank protection, protection of single-phase taps at main feeder tap points, and sectionalizing points,

Fuses should be NEMA ratings type "T" to obtain satisfactory coordinating characteristics.

13. Sectionalizing and Switching.

Coordinated automatic sectionalizing devices should be used on all primary distribution circuits. Automatic reclosing devices should be used where appropriate.

Radial three-phase feeders and major three-phase taps, which cannot be looped, may use three single-phase reclosers of appropriate size as required to protect important areas.

Fused cut-outs should be used on single-phase taps for coordinated protection of the system. Cut-outs should be equipped with hooks so that they will be "load break" when used with a portable load break tool. No fused cut-outs should be used in a three-phase circuit. However, cut-outs equipped with solid disconnecting switch blade may be used in lightly loaded three-phase circuits for manual sectionalizing.

A sectionalizing plan for each feeder should be made using acceptable methods to determine short circuits and sectionalizing points.

In applying sectionalizing devices, it should be remembered that the "sectionalizing factor", a factor less than unity, directly affects the service reliability of the feeder. Depending upon circuit length the following general considerations will be helpful. Since each feeder configuration presents different problems, good judgement must be exercised in each case to achieve best results.

a. Four reclosers or other automatic sectionalizing devices in series on a circuit usually are considered adequate, depending upon line length, in order to obtain reliable coordination. Non-automatic devices such as disconnect switches, spaced between automatic devices, will be helpful in system operations to minimize circuit outage during permanent faults.

b. Branch lines connected to the main circuit vary in their importance to service reliability depending upon length and at what point they are connected to the main circuit. They are the most vulnerable to faults affecting service reliability. Therefore, every branch circuit should be sectionalized regardless of length or connected load. The objective of sectionalizing branch circuits is to protect the main trunk circuit against permanent outage.

c. Lateral circuits connected to branch circuits are usually referred to as second, third, or fourth line sections and have a successively lesser possibility of impairing service reliability. They can be correspondingly longer in length or exposure before a sectionalizing device is justified.

d. Any branch or lateral circuit exposed to unusually hazardous conditions should be sectionalized with an automatic device.

e. Where a main trunk line is bifurcated (extending in two different directions), automatic sectionalizing devices, preferably reclosers, should be used to sectionalize each of the circuits at the junction point.

f. All sectionalizing locations should be easily accessible.

g. Sectionalizing devices should be located so as to minimize service interruption to important loads; i.e., if a sectionalizing device is to be located near an important load, it should be placed beyond that load.

h. When any changes are made to the system, such as additions or revisions of line or increase in size of the substations, a supplementary study should be made to keep the sectionalizing program up to date and to see that rating of devices is still adequate. Periodic checks of peak loads on sectionalizing devices should be made, to ensure that overloads do not occur with load growth.

14. Grounding.

All poles should have a ground assembly (driven or butt wrapped) with the common system neutral tied to this assembly.

A minimum of three driven grounds per kilometer will be used to make the system "effectively grounded" according to NESC rules. Driven grounds should be 5/8" x 8" - 0" galvanized rods and should have a resistance of less than 10 ohms individually, isolated and not connected to the grounding system, after installation. If this resistance is not obtained, additional sections should be driven to a greater depth. Driven grounds should be used at all poles on which transformers, capacitor banks, regulators, reclosers, switches or arresters are installed. Driven grounds are also to be used at all secondary deadends.

In addition to above grounding all down guys without strain insulators are to be connected to the common neutral system. All down guys are to be securely bonded to their anchor rods, using anchor rod bonding clamps.

15. Conductors, Type and Kind, Economic Size.

Present pricing determinations indicate that AAC (all Aluminum Cable) and AAAC (Aluminum 6201 Alloy Cable) bare conductors should be used for primary and secondary lines.

Considering kwh losses and estimated construction costs, using annual cost rates and growth factors applicable to rural systems, it is believed that the following sizes may be accepted as standards for use as line conductors on rural systems in Indonesia. It further uses conductors which have been extensively utilized in Central Java, thus precluding introducing another type and size of conductors.

| Use | Phase | Size of Conductors | |
|---|---|---|---|
| | | Phases | Neutral |
| Main feeders | 3 | 477/KCMIL | 4/0 AWG |
| Main feeders | 3 | 4/0 AWG | 1/0 AWG |
| Laterals | 3 | 2 AWG | 4 AWG |
| Taps | 1 | 4 AWG | 2 AWG |
| Taps | 1 | 4 AWG | 4 AWG |

For service conductors these sizes should be adequate:

| Size | Type | KW-Meters |
|---|---|---|
| # 6 | Duplex | 175 |
| # 4 | Duplex | 275 |
| # 4 | Triplex | 600 |
| # 2 | Triplex | 900 |
| # 2 | Quadruplex | 1,200 |
| # 1/0 | Quadruplex | 2,000 |

Mechanical Design Considerations.

All mechanical design should be in accordance with REA Bulettin 160-2, "Distribution Line Design (Mechanical)." This REA Bulletin is based on ANSI Bulletin C-2-1977 Electric Code of the U.S.A. However, certain changes described below should be made in loadings to conform with Indonesian weather conditions.

All construction should be in accordance with REA Form 803, "Specifications and Drawings for 14.4/24.9 KV Line Construction."

Both of the above published documents have been tried and tested, updated from experience, and have been the basis of constructing hundreds of thousands of kilometers of low investment, high reliability, economical electric lines.

Indonesian Conditions.

From available weather records of Indonesia a maximum design wind velocity (actual) of 80 kilometers per hour (22.25 meters/second) appears to be satisfactory. This is equivalent to approximately 50 miles per hour. Using acceptable pressure-velocity formula, these wind pressures may be used for an "Indonesian Loading Zone" in the line design standards mentioned above.

Cylindrical surfaces:

$$P = 0.0025V^2 = 0.00025(50)^2 = 6.25 \text{ pounds/sq. ft.}$$

Flat surfaces:

$$P = 0.0004V^2 = 0.004(50)^2 = 10 \text{ pounds/sq. ft.}$$

Design temperatures according to Indonesian conditions may be:

Maximum tensions in conductors - 60°F (15°C)
Minimal vertical clearances - 90°F (33°C)

With the modifications above and no ice loading, REA Bulletin 160-2, can be used for mechanical line design in Indonesia. This can be obtained from: Rural Electrification Administration, U.S. Department of Agriculture, Washington 20250, D.C., U.S.A.

# ANNEX B

# ANNEX B. LABOR COSTS

## 1. General.

Labor rates in Indonesia for various work classifications have no "going" price. In fact, depending upon source of information, wages vary from "nothing" to unbelievable highs. Apparently base wages for similar work vary between government enterprises and private concerns. It is reported that wage levels as well as benefits depend largely upon whether the employer is foreign or domestic and the type of financing of the project or business -- overseas or local.

There are very few formal labor laws and regulations in Indonesia. Those which exist have not been codified, making exact conditions and benefits difficult to assess and apply. Generally "Labor Law" is considered to be a collection of written regulations and unwritten customs and practices dealing with working for pay, either in cash or kind. It has been said that Indonesian Labor Law is most interested in these aspects of employment:

a. Making a work agreement.
b. Work obligations of employment.
c. Employers' obligations to employees both during and after the period of their work.
d. Termination of employment.
e. Settlement of labor disputes.

There are several publications in English which have gathered much of the pertinent information currently in use concerning labor. The 1974 publication of the Padjadjaran University Law School, Bandung, title "Labor Law", part of a series titled "Survey of Indonesian Economic Law", has been freely used to ascertain labor practices to estimate labor costs for this study.

Minimum or fixed wage rates are not proscribed by law, but wage rates contained in collective labor agreements have in several instances been extended to workers who are not part of the collective agreements. Generally unions do not exist, except in foreign or very large enterprises.

The above statements are recited for background only and are not to be construed as criticisms or that changes are suggested. However information gathered along with the above statements is being used to estimated total wages and salaries for both construction and operating personnel on the project.

2. Rate of Pay for Construction Employees.

In this rural electrification program, construction will be accomplished on four different islands of Indonesia. In three locations very little, if any, construction of this type has been done. We therefore assume all skilled and semi-skilled personnel for these locations will come from other areas. Compensation for these workers must be adjusted accordingly. These base rates are used in the table below, and include wages paid in cash, housing, and ration allowance, but not "benefits" or expenses away from place of employment.

| Classification | Monthly Base Pay (Rupiah) Central Java | Outer Islands |
|---|---|---|
| General Foreman | 78,000 | 80,000 |
| Foreman | 68,000 | 70,000 |
| Skilled Worker, 1st Class | 48,000 | 49,000 |
| Skilled Worker, 2nd Class | 38,000 | 39,000 |
| Skilled Worker, Apprentice | 31,000 | 30,000 |
| Heavy Equipment Operator | 35,000 | 33,000 |
| Truck Driver | 34,000 | 32,000 |
| Pick-up or Car Driver | 31,000 | 29,000 |
| Laborer | 28,000 | 26,000 |

Article 4 of Regulation No. 9-1964 of the Minister of Labor defines wages as:

a. Wages paid in cash.
b. Cost of rations supplied free of charge.
c. Cost of housing furnished free of charge.
d. Cost of medical treatment etc. provided free of charge
e. Other allowances-viz. vacation, bonus, severance pay, etc.

These items have become standard compensation for workers and may be paid in cash or kind (limited to housing, food, etc.). Employers use various methods of application but most construction firms prefer, when possible, to pay items a, b, and c in cash. When the job site is too far from villages, camps are established and employees' monthly cash payments are reduced. The base rates in the above table will, however, cover costs to the employer using either method to compensate for rations and quarters.

Various regulations require payments for vacation, bonus, etc. based on length of service. For construction workers it is believed the following schedule of payment will satisfy requirements of

items d and e. These payments are proscribed by Law 1/1951 and Law 12/1964.

| | | |
|---|---|---|
| a. | Paid holidays | - 11 days/year |
| b. | Bonus (Lebaran) | - 1 month's salary/year |
| c. | Paid vacation | - 12 work days/year |
| d. | Social Security Fund | - 5% of monthly wage |
| e. | Termination pay | - 1 month's salary/year of service |

The above payments would be extra compensation for the average employee. These added costs must be reduced to working time rates for each employee. Labor regulations define a month as 173 hours of work with a normal work week of no more than 40 hours and no more than 7 hours each day (Law 1/1951). The law provides exceptions, but since for most exceptions overtime rates apply, only the normal work week is considered here.

Reducing these allowances to hourly working time rates:

| | | | |
|---|---|---|---|
| a. | Paid holidays | 11 X 7 = | 77 hours |
| b. | Bonus | | 173 hours |
| c. | Vacation | 12 X 7 = | 84 hours |
| d. | Terminal pay | | 173 hours |
| | Total Hours Pay not worked | = | 507 hours/year |

Total work hours in a year 12X173 = 2,076 hours.
Total productive hours in a year 2,076-77-84 = 1,915 hrs.

The percent of non-productive hours to productive hours, using $\frac{507}{1915}$ X 100 works out at 26.48%.

Adding the Social Security Fund contribution of 5% to the above ratio gives a 31.48% additional cost which must be added to the hourly rates, calculated using monthly rates in the table to arrive at true hourly labor costs.

When employees are required to work away from their home area, a per diem allowance is paid in cash or kind to each employee. On large-scale operations camps are usually established, with the employer providing at no cost to the employee satisfactory camp type lodgings and prepared food. Under camp conditions no per diem is paid in cash. It is to be understood that base rates of pay including housing and ration allowance continue at the same level when the employee is working away from his home area. Customs and practices for cash payment of per diem allow Rp 1,800 to Rp 2,500 per employee depending upon his work classification. These amounts

are to be used in this study for those employees who will be working away from their home areas.

3. Rate of Pay for Operating Personnel.

In calculating pay for operating personnel the above rates are used for the entire study, over the 15 year period. Office workers and clerical help are not shown in the above schedules, but they for the most part will be local people and wage rates will be paid accordingly. Since administrative and general expenses are calculated in this study on a fixed percentage of investment, small variations in office salaries will not appreciably affect this study.

TABLE 12. MANPOWER NEEDS FOR SYSTEM OPERATION

Construction Period:

At least one year before energization:

| Title | Number |
|---|---|
| General manager | 1 |
| Department heads: | |
| Office services | 1 |
| Consumer services | 1 |
| Engineering | 1 |
| Line department | 1 |
| Sub-department heads: | |
| Office services | 5 |
| Consumer services | 3 |
| Engineering | 3 |
| Line department | 2 |
| Total | 18 |

During the year prior to energization:

| | |
|---|---|
| Office services | 20 |
| Consumer services | 3 |
| Engineering | 9 |
| Line department | 36 |
| Total | 68 |

Add in following years, as needed:

| | Department | | | |
|---|---|---|---|---|
| Year | Office Services | Consumer Services | Engineering | Line |
| 1 (after energization) | 4 | 1 | 2 | 10 |
| 2 (after energization) | 2 | 1 | 2 | 4 |
| 3 (after energization) | 2 | 1 | 2 | 4 |

Total personnel at end of third full operating year - 121.

TABLE 13.

## COMPOSITE MANHOUR RATES-CONSTRUCTION

### TYPE OF CREW: RIGHT-OF-WAY CLEARING

LOCATION: CENTRAL JAVA

| CLASSIFICATION | NUMBER IN CREW. | AVERAGE MONTHLY RATE | AVERAGE HOURLY RATE COL.(3) ÷ 173. | BENEFITS / HOUR COL (4) X 31.48 %. | DAILY EXPENSE ALLOWANCE | EXPENSE ALLOWANCE PER WORK HOUR * | TOTAL COST/WORKHOUR COLS.(4)+(5)+(7). | TOTAL COST / CREW WORK HOUR COL. (2) X (8). |
|---|---|---|---|---|---|---|---|---|
| UNIT | EACH | Rp | Rp | Rp | Rp | Rp | Rp | Rp |
| (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) |
| General Foreman | 1/5 | 78,000 | 451 | 142 | - | - | 693 | 139 |
| Foreman | 1 | 68,000 | 393 | 124 | - | - | 517 | 517 |
| Lineman, 2nd Class | 1 | 38,000 | 220 | 69 | - | - | 289 | 289 |
| Truck Driver | 1 | 34,000 | 196 | 62 | - | - | 258 | 258 |
| Pickup Driver | 1/5 | 31,000 | 179 | 56 | - | - | 235 | 47 |
| Laborers | 40 | 28,000 | 162 | 51 | - | - | 213 | 8520 |
| LABOR TOTAL | $43^2/_5$ | | | | | | | 9770 |
| Trucks | 1 | 225,000 | 1301 | | | | 1301 | 1301 |
| Pickup Truck | 1/5 | 135,000 | 780 | | | | 780 | 156 |
| GRAND TOTAL | | | | | | | | 11227 |

| | | |
|---|---|---|
| * | EXPENSE ALLOWANCE / WORK HOUR = COLUMN (6) X 7 - 40 | |
| (10) | MANHOUR COST / WORK HOUR = GRAND TOTAL COL (9) ÷ LABOR TOTAL COL.(2). | Rp. 259 |
| (11) | AVERAGE NON-PRODUCTIVE TIME (TRAVEL TIME - WEATHER - ETC.) | 23 % |
| (12) | PRODUCTIVITY FACTOR | 1.40 |
| 13 | MANHOUR RATE / PRODUCTIVE HOUR = LINE (10) X LINE (12) X $\left[\frac{\text{LINE (11)}}{100} + 1\right]$ | Rp 446 |

# COMPOSITE MANHOUR RATES-CONSTRUCTION

## TYPE OF CREW: POLE SETTING

LOCATION: CENTRAL JAVA

| CLASSIFICATION | NUMBER IN CREW. | AVERAGE MONTHLY RATE | AVERAGE HOURLY RATE COL.(3) ÷ 173. | BENEFITS / HOUR COL. (4) X 31 48 %. | DAILY EXPENSE ALLOWANCE. | EXPENSE ALLOWANCE PER WORK HOUR * | TOTAL COST/WORK HOUR COLS. (4)+(5)+(7) | TOTAL COST / CREW WORK HOUR COL (2) X (8). |
|---|---|---|---|---|---|---|---|---|
| UNIT | EACH | Rp | Rp | Rp | Rp | Rp | Rp | Rp |
| (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) |
| General Foreman | 1/5 | 78,000 | 451 | 142 | - | - | 693 | 139 |
| Foreman | 2 | 68,000 | 393 | 124 | - | - | 517 | 1034 |
| Lineman, 2nd Class | 1 | 38,000 | 220 | 69 | - | - | 289 | 289 |
| Lineman, Apprentice | 2 | 31,000 | 179 | 56 | - | - | 235 | 470 |
| Truck Driver | 2 | 34,000 | 196 | 62 | - | - | 258 | 516 |
| Pickup Driver | 2 1/5 | 31,000 | 179 | 56 | - | - | 235 | 517 |
| Laborer | 20 | 28,000 | 162 | 51 | - | - | 213 | 4260 |
| LABOR TOTAL | 29 1/5 | | | | | | | 7225 |
| Trucks with pole dolly | 1 | 325,000 | 1879 | | | | 1879 | 1879 |
| Trucks with Winch | 1 | 295,000 | 1705 | | | | 1705 | 1705 |
| Pickup Trucks | 2 1/5 | 135,000 | 780 | | | | 780 | 1716 |
| GRAND TOTAL | | | | | | | | 12525 |

| | | |
|---|---|---|
| * | EXPENSE ALLOWANCE / WORK HOUR = COLUMN (6) X 7 - 40 | |
| (10) | MANHOUR COST / WORK HOUR = GRAND TOTAL COL (9) ÷ LABOR TOTAL COL (2). | Rp. 429 |
| (11) | AVERAGE NON-PRODUCTIVE TIME (TRAVEL TIME - WEATHER - ETC.) | 23 % |
| (12) | PRODUCTIVITY FACTOR | 1.40 |
| 13 | MANHOUR RATE / PRODUCTIVE HOUR = LINE (10) X LINE (12) X $\left[\frac{\text{LINE (11)}}{100} + 1\right]$ | Rp 739 |

# COMPOSITE MANHOUR RATES-CONSTRUCTION

TYPE OF CREW: GUY & FRAMING

LOCATION: CENTRAL JAVA

| CLASSIFICATION | NUMBER IN CREW. | AVERAGE MONTHLY RATE | AVERAGE HOURLY RATE COL.(3) ÷ 173. | BENEFITS / HOUR COL (4) X 31.48 %. | DAILY EXPENSE ALLOWANCE | EXPENSE ALLOWANCE PER WORK HOUR * | TOTAL COST/WORK HOUR COLS. (4)+(5)+(7). | TOTAL COST / CREW WORK HOUR COL (2) X (8). |
|---|---|---|---|---|---|---|---|---|
| UNIT | EACH | Rp | Rp | Rp | Rp | Rp | Rp | Rp |
| (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) |
| General Foreman | 1/5 | 78,000 | 451 | 142 | - | - | 693 | 139 |
| Foreman | 1 | 68,000 | 393 | 124 | - | - | 517 | 517 |
| Lineman, 1st Class | 2 | 48,000 | 277 | 87 | - | - | 364 | 728 |
| Lineman, 2nd Class | 1 | 38,000 | 220 | 69 | - | - | 289 | 289 |
| Lineman, Apprentice | 3 | 31,000 | 179 | 56 | - | - | 235 | 705 |
| Truck Driver | 1 | 34,000 | 196 | 62 | - | - | 258 | 258 |
| Pickup Driver | 1/5 | 31,000 | 179 | 56 | - | - | 235 | 47 |
| LABOR TOTAL | 8 2/5 | | | | | | | 2683 |
| Trucks | 1 | 225,000 | 1301 | | | | 1301 | 1301 |
| Pickup Trucks | 1/5 | 135,000 | 780 | | | | 780 | 156 |
| GRAND TOTAL | | | | | | | | 4140 |

| | | |
|---|---|---|
| * | EXPENSE ALLOWANCE / WORK HOUR = COLUMN (6) X 7 - 40 | |
| (10) | MANHOUR COST / WORK HOUR = GRAND TOTAL COL (9) ÷ LABOR TOTAL COL (2) | Rp 493 |
| (11) | AVERAGE NON-PRODUCTIVE TIME (TRAVEL TIME - WEATHER - ETC) | 23 % |
| (12) | PRODUCTIVITY FACTOR | 1.40 |
| 13 | MANHOUR RATE / PRODUCTIVE HOUR = LINE (10) X LINE (12) X $\left[\frac{\text{LINE (11)}}{100} + 1\right]$ | Rp 849 |

# COMPOSITE MANHOUR RATES-CONSTRUCTION

TYPE OF CREW: CONDUCTOR STRINGING, SAGGING & CLIPPING

LOCATION. CENTRAL JAVA

| CLASSIFICATION | NUMBER IN CREW. | AVERAGE MONTHLY RATE | AVERAGE HOURLY RATE COL.(3) ÷ 173. | BENEFITS / HOUR COL.(4) X 31.48 %. | DAILY EXPENSE ALLOWANCE. | EXPENSE ALLOWANCE PER WORK HOUR * | TOTAL COST/WORK HOUR COLS.(4)+(5)+(7). | TOTAL COST / CREW WORK HOUR COL (2) X (8). |
|---|---|---|---|---|---|---|---|---|
| UNIT | EACH | Rp | Rp | Rp | Rp | Rp | Rp | Rp |
| (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) |
| General Foreman | 1/5 | 78,000 | 451 | 142 | - | - | 693 | 139 |
| Foreman | 2 | 68,000 | 393 | 124 | - | - | 517 | 1034 |
| Lineman, 1st Class | 5 | 48,000 | 277 | 87 | - | - | 364 | 1820 |
| Lineman, 2nd Class | 6 | 38,000 | 220 | 69 | - | - | 289 | 1734 |
| Lineman, Apprentice | 11 | 31,000 | 179 | 56 | - | - | 235 | 2585 |
| Truck Driver | 4 | 34,000 | 196 | 62 | - | - | 258 | 1032 |
| Pickup Driver | 3 1/5 | 31,000 | 179 | 56 | - | - | 235 | 752 |
| Laborer | 10 | 28,000 | 162 | 51 | - | - | 213 | 2130 |
| LABOR TOTAL | 41 2/5 | | | | | | | 11226 |
| Trucks with Winch | 1 | 295,000 | 1705 | | | | 1705 | 1705 |
| Trucks | 3 | 225,000 | 1301 | | | | 1301 | 3903 |
| Pickup Trucks | 3 1/5 | 135,000 | 780 | | | | 780 | 2496 |
| GRAND TOTAL | | | | | | | | 19330 |

| | | |
|---|---|---|
| * | EXPENSE ALLOWANCE / WORK HOUR = COLUMN (6) X 7 - 40 | |
| (10) | MANHOUR COST / WORK HOUR = GRAND TOTAL COL.(9) ÷ LABOR TOTAL COL (2). | Rp 467 |
| (11) | AVERAGE NON-PRODUCTIVE TIME (TRAVEL TIME - WEATHER - ETC) | 23 % |
| (12) | PRODUCTIVITY FACTOR | 1.40 |
| 13 | MANHOUR RATE / PRODUCTIVE HOUR = LINE (10) X LINE (12) X $\left[\frac{\text{LINE (11)}}{100} + 1\right]$ | Rp 804 |

# COMPOSITE MANHOUR RATES-CONSTRUCTION

TYPE OF CREW: TRANSFORMER, REGULATORS, & SECTIONALIZING INSTALLATIONS

LOCATION: CENTRAL JAVA

| CLASSIFICATION | NUMBER IN CREW. | AVERAGE MONTHLY RATE | AVERAGE HOURLY RATE COL (3) ÷ 173. | BENEFITS / HOUR COL. (4) X 31.48 % | DAILY EXPENSE ALLOWANCE. | EXPENSE ALLOWANCE PER WORK HOUR * | TOTAL COST/WORK HOUR COLS. (4)+(5)+(7) | TOTAL COST / CREW WORK HOUR COL (2) X (8). |
|---|---|---|---|---|---|---|---|---|
| UNIT | EACH | Rp | Rp | Rp | Rp | Rp | Rp | Rp |
| (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) |
| General Foreman | 1/5 | 78,000 | 451 | 142 | - | - | 693 | 139 |
| Foreman | 1 | 68,000 | 393 | 124 | - | - | 517 | 517 |
| Lineman, 1st Class | 4 | 48,000 | 277 | 87 | - | - | 364 | 1456 |
| Lineman, Apprentice | 6 | 31,000 | 179 | 56 | - | - | 235 | 1410 |
| Truck Driver | 2 | 34,000 | 196 | 62 | - | - | 258 | 516 |
| Pickup Driver | 1/5 | 31,000 | 179 | 56 | - | - | 235 | 47 |
| LABOR TOTAL | 13 2/5 | | | | | | | 4085 |
| Trucks | 1 | 225,000 | 1301 | | | | 1301 | 1301 |
| Truck with Winchs | 1 | 295,000 | 1705 | | | | 1705 | 1705 |
| Pickup Trucks | 1/5 | 135,000 | 780 | | | | 780 | 156 |
| GRAND TOTAL | | | | | | | | 7247 |

| | | |
|---|---|---|
| * | EXPENSE ALLOWANCE / WORK HOUR = COLUMN (6) X 7 - 40 | |
| (10) | MANHOUR COST / WORK HOUR = GRAND TOTAL COL (9) ÷ LABOR TOTAL COL (2). | Rp 541 |
| (11) | AVERAGE NON-PRODUCTIVE TIME (TRAVEL TIME - WEATHER - ETC.) | 23 % |
| (12) | PRODUCTIVITY FACTOR | 1.40 |
| 13 | MANHOUR RATE / PRODUCTIVE HOUR = LINE (10) X LINE (12) X $\left[\frac{\text{LINE (11)}}{100} + 1\right]$ | Rp 932 |

# COMPOSITE MANHOUR RATES-CONSTRUCTION

## TYPE OF CREW: METER & : SERVICE INSTALLATION

LOCATION: CENTRAL JAVA

| CLASSIFICATION | NUMBER IN CREW. | AVERAGE MONTHLY RATE | AVERAGE HOURLY RATE COL.(3) ÷ 173. | BENEFITS / HOUR COL.(4) X 31.48 %. | DAILY EXPENSE ALLOWANCE. | EXPENSE ALLOWANCE PER WORK HOUR * | TOTAL COST/WORK HOUR COLS.(4)+(5)+(7). | TOTAL COST / CREW WORK HOUR COL (2) X (8). |
|---|---|---|---|---|---|---|---|---|
| UNIT | EACH | Rp | Rp | Rp | Rp | Rp | Rp | Rp |
| (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) |
| Lineman, 1st Class | 2 | 48,000 | 277 | 87 | - | - | 364 | 728 |
| Lineman, Apprentice | 2 | 31,000 | 179 | 56 | - | - | 235 | 470 |
| Pickup Driver | 1 | 31,000 | 179 | 56 | - | - | 235 | 235 |
| LABOR TOTAL | 5 | | | | | | | 1433 |
| Pickup Trucks | 1 | 135,000 | 780 | | | | 780 | 780 |
| GRAND TOTAL | | | | | | | | 2213 |

| | | |
|---|---|---|
| * | EXPENSE ALLOWANCE / WORK HOUR = COLUMN (6) X 7 - 40 | |
| (10) | MANHOUR COST / WORK HOUR = GRAND TOTAL COL (9) ÷ LABOR TOTAL COL.(2) | Rp 443 |
| (11) | AVERAGE NON-PRODUCTIVE TIME (TRAVEL TIME - WEATHER - ETC.) | 35 % |
| (12) | PRODUCTIVITY FACTOR | 1.40 |
| 13 | MANHOUR RATE / PRODUCTIVE HOUR = LINE (10) X LINE (12) X $\left[\frac{\text{LINE (11)}}{100} + 1\right]$ | Rp 837 |

# ANNEX C

TABLE 14.
UNIT COSTS - MID 1977

SHEET 1 OF 6

LOCATION - CENTRAL JAVA

| UNIT DESIGNATION | DESCRIPTION | MATERIAL - INDONESIAN WHSE | | | LABOR | | | JOB EXPENSE | TOTAL INSTALLED COST | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | RUPIAH | US $ | EQUIVALENT US $ | MAN HOURS | RATE RUPIAH | EXTENSION RUPIAH | RUPIAH | RUPIAH | US $ | EQUIVALENT US $ |
| (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) | (10) | (11) | (12) |
| VA1 | Prim Supt, 10-0°-5° Ang | 249 | 14.60 | 15.20 | 1.5 | 849 | 1274 | 758 | 2281 | 14.60 | 20.10 |
| VA1A | Prim Supt, 10-Offset Neu 0°-5° Ang | 338 | 20.54 | 21.35 | 1.5 | 849 | 1274 | 1014 | 2626 | 20.54 | 26.87 |
| VA1-1 | Prim Dble Supt, 10-0°-5° Ang | 541 | 31.67 | 32.97 | 2.0 | 849 | 1698 | 1536 | 3777 | 31.67 | 40.77 |
| VA1-1A | Prim Dble Supt, 10-Offset Neu. 0°-5° Ang | 630 | 37.61 | 39.13 | 2.0 | 849 | 1698 | 1794 | 4122 | 37.61 | 47.54 |
| VA1-2 | Prim & Neu Dble Supt, 10-0°-5° Ang | 648 | 37.11 | 38.67 | 2.1 | 849 | 1783 | 1783 | 4214 | 37.11 | 47.26 |
| VA2 | Prim Dble Supt, 10-5°-30° Ang | 584 | 33.56 | 34.97 | 2.0 | 849 | 1698 | 1621 | 3903 | 33.56 | 42.96 |
| VA2-3 | Prim&Neu Dble Supt 10-5°-30° | 680 | 38.21 | 39.55 | 2.1 | 849 | 1783 | 1832 | 4295 | 38.21 | 48.56 |
| VA3 | Prim Supt, 10-30°-60° Ang | 484 | 27.79 | 28.96 | 1.5 | 849 | 1274 | 1329 | 3087 | 27.79 | 35.23 |
| VA4 | Prim Supt, 10-60°-90° Ang | 1025 | 61.62 | 64.09 | 3.0 | 849 | 2547 | 2914 | 6486 | 61.62 | 77.25 |
| VA5 | Prim Dead End, 10 | 510 | 29.84 | 31.07 | 1.5 | 849 | 1274 | 1417 | 3201 | 29.84 | 37.55 |
| VA5-1 | Prim Tap, 10 | 518 | 32.38 | 33.63 | 2.0 | 849 | 1698 | 1565 | 3781 | 32.38 | 41.49 |
| VA5-2 | Prim Tap, 10 | 557 | 35.79 | 37.13 | 2.0 | 849 | 1698 | 1711 | 3966 | 35.79 | 45.35 |
| VA5-2A | Prim Tap, 10 | 526 | 34.18 | 33.45 | 2.0 | 849 | 1698 | 1641 | 3865 | 34.18 | 43.49 |
| VA5-3 | Prim Tap, 10 | 456 | 31.55 | 32.73 | 2.0 | 849 | 1698 | 1528 | 3714 | 31.55 | 40.50 |
| VA5-4 | Prim Tap, 10 | 706 | 44.88 | 46.58 | 2.2 | 849 | 1868 | 2120 | 4694 | 44.88 | 56.19 |
| VA6 | Prim Dble Dead End, 10 | 1000 | 60.29 | 62.70 | 3.0 | 849 | 2547 | 2883 | 6430 | 60.29 | 75.78 |
| | | | | | | | | | | | |
| VB1 | Prim Supt, "V" 0-0°-5° Ang | 4325 | 33.42 | 43.85 | 3.0 | 849 | 2547 | 2074 | 8949 | 33.42 | 54.98 |
| VB1A | Prim Supt, "V" 0-Offset Neu 0°-5° Ang | 4418 | 39.43 | 50.07 | 3.0 | 849 | 2547 | 2333 | 9298 | 39.43 | 61.83 |
| VB1-1 | Prim Dble Supt, "V" 0-0°-5° Ang | 8716 | 68.14 | 89.14 | 4.1 | 849 | 3481 | 4048 | 16245 | 68.14 | 107.28 |
| VB1-1A | Prim Dble Supt, "V" 0 Offset Neu 0°-5° | 8806 | 74.07 | 95.29 | 4.1 | 849 | 3481 | 4303 | 16590 | 74.07 | 114.05 |
| VB2 | Prim Dble Supt, "V" 0 5°-30° | 5774 | 69.90 | 91.04 | 4.1 | 849 | 3481 | 4126 | 16381 | 69.90 | 109.37 |
| VB3 | Prim Supt, "V" 0 30°-60° Ang | 859 | 51.04 | 53.18 | 3.2 | 849 | 2717 | 2479 | 6085 | 51.04 | 65.70 |
| VB4-1 | Prim Supt, "V" 0 60°-90° Ang | 1944 | 121.51 | 126.19 | 7.0 | 849 | 5943 | 5831 | 13718 | 121.51 | 154.57 |
| VB5-1 | Prim Dead End "V" 0 | 970 | 57.59 | 59.93 | 3.8 | 849 | 3226 | 2810 | 7006 | 57.59 | 74.47 |
| | | | | | | | | | | | |
| VC1 | Prim Supt, 30 0°-5° Ang | 4099 | 48.83 | 55.71 | 4.0 | 849 | 3396 | 2652 | 10147 | 45.83 | 70.28 |
| VC1-A | Prim Supt, 30 Offset Neu 0°-5° Ang | 4169 | 51.76 | 61.55 | 4.0 | 849 | 3396 | 2907 | 10492 | 51.76 | 77.04 |
| VC1-1 | Prim Dble Supt, 30 0°-5° Ang | 5340 | 97.58 | 117.68 | 5.1 | 849 | 4330 | 5316 | 17986 | 97.58 | 140.92 |
| VC1-1A | Prim Dble Supt, 30 Offset Neu 0°-5° | 6430 | 103.51 | 123.52 | 5.1 | 849 | 4330 | 5572 | 18332 | 103.51 | 147.68 |
| VC1-2 | Prim Supt, 30 Large Cond 0°-2° Ang | 4702 | 57.15 | 68.48 | 4.3 | 849 | 3651 | 3208 | 11561 | 57.15 | 85.01 |
| VC1-3 | Prim Dble Supt, 30 Large Cond 0°-5° Ang | 9512 | 118.25 | 141.17 | 5.4 | 849 | 4585 | 6317 | 20414 | 118.25 | 167.44 |
| VC1-4 | Prim Supt, 30 Large Cond 0°-5° Angle | 5072 | 75.84 | 85.06 | 4.3 | 849 | 3651 | 4020 | 12743 | 75.84 | 106.55 |
| VC2 | Prim Dble Supt, 30 5°-30° Ang | 8419 | 100.67 | 121.16 | 5.1 | 849 | 4330 | 5461 | 18210 | 100.87 | 144.75 |
| VC2-1 | Prim Dble Supt, 30 5°-30° Ang | 9552 | 99.67 | 121.96 | 5.3 | 849 | 4500 | 5542 | 19594 | 99.67 | 146.58 |
| VC2-2 | Prim Dble Supt, 30 5°-30° Ang | 9489 | 122.54 | 145.71 | 5.3 | 849 | 4500 | 6497 | 20486 | 122.84 | 172.20 |

# UNIT COSTS - MID 1977

SHEET 2 OF 6

LOCATION - CENTRAL JAVA

| UNIT DESIGNATION | DESCRIPTION | MATERIAL - INDONESIAN WISE | | | LABOR | | | JOB EXPENSE | TOTAL INSTALLED COST | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | RUPIAH | US $ | EQUIVALENT US $ | MAN HOURS | RATE RUPIAH | EXTENSION RUPIAH | RUPIAH | RUPIAH | US $ | EQUIVALENT US $ |
| (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) | (10) | (11) | (12) |
| VC3 | Primary Support, 30 30°-60° Angle | 1301 | 76.89 | 80.02 | 4.2 | 849 | 3566 | 3678 | 8545 | 76.89 | 97.48 |
| VC3-L | Prim Supt, 30 30°-60° Angle Large Cond | 1490 | 109.12 | 112.71 | 4.8 | 849 | 4075 | 5065 | 10650 | 109.12 | 134.78 |
| VC3-1 | Prim Supt, 30 Vertical 10°-20° Ang | 1665 | 118.33 | 122.34 | 6.4 | 849 | 5434 | 5621 | 12720 | 118.33 | 148.98 |
| VC4-1 | Prim Supt, 30 Vertical Const 60°-90° Ang | 2562 | 174.58 | 181.46 | 8.0 | 849 | 6792 | 8211 | 17665 | 174.58 | 217.63 |
| VC4-1L | Prim Supt, 30 Vert Const 60°-90° Angle | 3015 | 225.87 | 233.14 | 8.5 | 849 | 7217 | 10397 | 20629 | 225.87 | 275.58 |
| VC5-1 | Prim Supt, 30 Vert Const D.E. | 1384 | 82.74 | 85.81 | 4.8 | 849 | 4075 | 3980 | 9439 | 82.74 | 105.48 |
| VC5-1L | Prim Supt, 30 Vert Const D.E | 1503 | 111.39 | 115.01 | 5.0 | 849 | 4245 | 5198 | 10946 | 111.39 | 137.77 |
| VC7 | Prim Supt, 30 Single D.E. X-Arm | 8343 | 98.15 | 116.25 | 7.0 | 849 | 5943 | 5502 | 19788 | 98.15 | 145.83 |
| VC7-1 | Prim Supt, 30 Single D.E.X-Arm | 11702 | 98.15 | 126.35 | 7.3 | 849 | 6198 | 5863 | 23763 | 98.15 | 155.41 |
| VC8 | Prim Supt, 30 Double D.E.X-Arm | 9775 | 183.10 | 206.62 | 8.4 | 849 | 7132 | 9289 | 26196 | 183.10 | 246.27 |
| VC8-2 | Prim Supt, 30 Double D.E.X-Arm | 10819 | 196.38 | 222.45 | 8.4 | 849 | 7132 | 9945 | 27896 | 196.38 | 263.60 |
| | | | | | | | | | | | |
| VE1-1 | Down guy-thru Bolt Type - ½" | 218 | 13.16 | 13.69 | 3.1 | 849 | 2632 | 831 | 3681 | 13.16 | 22.03 |
| VE1-2 | Down guy-thru Bolt Type - 3/8" | 366 | 17.72 | 18.60 | 3.4 | 849 | 2887 | 1061 | 4314 | 17.72 | 28.12 |
| VE1-3 | Down guy-thru Bolt Type - 7/16" | 546 | 22.45 | 23.77 | 3.7 | 849 | 3141 | 1300 | 4987 | 22.45 | 34.47 |
| E2-1 | Overhead Guy - ½" | 264 | 17.00 | 17.64 | 4.4 | 849 | 3736 | 1106 | 5106 | 17.00 | 29.30 |
| E2-2 | Overhead Guy - 3/8" | 454 | 22.95 | 24.04 | 4.7 | 849 | 3990 | 1397 | 5841 | 22.95 | 37.02 |
| E2-3 | Overhead Guy - 7/16" | 669 | 28.31 | 29.92 | 5.0 | 849 | 4245 | 1666 | 6579 | 28.31 | 44.16 |
| E3-2 | Down Guy-Wrapped Type-3/8" | 399 | 19.29 | 20.25 | 3.8 | 849 | 3226 | 1163 | 4788 | 19.29 | 30.83 |
| E3-3 | Down Guy-Wrapped Type-7/16" | 570 | 23.62 | 24.99 | 4.1 | 849 | 3481 | 1385 | 5436 | 23.62 | 36.72 |
| E3-10 | Guy Guard | 42 | 5.06 | 5.16 | 0.5 | 849 | 425 | 257 | 724 | 5.06 | 6.80 |
| E4-2 | Overhead Guy-Wrapped Type-3/8" | 470 | 23.07 | 24.20 | 4.9 | 849 | 4160 | 1420 | 6050 | 23.07 | 37.65 |
| E4-3 | Overhead Guy-Wrapped Type-7/16" | 684 | 28.43 | 30.08 | 5.2 | 849 | 4415 | 1690 | 6789 | 28.43 | 44.79 |
| VE5-1 | D.E.Guys X-Arm Const ½" | 541 | 47.80 | 49.63 | 12.0 | 849 | 10188 | 3087 | 14116 | 47.80 | 81.81 |
| VE5-2 | D E Guys X-Arm Const 3/8" | 1395 | 64.96 | 68.32 | 14.0 | 849 | 11886 | 4024 | 17305 | 64.96 | 106.66 |
| VE7-2L | D.E.Guys-Vert Const 3/8" | 1120 | 52.67 | 55.37 | 11.4 | 849 | 9679 | 3266 | 14065 | 52.67 | 86.56 |
| VE7-3L | D.E.Guys-Vert Const 7/16" | 1630 | 64.98 | 68.91 | 12.3 | 849 | 10443 | 3901 | 15974 | 64.98 | 103.47 |
| | | | | | | | | | | | |
| F1-1 | Anchor-Expanding-6000 pound | 223 | 11.58 | 12.12 | 4.0 | 739 | 2956 | 799 | 3978 | 11.58 | 21.17 |
| F1-2 | Anchor-Expanding-8000 pound | 223 | 11.58 | 12.12 | 4.0 | 739 | 2956 | 799 | 3978 | 11.58 | 21.17 |
| F1-3 | Anchor-Expanding-10000 pound | 307 | 15.09 | 15.83 | 4.2 | 739 | 3104 | 957 | 4368 | 15.09 | 25.62 |
| F1-4 | Anchor-Expanding-12000 pound | 307 | 15.09 | 15.83 | 4.2 | 739 | 3104 | 957 | 4368 | 15.09 | 25.62 |
| F2-4 | Anchor-Log Type- 16000 pound | 6457 | 16.13 | 31.69 | 10.0 | 739 | 7390 | 2054 | 15901 | 16.13 | 54.45 |
| F5-1 | Anchor-Rock Type | 99 | 4.32 | 4.56 | 8.0 | 739 | 5912 | 780 | 6791 | 4.32 | 20.68 |
| F6-1 | Anchor-Swamp Type-6000 pound | 3312 | 26.14 | 34.12 | 6.0 | 739 | 4434 | 1859 | 9605 | 26.14 | 49.26 |
| F6-2 | Anchor-Swamp Type-9000 pound | 4406 | 43.46 | 54.05 | 6.5 | 739 | 4804 | 2725 | 11935 | 43.46 | 72.22 |

# UNIT COSTS - MID 1977

SHEET 3 OF 6

LOCATION CENTRAL JAVA

| UNIT DESIGNATION | DESCRIPTION | MATERIAL - INDONESIAN W/HSE RUPIAH | US $ | EQUIVALENT US $ | LABOR MAN HOURS | RATE RUPIAH | EXTENSION RUPIAH | JOB EXPENSE RUPIAH | TOTAL INSTALLED COST RUPIAH | US $ | EQUIVALENT US $ |
|---|---|---|---|---|---|---|---|---|---|---|---|
| (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) | (10) | (11) | (12) |
| VG-105, | VG106 or VG 136 1Ø Transformer | | | | | | | | | | |
| -10 | CSP Type | 4677 | 487.58 | 498.85 | 8.0 | 932 | 7456 | 6434 | 18567 | 487.58 | 532.32 |
| -15 | CSP Type | 4804 | 505.59 | 517.17 | 9.0 | 932 | 8388 | 6690 | 19882 | 505.59 | 533.50 |
| -25 | CSP Type | 6622 | 603.41 | 619.35 | 12.0 | 932 | 11184 | 8047 | 25853 | 603.41 | 665.71 |
| -37.5 | CSP Type | 8703 | 802.22 | 828.19 | 15.0 | 932 | 13950 | 10668 | 33351 | 802.22 | 882.58 |
| -50 | CSP Type | 10481 | 888.85 | 914.11 | 20.0 | 932 | 18640 | 11940 | 41061 | 888.85 | 987.79 |
| VG-312 | Three 1Ø Transformer Cluster Htg | | | | | | | | | | |
| -15 | CSP Type | 22672 | 1700.16 | 1754.80 | 30.0 | 932 | 27960 | 22686 | 73318 | 1700.16 | 1876.83 |
| -25 | CSP Type | 28126 | 1993.62 | 2061.40 | 40.0 | 932 | 37280 | 26783 | 92189 | 1993.62 | 2215.76 |
| -37.5 | CSP Type | 34369 | 2590.05 | 2672.86 | 50.0 | 932 | 46600 | 34675 | 115644 | 2590.05 | 2868.71 |
| -50 | CSP Type | 39703 | 2849.94 | 2945.61 | 60.0 | 932 | 55920 | 38680 | 134303 | 2849.94 | 3173.56 |
| | | | | | | | | | | | |
| J5 | Secondary Assembly, 0°-3° Angle | 41 | 2.46 | 2.56 | 0.7 | 849 | 594 | 166 | 801 | 2.46 | 4.39 |
| J6 | Secondary D.E. Assembly | 90 | 5.81 | 6.03 | 1.3 | 849 | 1104 | 361 | 1555 | 5.81 | 9.56 |
| J7 | Secondary Assembly, 30°-60° Angle | 58 | 3.14 | 3.28 | 0.7 | 849 | 594 | 196 | 848 | 3.14 | 5.18 |
| J8 | Neutral Assembly, 0°-3° Angle | 40 | 2.23 | 2.33 | 0.7 | 849 | 594 | 156 | 790 | 2.23 | 4.13 |
| J10 | Secondary Assembly, Fixed, 5°-60° Angle | 67 | 3.22 | 3.38 | 0.7 | 849 | 594 | 200 | 816 | 3.22 | 5.30 |
| J12 | Secondary Assembly, Transf Bracket | 21 | 1.76 | 1.81 | 0.1 | 849 | 85 | 84 | 190 | 1.76 | 2.22 |
| | | | | | | | | | | | |
| | SERVICE ASSEMBLIES | | | | | | | | | | |
| K10C | Multiplex Cable-House End | 33 | 2.96 | 3.04 | 1.0 | 837 | 837 | 210 | 1080 | 2.96 | 5.56 |
| K10L | Single Conductor-House End | 28 | 4.12 | 4.19 | 0.3 | 837 | 251 | 199 | 478 | 4.12 | 5.27 |
| K11C | Multiplex Cable-Pole End | 82 | 6.81 | 7.01 | 1.2 | 837 | 1004 | 391 | 1477 | 6.81 | 10.37 |
| K14C | Multiplex Cable-Pole End | 94 | 6.81 | 7.04 | 1.2 | 837 | 1004 | 392 | 1490 | 6.81 | 10.40 |
| K14L | Single Cond-Pole End | 57 | 5.60 | 5.74 | 1.0 | 837 | 836 | 322 | 1215 | 5.60 | 8.53 |
| K15C | Multiplex Cable-Pole End | 29 | 4.43 | 4.50 | 0.3 | 837 | 251 | 212 | 492 | 4.43 | 5.62 |
| K16C | Multiplex Cable-House End-Cond Stem | 80 | 6.25 | 6.44 | 1.2 | 837 | 1004 | 368 | 1452 | 6.25 | 9.75 |
| K17L | Single Cond-House End Conduit Stem | 38 | 5.82 | 5.91 | 0.5 | 837 | 419 | 287 | 744 | 5.82 | 7.61 |
| | | | | | | | | | | | |
| VM2-11 | Grounding Assembly-Grd Rod Type | 216 | 15.32 | 15.84 | 3.0 | 849 | 2547 | 912 | 3675 | 15.32 | 24.18 |
| VM2-12A | Butt Wrapped Ground | 133 | 12.71 | 13.03 | 1.5 | 849 | 1274 | 668 | 2075 | 12.71 | 17.71 |
| VM2-12AZ | Butt Ground, Plate Type | 131 | 11.82 | 12.14 | 1.7 | 849 | 1443 | 648 | 2222 | 11.82 | 17.17 |
| M2-15 | Grounding Assy Platform Type for ABS | 24636 | 23.52 | 82.63 | 10.0 | 932 | 9320 | 4372 | 38328 | 23.52 | 115.88 |

# UNIT COSTS - MID 1977

SHEET 4 OF 6

LOCATION CENTRAL JAVA

| UNIT DESIGNATION | DESCRIPTION | MATERIAL - INDONESIAN WHSE | | | LABOR | | | JOB EXPENSE | TOTAL INSTALLED COST | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | RUPIAH | US $ | EQUIVALENT US $ | MAN HOURS | RATE RUPIAH | EXTENSION RUPIAH | RUPIAH | RUPIAH | US $ | EQUIVALENT US $ |
| (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) | (10) | (11) | (12) |
| VM3-4 | Sectionalizing Fuse Cut-out-10 | 505 | 61.86 | 63.08 | 7.0 | 932 | 6524 | 3270 | 10299 | 61.86 | 86.68 |
| VM3-10A | Sectionalizing OCR-10 | 3114 | 851.68 | 859.18 | 12.0 | 932 | 11184 | 11032 | 25330 | 851.68 | 912.72 |
| VM3-16 | Air Break Switch -30 | 20011 | 1304 | 1352 | 60.0 | 932 | 55920 | 18513 | 94444 | 1304 | 1532 |
| VM3-20 | Sectionalizing OCR-30-Cross Arm Mtg | 26485 | 2492 | 2556 | 40.0 | 932 | 37280 | 32938 | 96703 | 2492 | 2725 |
| VM3-20A | Sectionalizing OCR-30-Cluster Mtg | 9679 | 2593 | 2616 | 35.0 | 932 | 32620 | 33552 | 75850 | 2593 | 2776 |
| VM3-23 | Sectionalizing OCR-10-W/By Pass Sw | 10819 | 984 | 1010 | 15.0 | 932 | 13950 | 12995 | 37794 | 984 | 1075 |
| VM3-25 | Sectionalizing OCR-30-W/By Pass Sws | 35801 | 2974 | 3060 | 50.0 | 932 | 46600 | 39498 | 121899 | 2974 | 3268 |
| | | | | | | | | | | | |
| VM7 | VOLTAGE REGULATOR-STEP TYPE 10 | | | | | | | | | | |
| -1 | 1 X 50 Amp | 65412 | 6340 | 6496 | 100 | 932 | 93200 | 83691 | 242303 | 6340 | 6924 |
| -3 | 3 X 50 Amp | 178522 | 18976 | 19406 | 250 | 932 | 233000 | 248597 | 660119 | 18976 | 20567 |
| -3 | 3 X 100 Amp | 199528 | 22903 | 23394 | 300 | 932 | 279600 | 299516 | 778644 | 22903 | 24779 |
| -3 | 3 X 200 Amp | 247324 | 30506 | 31102 | 350 | 932 | 326200 | 397005 | 970529 | 30506 | 32845 |
| | | | | | | | | | | | |
| - | Security or Street Light-175W Merc. | 856 | 78.38 | 80.44 | 5.2 | 932 | 4846 | 3823 | 9525 | 78.38 | 101.33 |
| | | | | | | | | | | | |
| - | REVENUE METERS -50 HERTZ | | | | | | | | | | |
| - | 10-2W-10 Amp-240 Volt-Bottom Conn | 77 | 6.93 | 7.12 | 1.5 | 837 | 1256 | 421 | 1754 | 6.93 | 11.16 |
| - | 10-2W-15 Amp-240 Volt- Socket Type | 104 | 34.45 | 34.70 | 1.5 | 837 | 1256 | 1566 | 2926 | 34.45 | 41.50 |
| - | 10-3W-30 Amp-240/480Volt-SocketType | 104 | 28.86 | 29.11 | 1.8 | 837 | 1507 | 1359 | 2970 | 28.86 | 36.02 |
| - | 30-4W-30 Amp-240/415Volt-SocketType | 251 | 132.26 | 132.86 | 4.0 | 837 | 3348 | 5845 | 9408 | 132.26 | 154.93 |
| - | 30-4W-2.5Amp-240/415V.W/3 CTS. | 3207 | 218.58 | 226.31 | 22.0 | 837 | 18414 | 11233 | 32854 | 218.58 | 297.75 |
| - | 10-3W-2.5Amp-240/480V.W/2 CTS. | 2136 | 94.29 | 94.44 | 20.0 | 837 | 16740 | 5801 | 24677 | 94.29 | 153.75 |
| | | | | | | | | | | | |
| - | ACSR CONDUCTOR, BARE - KILOMETERS | | | | | | | | | | |
| PENGUIN | # 4/0-6/1 Stranding | 14389 | 717.58 | 752.25 | 50.0 | 804 | 40200 | 33810 | 88399 | 717.58 | 930.59 |
| PIGEON | # 3/0-6/1 " | 11411 | 574.78 | 602.28 | 48.0 | 804 | 38592 | 28854 | 78857 | 574.78 | 764.80 |
| QUAIL | # 2/0-6/1 " | 9903 | 466.44 | 490.30 | 45.0 | 804 | 36180 | 23966 | 70049 | 466.44 | 635.23 |
| RAVEN | # 1/ -6/1 " | 7215 | 369.96 | 387.35 | 40.0 | 804 | 32160 | 19291 | 58666 | 369.96 | 511.32 |
| SPARROW | # 2-6/1 " | 6834 | 235.72 | 252.19 | 35.0 | 804 | 28140 | 12380 | 48257 | 235.72 | 352.00 |
| SWAN | # 4-6/1 " | 3002 | 157.14 | 164.37 | 30.0 | 804 | 24120 | 9234 | 36356 | 157.14 | 244.75 |
| TURKEY | # 6-6/1 " | 1956 | 107.59 | 112.30 | 28.0 | 804 | 22512 | 6912 | 31380 | 107.59 | 183.20 |

ANNEX C. UNIT COST ASSEMBLIES

# UNIT COSTS - MID 1977

SHEET 5 OF 6

LOCATION CENTRAL JAVA

| UNIT DESIGNATION | DESCRIPTION | MATERIAL - INDONESIAN WHSE | | | LABOR | | | JOB EXPENSE | TOTAL INSTALLED COST | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | RUPIAH | US $ | EQUIVALENT US $ | MAN HOURS | RATE RUPIAH | EXTENSION RUPIAH | RUPIAH | RUPIAH | US $ | EQUIVALENT US $ |
| (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) | (10) | (11) | (12) |
| | ALL ALUMINUM COND BARE - KILOMETERS | | | | | | | | | | |
| COSMOS | 477 MCM-Strand | 22096 | 1288 | 1341 | 70.0 | 804 | 56280 | 61280 | 139656 | 1288 | 1624.52 |
| OXLIP | #4/0 - 19 Strand | 10226 | 571.20 | 595.84 | 45.0 | 804 | 36180 | 28345 | 74751 | 571.20 | 751.32 |
| | 6201 ALUM ALLOY COND BARE-KILOMETERS | | | | | | | | | | |
| AZUZA | #1/0 Equiv - 7 Strand | 6348 | 366.96 | 382.26 | 38.0 | 804 | 30552 | 18919 | 55819 | 366.96 | 501.46 |
| AMES | #2 Equiv - 7 Strand | 3960 | 230.95 | 240.4 | 33.0 | 804 | 26532 | 12634 | 43126 | 230.95 | 334.87 |
| ALTON | #4 Equiv - 7 Strand | 2521 | 151.66 | 157.73 | 28.0 | 804 | 22512 | 8797 | 33830 | 151.66 | 233.18 |
| | MULTIPLEX SERVICE CABLE-KILOMETERS | | | | | | | | | | |
| SHEPHERD | # 6 Duplex - XLP Insulated | 4091 | 343.22 | 353.08 | 95.0 | 837 | 79515 | 22604 | 106210 | 343.22 | 599.15 |
| TERRIER | # 4 Duplex " | 6104 | 466.03 | 480.74 | 105.0 | 837 | 87885 | 23643 | 117532 | 466.03 | 749.08 |
| PERIWINKLE | # 4 Triplex " | 8952 | 636.26 | 657.83 | 115.0 | 837 | 96255 | 36926 | 142133 | 636.26 | 978.75 |
| CONCH | # 2 Triplex " | 13941 | 884.76 | 918.35 | 125.0 | 837 | 104625 | 48574 | 167140 | 884.76 | 1287.50 |
| HERITINA | # 1/0 Triplex " | 22094 | 1327 | 1379 | 150.0 | 837 | 125550 | 69340 | 217484 | 1327 | 1851 |
| PALOMINO | # 2 Quadruplex " | 18626 | 1247 | 1292 | 130.0 | 837 | 108810 | 64494 | 191930 | 1247 | 1709 |
| COSTINA | #1/0 Quadruplex " | 30089 | 1985 | 2057 | 160.0 | 837 | 133920 | 98778 | 262787 | 1985 | 2618 |
| CRULLO | #2/0 Quadruplex " | 37750 | 2274 | 2365 | 175.0 | 837 | 146475 | 112793 | 297018 | 2274 | 2990 |
| | SINGLE CONDUCTOR SERVICE CABLE-KMS | | | | | | | | | | |
| OLIVE | #4/0 Alum Stranded-XLP Insulated | 12313 | 904 | 934 | 80.0 | 837 | 66960 | 45443 | 124716 | 904 | 1205 |
| HOLLES | 397.5 MCM Alum Stranded " | 24592 | 1460 | 1519 | 150.0 | 837 | 125550 | 75605 | 225747 | 1460 | 2004 |
| 10M-5 | POLES FOREIGN SUPPLY ( U.S.A. ) | 1050 | 114.00 | 116.52 | 10.0 | 739 | 7390 | 5575 | 14015 | 114.00 | 147.77 |
| 10M-5 | Treated SYP | 950 | 101.00 | 103.28 | 9.5 | 739 | 7021 | 4989 | 12960 | 101.00 | 132.23 |
| 10M-7 | " " | 900 | 80.00 | 82.17 | 9.0 | 739 | 6651 | 4075 | 11626 | 80.00 | 108.02 |
| 11M-5 | " " | 3750 | 123.00 | 132.04 | 13.0 | 739 | 9607 | 6440 | 19797 | 123.00 | 170.70 |
| 11M-6 | " " | 3500 | 107.00 | 115.43 | 12.0 | 739 | 8868 | 5672 | 18040 | 107.00 | 150.47 |
| 11M-7 | " " | 3000 | 87.00 | 94.23 | 11.5 | 739 | 8499 | 4760 | 16259 | 87.00 | 126.18 |

# UNIT COSTS - MID 1977

SHEET 6 OF 6

LOCATION CENTRAL JAVA

| UNIT DESIGNATION | DESCRIPTION | MATERIAL - INDONESIAN WHSE | | | LABOR | | | JOB EXPENSE | TOTAL INSTALLED COST | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | RUPIAH | US $ | EQUIVALENT US $ | MAN HOURS | RATE RUPIAH | EXTENSION RUPIAH | RUPIAH | RUPIAH | US $ | EQUIVALENT US $ |
| (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) | (10) | (11) | (12) |
| | POLES-DOMESTIC SUPPLY | | | | | | | | | | |
| 8H-A | Treated Indonesian Woods | 12710 | 8.59 | 39.22 | 7.2 | 739 | 5321 | 2160 | 20191 | 8.59 | 57.24 |
| 9.5H-A | " " " | 16400 | 11.08 | 50.60 | 7.5 | 739 | 5543 | 2654 | 24597 | 11.08 | 70.35 |
| 9.5H-B | " " " | 18266 | 12.36 | 56.42 | 8.0 | 739 | 5912 | 2933 | 27131 | 12.36 | 77.74 |
| 9.5H-C | " " " | 23124 | 15.63 | 71.35 | 5.5 | 739 | 6282 | 3569 | 32995 | 15.63 | 95.14 |
| 11H-A | " " " | 19926 | 13.47 | 61.48 | 10.5 | 739 | 7760 | 3327 | 31013 | 13.47 | 88.20 |
| 11H-B | " " " | 23944 | 16.18 | 73.88 | 11.0 | 739 | 8129 | 3879 | 35952 | 16.18 | 102.81 |
| 11H-C | " " " | 25502 | 17.24 | 78.69 | 11.5 | 739 | 8499 | 4116 | 38117 | 17.24 | 109.09 |
| 12.5H-A | " " " | 24108 | 16.29 | 74.38 | 12.0 | 739 | 8868 | 3974 | 36950 | 16.29 | 105.33 |
| 12.5H-B | " " " | 27224 | 18.40 | 84.00 | 12.5 | 739 | 9238 | 4410 | 40872 | 18.40 | 116.89 |
| 12.5H-C | " " " | 33620 | 22.72 | 103.73 | 13.0 | 739 | 9607 | 5265 | 48492 | 22.72 | 139.57 |
| 14H-B | " " " | 28946 | 19.56 | 89.31 | 14.5 | 739 | 10716 | 4778 | 44440 | 19.56 | 126.64 |
| 14H-C | " " " | 35834 | 24.22 | 110.57 | 15.0 | 739 | 11085 | 5697 | 52616 | 24.22 | 151.00 |
| 15.5H-B | " " " | 39688 | 26.82 | 122.45 | 16.0 | 739 | 11824 | 6264 | 57776 | 26.82 | 166.04 |
| 15.5H-C | " " " | 41820 | 28.27 | 129.04 | 16.5 | 739 | 12194 | 6575 | 60589 | 28.27 | 174.27 |
| R1-20 | R/W CLEARING-KILOMETERS | - | - | - | 80 | 446 | 35680 | 3568 | 39248 | - | 94.59 |

TABLE 15.

# DISTRIBUTION SYSTEM COST

11.55/20KV (NOMINAL) PRIMARY OVERHEAD

WOOD POLE LINE

THREE-PHASE CONSTRUCTION 477 KCMIL ALL-ALUMINUM CONDUCTOR

STANDARD KILOMETER

**LOCATION: CENTRAL JAVA**

| | DESIGNATION | DESCRIPTION | UNIT | UNIT COST - INSTALLED | | | QUANTITY | EXTENSION | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | RUPIAH | US $ | EQUIVALENT US $ | | RUPIAH | US $ | EQUIVALENT US $ |
| 1 | 8M-A | Poles | ea | 20191 | 8.59 | 57.24 | 0.5 | 10096 | 4.30 | 28.62 |
| 2 | 9.5M-C | " | ea | 32995 | 15.63 | 95.14 | 0.5 | 16498 | 7.82 | 47.57 |
| 3 | 11M-C | " | ea | 38117 | 17.24 | 109.09 | 11 | 419287 | 189.64 | 1199.99 |
| 4 | 12.5M-C | " | ea | 48492 | 22.72 | 139.57 | 4 | 193968 | 90.88 | 558.28 |
| 5 | 14M-C | " | ea | 52616 | 24.22 | 151.00 | 0.5 | 26308 | 12.11 | 75.50 |
| 6 | 15.5M-C | " | ea | 60589 | 28.27 | 174.27 | 0.5 | 30295 | 14.14 | 87.14 |
| 7 | | | | | | | | | | |
| 8 | \C1-2 | Primary Supports | ea | 11561 | 57.15 | 85.01 | 9.5 | 109830 | 542.93 | 807.60 |
| 9 | \C2-1 | " " | ea | 19594 | 99.67 | 146.88 | 2 | 39188 | 199.34 | 293.76 |
| 10 | \C3L | " " | ea | 10650 | 109.12 | 134.78 | 2 | 21300 | 218.24 | 269.56 |
| 11 | \C4-1L | " " | ea | 20629 | 225.87 | 275.58 | 0.5 | 10315 | 112.94 | 137.79 |
| 12 | \C7-1 | " " | ea | 23763 | 98.15 | 155.41 | 0.5 | 11882 | 49.08 | 77.71 |
| 13 | \C8-2 | " " | ea | 27896 | 196.38 | 263.60 | 1 | 27896 | 196.38 | 263.60 |
| 14 | \\5-2 | " " | ea | 3966 | 35.79 | 45.35 | 1 | 3966 | 35.79 | 45.35 |
| 15 | | | | | | | | | | |
| 16 | Cosmos | Conductors | KM | 139656 | 1288 | 1624.52 | 3 | 418968 | 3864 | 2873.56 |
| 17 | Oxlip | " | KM | 73751 | 571.20 | 751.32 | 1 | 74751 | 571.20 | 751.32 |
| 18 | | | | | | | | | | |
| 19 | \E1-3 | Guys | ea | 4987 | 22.45 | 34.47 | 13 | 64831 | 291.85 | 448.11 |
| 20 | \E5-1 | " | ea | 14116 | 47.80 | 81.81 | 0.5 | 7058 | 23.90 | 40.91 |
| 21 | F1-3 | Anchors | ea | 4368 | 15.09 | 25.62 | 8 | 34944 | 120.72 | 704.96 |
| 22 | F1-4 | " | ea | 4368 | 15.09 | 25.62 | 2 | 8736 | 30.18 | 51.24 |
| 23 | F6-2 | " | ea | 11935 | 43.46 | 72.22 | 1 | 11935 | 43.46 | 72.22 |
| 24 | | | | | | | | | | |
| 25 | \H2-12A2 | Grounds | ea | 2222 | 11.82 | 17.17 | 13 | 28886 | 153.66 | 223.21 |
| 26 | \H2-11 | " | ea | 3675 | 15.32 | 24.18 | 4 | 14700 | 61.28 | 96.72 |
| 27 | | TOTAL COST - STANDARD KILOMETER | | | | | | 1585638 | 6833.84 | 10654.64 |

# DISTRIBUTION SYSTEM COST

11.55/20KV (NOMINAL) PRIMARY OVERHEAD

WOOD POLE LINE

THREE-PHASE CONSTRUCTION #4/0 ALL-ALUMINUM CONDUCTOR

STANDARD KILOMETER

**LOCATION: CENTRAL JAVA**

| | DESIGNATION | DESCRIPTION | UNIT | UNIT COST - INSTALLED | | | QUANTITY | EXTENSION | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | RUPIAH | US $ | EQUIVALENT US $ | | RUPIAH | US $ | EQUIVALENT US $ |
| 1 | 8M-A | Poles | ea | 20191 | 8.59 | 57.24 | 0.2 | 4038 | 1.72 | 11.45 |
| 2 | 9.5M-B | " | ea | 27131 | 13.36 | 77.74 | 0.1 | 2713 | 1.24 | 7.77 |
| 3 | 11M-B | " | ea | 35952 | 16.18 | 102.81 | 11 | 395472 | 177.98 | 1130.91 |
| 4 | 12.5M-B | " | ea | 40872 | 18.40 | 116.89 | 4 | 163488 | 73.60 | 467.56 |
| 5 | 14M-B | " | ea | 44440 | 19.56 | 126.64 | 0.5 | 22220 | 9.76 | 63.32 |
| 6 | 15.5M-B | " | ea | 57776 | 26.82 | 166.04 | 0.2 | 11555 | 5.36 | 33.21 |
| 7 | | | | | | | | | | |
| 8 | VC1 | Primary Supports | ea | 10147 | 45.83 | 70.28 | 9 | 91323 | 412.47 | 632.52 |
| 9 | VC2 | " " | ea | 18210 | 100.87 | 144.75 | 2 | 36420 | 201.74 | 289.50 |
| 10 | VC3 | " " | ea | 8545 | 76.89 | 97.48 | 1 | 8545 | 76.89 | 97.48 |
| 11 | VC4-1 | " " | ea | 17865 | 174.58 | 217.63 | 0.5 | 8933 | 87.29 | 108.82 |
| 12 | VC7 | " " | ea | 19788 | 98.15 | 145.83 | 0.5 | 9894 | 49.08 | 72.92 |
| 13 | VC8 | " " | ea | 26196 | 183.10 | 246.22 | 1 | 26196 | 183.10 | 246.22 |
| 14 | VA5-2 | " " | ea | 3966 | 35.79 | 45.35 | 1 | 3966 | 35.79 | 45.35 |
| 15 | | | | | | | | | | |
| 16 | Oxlip | Conductors | KM | 74751 | 571.20 | 751.32 | 3 | 224253 | 1713.60 | 2253.96 |
| 17 | Azuza | " | KM | 55819 | 366.96 | 501.46 | 1 | 55819 | 366.96 | 501.46 |
| 18 | | | | | | | | | | |
| 19 | VE1-2 | Guys | ea | 4314 | 17.72 | 28.12 | 13 | 56082 | 230.36 | 365.56 |
| 20 | E2-2 | " | ea | 5841 | 22.95 | 37.02 | 0.2 | 1168 | 4.59 | 7.40 |
| 21 | F1-2 | Anchors | ea | 3978 | 11.58 | 21.17 | 7 | 27846 | 81.06 | 148.19 |
| 22 | F1-3 | " | ea | 4368 | 15.09 | 25.62 | 3 | 13104 | 45.27 | 76.86 |
| 23 | | | | | | | | | | |
| 24 | VH2-12A2 | Grounds | ea | 2222 | 11.82 | 17.17 | 12 | 26664 | 141.84 | 206.04 |
| 25 | VH2-11 | " | ea | 3675 | 15.32 | 24.18 | 4 | 14700 | 61.28 | 96.72 |
| 26 | | | | | | | | | | |
| 27 | | Total Cost-Standard Kilometer | | | | | | 1204397 | 3960.98 | 6863.14 |

# DISTRIBUTION SYSTEM COST

11.55/20KV (NOMINAL) PRIMARY OVERHEAD

WOOD POLE LINE

THREE-PHASE CONSTRUCTION #1/0 (EQUIVALENT) ALUMINUM ALLOY CONSTRUCTION

STANDARD KILOMETER

**LOCATION: CENTRAL JAVA**

| | DESIGNATION | DESCRIPTION | UNIT | UNIT COST - INSTALLED | | | QUANTITY | EXTENSION | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | RUPIAH | US $ | EQUIVALENT US $ | | RUPIAH | US $ | EQUIVALENT US $ |
| 1 | 511-A | Poles | ea | 20191 | 8.59 | 57.24 | 0.2 | 4038 | 1.72 | 11.45 |
| 2 | 9.511-B | " | ea | 27131 | 12.36 | 77.74 | 0.1 | 2713 | 1.24 | 7.77 |
| 3 | 1111-B | " | ea | 35956 | 16.18 | 102.81 | 11 | 395472 | 177.98 | 1130.91 |
| 4 | 12.511-B | " | ea | 40872 | 18.40 | 116.89 | 3 | 122616 | 55.20 | 350.67 |
| 5 | 1411-B | " | ea | 44440 | 19.56 | 126.64 | 0.5 | 22220 | 9.76 | 63.32 |
| 6 | 15.511-B | " | ea | 57776 | 26.82 | 166.04 | 0.2 | 11555 | 5.36 | 33.21 |
| 7 | | | | | | | | | | |
| 8 | VC1 | Primary Supports | ea | 10147 | 45.83 | 70.28 | 8 | 81176 | 366.64 | 562.24 |
| 9 | VC2 | " " | ea | 18210 | 100.87 | 144.75 | 2 | 36420 | 201.74 | 289.50 |
| 10 | VC3 | " " | ea | 8545 | 76.89 | 97.48 | 1 | 8545 | 76.89 | 97.48 |
| 11 | VC4-1 | " " | ea | 17865 | 174.58 | 217.63 | 0.5 | 8933 | 87.29 | 108.82 |
| 12 | VC7 | " " | ea | 19788 | 98.15 | 145.83 | 0.5 | 9894 | 49.08 | 72.92 |
| 13 | VC9 | " " | ea | 26196 | 183.10 | 246.22 | 1 | 26196 | 183.10 | 246.22 |
| 14 | VA5-2 | " " | ea | 3966 | 35.79 | 45.35 | 1 | 3966 | 35.79 | 45.35 |
| 15 | | | | | | | | | | |
| 16 | Azuza | Conductors | KM | 55819 | 366.96 | 501.46 | 3 | 167457 | 1100.88 | 1504.38 |
| 17 | Ames | " | KM | 43126 | 230.95 | 334.87 | 1 | 43126 | 230.95 | 334.87 |
| 18 | | | | | | | | | | |
| 19 | VE1-2 | Guys | ea | 4314 | 17.72 | 28.12 | 13 | 56082 | 230.36 | 365.56 |
| 20 | E2-2 | " | ea | 5841 | 22.95 | 37.02 | 0.2 | 1168 | 4.59 | 7.40 |
| 21 | F1-2 | Anchors | ea | 3978 | 11.58 | 21.17 | 6 | 27846 | 81.06 | 148.19 |
| 22 | F1-3 | " | ea | 4368 | 15.09 | 25.62 | 3 | 13104 | 45.27 | 76.86 |
| 23 | F6-2 | " | ea | 11935 | 43.46 | 72.22 | 1 | 11935 | 43.46 | 72.22 |
| 24 | | | | | | | | | | |
| 25 | VH2-12A2 | Grounds | ea | 2222 | 11.82 | 17.17 | 11 | 24442 | 130.02 | 188.87 |
| 26 | VH2-11 | " | ea | 3675 | 15.32 | 24.18 | 4 | 14700 | 61.28 | 96.72 |
| 27 | | Total Cost-Standard Kilometer | | | | | | 1093604 | 3179.66 | 5814.85 |

# DISTRIBUTION SYSTEM COST

11.55/20KV (NOMINAL) PRIMARY OVERHEAD

WOOD POLE LINE

THREE-PHASE CONSTRUCTION #2 (EQUIVALENT) ALUMINUM ALLOY CONDUCTOR

STANDARD KILOMETER

**LOCATION: CENTRAL JAVA**

| | DESIGNATION | DESCRIPTION | UNIT | UNIT COST - INSTALLED | | | QUANTITY | EXTENSION | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | RUPIAH | US $ | EQUIVALENT US $ | | RUPIAH | US $ | EQUIVALENT US $ |
| 1. | 8M-A | Poles | ea | 20191 | 8.59 | 57.24 | 0.2 | 4038 | 1.72 | 11.45 |
| 2. | 9.5M-B | " | ea | 27131 | 12.36 | 77.74 | 0.1 | 2713 | 1.24 | 7.77 |
| 3 | 11M-B | " | ea | 35952 | 16.18 | 102.84 | 11 | 395472 | 177.98 | 1130.93 |
| 4 | 12.5M-B | " | ea | 40872 | 18.40 | 116.89 | 3 | 122616 | 55.20 | 350.67 |
| 5 | 14M-B | " | ea | 44440 | 19.56 | 126.64 | 0.5 | 22220 | 9.76 | 63.32 |
| 6 | 15.5M-B | " | ea | 57776 | 26.82 | 166.04 | 0.2 | 11555 | 5.36 | 33.21 |
| 7 | | | | | | | | | | |
| 8 | VC1 | Primary Supports | ea | 10147 | 45.83 | 70.28 | 8 | 81176 | 366.64 | 562.24 |
| 9 | VC2 | " " | ea | 18210 | 100.87 | 144.75 | 2 | 36420 | 201.74 | 289.50 |
| 10 | VC3 | " " | ea | 8545 | 76.89 | 97.48 | 1 | 8545 | 76.89 | 97.84 |
| 11 | VC4-1 | " " | ea | 17865 | 174.58 | 217.63 | 0.5 | 8933 | 87.29 | 108.82 |
| 12 | VC7 | " " | ea | 19788 | 98.15 | 145.83 | 0.5 | 9894 | 49.08 | 72.92 |
| 13 | VC8 | " " | ea | 26196 | 183.10 | 246.22 | 1 | 26196 | 183.10 | 246.22 |
| 14 | VA5-2 | " " | ea | 3966 | 35.79 | 45.35 | 1 | 3966 | 35.79 | 45.35 |
| 15 | | | | | | | | | | |
| 16. | Ames | Conductors | KM | 43126 | 230.95 | 334.87 | 4 | 172504 | 923.80 | 1339.48 |
| 17. | | | | | | | | | | |
| 18 | VE1-2 | Guys | ea | 4314 | 17.72 | 28.12 | 13 | 56082 | 230.36 | 365.56 |
| 19 | E2-2 | " | ea | 5841 | 22.95 | 37.02 | 0.2 | 1168 | 4.59 | 7.40 |
| 20 | E1-2 | Anchors | ea | 3978 | 11.58 | 21.17 | 6 | 27846 | 81.06 | 148.19 |
| 21 | E1-3 | " | ea | 4368 | 15.09 | 25.62 | 3 | 13104 | 45.27 | 75.86 |
| 22 | E6-2 | " | ea | 11935 | 43.46 | 72.22 | 1 | 11935 | 43.46 | 72.22 |
| 23 | | | | | | | | | | |
| 24 | VH2-12A2 | Grounds | ea | 2222 | 11.82 | 17.17 | 11 | 24442 | 130.02 | 188.87 |
| 25 | VH2-11 | " | ea | 3675 | 15.32 | 24.18 | 4 | 14700 | 61.28 | 96.72 |
| 26 | | | | | | | | | | |
| 27 | | Total Cost-Standard Kilometer | | | | | | 1055525 | 2771.63 | 5315.06 |

# DISTRIBUTION SYSTEM COST

11.55/20KV(NOMINAL) PRIMARY OVERHEAD

WOOD POLE LINE

"V"-PHASE CONSTRUCTION #1/0 (EQUIVALENT) ALUMINUM ALLOY CONDUCTOR

STANDARD KILOMETER

**LOCATION: CENTRAL JAVA**

| | DESIGNATION | DESCRIPTION | UNIT | UNIT COST - INSTALLED | | | QUANTITY | EXTENSION | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | RUPIAH | US $ | EQUIVALENT US $ | | RUPIAH | US $ | EQUIVALENT US $ |
| 1. | 9M-A | Poles | ea | 20191 | 8.59 | 57.24 | 0.2 | 4038 | 1.72 | 11.45 |
| 2. | 9.5M-B | " | ea | 27131 | 12.36 | 77.74 | 0.1 | 2713 | 1.24 | 7.77 |
| 3. | 11M-B | " | ea | 35952 | 16.18 | 102.81 | 10 | 359520 | 161.80 | 1028.10 |
| 4 | 12.5M-B | " | ea | 40872 | 18.40 | 116.89 | 3 | 122616 | 55.20 | 350.67 |
| 5. | 14M-B | " | ea | 44440 | 19.56 | 126.64 | 0.5 | 22220 | 9.76 | 63.32 |
| 6. | 15.5M-B | " | ea | 57776 | 26.82 | 166.04 | 0.2 | 111555 | 5.36 | 33.21 |
| 7. | | | | | | | | | | |
| 8 | VB1 | Primary Supports | ea | 8949 | 33.42 | 54.98 | 10 | 89490 | 334.20 | 549.80 |
| 9. | VB2 | " " | ea | 16381 | 69.90 | 109.37 | 3 | 49143 | 209.70 | 328.11 |
| 10 | VB3 | " " | ea | 6085 | 51.04 | 65.70 | 1 | 6085 | 51.04 | 65.70 |
| 11. | VB4-1 | " " | ea | 13718 | 121.51 | 154.57 | 0.5 | 6859 | 60.76 | 77.29 |
| 12 | VB5-1 | " " | ea | 7006 | 57.59 | 74.47 | 0.5 | 3503 | 28.80 | 37.24 |
| 13. | VA5-2 | " " | ea | 3966 | 35.79 | 45.35 | 1 | 3966 | 35.79 | 45.35 |
| 14 | | | | | | | | | | |
| 15 | Azuza | Conductors | KM | 55819 | 366.96 | 501.46 | 2 | 111638 | 733.92 | 1002.93 |
| 16. | Ames | " | KM | 43126 | 230.95 | 334.87 | 1 | 43126 | 230.95 | 334.87 |
| 17. | | | | | | | | | | |
| 18 | VE1-2 | Guys | ea | 4314 | 17.72 | 28.12 | 13 | 56082 | 230.36 | 365.56 |
| 19 | E2-2 | " | ea | 5841 | 22.95 | 37.02 | 0.2 | 1168 | 4.59 | 7.40 |
| 20 | F1-2 | Anchors | ea | 3978 | 11.58 | 21.17 | 6 | 23868 | 69.48 | 127.02 |
| 21 | F1-3 | " | ea | 4368 | 15.09 | 25.62 | 3 | 13104 | 45.27 | 76.86 |
| 22 | F6-2 | " | ea | 11935 | 43.46 | 72.22 | 1 | 11935 | 43.46 | 72.22 |
| 23 | | | | | | | | | | |
| 24 | VH2-12A2 | Grounds | ea | 2222 | 11.82 | 17.17 | 11 | 24442 | 130.02 | 188.87 |
| 25 | VH2-11 | " | ea | 3675 | 15.32 | 24.18 | 4 | 14700 | 61.28 | 96.72 |
| 26 | | | | | | | | | | |
| 27. | | Total Cost-Standard Kilometer | | | | | | 981771 | 2504.70 | 4870.42 |

# DISTRIBUTION SYSTEM COST

11.55/20KV (NOMINAL) PRIMARY OVERHEAD

WOOD POLE LINE

"V"-PHASE CONSTRUCTION #2 (EQUIVALENT) ALUMINUM ALLOY CONDUCTOR

STANDARD KILOMETER

**LOCATION: CENTRAL JAVA**

| | DESIGNATION | DESCRIPTION | UNIT | UNIT COST - INSTALLED | | | QUANTITY | EXTENSION | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | RUPIAH | US $ | EQUIVALENT US $ | | RUPIAH | US $ | EQUIVALENT US $ |
| 1 | 8M-A | Poles | ea | 20191 | 8.59 | 57.24 | 0.2 | 4038 | 1.72 | 11.45 |
| 2 | 9.5M-B | " | ea | 27131 | 12.36 | 77.74 | 0.1 | 2713 | 1.24 | 7.77 |
| 3 | 11M-B | " | ea | 35952 | 16.18 | 102.81 | 10 | 359520 | 161.80 | 1028.10 |
| 4 | 12.5M-B | " | ea | 40872 | 18.40 | 116.89 | 3 | 122616 | 55.20 | 350.67 |
| 5 | 14M-B | " | ea | 44440 | 19.56 | 126.64 | 0.5 | 22220 | 9.76 | 63.32 |
| 6 | 15.5M-B | " | ea | 57776 | 26.82 | 166.04 | 0.2 | 11555 | 5.36 | 33.21 |
| 7 | | | | | | | | | | |
| 8 | VB1 | Primary Supports | ea | 8949 | 33.42 | 54.98 | 10 | 89490 | 334.20 | 549.80 |
| 9 | VB2 | " " | ea | 16381 | 69.90 | 109.37 | 3 | 49143 | 209.70 | 328.11 |
| 10 | VB3 | " " | ea | 6085 | 51.04 | 65.70 | 1 | 6085 | 51.04 | 65.70 |
| 11 | VB4-1 | " " | ea | 13718 | 121.51 | 154.57 | 0.5 | 6859 | 60.76 | 77.29 |
| 12 | VB5-1 | " " | ea | 7006 | 57.59 | 62.42 | 0.5 | 3503 | 28.80 | 37.24 |
| 13 | VA5-2 | " " | ea | 3966 | 35.79 | 45.35 | 1 | 3966 | 35.79 | 45.35 |
| 14 | | | | | | | | | | |
| 15 | Ames | Conductors | Km | 43126 | 230.95 | 334.87 | 3 | 129378 | 692.85 | 1004.61 |
| 16 | | | | | | | | | | |
| 17 | VE1-2 | Guys | ea | 4314 | 17.72 | 28.12 | 13 | 56082 | 230.36 | 365.56 |
| 18 | F2 2 | " | ea | 5841 | 22.95 | 37.02 | 0.2 | 1168 | 4.59 | 7.40 |
| 19 | F1-2 | Anchors | ea | 3978 | 11.58 | 21.17 | 6 | 23868 | 69.48 | 127.02 |
| 20 | F1-3 | " | ea | 4368 | 15.09 | 25.62 | 3 | 13104 | 45.27 | 76.86 |
| 21 | F6-2 | " | ea | 11935 | 43.46 | 72.22 | 1 | 11935 | 43.46 | 77.22 |
| 22 | | | | | | | | | | |
| 23 | VH2-12A2 | Grounds | ea | 2222 | 11.82 | 17.17 | 11 | 24442 | 130.02 | 188.87 |
| 24 | VH2-11 | " | ea | 3675 | 15.32 | 24.18 | 4 | 14700 | 61.28 | 96.72 |
| 25 | | | | | | | | | | |
| 26 | | | | | | | | | | |
| 27 | | Total Cost-Standard Kilometer | | | | | | 956385 | 2232.68 | 4537.22 |

# DISTRIBUTION SYSTEM COST

11.55 KV (NOMINAL) PRIMARY, OVERHEAD

WOOD POLE LINE

SINGLE-PHASE CONSTRUCTION, #2 (EQUIVALENT) ALUMINUM ALLOY CONDUCTOR

STANDARD KILOMETER

**LOCATION: CENTRAL JAVA**

| | DESIGNATION | DESCRIPTION | UNIT | UNIT COST - INSTALLED | | | QUANTITY | EXTENSION | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | RUPIAH | US $ | EQUIVALENT US $ | | RUPIAH | US $ | EQUIVALENT US $ |
| 1 | 8M-A | Poles | ea | 20191 | 8.59 | 57.24 | 0.2 | 4038 | 1.72 | 111.45 |
| 2 | 9.5M-A | " | ea | 24597 | 11.08 | 70.35 | 0.5 | 12299 | 5.54 | 35.18 |
| 3 | 11M-A | " | ea | 31013 | 13.47 | 88.20 | 10 | 310130 | 134.70 | 882.00 |
| 4 | 12.5M-A | " | ea | 36950 | 16.29 | 105.33 | 2 | 73900 | 32.58 | 210.66 |
| 5 | 14M-B | " | ea | 44440 | 19.56 | 126.64 | 0.2 | 8888 | 3.91 | 25.33 |
| 6 | 15.5M-B | " | ea | 57776 | 26.82 | 166.04 | 0.1 | 5778 | 2.68 | 16.60 |
| 7 | | | | | | | | | | |
| 8 | VA1 | Primary Supports | ea | 2281 | 14.60 | 20.10 | 9 | 20529 | 131.40 | 180.90 |
| 9 | VA2 | " " | ea | 3903 | 33.56 | 42.96 | 2 | 7806 | 67.12 | 85.92 |
| 10 | VA3 | " " | ea | 3087 | 27.79 | 35.23 | 1 | 3087 | 27.79 | 35.23 |
| 11 | VA4 | " " | ea | 6486 | 61.62 | 77.25 | 0.5 | 3243 | 30.81 | 38.62 |
| 12 | VA5 | " " | ea | 3201 | 29.84 | 37.55 | 0.3 | 960 | 8.95 | 11.26 |
| 13 | VA5-1 | " " | ea | 3781 | 32.38 | 41.49 | 1 | 3781 | 32.38 | 41.49 |
| 14 | VA6 | " " | ea | 6430 | 60.29 | 75.78 | 0.2 | 1286 | 12.06 | 15.16 |
| 15 | | | | | | | | | | |
| 16 | Ames | Conductors | KM | 43126 | 230.95 | 334.87 | 2 | 86252 | 461.90 | 669.74 |
| 17 | | | | | | | | | | |
| 18 | VE1-2 | Guys | ea | 4314 | 17.72 | 28.12 | 8 | 34512 | 141.76 | 224.96 |
| 19 | E2-2 | " | ea | 5841 | 22.95 | 37.02 | 0.2 | 1168 | 4.59 | 7.40 |
| 20 | F1-2 | Anchors | ea | 3978 | 11.58 | 21.17 | 7 | 27846 | 81.06 | 148.19 |
| 21 | F6-2 | " | ea | 11935 | 43.46 | 72.22 | 1 | 11935 | 43.46 | 72.22 |
| 22 | | | | | | | | | | |
| 23 | VH2-12A2 | Grounds | ea | 2222 | 11.82 | 17.17 | 9 | 19998 | 106.38 | 154.53 |
| 24 | VH2-11 | " | ea | 3675 | 15.32 | 24.18 | 4 | 14700 | 61.28 | 96.72 |
| 25 | | | | | | | | | | |
| 26 | | | | | | | | | | |
| 27 | | Total Cost-Standard Kilometer | | | | | | 652136 | 1392.07 | 2963.48 |

# DISTRIBUTION SYSTEM COST

11.55 KV (NOMINAL) PRIMARY OVERHEAD

WOOD POLE LINE

SINGLE-PHASE CONSTRUCTION, #4 (EQUIVALENT) ALUMINUM ALLOY CONDUCTOR

STANDARD KILOMETER

**LOCATION: CENTRAL JAVA**

| | DESIGNATION | DESCRIPTION | UNIT | UNIT COST - INSTALLED | | | QUANTITY | EXTENSION | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | RUPIAH | US. $ | EQUIVALENT US. $ | | RUPIAH | US. $ | EQUIVALENT US. $ |
| 1. | 8M-A | Poles | ea | 20191 | 8.59 | 57.24 | 0.2 | 4038 | 1.72 | 11.45 |
| 2. | 9.5M-A | " | ea | 24597 | 11.08 | 70.35 | 0.5 | 12298 | 5.54 | 35.17 |
| 3. | 11M-A | " | ea | 31013 | 13.47 | 88.20 | 9 | 279117 | 121.23 | 793.80 |
| 4. | 12.5M-A | " | ea | 36950 | 16.29 | 105.33 | 2 | 73900 | 32.58 | 210.66 |
| 5. | 14M-B | " | ea | 44440 | 19.56 | 126.64 | 0.2 | 8888 | 3.91 | 25.33 |
| 6. | 15.5M-B | " | ea | 57776 | 26.[illegible] | 166.04 | 0.1 | 5778 | 2.68 | 16.60 |
| 7 | | | | | | | | | | |
| 8. | VA1 | Primary Support | ea | 2281 | 14.60 | 20.10 | 8 | 18248 | 116.80 | 160.80 |
| 9. | VA2 | " " | ea | 3903 | 33.56 | 42.96 | 2 | 7806 | 67.12 | 85.92 |
| 10. | VA3 | " " | ea | 3087 | 27.79 | 35.23 | 1 | 3087 | 27.79 | 35.23 |
| 11. | VA4 | " " | ea | 6486 | 61.62 | 77.25 | 0.5 | 3243 | 30.81 | 38.63 |
| 12. | VA5 | " " | ea | 3201 | 29.84 | 37.55 | 0.3 | 960 | 8.95 | 11.26 |
| 13 | VA5-1 | " " | ea | 3781 | 32.38 | 41.49 | 1 | 3781 | 32.38 | 41.49 |
| 14. | VA6 | " " | ea | 6430 | 60.29 | 75.78 | 0.2 | 1286 | 12.06 | 15.16 |
| 15. | | | | | | | | | | |
| 16. | Alton | Conductors | KM | 33830 | 151.66 | 233.18 | 2 | 67660 | 303.32 | 466.36 |
| 17 | | | | | | | | | | |
| 18 | VE1-2 | Guys | ea | 4314 | 17.72 | 28.12 | 8 | 34512 | 141.76 | 224.96 |
| 19 | E2-2 | " | ea | 5841 | 22.95 | 37.02 | 0.2 | 1168 | 4.59 | 7.40 |
| 20 | F1-2 | Anchors | ea | 3978 | 11.58 | 21.17 | 7 | 27846 | 81.06 | 148.19 |
| 21. | F6-2 | " | ea | 11935 | 43.46 | 72.22 | 1 | 11935 | 43.46 | 72.22 |
| 22 | | | | | | | | | | |
| 23 | VM2-12A2 | Grounds | ea | 2222 | 11.82 | 17.17 | 8 | 26664 | 141.84 | 206.04 |
| 24 | VM2-11 | " | ea | 3675 | 15.32 | 24.18 | 4 | 14700 | 61.28 | 96.72 |
| 25 | | | | | | | | | | |
| 26 | | | | | | | | | | |
| 27. | | Total Cost-Standard Kilometer | | | | | | 606915 | 1240.88 | 2703.33 |

# DISTRIBUTION SYSTEM COST

240/480 VOLT (NOMINAL) SECONDARY OVERHEAD

WOOD POLE LINE

SINGLE-PHASE 3-WIRE CONSTRUCTION, #1/0 (EQUIVALENT) ALUMINUM ALLOY CONDUCTOR

STANDARD KILOMETER

**LOCATION: CENTRAL JAVA**

| | DESIGNATION | DESCRIPTION | UNIT | UNIT COST - INSTALLED | | | QUANTITY | EXTENSION | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | RUPIAH | US $ | EQUIVALENT US. $ | | RUPIAH | US. $ | EQUIVALENT US. $ |
| 1 | 811-A | Poles | ea | 20191 | 8.59 | 57.24 | 1 | 20191 | 8.59 | 57.24 |
| 2 | 9.511-A | " | ea | 24597 | 11.08 | 70.35 | 10 | 245970 | 110.80 | 703.50 |
| 3 | 1111-A | " | ea | 31013 | 13.47 | 88.20 | 4 | 124052 | 53.88 | 352.80 |
| 4 | 12.511-A | " | ea | 36950 | 16.29 | 105.33 | 1 | 36950 | 16.29 | 105.33 |
| 5 | | | | | | | | | | |
| 6 | J5 | Secondary Assemblies | ea | 801 | 2.46 | 4.39 | 18 | 14418 | 44.28 | 79.02 |
| 7 | J6 | " " | ea | 1555 | 5.31 | 9.56 | 24 | 37320 | 139.44 | 229.44 |
| 8 | J7 | " " | ea | 848 | 3.14 | 5.18 | 6 | 5088 | 18.84 | 31.08 |
| 9 | J8 | Neutral Assemblies | ea | 790 | 2.23 | 4.13 | 9 | 7110 | 20.07 | 37.17 |
| 10 | J10 | Secondary Assemblies | ea | 861 | 3.22 | 5.30 | 3 | 2583 | 9.66 | 15.90 |
| 11 | | | | | | | | | | |
| 12 | Azuza | Conductors | KM | 55819 | 366.96 | 501.46 | 2 | 111638 | 733.92 | 1002.92 |
| 13 | Ames | " | KM | 43126 | 230.95 | 334.87 | 1 | 43126 | 230.95 | 334.82 |
| 14 | | | | | | | | | | |
| 15 | VE1-2 | Guys | ea | 4314 | 17.72 | 28.12 | 9 | 38826 | 159.48 | 253.08 |
| 16 | E2-2 | " | ea | 5841 | 22.95 | 37.02 | 1 | 5841 | 22.95 | 37.02 |
| 17 | F1-2 | Anchors | ea | 3978 | 11.58 | 21.17 | 8 | 31824 | 92.64 | 169.36 |
| 18 | F6-2 | " | ea | 11935 | 43.46 | 72.22 | 1 | 11935 | 43.46 | 72.22 |
| 19 | | | | | | | | | | |
| 20 | VH2-12A2 | Grounds | ea | 2222 | 11.82 | 17.17 | 12 | 26664 | 141.84 | 206.04 |
| 21 | VH2-11 | " | ea | 3675 | 15.32 | 24.18 | 4 | 14700 | 61.28 | 95.72 |
| 22 | | | | | | | | | | |
| 23 | | | | | | | | | | |
| 24 | | | | | | | | | | |
| 25 | | | | | | | | | | |
| 26 | | | | | | | | | | |
| 27 | | Total Cost-Standard Kilometer | | | | | | 778236 | 1908.37 | 3783.63 |

# DISTRIBUTION SYSTEM COST

240/480 VOLT (NOMINAL) SECONDARY OVERHEAD

WOOD POLE LINE

SINGLE-PHASE 3-WIRE CONSTRUCTION, #2 (EQUIVALENT) ALUMINUM ALLOY CONDUCTOR

STANDARD KILOMETER

**LOCATION: CENTRAL JAVA**

| | DESIGNATION | DESCRIPTION | UNIT | UNIT COST - INSTALLED | | | QUANTITY | EXTENSION | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | RUPIAH | US $ | EQUIVALENT US $ | | RUPIAH | US $ | EQUIVALENT US $ |
| 1 | 811-A | Poles | ea | 20191 | 8.59 | 57.24 | 1 | 20191 | 8.59 | 57.24 |
| 2 | 9.511-A | " | ea | 24597 | 11.08 | 70.35 | 10 | 245970 | 110.80 | 703.50 |
| 3 | 1111-A | " | ea | 31013 | 13.47 | 88.20 | 4 | 124052 | 53.88 | 352.80 |
| 4 | 12.511-A | " | ea | 36950 | 16.29 | 105.33 | 1 | 36950 | 16.79 | 105.33 |
| 5 | | | | | | | | | | |
| 6 | J5 | Secondary Assemblies | ea | 801 | 2.46 | 4.39 | 18 | 14418 | 44.28 | 79.02 |
| 7 | J6 | " " | ea | 1555 | 5.81 | 9.56 | 24 | 37320 | 139.44 | 229.44 |
| 8 | J7 | " " | ea | 848 | 3.14 | 5.18 | 6 | 5088 | 18.84 | 31.08 |
| 9 | J8 | Neutral Assemblies | ea | 790 | 2.23 | 4.13 | 9 | 7110 | 20.07 | 37.17 |
| 10 | J10 | Secondary " | ea | 861 | 3.22 | 5.30 | 3 | 2583 | 9.66 | 15.90 |
| 11 | | | | | | | | | | |
| 12 | Ames | Conductors | KM | 43126 | 230.95 | 334.87 | 3 | 129378 | 692.85 | 1004.61 |
| 13 | | | | | | | | | | |
| 14 | VE1-2 | Guys | ea | 4314 | 17.72 | 28.12 | 9 | 38826 | 159.48 | 253.08 |
| 15 | E2-2 | " | ea | 5841 | 22.95 | 37.02 | 1 | 5841 | 22.95 | 37.02 |
| 16 | F1-2 | Anchors | ea | 3978 | 11.58 | 21.17 | 8 | 31824 | 92.64 | 169.36 |
| 17 | F6-2 | " | ea | 11935 | 43.46 | 72.22 | 1 | 11935 | 43.46 | 72.22 |
| 18 | | | | | | | | | | |
| 19 | VM2-12A2 | Grounds | ea | 2222 | 11.82 | 17.17 | 12 | 26664 | 141.84 | 206.04 |
| 20 | VM2-11 | " | ea | 3675 | 15.32 | 24.18 | 4 | 14700 | 61.28 | 96.72 |
| 21 | | | | | | | | | | |
| 22 | | | | | | | | | | |
| 23 | | | | | | | | | | |
| 24 | | | | | | | | | | |
| 25 | | | | | | | | | | |
| 26 | | | | | | | | | | |
| 27 | | Total Cost-Standard Kilometer | | | | | | 752850 | 1636.35 | 3450.45 |

# DISTRIBUTION SYSTEM COST

240/480 VOLT (NOMINAL) SECONDARY UNDERBUILT ON
PRIMARY OVERHEAD WOOD POLE LINE
SINGLE-PHASE, 2-WIRE CONSTRUCTION, #1/0 (EQUIVALENT) ALUMINUM ALLOY CONDUCTOR
STANDARD KILOMETER

**LOCATION: CENTRAL JAVA**

| | DESIGNATION | DESCRIPTION | UNIT | UNIT COST - INSTALLED | | | QUANTITY | EXTENSION | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | RUPIAH | US $ | EQUIVALENT US $ | | RUPIAH | US $ | EQUIVALENT US $ |
| 1 | J5 | Secondary Assemblies | ea | 801 | 2.46 | 4.39 | 20 | 16020 | 49.20 | 87.80 |
| 2 | J6 | " " | ea | 1555 | 5.81 | 9.56 | 10 | 15550 | 58.10 | 95.60 |
| 3 | J7 | " " | ea | 848 | 3.14 | 5.18 | 4 | 3392 | 12.56 | 20.72 |
| 4 | J10 | " " | ea | 861 | 3.22 | 5.30 | 2 | 1722 | 6.44 | 10.60 |
| 5 | | | | | | | | | | |
| 6 | | | | | | | | | | |
| 7 | Azuza | Conductors | KIT | 55819 | 366.96 | 501.46 | 2 | 111638 | 733.92 | 1002.92 |
| 8 | | | | | | | | | | |
| 9 | VE1-1 | Guys | ea | 3681 | 13.16 | 22.03 | 8 | 29448 | 105.28 | 176.24 |
| 10 | E2-1 | " | ea | 5106 | 17.00 | 29.30 | 1 | 5106 | 17.00 | 29.30 |
| 11 | F1-1 | Anchors | ea | 3978 | 11.58 | 21.17 | 7 | 27846 | 81.06 | 148.19 |
| 12 | F6-1 | " | ea | 9605 | 26.14 | 49.28 | 1 | 9605 | 26.14 | 49.28 |
| 13 | | | | | | | | | | |
| 14 | | | | | | | | | | |
| 15 | | | | | | | | | | |
| 16 | | | | | | | | | | |
| 17 | | | | | | | | | | |
| 18 | | | | | | | | | | |
| 19 | | | | | | | | | | |
| 20 | | | | | | | | | | |
| 21 | | | | | | | | | | |
| 22 | | | | | | | | | | |
| 23 | | | | | | | | | | |
| 24 | | | | | | | | | | |
| 25 | | | | | | | | | | |
| 26 | | | | | | | | | | |
| 27 | | Total Cost-Standard Kilometer | | | | | | 220327 | 1089.70 | 1620.60 |

# DISTRIBUTION SYSTEM COST

240/480 VOLT (NOMINAL) SECONDARY UNDERBUILT ON
PRIMARY OVERHEAD WOOD POLE LINE
SINGLE-PHASE, 2-WIRE CONSTRUCTION, #2 (EQUIVALENT) ALUMINUM ALLOY CONDUCTOR
STANDARD KILOMETER

**LOCATION: CENTRAL JAVA**

| | DESIGNATION | DESCRIPTION | UNIT | UNIT COST - INSTALLED | | | QUANTITY | EXTENSION | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | RUPIAH | US. $ | EQUIVALENT US. $ | | RUPIAH | US. $ | EQUIVALENT US. $ |
| 1. | J5 | Secondary Assemblies | ea | 801 | 2.46 | 4.39 | 20 | 16020 | 49.20 | 87.80 |
| 2. | J6 | " " | ea | 1555 | 5.81 | 9.56 | 10 | 15550 | 58.10 | 95.60 |
| 3. | J7 | " " | ea | 848 | 3.14 | 5.18 | 4 | 3392 | 12.56 | 20.72 |
| 4. | J10 | " " | ea | 861 | 3.22 | 5.30 | 2 | 1722 | 6.44 | 10.60 |
| 5. | | | | | | | | | | |
| 6. | | | | | | | | | | |
| 7. | Ames | Conductors | KM | 43126 | 230.95 | 334.87 | 2 | 86252 | 461.90 | 669.74 |
| 8 | | | | | | | | | | |
| 9. | VE1-1 | Guys | ea | 3681 | 13.16 | 22.03 | 8 | 29448 | 105.28 | 176.24 |
| 10. | E2-1 | " | ea | 5106 | 17.00 | 29.30 | 1 | 5106 | 17.00 | 29.30 |
| 11. | F1-1 | Anchors | ea | 3978 | 11.58 | 21.17 | 7 | 27846 | 81.06 | 148.19 |
| 12. | F6-1 | " | ea | 9605 | 26.14 | 49.28 | 1 | 9605 | 26.14 | 49.28 |
| 13. | | | | | | | | | | |
| 14. | | | | | | | | | | |
| 15. | | | | | | | | | | |
| 16. | | | | | | | | | | |
| 17. | | | | | | | | | | |
| 18. | | | | | | | | | | |
| 19 | | | | | | | | | | |
| 20 | | | | | | | | | | |
| 21 | | | | | | | | | | |
| 22. | | | | | | | | | | |
| 23 | | | | | | | | | | |
| 24 | | | | | | | | | | |
| 25 | | | | | | | | | | |
| 26 | | | | | | | | | | |
| 27 | | Total Cost-Standard Kilometer | | | | | | 194941 | 817.68 | 1287.42 |

# DISTRIBUTION SYSTEM COST

SERVICES AND METERS

SINGLE-PHASE 2 - WIRE 240 VOLTS

STANDARD UNIT

LOCATION: CENTRAL JAVA

| | DESIGNATION | DESCRIPTION | UNIT | UNIT COST - INSTALLED | | | QUANTITY | EXTENSION | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | RUPIAH | US $ | EQUIVALENT US $ | | RUPIAH | US $ | EQUIVALENT US $ |
| 1 | 811-A | Lift Pole | ea | 20191 | 8.59 | 57.24 | 0.1 | 2019 | 0.86 | 5.73 |
| 2 | | | | | | | | | | |
| 3 | K16C | Service Assembly-House End | ea | 1452 | 6.25 | 9.75 | 1 | 1452 | 6.25 | 9.75 |
| 4 | K15C | Service Assembly-Pole End | ea | 492 | 4.43 | 5.62 | 1 | 492 | 4.43 | 5.62 |
| 5 | J8 | Secondary Assembly | ea | 790 | 2.23 | 4.13 | 0.1 | 79 | 0.22 | 0.41 |
| 6 | | | | | | | | | | |
| 7 | - | Service Cond. #6-"Shepherd" | M | 106 | 0.34 | 0.60 | 35 | 3710 | 11.90 | 20.84 |
| 8 | | | | | | | | | | |
| 9 | - | Meter, Conventional Type, 1Ø | | | | | | | | |
| 10 | | 2 wire 10 Amp. 240 Volt | ea | 77 | 6.93 | 7.12 | 1 | 77 | 6.93 | 7.12 |
| 11 | | | | | | | | | | |
| 12 | | | | | | | | | | |
| 13 | | | | | | | | | | |
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| 23 | | | | | | | | | | |
| 24 | | | | | | | | | | |
| 25 | | | | | | | | | | |
| 26 | | | | | | | | | | |
| 27 | | TOTAL COST - STANDARD UNIT | | | | | | 7829 | 30.59 | 49.46 |

# DISTRIBUTION SYSTEM COST

SERVICES AND METERS

SINGLE-PHASE, 3-WIRE, 240/480 VOLTS

STANDARD UNIT

**LOCATION: CENTRAL JAVA**

| | DESIGNATION | DESCRIPTION | UNIT | UNIT COST - INSTALLED | | | QUANTITY | EXTENSION | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | RUPIAH | US $ | EQUIVALENT US $ | | RUPIAH | US $ | EQUIVALENT US $ |
| 1 | SH-A | Lift Pole | ea | 20191 | 8.59 | 57.24 | 0.2 | 4038 | 1.72 | 11.45 |
| 2 | | | | | | | | | | |
| 3 | K-10C | Service Assembly-House End | ea | 1080 | 2.96 | 5.56 | 1 | 1080 | 2.96 | 5.56 |
| 4 | K-15C | Service Assembly-Pole End | ea | 492 | 4.43 | 5.62 | 1 | 492 | 4.43 | 5.62 |
| 5 | JS | Secondary Assembly | ea | 790 | 2.23 | 4.13 | 0.2 | 158 | 0.45 | 0.83 |
| 6 | | | | | | | | | | |
| 7 | - | Service Cond.#4 Triplex- | | | | | | | | |
| 8 | | "Periwinkle" | M | 142 | 0.636 | 0.979 | 30 | 4260 | 19.08 | 29.35 |
| 9 | - | Meter, Socket Type, 1Ø, 3 wire | | | | | | | | |
| 10 | | 30 Amp 240/480 Volt | ea | 2970 | 28.86 | 36.02 | 1 | 2970 | 28.86 | 36.02 |
| 11 | | | | | | | | | | |
| 12 | | | | | | | | | | |
| 13 | | | | | | | | | | |
| 14 | | | | | | | | | | |
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| 23 | | | | | | | | | | |
| 24 | | | | | | | | | | |
| 25 | | | | | | | | | | |
| 26 | | | | | | | | | | |
| 27 | | TOTAL COST - STANDARD UNIT | | | | | | 12998 | 57.50 | 88.83 |

# DISTRIBUTION SYSTEM COST

SERVICES AND METERS

THREE-PHASE, 4-WIRE, 240/415 VOLTS, 100 AMP MAXIMUM

SELF-CONTAINED METER

STANDARD UNIT

**LOCATION: CENTRAL JAVA**

| | DESIGNATION | DESCRIPTION | UNIT | UNIT COST - INSTALLED | | | QUANTITY | EXTENSION | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | RUPIAH | US $ | EQUIVALENT US $ | | RUPIAH | US $ | EQUIVALENT US $ |
| 1 | SH-A | Lift Pole | ea | 20191 | 8.59 | 57.24 | 0.4 | 8076 | 3.44 | 22.90 |
| 2 | | | | | | | | | | |
| 3 | K10C | Service Assembly-House End | ea | 1080 | 2.96 | 5.56 | 1 | 1080 | 2.96 | 5.56 |
| 4 | K11C | Service Assembly-Pole End | ea | 1477 | 6.81 | 10.37 | 1 | 1477 | 6.81 | 10.37 |
| 5 | J9 | Secondary Assembly | ea | 790 | 2.23 | 4.13 | 0.4 | 316 | 0.89 | 1.65 |
| 6 | | | | | | | | | | |
| 7 | - | Service Cable, Quadruplex | | | | | | | | |
| 8 | | "Palomino" | M | 192 | 1.247 | 1.709 | 30 | 5760 | 37.41 | 51.28 |
| 9 | - | Meter, Socket Type, 3Ø, 4wire, | | | | | | | | |
| 10 | | 30 Amp, 240/415 Volt | ea | 9408 | 132.26 | 154.93 | 1 | 9408 | 132.26 | 154.93 |
| 11 | | | | | | | | | | |
| 12 | | | | | | | | | | |
| 13 | | | | | | | | | | |
| 14 | | | | | | | | | | |
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| 24 | | | | | | | | | | |
| 25 | | | | | | | | | | |
| 26 | | | | | | | | | | |
| 27 | | TOTAL COST - STANDARD UNIT | | - | | | | 26117 | 183.77 | 246.70 |

# DISTRIBUTION SYSTEM COST

SERVICES AND METERS

THREE-PHASE, 4-WIRE, 240/415 VOLTS, MORE THAN 100 AMPS

TRANSFORMER METERING

STANDARD UNIT

**LOCATION: CENTRAL JAVA**

| | DESIGNATION | DESCRIPTION | UNIT | UNIT COST - INSTALLED | | | QUANTITY | EXTENSION | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | RUPIAH | US $ | EQUIVALENT US $ | | RUPIAH | US $ | EQUIVALENT US $ |
| 1 | S11-A | Lift Pole | ea | 20191 | 8.59 | 57.24 | 0.5 | 10096 | 4.30 | 28.62 |
| 2 | | | | | | | | | | |
| 3 | K10C | Service Assembly-House End | ea | 1080 | 2.96 | 5.56 | 1 | 1080 | 2.96 | 5.56 |
| 4 | K11C | Service Assembly-Pole End | ea | 1477 | 6.81 | 10.37 | 1 | 1477 | 6.81 | 10.37 |
| 5 | J9 | Secondary Assembly | ea | 790 | 2.23 | 4.13 | 0.5 | 395 | 1.12 | 2.07 |
| 6 | | | | | | | | | | |
| 7 | - | Service Cable, #2/0 Quadruplex | | | | | | | | |
| 8 | | "Grullo" | M | 297 | 2.274 | 2.99 | 25 | 7425 | 56.85 | 74.75 |
| 9 | | | | | | | | | | |
| 10 | - | Meter, Socket Type, 3Ø, 4 wire | | | | | | | | |
| 11 | | 2.5 Amp 240/415 Volt, with | | | | | | | | |
| 12 | | 3-200/5 Amp C.T.S. | ea | 22744 | 218.58 | 273.38 | 1 | 22744 | 218.58 | 273.39 |
| 13 | | | | | | | | | | |
| 14 | | | | | | | | | | |
| 15 | | | | | | | | | | |
| 16 | | | | | | | | | | |
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| 24 | | | | | | | | | | |
| 25 | | | | | | | | | | |
| 26 | | | | | | | | | | |
| 27 | | **TOTAL COST - STANDARD UNIT** | | | | | | 43217 | 290.62 | 394.76 |

# DISTRIBUTION SYSTEM COST

## MISCELLANEOUS CONSTRUCTION ITEMS
## ANDARD UNITS

LOCATION: **CENTRAL JAVA**

| | DESIGNATION | DESCRIPTION | UNIT | UNIT COST - INSTALLED | | | QUANTITY | EXTENSION | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | RUPIAH | US $ | EQUIVALENT US. $ | | RUPIAH | US $ | EQUIVALENT US. $ |
| 1. | - | Security Light-175 Watt Merc | ea | | | | | 9525 | 78.38 | 101.33 |
| 2. | | | | | | | | | | |
| 3 | VM7-1 | Regulators-10-1X50 Amp | ea | | | | | 242303 | 6340 | 6924 |
| 4 | VM7-3 | " 30-3X50 Amp | ea | | | | | 660119 | 18976 | 20567 |
| 5 | VM7-3 | " 30-3X100Amp | ea | | | | | 778644 | 22903 | 24779 |
| 6 | VM7-3 | " 30-3X200Amp | ea | | | | | 970529 | 30506 | 32845 |
| 7 | | | | | | | | | | |
| 8 | VM3-4 | Sectionalizing Fused C.O.-10 | ea | | | | | 10299 | 61.86 | 86.68 |
| 9. | VM3-10A | Oil CKT Recloser-10 | ea | | | | | 25330 | 851.68 | 912.72 |
| 10 | VM3-16 | Air Break SW.G.O.-30 | ea | | | | | 94444 | 1304 | 1532 |
| 11 | VM3-20 | Oil CKT Recloser-30X-Arm Mtg | ea | | | | | 96703 | 2492 | 2725 |
| 12 | VM3-20A | " " " 30 Cluster Mtg | ea | | | | | 75850 | 2593 | 2776 |
| 13. | VM3-23 | " " " 10 W/By Pass Sw | ea | | | | | 37794 | 984 | 1075 |
| 14. | VM3-25 | " " " 30 W/By Pass Sw | ea | | | | | 121899 | 2974 | 3268 |
| 15. | | | | | | | | | | |
| 16. | R1-20 | R/W Clearing | KM | | | | | 39248 | - | 94.59 |
| 17. | | | | | | | | | | |
| 18 | | | | | | | | | | |
| 19 | | | | | | | | | | |
| 20. | | | | | | | | | | |
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# DISTRIBUTION SYSTEM COST

TRANSFORMERS-OVERHEAD POLE TYPE
SINGLE H.V BUSHING COMPLETELY SELF-PROTECTED
SINGLE-PHASE, 50 Hz.11.55-220/440 VOLTS WITH TAPS
STANDARD KVA UNIT

**LOCATION: CENTRAL JAVA**

| | DESIGNATION | DESCRIPTION | | UNIT | UNIT COST - INSTALLED RUPIAH | US. $ | EQUIVALENT US. $ | QUANTITY | EXTENSION RUPIAH | US. $ | EQUIVALENT US. $ |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1. | | The "MIX" of transformers by | | | | | | | | | |
| 2 | | KVA capacity needed per 100 | | | | | | | | | |
| 3 | | installation is estimated on | | | | | | | | | |
| 4 | | these quantities | | | | | | | | | |
| 5 | | TOTAL | KVA | | | | | | | | |
| 6 | VG-105 | 10 KVA | 190 | ea | 18567 | 487.58 | 532.32 | 19 | 352773 | 9264 | 10114 |
| 7 | | 15 KVA | 375 | ea | 19882 | 505.59 | 553.50 | 25 | 497050 | 12640 | 13838 |
| 8 | | 25 KVA | 1250 | ea | 25853 | 603.41 | 665.71 | 50 | 1292650 | 30170 | 33285 |
| 9. | | 37.5 KVA | 112.5 | ea | 33351 | 802.22 | 882.58 | 3 | 100053 | 2407 | 2648 |
| 10 | | 50 KVA | 150 | ea | 41061 | 888.85 | 987.79 | 3 | 123183 | 2666 | 2963 |
| 11 | | | | | | | | | | | |
| 12 | | Total KVA/100 Installations | | | | | | | | | |
| 13. | | | 2077.5 | | | | | | | | |
| 14 | | | | | | | | | | | |
| 15 | | Total Cost/100 Installations | | | | | | | 2365709 | 57147 | 62848 |
| 16. | | | | | | | | | | | |
| 17 | | Cost/KVA=Line 15 ÷ 2077.5 | | | | | | | 1139 | 27.51 | 30.25 |
| 18 | | | | | | | | | | | |
| 19 | | | | | | | | | | | |
| 20 | | | | | | | | | | | |
| 21 | | | | | | | | | | | |
| 22 | | | | | | | | | | | |
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| 24 | | | | | | | | | | | |
| 25 | | | | | | | | | | | |
| 26 | | | | | | | | | | | |
| 27 | | **TOTAL COST - STANDARD KVA Unit** | | | | | | | 1139 | 27.51 | 30.25 |

TABLE 16. DISTRIBUTION SYSTEM COST-OPERATING YEAR INITIAL LOCATION: KLATEN - C.JAVA

| | DESCRIPTION | UNIT COST | | | QUANTITY | EXTENSION | | |
|---|---|---|---|---|---|---|---|---|
| | | RUPIAH | U.S. $ | EQUIV U.S $ | | RUPIAH | U.S $ | EQUIVALENT U.S $ |
| 1. | PRIMARY LINES - KMS | | | | 449.64 | | | |
| 2 | a)477Kcmil-AAC-3Ø | 1585638 | 6833.84 | 10654.66 | 25.83 | 40957030 | 176518.09 | 275209.73 |
| 3 | b)#4/0-AAC-3Ø | 1204397 | 3960.98 | 6863.14 | - | - | - | - |
| 4 | c)#1/0-AAAC-3Ø | 1093604 | 3179.66 | 5814.85 | 19.64 | 21478383 | 62448.52 | 114203.65 |
| 5 | d)#2-AAAC-3Ø | 1055525 | 2771.63 | 5315.06 | 2.42 | 2554370 | 6707.34 | 12862.45 |
| 6. | e)#1/0-AAAC-"V"Ø | 981771 | 2504.70 | 4870.42 | - | - | - | - |
| 7 | f)#2-AAAC-"V"Ø | 956385 | 2232.68 | 4537.22 | 18.20 | 17406207 | 40634.78 | 82577.45 |
| 8. | g)#2-AAAC-1Ø | 652136 | 1392.07 | 2963.48 | 5.36 | 3495449 | 7461.50 | 15884.27 |
| 9 | h)#4-AAAC-1Ø | 606915 | 1240.88 | 2703.33 | 378.19 | 229529183 | 469288.41 | 1022370.67 |
| 10. | SECONDARY LINES-KMS | | | | 105.00 | | | |
| 11. | a)#1/0 AAAC-3wire | 778236 | 1908.37 | 3783.63 | 78.75 | 61286085 | 150284.14 | 297961.45 |
| 12. | b)#2-AAAC-3 wire | 752850 | 1636.35 | 3450.45 | 26.25 | 19762312 | 42954.19 | 90574.22 |
| 13. | SECONDARY UNDERBUILD-KMS | | | | 385.85 | | | |
| 14 | a) #1/0-AAAC-2wire | 220327 | 1089.70 | 1620.60 | 289.65 | 63817716 | 315631.61 | 469406.79 |
| 15. | b) #2-AAAC-2 wire | 194941 | 817.68 | 1287.42 | 96.2 | 18753324 | 78660 .81 | 123849.54 |
| 16. | SERVICES & METERS-EACH | | | | 2255 | | | |
| 17. | a) 1Ø-2 WIRE | 7829 | 30.59 | 49.46 | 2070 | 16206030 | 63321.30 | 102371.97 |
| 18. | b) 1Ø-3 WIRE | 12998 | 57.50 | 88.83 | 180 | 2339640 | 10350.00 | 15987.69 |
| 19 | c) 3Ø-4 WIRE | 26117 | 183.77 | 246.70 | 5 | 130585 | 918.85 | 1233.51 |
| 20 | TRANSFORMERS-KVA | 1139 | 27.51 | 30.25 | 7060 | 8041340 | 194220.60 | 213597.32 |
| 21 | SECURITY LIGHTS-EACH | 9529 | 78.38 | 101.33 | 480 | 4573920 | 37622.40 | 48643.89 |
| 22. | VOLTAGE REGULATORS-EACH | | | | | | | |
| 23 | a)1Ø-50 Amp | 242303 | 6340.00 | 6924.00 | - | - | - | - |
| 24 | b)3Ø 3X100 Amp | 778644 | 22903.00 | 24779.00 | - | - | - | - |
| 25 | SECTIONALIZING - EA | | | | | | | |
| 26. | a)1Ø FUSED C O | 10299 | 61.86 | 86.68 | 16 | 164784 | 989.76 | 1386.83 |
| 27. | b)1Ø OCR.W/SW | 37794 | 984.00 | 1075.00 | 14 | 529116 | 13776.00 | 15050.98 |
| 28. | c)3X1Ø OCR W/SW | 121899 | 2974.00 | 3268.00 | 17 | 2072283 | 50558.00 | 55551.45 |
| 29. | d)3Ø ABS. | 94444 | 1304.00 | 1532.00 | 3 | 383332 | 3912.00 | 4594.73 |
| 30 | R/W CLEARING-KMS. | 39248 | - | 94.57 | 212.00 | 8320576 | - | 20049.58 |
| 31 | SUB-TOTAL | | | | | - | - | - |
| 32 | ADJUSTED FOR LOCATION | | | | | - | - | - |
| 33 | SUB-TOTAL | | | | | 521,701,665 | 1,726,258.30 | 2,983,370.75 |
| 34. | ENGINEERING AT 5 % | | | | | 61,904,943 | - | 149,168.54 |
| 35. | TOTAL COST | | | | | 583,606,608 | 1,726,258.30 | 3,132,539.29 |

# DISTRIBUTION SYSTEM COST- OPERATING YEAR 1 LOCATION: KLATEN C. JAVA

| | DESCRIPTION | UNIT COST | | | QUANTITY | EXTENSION | | |
|---|---|---|---|---|---|---|---|---|
| | | RUPIAH | U.S. $ | EQUIV. U.S. $ | | RUPIAH | U.S. $ | EQUIVALENT U.S. $ |
| 1. | PRIMARY LINES - KMS | | | | 1.0 | | | |
| 2. | a) 477Kcmil-AAC-3Ø | 1585638 | 6833.84 | 10654.66 | | | | |
| 3 | b) #4/0-AAC-3Ø | 1204397 | 3960.98 | 6863.14 | | | | |
| 4 | c) #1/0-AAAC-3Ø | 1093604 | 3179.66 | 5814.85 | | | | |
| 5 | d) #2-AAAC-3Ø | 1055525 | 2771.63 | 5315.06 | | | | |
| 6. | e) #1/0-AAAC-"V"Ø | 981771 | 2504.70 | 4870.42 | | | | |
| 7. | f) #2-AAAC-"V"Ø | 956385 | 2232.68 | 4537.22 | | | | |
| 8 | g) #2-AAAC-1Ø | 652136 | 1392.07 | 2963.48 | | | | |
| 9. | h) #4-AAAC-1Ø | 606915 | 1240.88 | 2703.33 | 1.0 | 606915 | 1240.88 | 2703.33 |
| 10. | SECONDARY LINES-KMS | | | | 2.0 | | | |
| 11. | a) #1/0 AAAC-3wire | 778236 | 1908.37 | 3783.63 | 1.0 | 778236 | 1908.37 | 3783.63 |
| 12. | b) #2-AAAC-3 wire | 752850 | 1636.35 | 3450.45 | 1.0 | 752850 | 1636.35 | 3450.45 |
| 13. | SECONDARY UNDERBUILD-KMS | | | | 2.0 | | | |
| 14. | a) #1/0-AAAC-2wire | 220327 | 1089.70 | 1620.60 | 1.0 | 220327 | 1089.70 | 1620.60 |
| 15 | b) #2-AAAC-2 wire | 194941 | 817.68 | 1287.42 | 1.0 | 194941 | 817.68 | 1287.42 |
| 16 | SERVICES & METERS-EACH | | | | 8503 | | | |
| 17 | a) 1Ø-2 WIRE | 7829 | 30.59 | 49.46 | 8300 | 64,980,700 | 253,897.00 | 410,477.00 |
| 18. | b) 1Ø-3 WIRE | 12998 | 57.50 | 88.83 | 200 | 2,599,600 | 11,500.00 | 17,764.10 |
| 19 | c) 3Ø-4 WIRE | 26117 | 183.77 | 246.70 | 3 | 78,351 | 551.31 | 740.11 |
| 20. | TRANSFORMERS-KVA | 1139 | 27.51 | 30.25 | 375 | 427,125 | 10316.25 | 11,345.47 |
| 21 | SECURITY LIGHTS-EACH | 9529 | 78.38 | 101.33 | 192 | 1,829,568 | 15048.96 | 19,457.56 |
| 22. | VOLTAGE REGULATORS-EACH | | | | | | | |
| 23 | a) 1Ø-50 Amp | 242303 | 6340.00 | 6924.00 | | | | |
| 24. | b) 3Ø 3X100 Amp | 778644 | 22903.00 | 24779.00 | | | | |
| 25. | SECTIONALIZING - EA | | | | | | | |
| 26. | a) 1Ø FUSED C O | 10299 | 61.86 | 86.68 | | | | |
| 27. | b) 1Ø OCR. W/SW | 37794 | 984.00 | 1075.00 | | | | |
| 28. | c) 3X1Ø OCR W/SW | 121899 | 2974.00 | 3268.00 | | | | |
| 29. | d) 3Ø ABS. | 94444 | 1304.00 | 1532.00 | | | | |
| 30. | R/W CLEARING-KMS. | 39248 | - | 94.57 | | | | |
| 31. | SUB-TOTAL | | | | | | | |
| 32 | ADJUSTED FOR LOCATION | | | | | | | |
| 33. | SUB-TOTAL | | | | | 72,468,613 | 298,006.50 | 472,629.66 |
| 34. | ENGINEERING AT 5 % | | | | | 9,807,065 | - | 23,631.48 |
| 35. | TOTAL COST | | | | | 82,275,678 | 298,006.50 | 496,261.14 |

# DISTRIBUTION SYSTEM COST-OPERATING YEAR 2 LOCATION: KLATEN - C.JAVA

| | DESCRIPTION | UNIT COST | | | QUANTITY | EXTENSION | | |
|---|---|---|---|---|---|---|---|---|
| | | RUPIAH | U.S. $ | EQUIV. U.S. $ | | RUPIAH | U.S. $ | EQUIVALENT U.S. $ |
| 1 | PRIMARY LINES - KMS | | | | | | | |
| 2 | a) 477Kcmil-AAC-3Ø | 1585638 | 6833.84 | 10654.66 | | | | |
| 3 | b) #4/0-AAC-3Ø | 1204397 | 3960.98 | 6863.14 | | | | |
| 4 | c) #1/0-AAAC-3Ø | 1093604 | 3179.66 | 5814.85 | | | | |
| 5 | d) #2-AAAC-3Ø | 1055525 | 2771.83 | 5315.06 | | | | |
| 6 | e) #1/0-AAAC-"V"Ø | 981771 | 2504.70 | 4870.42 | | | | |
| 7 | f) #2-AAAC-"V"Ø | 956385 | 2232.68 | 4537.22 | | | | |
| 8 | g) #2-AAAC-1Ø | 652136 | 1392.07 | 2963.48 | | | | |
| 9 | h) #4-AAAC-1Ø | 606915 | 1240.88 | 2703.33 | | | | |
| 10 | SECONDARY LINES-KMS. | | | | 1.0 | | | |
| 11 | a) #1/0 AAAC-3wire | 778236 | 1908.37 | 3783.63 | 1.0 | 778236 | 1908.37 | 3783.63 |
| 12 | b) #2-AAAC-3 wire | 752850 | 1636.35 | 3450.45 | | | | |
| 13 | SECONDARY UNDERBUILD-KMS. | | | | | | | |
| 14 | a) #1/0-AAAC-2wire | 220327 | 1089.70 | 1620.60 | | | | |
| 15 | b) #2-AAAC-2 wire | 194941 | 817.68 | 1287.42 | | | | |
| 16 | SERVICES & METERS-EACH. | | | | 8407 | | | |
| 17 | a) 1Ø-2 WIRE | 7829 | 20.59 | 49.46 | 8250 | 64,589,250 | 252367.50 | 408,004.25 |
| 18 | b) 1Ø-3 WIRE | 12998 | 57.50 | 88.83 | 150 | 1,949,700 | 8625.00 | 13,323.07 |
| 19 | c) 3Ø-4 WIRE | 26117 | 183.77 | 246.70 | 7 | 182,189 | 1286.39 | 1,725.40 |
| 20 | TRANSFORMERS-KVA | 1139 | 27.51 | 30.25 | 125 | 142,375 | 3438.75 | 3781.82 |
| 21 | SECURITY LIGHTS-EACH. | 9529 | 78.38 | 101.33 | 192 | 1,829,568 | 15048.96 | 19457.56 |
| 22 | VOLTAGE REGULATORS-EACH | | | | | | | |
| 23 | a) 1Ø-50 Amp | 242303 | 6340.00 | 6924.00 | | | | |
| 24 | b) 3Ø 3X100 Amp | 778644 | 22903.00 | 24779.00 | | | | |
| 25 | SECTIONALIZING - EA. | | | | | | | |
| 26 | a) 1Ø FUSED C O | 10299 | 61.86 | 86.68 | | | | |
| 27 | b) 1Ø OCR W/SW | 37794 | 984.00 | 1075.00 | | | | |
| 28 | c) 3X1Ø OCR W/SW | 121899 | 2974.00 | 3268.00 | | | | |
| 29 | d) 3Ø ABS | 94444 | 1304.00 | 1532.00 | | | | |
| 30 | R/W CLEARING-KMS. | 39248 | - | 94.57 | | | | |
| 31 | SUB-TOTAL | | | | | 69,471,318 | 282,674.97 | 450,075.73 |
| 32 | ADJUSTED FOR LOCATION | | | | | | | |
| 33 | SUB-TOTAL | | | | | 69,471,318 | 282,674.97 | 450,075.73 |
| 34 | ENGINEERING AT 5 % | | | | | 9,339,071 | - | 22,503.79 |
| 35 | TOTAL COST | | | | | 78,810,389 | 282,674.97 | 472,579.52 |

# DISTRIBUTION SYSTEM COST- OPERATING YEAR 3 LOCATION: KLATEN C.JAVA

| | DESCRIPTION | UNIT COST | | | QUANTITY | EXTENSION | | |
|---|---|---|---|---|---|---|---|---|
| | | RUPIAH | U.S. $ | EQUIV. U.S. $ | | RUPIAH | U.S. $ | EQUIVALENT U.S. $ |
| 1 | PRIMARY LINES - KMS | | | | | | | |
| 2 | a) 477Kcmil-AAC-3Ø | 1585638 | 6833.84 | 10654.66 | | | | |
| 3 | b) #4/0-AAC-3Ø | 1204397 | 3960.98 | 6863.14 | | | | |
| 4 | c) #1/0-AAAC-3Ø | 1093604 | 3179.66 | 5814.85 | | | | |
| 5 | d) #2-AAAC-3Ø | 1055525 | 2771.63 | 5315.06 | | | | |
| 6 | e) #1/0-AAAC-"V"Ø | 981771 | 2504.70 | 4870.42 | | | | |
| 7 | f) #2-AAAC-"V"Ø | 956385 | 2232.68 | 4537.22 | | | | |
| 8 | g) #2-AAAC-1Ø | 652136 | 1392.07 | 2963.48 | | | | |
| 9 | h) #4-AAAC-1Ø | 606915 | 1240.88 | 2703.33 | | | | |
| 10 | SECONDARY LINES-KMS | | | | 2.0 | | | |
| 11 | a) #1/0 AAAC-3wire | 778236 | 1908.37 | 3783.63 | 1.0 | 778236 | 1908.37 | 3783.63 |
| 12 | b) #2-AAAC-3 wire | 752850 | 1636.35 | 3450.45 | 1.0 | 752850 | 1636.35 | 3450.45 |
| 13 | SECONDARY UNDERBUILD-KMS | | | | 2.0 | | | |
| 14 | a) #1/0-AAAC-2wire | 220327 | 1089.70 | 1620.60 | 1.0 | 220327 | 1089.70 | 1620.60 |
| 15 | b) #2-AAAC-2 wire | 194941 | 817.68 | 1287.42 | 1.0 | 194941 | 817.68 | 1287.42 |
| 16 | SERVICES & METERS-EACH | | | | 7304 | | | |
| 17 | a) 1Ø-2 WIRE | 7829 | 30.59 | 49.46 | 7200 | 56,368,800 | 220248.00 | 356076.43 |
| 18 | b) 1Ø-3 WIRE | 12998 | 57.50 | 88.83 | 100 | 1,299,800 | 5750.00 | 8882.05 |
| 19 | c) 3Ø-4 WIRE | 26117 | 183.77 | 246.70 | 4 | 104,468 | 735.08 | 986.81 |
| 20 | TRANSFORMERS-KVA | 1139 | 27.51 | 30.25 | 330 | 375870 | 9078.30 | 9984.01 |
| 21 | SECURITY LIGHTS-EACH | 9529 | 78.38 | 101.33 | 192 | 1,829,568 | 15048.96 | 19457.56 |
| 22 | VOLTAGE REGULATORS-EACH | | | | | | | |
| 23 | a) 1Ø -50 Amp | 242303 | 6340.00 | 6924.00 | | | | |
| 24 | b) 3Ø 3X100 Amp | 778644 | 22903.00 | 24779.00 | | | | |
| 25 | SECTIONALIZING - EA | | | | | | | |
| 26 | a) 1Ø FUSED C O | 10299 | 61.86 | 86.68 | | | | |
| 27 | b) 1Ø OCR. W/SW | 37794 | 984.00 | 1075.00 | 1 | 37794 | 984.00 | 1075.00 |
| 28 | c) 3X1Ø OCR W/SW | 121899 | 2974.00 | 3268.00 | | | | |
| 29 | d) 3Ø ABS | 94444 | 1304.00 | 1532.00 | | | | |
| 30 | R/W CLEARING-KMS. | 39248 | - | 94.57 | 1.0 | 39248 | - | 94.59 |
| 31 | SUB-TOTAL | | | | | | | |
| 32 | ADJUSTED FOR LOCATION | | | | | | | |
| 33 | SUB-TOTAL | | | | | 62,001,902 | 257296.44 | 406,698.61 |
| 34 | ENGINEERING AT 5% | | | | | 8,438,996 | - | 20,334.93 |
| 35 | TOTAL COST | | | | | 70,440,898 | 257,296.44 | 427,033.54 |

# DISTRIBUTION SYSTEM COST-OPERATING YEAR 4 LOCATION: KLATEN C.JAVA

| | DESCRIPTION | UNIT COST RUPIAH | UNIT COST U.S. $ | UNIT COST EQUIV. U.S. $ | QUANTITY | EXTENSION RUPIAH | EXTENSION U.S. $ | EXTENSION EQUIVALENT U.S. $ |
|---|---|---|---|---|---|---|---|---|
| 1 | PRIMARY LINES - KMS | | | | | | | |
| 2 | a)477Kcmil-AAC-3Ø | 1585638 | 6833.84 | 10654.66 | | | | |
| 3 | b)#4/0-AAC-3Ø | 1204397 | 3960.98 | 6863.14 | | | | |
| 4 | c)#1/0-AAAC-3Ø | 1093604 | 3179.66 | 5814.85 | | | | |
| 5 | d)#2-AAAC-3Ø | 1055525 | 2771.63 | 5315.06 | | | | |
| 6. | e)#1/0-AAAC-"V"Ø | 981771 | 2504.70 | 4870.42 | | | | |
| 7 | f)#2-AAAC-"V"Ø | 956385 | 2232.68 | 4537.22 | | | | |
| 8 | g)#2-AAAC-1Ø | 652136 | 1392.07 | 2963.48 | | | | |
| 9 | h)#4-AAAC-1Ø | 606915 | 1240.88 | 2703.33 | | | | |
| 10. | SECONDARY LINES-KMS | | | | | | | |
| 11 | a)#1/0 AAAC-3wire | 778236 | 1908.37 | 3783.63 | | | | |
| 12. | b)#2-AAAC-3 wire | 752850 | 1636.35 | 3450.45 | | | | |
| 13. | SECONDARY UNDERBUILD-KMS | | | | | | | |
| 14. | a) #1/0-AAAC-2wire | 220327 | 1089.70 | 1620.60 | | | | |
| 15. | b) #2-AAAC-2 wire | 194941 | 817.68 | 1287.42 | | | | |
| 16 | SERVICES & METERS-EACH | | | | 5702 | | | |
| 17 | a) 1Ø-2 WIRE | 7829 | 30.59 | 49.46 | 5650 | 44,233,850 | 172,833.50 | 279,421.10 |
| 18 | b) 1Ø-3 WIRE | 12998 | 57.50 | 88.83 | 50 | 649,900 | 2875.00 | 4441 .02 |
| 19. | c) 3Ø-4 WIRE | 26117 | 183.77 | 246.70 | 2 | 52234 | 367.54 | 493.40 |
| 20 | TRANSFORMERS-KVA | 1139 | 27.51 | 30.25 | 1535 | 1,748,365 | 42227.85 | 46440.77 |
| 21 | SECURITY LIGHTS-EACH | 9529 | 78.38 | 101.33 | 96 | 914,784 | 7524.48 | 9728.78 |
| 22. | VOLTAGE REGULATORS-EACH | | | | | | | |
| 23 | a)1Ø-50 Amp | 242303 | 6340.00 | 6924.00 | | | | |
| 24 | b)3Ø 3X100 Amp | 778644 | 22903.00 | 24779.00 | | | | |
| 25 | SECTIONALIZING - EA | | | | | | | |
| 26. | a)1Ø FUSED C O | 10299 | 61.86 | 86.68 | | | | |
| 27 | b)1Ø OCR W/SW | 37794 | 984.00 | 1075.00 | | | | |
| 28 | c)3X1Ø OCR W/SW | 121899 | 2974.00 | 3268.00 | | | | |
| 29 | d)3Ø ABS | 94444 | 1304.00 | 1532.00 | | | | |
| 30 | R/W CLEARING-KMS. | 39249 | - | 94.57 | | | | |
| 31 | SUB-TOTAL | | | | | 47,599,133 | 225,828.37 | 340,525.07 |
| 32 | ADJUSTED FOR LOCATION | | | | | | | |
| 33 | SUB-TOTAL | | | | | 7,065,895 | - | 17,026.25 |
| 34 | ENGINEERING AT 5 % | | | | | | | |
| 35 | TOTAL COST | | | | | 54,665,028 | 225,828.37 | 357,551.32 |

# DISTRIBUTION SYSTEM COST- OPERATING YEAR 5 LOCATION: KLATEN C.JAVA

| | DESCRIPTION | UNIT COST RUPIAH | UNIT COST US $ | UNIT COST EQUIV US $ | QUANTITY | EXTENSION RUPIAH | EXTENSION US $ | EXTENSION EQUIVALENT US $ |
|---|---|---|---|---|---|---|---|---|
| 1 | PRIMARY LINES - KMS | | | | 1.0 | | | |
| 2 | a)477Kcmil-AAC-3Ø | 1585638 | 6833.84 | 10654.66 | - | | | |
| 3 | b)#4/0-AAC-3Ø | 1204397 | 3960.98 | 6863.14 | - | | | |
| 4 | c)#1/0-AAAC-3Ø | 1093604 | 3179.66 | 5814.85 | - | | | |
| 5 | d)#2-AAAC-3Ø | 1055525 | 2771.63 | 5315.06 | - | | | |
| 6. | e)#1/0-AAAC-"V"Ø | 981771 | 2504.70 | 4870.42 | - | | | |
| 7 | f)#2-AAAC-"V"Ø | 956385 | 2232.68 | 4537.22 | - | | | |
| 8 | g)#2-AAAC-1Ø | 652136 | 1392.07 | 2963.48 | - | | | |
| 9 | h)#4-AAAC-1Ø | 606915 | 1240.88 | 2703.33 | 1.0 | 606915 | 1240.88 | 2703.33 |
| 10. | SECONDARY LINES-KMS | | | | 2.0 | | | |
| 11. | a)#1/0 AAAC-3wire | 778236 | 1908.37 | 3783.63 | 1.0 | 778236 | 1908.37 | 3783.63 |
| 12. | b)#2-AAAC-3 wire | 752850 | 1636.35 | 3450.45 | 1.0 | 752850 | 1636.35 | 3450.45 |
| 13 | SECONDARY UNDERBUILD-KMS | | | | 1.0 | | | |
| 14 | a) #1/0-AAAC-2wire | 220327 | 1089.70 | 1620.60 | - | | | |
| 15 | b) #2-AAAC-2 wire | 194941 | 817.68 | 1287.42 | 1.0 | 194941 | 817.68 | 1287.42 |
| 16. | SERVICES & METERS-EACH | | | | 4301 | | | |
| 17 | a) 1Ø-2 WIRE | 7829 | 30.59 | 49.46 | 4270 | 33,429,830 | 130619.30 | 211,173.11 |
| 18. | b) 1Ø-3 WIRE | 12998 | 57.50 | 88.83 | 30 | 389,940 | 1725.00 | 2,664.61 |
| 19. | c) 3Ø-4 WIRE | 26117 | 183.77 | 246.70 | 1 | 26117 | 183.77 | 246.70 |
| 20 | TRANSFORMERS-KVA | 1139 | 27.51 | 30.25 | 1175 | 1,338,325 | 32324.25 | 35,549.13 |
| 21 | SECURITY LIGHTS-EACH | 9529 | 78.38 | 101.33 | 96 | 914,784 | 7524.48 | 9,728.78 |
| 22. | VOLTAGE REGULATORS-EACH | | | | | | | |
| 23 | a)1Ø-50 Amp | 242303 | 6340.00 | 6924.00 | | | | |
| 24. | b)3Ø 3X100 Amp | 778644 | 22903.00 | 24779.00 | | | | |
| 25 | SECTIONALIZING - EA | | | | | | | |
| 26. | a)1Ø FUSED C O | 10299 | 61.86 | 86.68 | | | | |
| 27 | b)1Ø OCR.W/SW | 37794 | 984.00 | 1075.00 | | | | |
| 28 | c)3X1Ø OCR W/SW | 121899 | 2974.00 | 3268.00 | | | | |
| 29 | d)3Ø ABS. | 94444 | 1304.00 | 1532.00 | | | | |
| 30. | R/W CLEARING-KMS. | 39248 | - | 94.57 | 1.0 | 39248 | - | 94.59 |
| 31 | SUB-TOTAL | | | | | | | |
| 32 | ADJUSTED FOR LOCATION | | | | | | | |
| 33 | SUB-TOTAL | | | | | 38,417,186 | 177,980.08 | 270,681.73 |
| 34 | ENGINEERING AT 5 % | | | | | 5,616,646 | - | 13,534.09 |
| 35. | TOTAL COST | | | | | 44,087,813 | 177,980.08 | 284,215.82 |

# DISTRIBUTION SYSTEM COST- OPERATING YEAR 6 LOCATION: KLATEN C. JAVA

| | DESCRIPTION | UNIT COST | | | QUANTITY | EXTENSION | | |
|---|---|---|---|---|---|---|---|---|
| | | RUPIAH | U.S $ | EQUIV. U.S. $ | | RUPIAH | U.S. $ | EQUIVALENT U.S $ |
| 1 | PRIMARY LINES - KMS | | | | | | | |
| 2 | a)477Kcmil-AAC-3Ø | 1585638 | 6833.84 | 10654.66 | | | | |
| 3 | b)#4/0-AAC-3Ø | 1204397 | 3960.98 | 6863.14 | | | | |
| 4 | c)#1/0-AAAC-3Ø | 1093604 | 3179.66 | 5814.85 | | | | |
| 5 | d)#2-AAAC-3Ø | 1055525 | 2771.63 | 5315.06 | | | | |
| 6 | e)#1/0-AAAC-"V"Ø | 981771 | 2504.70 | 4870.42 | | | | |
| 7 | f)#2-AAAC-"V"Ø | 956385 | 2232.68 | 4537.22 | | | | |
| 8 | g)#2 AAAC-1Ø | 652136 | 1392.07 | 2963.48 | | | | |
| 9 | h)#4-AAAC-1Ø | 606915 | 1240.88 | 2703.33 | | | | |
| 10 | SECONDARY LINES-KMS | | | | 1.0 | | | |
| 11 | a)#1/0 AAAC-3wire | 778236 | 1908.37 | 3783.63 | | | | |
| 12 | b)#2-AAAC-3 wire | 752850 | 1636.35 | 3450.45 | 1.0 | 752850 | 1636.35 | 3450.45 |
| 13 | SECONDARY UNDERBUILD-KMS | | | | | | | |
| 14 | a) #1/0-AAAC-2wire | 220327 | 1089.70 | 1620.60 | | | | |
| 15 | b) #2-AAAC-2 wire | 194941 | 817.68 | 1287.42 | | | | |
| 16 | SERVICES & METERS-EACH | | | | 2801 | | | |
| 17 | a) 1Ø-2 WIRE | 7829 | 30.59 | 49.46 | 2770 | 21,686,330 | 84734.30 | 136,990.52 |
| 18 | b) 1Ø-3 WIRE | 12998 | 57.50 | 88.83 | 30 | 389,940 | 1725.00 | 2664.61 |
| 19 | c) 3Ø-4 WIRE | 26117 | 183.77 | 246.70 | 1 | 26117 | 183.77 | 246.70 |
| 20 | TRANSFORMERS-KVA | 1139 | 27.51 | 30.25 | 755 | 859945 | 20770.05 | 22842.21 |
| 21 | SECURITY LIGHTS-EACH | 9529 | 78.38 | 101.33 | 96 | 914784 | 7524.48 | 9728.78 |
| 22 | VOLTAGE REGULATORS-EACH | | | | | | | |
| 23 | a)1Ø -50 Amp | 242303 | 6340.00 | 6924.00 | | | | |
| 24 | b)3Ø 3x100 Amp | 778644 | 22903.00 | 24779.00 | | | | |
| 25 | SECTIONALIZING - EA | | | | | | | |
| 26 | a)1Ø FUSED C O | 10299 | 61.86 | 86.68 | | | | |
| 27 | b)1Ø OCR.W/SW | 37794 | 984.00 | 1075.00 | 1 | 37794 | 984.00 | 1075.06 |
| 28 | c)3x1Ø OCR W/SW | 121899 | 2974.00 | 3268.00 | | | | |
| 29 | d)3Ø ABS | 94444 | 1304.00 | 1532.00 | | | | |
| 30 | R/W CLEARING-KMS. | 39248 | - | 94.57 | | | | |
| 31 | SUB-TOTAL | | | | | | | |
| 32 | ADJUSTED FOR LOCATION | | | | | | | |
| 33 | SUB-TOTAL | | | | | 24,667,760 | 117,557.95 | 176,998.33 |
| 34 | ENGINEERING AT 5 % | | | | | 3,672,715 | - | 8,849.92 |
| 35 | TOTAL COST | | | | | 28,340,475 | 117,557.95 | 185,848.25 |

# DISTRIBUTION SYSTEM COST-OPERATING YEAR 7 LOCATION: KL[illegible] C.JAVA

| | DESCRIPTION | UNIT COST | | | QUANTITY | EXTENSION | | |
|---|---|---|---|---|---|---|---|---|
| | | RUPIAH | U.S. $ | EQUIV. U.S. $ | | RUPIAH | U.S. $ | EQUIVALENT US $ |
| 1 | PRIMARY LINES - KMS | | | | 1.0 | | | |
| 2 | a)477Kcmil-AAC-3Ø | 1555638 | 6833.84 | 10654.66 | | | | |
| 3 | b)#4/0-AAC-3Ø | 1204397 | 3960.98 | 6863.14 | | | | |
| 4 | c)#1/0-AAAC-3Ø | 1093604 | 3179.66 | 5814.85 | | | | |
| 5 | d)#2-AAAC-3Ø | 1055525 | 2771.63 | 5315.06 | | | | |
| 6 | e)#1/0-AAAC-"V"Ø | 981771 | 2504.70 | 4870.42 | | | | |
| 7 | f)#2-AAAC-"V"Ø | 956385 | 2232.68 | 4537.22 | | | | |
| 8 | g)#2-AAAC-1Ø | 652136 | 1392.07 | 2963.48 | | | | |
| 9 | h)#4-AAAC-1Ø | 606915 | 1240.88 | 2703.33 | 1.0 | 606915 | 1240.88 | 2703.33 |
| 10 | SECONDARY LINES-KMS | | | | 1.0 | | | |
| 11 | a)#1/0 AAAC-3wire | 778236 | 1908.37 | 3783.63 | 1.0 | 778236 | 1908.37 | 3783.64 |
| 12 | b)#2-AAAC-3 wire | 752850 | 1636.35 | 3450.45 | - | | | |
| 13 | SECONDARY UNDERBUILD-KMS | | | | | | | |
| 14 | a) #1/0-AAAC-2wire | 220327 | 1089.70 | 1620.60 | | | | |
| 15 | b) #2-AAAC-2 wire | 194941 | 817.68 | 1287.42 | 1.0 | 194941 | 817.68 | 1287.42 |
| 16 | SERVICES & METERS-EACH | | | | 2092 | | | |
| 17 | a) 1Ø-2 WIRE | 7829 | 30.59 | 49.46 | 2060 | 16,127,740 | 63015.40 | 101877.42 |
| 18 | b) 1Ø-3 WIRE | 12998 | 57.50 | 88.83 | 30 | 389,940 | 1725.00 | 2664.61 |
| 19 | c) 3Ø-4 WIRE | 26117 | 183.77 | 246.70 | 2 | 52234 | 367,54 | 493.40 |
| 20 | TRANSFORMERS-KVA | 1139 | 27.51 | 30.25 | 590 | 672010 | 16230.90 | 17850.20 |
| 21 | SECURITY LIGHTS-EACH | 9529 | 78.38 | 101.33 | 96 | 914784 | 7524.48 | 9728.78 |
| 22 | VOLTAGE REGULATORS-EACH | ? | | | | | | |
| 23 | a)1Ø-50 Amp | 242303 | 6340.00 | 6924.00 | | | | |
| 24 | b)3Ø 3X100 Amp | 778644 | 22903.00 | 24779.00 | | | | |
| 25 | SECTIONALIZING - EA. | | | | | | | |
| 26 | a)1Ø FUSED C O | 10299 | 61.86 | 86.68 | | | | |
| 27 | b)1Ø OCR W/SW | 17794 | 984.00 | 1075.00 | | | | |
| 28 | c)3X1Ø OCR W/SW | 121859 | 2974.00 | 3268.00 | | | | |
| 29 | d)3Ø ABS | 94444 | 1304.00 | 1532.00 | | | | |
| 30 | R/W CLEARING-KMS. | 39248 | - | 94.57 | 1.0 | 39248 | - | 94.57 |
| 31 | SUB-TOTAL | | | | | | | |
| 32 | ADJUSTED FOR LOCATION | | | | | | | |
| 33 | SUB-TOTAL | | | | | 19,776,048 | 92830.25 | 140,483.38 |
| 34 | ENGINEERING AT 5 % | | | | | 2,915,030 | - | 7024.17 |
| 35 | TOTAL COST | | | | | 22,691,078 | 92830.25 | 147,507.55 |

# DISTRIBUTION SYSTEM COST-OPERATING YEAR 8 LOCATION: KLATEN C.JAVA

| | DESCRIPTION | UNIT COST | | | QUANTITY | EXTENSION | | |
|---|---|---|---|---|---|---|---|---|
| | | RUPIAH | US. $ | EQUIV US $ | | RUPIAH | U.S. $ | EQUIVALENT US $ |
| 1 | PRIMARY LINES - KMS | | | | | | | |
| 2 | a) 477Kcmil-AAC-3Ø | 1585638 | 6833.84 | 10654.66 | | | | |
| 3 | b) #4/0-AAC-3Ø | 1204397 | 3960.98 | 6863.14 | | | | |
| 4 | c) #1/0-AAAC-3Ø | 1093604 | 3179.66 | 5814.85 | | | | |
| 5 | d) #2-AAAC-3Ø | 1055525 | 2771.63 | 5315.06 | | | | |
| 6 | e) #1/0-AAAC-"V"Ø | 981771 | 2504.70 | 4870.42 | | | | |
| 7 | f) #2-AAAC-"V"Ø | 956385 | 2232.68 | 4537.22 | | | | |
| 8 | g) #2-AAAC-1Ø | 652136 | 1392.07 | 2963.48 | | | | |
| 9 | h) #4-AAAC-1Ø | 606915 | 1240.88 | 2703.33 | | | | |
| 10 | SECONDARY LINES-KMS | | | | 1.0 | | | |
| 11 | c) #1/0 AAAC-3wire | 778236 | 1908.37 | 3783.63 | | | | |
| 12 | b) #2-AAAC-3 wire | 752850 | 1636.35 | 3450.45 | 1.0 | 752850 | 1636.35 | 3450.45 |
| 13 | SECONDARY UNDERBUILD-KMS | | | | | | | |
| 14 | a) #1/0-AAAC-2wire | 220327 | 1089.70 | 1620.60 | | | | |
| 15 | b) #2-AAAC-2 wire | 194941 | 617.68 | 1287.42 | | | | |
| 16 | SERVICES & METERS-EACH | | | | 1492 | | | |
| 17 | a) 1Ø-2 WIRE | 7829 | 30.59 | 49.46 | 1470 | 11,508,630 | 44967.30 | 72,698,94 |
| 18 | b) 1Ø-3 WIRE | 12998 | 57.50 | 88.83 | 20 | 259,960 | 1150.00 | 1776.41 |
| 19 | c) 3Ø-4 WIRE | 26117 | 183.77 | 246.70 | 2 | 52,234 | 367,57 | 493.40 |
| 20 | TRANSFORMERS-KVA | 1139 | 27.51 | 30.25 | 435 | 495465 | 11966.85 | 13160.74 |
| 21 | SECURITY LIGHTS-EACH | 9529 | 78.38 | 101.33 | 96 | 914784 | 7524.48 | 9728.78 |
| 22 | VOLTAGE REGULATORS-EACH | | | | | | | |
| 23 | a) 1Ø-50 Amp | 242303 | 6340.00 | 6924.00 | | | | |
| 24 | b) 3Ø 3X100 Amp | 778644 | 22903.00 | 24779.00 | | | | |
| 25 | SECTIONALIZING - EA | | | | | | | |
| 26 | a) 1Ø FUSED C O | 10799 | 61.86 | 86.68 | | | | |
| 27 | b) 1Ø OCR W/SW | 37794 | 984.00 | 1075.00 | | | | |
| 28 | c) 3X1Ø OCR W/SW | 121899 | 2974.00 | 3268.00 | | | | |
| 29 | d) 3Ø ABS | 94444 | 1304.00 | 1532.00 | | | | |
| 30 | R/W CLEARING-KMS. | 39248 | - | 94.57 | | | | |
| 31 | SUB-TOTAL | | | | | | | |
| 32 | ADJUSTED FOR LOCATION | | | | | | | |
| 33 | SUB-TOTAL | | | | | 13,983,923 | 67612.55 | 101,308.75 |
| 34 | ENGINEERING AT 5 % | | | | | 2,102,157 | | 5,065.44 |
| 35 | TOTAL COST | | | | | 16,086,080 | 67612.55 | 106,374.19 |

# DISTRIBUTION SYSTEM COST - OPERATING YEAR 9 LOCATION: KLATEN C.JAVA

| | DESCRIPTION | UNIT COST RUPIAH | UNIT COST US $ | UNIT COST EQUIV. US $ | QUANTITY | EXTENSION RUPIAH | EXTENSION U.S $ | EXTENSION EQUIVALENT US $ |
|---|---|---|---|---|---|---|---|---|
| 1 | PRIMARY LINES - KMS | | | | 1.0 | | | |
| 2 | a) 477Kcmil-AAC-3Ø | 1585638 | 6833.84 | 10654.66 | | | | |
| 3 | b) #4/0-AAC-3Ø | 1204397 | 3960.98 | 6863.14 | | | | |
| 4 | c) #1/0-AAAC-3Ø | 1093604 | 3179.66 | 5814.85 | | | | |
| 5 | d) #2-AAAC-3Ø | 1055525 | 2771.63 | 5315.06 | | | | |
| 6 | e) #1/0-AAAC-"V"Ø | 981771 | 2504.70 | 4870.42 | | | | |
| 7 | f) #2-AAAC-"V"Ø | 956385 | 2232.68 | 4537.22 | | | | |
| 8 | g) #2-AAAC-1Ø | 652136 | 1392.07 | 2963.48 | | | | |
| 9 | h) #4-AAAC-1Ø | 606915 | 1240.88 | 2703.33 | 1.0 | 606915 | 1240.88 | 2703.33 |
| 10 | SECONDARY LINES-KMS | | | | 1.0 | | | |
| 11 | a) #1/0 AAAC-3wire | 778236 | 1908.37 | 3783.63 | 1.0 | 778236 | 1908.37 | 3783.63 |
| 12 | b) #2-AAAC-3 wire | 752850 | 1636.35 | 3450.45 | | | | |
| 13 | SECONDARY UNDERBUILD-KMS | | | | 2.0 | | | |
| 14 | a) #1/0-AAAC-2wire | 220327 | 1089.70 | 1620.60 | 1.0 | 220327 | 1089.70 | 1620.39 |
| 15 | b) #2-AAAC-2 wire | 194941 | 817.68 | 1287.42 | 1.0 | 194941 | 817.68 | 1287.42 |
| 16 | SERVICES & METERS-EACH | | | | | | | |
| 17 | a) 1Ø-2 WIRE | 7829 | 30.59 | 49.46 | 1270 | 9,942,830 | 38849.30 | 62807.93 |
| 18 | b) 1Ø-3 WIRE | 12998 | 57.50 | 88.83 | 20 | 259960 | 1150.00 | 1776.41 |
| 19 | c) 3Ø-4 WIRE | 26117 | 183.77 | 246.70 | 2 | 52234 | 367.57 | 493.40 |
| 20 | TRANSFORMERS-KVA | 1139 | 27.51 | 30.25 | 380 | 432820 | 10453.80 | 11496.74 |
| 21 | SECURITY LIGHTS-EACH | 9529 | 78.38 | 101.33 | 96 | 914784 | 7524.48 | 9728.78 |
| 22 | VOLTAGE REGULATORS-EACH | | | | | | | |
| 23 | a) 1Ø-50 Amp | 242303 | 6340.00 | 6924.00 | | | | |
| 24 | b) 3Ø 3X100 Amp | 778644 | 22903.00 | 24779.00 | | | | |
| 25 | SECTIONALIZING - EA | | | | | | | |
| 26 | a) 1Ø FUSED C O | 10799 | 61.86 | 96.69 | | | | |
| 27 | b) 1Ø OCR W/SW | [illegible] | 954.00 | 1075.00 | | | | |
| 28 | c) 3X1Ø OCR W/SW | 121999 | 2974.00 | 3268.00 | | | | |
| 29 | d) 3Ø ABS | 94444 | 1304.00 | 1532.00 | | | | |
| 30 | R/W CLEARING-KMS. | 39248 | - | 94.57 | 1.0 | 39248 | - | 94.57 |
| 31 | SUB-TOTAL | | | | | | | |
| 32 | ADJUSTED FOR LOCATION | | | | | | | |
| 33 | SUB-TOTAL | | | | | 13,442,295 | 63,401.78 | 95972.85 |
| 34 | ENGINEERING AT 5 % | | | | | 1,987,702 | - | 4789.64 |
| 35 | TOTAL COST | | | | | 15,427,997 | 63,401.78 | 100,582.49 |

# DISTRIBUTION SYSTEM COST-OPERATING YEAR 10 LOCATION: KLATEN - C.JAVA

| | DESCRIPTION | UNIT COST | | | QUANTITY | EXTENSION | | |
|---|---|---|---|---|---|---|---|---|
| | | RUPIAH | U.S. $ | EQUIV. U.S $ | | RUPIAH | U.S $ | EQUIVALENT U.S $ |
| 1 | PRIMARY LINES - KMS | | | | 1.0 | | | |
| 2 | a) 477Kcmil-AAC-3Ø | 1585638 | 6833.84 | 10654.66 | | | | |
| 3 | b) #4/0-AAC-3Ø | 1204397 | 3960.98 | 6863.14 | | | | |
| 4 | c) #1/0-AAAC-3Ø | 1093604 | 3179.66 | 5814.85 | | | | |
| 5 | d) #2-AAAC-3Ø | 1055525 | 2771.63 | 5315.06 | | | | |
| 6. | e) #1/0-AAAC-"V"Ø | 981771 | 2504.70 | 4870.42 | | | | |
| 7 | f) #2-AAAC-"V"Ø | 956385 | 2232.68 | 4537.22 | | | | |
| 8 | g) #2-AAAC-1Ø | 652136 | 1392.07 | 2963.48 | | | | |
| 9. | h) #4-AAAC-1Ø | 606915 | 1240.88 | 2703.33 | 1.0 | 606915 | 1240.88 | 2,703.33 |
| 10 | SECONDARY LINES-KMS. | | | | | | | |
| 11 | a) #1/0 AAAC-3wire | 778236 | 1908.37 | 3783.63 | | | | |
| 12. | b) #2-AAAC-3 wire | 752850 | 1636.35 | 3450.45 | | | | |
| 13. | SECONDARY UNDERBUILD-KMS. | | | | | | | |
| 14 | a) #1/0-AAAC-2wire | 220327 | 1089.70 | 1620.60 | | | | |
| 15 | b) #2-AAAC-2 wire | 194941 | 817.68 | 1287.42 | | | | |
| 16. | SERVICES & METERS-EACH | | | | 1092 | | | |
| 17 | a) 1Ø-2 WIRE | 7829 | 30.59 | 49.46 | 1060 | 8,298,740 | 32,425.40 | 52,422.36 |
| 18. | b) 1Ø-3 WIRE | 12998 | 57.50 | 88.83 | 30 | 389,940 | 1,725.00 | 2,664.61 |
| 19 | c) 3Ø-4 WIRE | 26117 | 183.77 | 246.70 | 2 | 52,234 | 367.54 | 493.41 |
| 20 | TRANSFORMERS-KVA. | 1139 | 27.51 | 30.25 | 305 | 347,395 | 8,390.55 | 9,227.65 |
| 21 | SECURITY LIGHTS-EACH | 9529 | 78.38 | 101.33 | 96 | 914,688 | 7,524.48 | 9,728.55 |
| 22. | VOLTAGE REGULATORS-EACH | | | | | | | |
| 23 | a) 1Ø-50 Amp | 242303 | 6340.00 | 6924.00 | | | | |
| 24. | b) 3Ø 3X100 Amp | 778644 | 22903.00 | 24779.00 | | | | |
| 25 | SECTIONALIZING - EA | | | | | | | |
| 26 | a) 1Ø FUSED C O | 10299 | 61.86 | 86.68 | | | | |
| 27 | b) 1Ø OCR W/SW | 37794 | 984.00 | 1075.00 | 1 | 37,794 | 984.00 | 1,075.07 |
| 28 | c) 3X1Ø OCR W/SW | 121499 | 2974.00 | 3268.00 | | | | |
| 29 | d) 3Ø ABS | 94444 | 1304.00 | 1537.00 | | | | |
| 30 | R/W CLEARING-KMS. | 39248 | - | 94.57 | | | | |
| 31 | SUB-TOTAL | | | | | | | |
| 32 | ADJUSTED FOR LOCATION | | | | | | | |
| 33 | SUB-TOTAL | | | | | 10,647,706 | 52,657.85 | 78,314.98 |
| 34. | ENGINEERING AT 5 % | | | | | 1,625,036 | - | 3,915.75 |
| 35. | TOTAL COST | | | | | 12,272,742 | 52,657.85 | 82,230.73 |

# DISTRIBUTION SYSTEM COST-OPERATING YEAR 11 LOCATION: KLATEN C.JAVA

| | DESCRIPTION | UNIT COST RUPIAH | UNIT COST US $ | UNIT COST EQUIV US $ | QUANTITY | EXTENSION RUPIAH | EXTENSION U.S $ | EXTENSION EQUIVALENT US $ |
|---|---|---|---|---|---|---|---|---|
| 1 | PRIMARY LINES - KMS | | | | 1.0 | | | |
| 2 | a) 477Kcmil-AAC-3Ø | 1585638 | 6833.84 | 10654.66 | | | | |
| 3 | b) #4/0-AAC-3Ø | 1204397 | 3960.98 | 6863.14 | | | | |
| 4 | c) #1/0-AAAC-3Ø | 1093604 | 3179.66 | 5814.85 | | | | |
| 5 | d) #2-AAAC-3Ø | 1055525 | 2771.63 | 5315.06 | | | | |
| 6 | e) #1/0-AAAC-"V"Ø | 981771 | 2504.70 | 4870.42 | | | | |
| 7 | f) #2-AAAC-"V"Ø | 956385 | 2232.68 | 4537.22 | | | | |
| 8 | g) #2-AAAC-1Ø | 652136 | 1392.07 | 2963.48 | | | | |
| 9 | h) #4-AAAC-1Ø | 606915 | 1240.88 | 2703.33 | 1.0 | 606,915 | 1,240.88 | 2,703.33 |
| 10 | SECONDARY LINES-KMS | | | | 2.0 | | | |
| 11 | a) #1/0 AAAC-3wire | 778236 | 1908.37 | 3783.63 | 1.0 | 778,236 | 1,908.37 | 3.783.64 |
| 12 | b) #2-AAAC-3 wire | 752850 | 1636.35 | 3450.45 | 1.0 | 752,850 | 1,636.35 | 3,450.45 |
| 13 | SECONDARY UNDERBUILD-KMS | | | | 1.0 | | | |
| 14 | a) #1/0-AAAC-2wire | 220327 | 1089.70 | 1620.60 | 1.0 | 220,327 | 1,089.70 | 1,620.61 |
| 15 | b) #2-AAAC-2 wire | 194941 | 817.68 | 1287.42 | | | | |
| 16 | SERVICES & METERS-EACH | | | | 882 | | | |
| 17 | a) 1Ø-2 WIRE | 7829 | 30.59 | 49.46 | .860 | 6,732,940 | 26,307.40 | 42,531.35 |
| 18 | b) 1Ø-3 WIRE | 12998 | 57.50 | 88.83 | 20 | 259,960 | 1,150.00 | 1,776.41 |
| 19 | c) 3Ø-4 WIRE | 26117 | 183.77 | 246.70 | 2 | 52,234 | 367.54 | 493.41 |
| 20 | TRANSFORMERS-KVA | 1139 | 27.51 | 30.25 | 270 | 307,530 | 7,427.70 | 8,168.74 |
| 21 | SECURITY LIGHTS-EACH | 9529 | 78.39 | 101.33 | 96 | 914,784 | 7,524.48 | 9728.78 |
| 22 | VOLTAGE REGULATORS-EACH | | | | | | | |
| 23 | a) 1Ø-50 Amp | 242303 | 6340.00 | 6924.00 | | | | |
| 24 | b) 3Ø 3X100 Amp | 778644 | 22903.00 | 24779.00 | | | | |
| 25 | SECTIONALIZING - EA. | | | | | | | |
| 26 | a) 1Ø FUSED C O | 10292 | 61.96 | 86.68 | | | | |
| 27 | b) 1Ø OCR W/SW | 37794 | 984.00 | 1075.00 | | | | |
| 28 | c) 3X1Ø OCR W/SW | 121899 | 2974.00 | 3268.00 | | | | |
| 29 | d) 3Ø ABS | 94444 | 1304.00 | 1532.00 | | | | |
| 30 | R/W CLEARING - KMS. | 39248 | - | 94.57 | 1.0 | 39,248 | - | 94.57 |
| 31 | SUB-TOTAL | | | | | | | |
| 32 | ADJUSTED FOR LOCATION | | | | | | | |
| 33 | SUB-TOTAL | | | | | 10,665,024 | 48,652.42 | 74,351.27 |
| 34 | ENGINEERING AT 5 % | | | | | 1,541,957 | - | 3717.56 |
| 35 | TOTAL COST | | | | | 12,206,981 | 48,652.42 | 78,068.83 |

# DISTRIBUTION SYSTEM COST-OPERATING YEAR 12 LOCATION: KLATEN C.JAVA

| | DESCRIPTION | UNIT COST RUPIAH | UNIT COST U.S. $ | UNIT COST EQUIV. U.S $ | QUANTITY | EXTENSION RUPIAH | EXTENSION U.S. $ | EXTENSION EQUIVALENT U.S $ |
|---|---|---|---|---|---|---|---|---|
| 1 | PRIMARY LINES - KMS | | | | 1.0 | | | |
| 2 | a)477Kcmil-AAC-3Ø | 1585638 | 6833.84 | 10654.66 | | | | |
| 3 | b)#4/0-AAC-3Ø | 1204397 | 3960.98 | 6863.14 | | | | |
| 4 | c)#1/0-AAAC-3Ø | 1093604 | 3179.66 | 5814.85 | | | | |
| 5 | d)#2-AAAC-3Ø | 1055525 | 2771.63 | 5315.06 | | | | |
| 6. | e)#1/0-AAAC-"V"Ø | 981771 | 2504.70 | 4870.42 | | | | |
| 7 | f)#2-AAAC-"V"Ø | 956385 | 2232.68 | 4537.22 | | | | |
| 8 | g)#2-AAAC-1Ø | 652136 | 1392.07 | 2963.48 | | | | |
| 9 | h)#4-AAAC-1Ø | 606915 | 1240.88 | 2703.33 | 1.0 | 606,915 | 1,240.88 | 2,703.33 |
| 10 | SECONDARY LINES-KMS. | | | | | | | |
| 11 | a)#1/0 AAAC-3wire | 778236 | 1908.37 | 3783.63 | | | | |
| 12. | b)#2-AAAC-3 wire | 752850 | 1636.35 | 3450.45 | | | | |
| 13 | SECONDARY UNDERBUILD-KMS. | | | | 1.0 | | | |
| 14 | a) #1/0-AAAC-2wire | 220327 | 1089.70 | 1620.60 | | | | |
| 15 | b) #2-AAAC-2 wire | 194941 | 817.68 | 1287.42 | 1.0 | 194,941 | 817.68 | 1,287.42 |
| 16 | SERVICES & METERS-EACH | | | | 682 | | | |
| 17 | a) 1Ø-2 WIRE | 7929 | 30.59 | 49.46 | 650 | 5,088,850 | 19,883.50 | 32,145.79 |
| 18 | b) 1Ø-3 WIRE | 12998 | 57.50 | 88.83 | 30 | 389,940 | 1,725.00 | 2,664.61 |
| 19 | c) 3Ø-4 WIRE | 26117 | 183.77 | 246.70 | 2 | 52,234 | 367.54 | 493.41 |
| 20 | TRANSFORMERS-KVA | 1139 | 27.51 | 30.25 | 195 | 222,105 | 5,364.45 | 5,899.64 |
| 21 | SECURITY LIGHTS-EACH. | 9529 | 78.38 | 101.33 | 96 | 914,784 | 7,524.48 | 9,728.78 |
| 22. | VOLTAGE REGULATORS-EACH | ? | | | | | | |
| 23 | a)1Ø-50 Amp | 242303 | 6340.00 | 6924.00 | | | | |
| 24 | b)3Ø 3X100 Amp | 778644 | 22903.00 | 24779.00 | | | | |
| 25 | SECTIONALIZING - EA | | | | | | | |
| 26. | a)1Ø FUSED C O | 10299 | 61.86 | 86.68 | | | | |
| 27 | b)1Ø OCR W/SW | 37794 | 984.00 | 1075.00 | | | | |
| 28 | c)3X1Ø OCR W/SW | 121599 | 2974.00 | 3268.00 | | | | |
| 29 | d)3Ø ABS | 94[illegible] | 1304.00 | 1532.00 | | | | |
| 30 | R/W CLEARING-KMS. | 39248 | - | 94.57 | | | | |
| 31 | SUB-TOTAL | | | | | | | |
| 32 | ADJUSTED FOR LOCATION | | | | | | | |
| 33 | SUB-TOTAL | | | | | 7,486,769 | 36,923.44 | 54,922.88 |
| 34. | ENGINEERING AT 5 % | | | | | 1,139,648 | - | 2,746.14 |
| 35 | TOTAL COST | | | | | 8,609,417 | 36,923.44 | 57,669.02 |

# DISTRIBUTION SYSTEM COST-OPERATING YEAR 13 LOCATION: KLATEN C.JAVA

| | DESCRIPTION | UNIT COST | | | QUANTITY | EXTENSION | | |
|---|---|---|---|---|---|---|---|---|
| | | RUPIAH | U.S. $ | EQUIV. U.S. $ | | RUPIAH | U.S. $ | EQUIVALENT U.S. $ |
| 1 | PRIMARY LINES - KMS | | | | 1.0 | | | |
| 2 | a) 477Kcmil-AAC-3Ø | 1585638 | 6833.84 | 10654.66 | | | | |
| 3 | b) #4/0-AAC-3Ø | 1204397 | 3960.98 | 6863.14 | | | | |
| 4 | c) #1/0-AAAC-3Ø | 1093604 | 3179.66 | 5814.85 | | | | |
| 5 | d) #2-AAAC-3Ø | 1055525 | 2771.63 | 5315.06 | | | | |
| 6 | e) #1/0-AAAC-"V"Ø | 981771 | 2504.70 | 4870.42 | | | | |
| 7 | f) #2-AAAC-"V"Ø | 956385 | 2232.68 | 4537.22 | | | | |
| 8 | g) #2-AAAC-1Ø | 652136 | 1392.07 | 2963.48 | | | | |
| 9 | h) #4-AAAC-1Ø | 606915 | 1240.88 | 2703.33 | 1.0 | 606,915 | 1,240.88 | 2,703.33 |
| 10 | SECONDARY LINES-KMS | | | | 1.0 | | | |
| 11 | a) #1/0 AAAC-3wire | 778236 | 1908.37 | 3783.63 | 1.0 | 778,236 | 1,908.37 | 3,783.64 |
| 12 | b) #2-AAAC-3 wire | 7[illegible]950 | 1636.35 | 3450.45 | | | | |
| 13 | SECONDARY UNDERBUILD-KMS | | | | 1.0 | | | |
| 14 | a) #1/0-AAAC-2wire | 220327 | 1089.70 | 1620.60 | 1.0 | 220,327 | 1,089.70 | 1,620.61 |
| 15 | b) #2-AAAC-2 wire | 194941 | 817.68 | 1287.42 | | | | |
| 16 | SERVICES & METERS-EACH | | | | | | | |
| 17 | a) 1Ø-2 WIRE | 7829 | 30.59 | 49.46 | 450 | 3,523,050 | 13,765.50 | 22,254.78 |
| 18 | b) 1Ø-3 WIRE | 12998 | 57.50 | 88.83 | 25 | 324,950 | 1,437.50 | 2,220.51 |
| 19 | c) 3Ø-4 WIRE | 26117 | 183.77 | 246.70 | 2 | 52,234 | 367.54 | 493.41 |
| 20 | TRANSFORMERS-KVA. | 1139 | 27.51 | 30.25 | 165 | 187,935 | 4,539.15 | 4,992.01 |
| 21 | SECURITY LIGHTS-EACH | 9529 | 78.38 | 101.33 | 96 | 914,784 | 7,524.48 | 9,728.78 |
| 22 | VOLTAGE REGULATORS-EACH | | | | | | | |
| 23 | a) 1Ø-50 Amp | 242303 | 6340.00 | 6924.00 | | | | |
| 24 | b) 3Ø 3X100 Amp | 778644 | 22903.00 | 24779.00 | | | | |
| 25 | SECTIONALIZING - EA | | | | | | | |
| 26 | a) 1Ø FUSED C O | 10299 | 61.86 | 86.68 | | | | |
| 27 | b) 1Ø OCR W/SW | 37794 | 984.00 | 1075.00 | | | | |
| 28 | c) 3X1Ø OCR W/SW | 121899 | 2974.00 | 3268.00 | | | | |
| 29 | d) 3Ø ABS. | 94444 | 1304.00 | 1532.00 | | | | |
| 30 | R/W CLEARING-KMS. | 39248 | - | 94.57 | 1.0 | 39,248 | - | 94.57 |
| 31 | SUB-TOTAL | | | | | | | |
| 32 | ADJUSTED FOR LOCATION | | | | | | | |
| 33 | SUB-TOTAL | | | | | 6,647,679 | 31,873.12 | 47,891.64 |
| 34 | ENGINEERING AT 5% | | | | | 993,751 | - | 2,394.58 |
| 35 | TOTAL COST | | | | | 7,641,430 | 31,873.12 | 50,286.22 |

# DISTRIBUTION SYSTEM COST-OPERATING YEAR 14 LOCATION: KLATEN C.JAVA

| | DESCRIPTION | UNIT COST RUPIAH | UNIT COST US $ | UNIT COST EQUIV. U.S. $ | QUANTITY | EXTENSION RUPIAH | EXTENSION U.S. $ | EXTENSION EQUIVALENT U.S. $ |
|---|---|---|---|---|---|---|---|---|
| 1 | PRIMARY LINES - KMS | | | | 1.0 | | | |
| 2 | a) 477Kcmil-AAC-3Ø | 1585635 | 6833.84 | 10654.66 | | | | |
| 3 | b) #4/0-AAC-3Ø | 1204397 | 3960.98 | 6863.14 | | | | |
| 4 | c) #1/0-AAAC-3Ø | 1093604 | 3179.66 | 5814.85 | | | | |
| 5 | d) #2-AAAC-3Ø | 1055525 | 2771.63 | 5315.06 | | | | |
| 6 | e) #1/0-AAAC-"V"Ø | 991771 | 2504.70 | 4870.42 | | | | |
| 7 | f) #2-AAAC-"V"Ø | 956385 | 2232.68 | 4537.22 | | | | |
| 8 | g) #2-AAAC-1Ø | 652136 | 1392.07 | 2963.48 | | | | |
| 9 | h) #4-AAAC-1Ø | 606915 | 1240.88 | 2703.33 | 1.0 | 606,915 | 1,240.88 | 2703.33 |
| 10 | SECONDARY LINES-KMS | | | | 1.0 | | | |
| 11 | a) #1/0 AAAC-3wire | 778236 | 1909.37 | 3783.63 | 1.0 | 778,236 | 1,908.37 | 3783.63 |
| 12 | b) #2-AAAC-3 wire | 752850 | 1636.35 | 3450.45 | | | | |
| 13 | SECONDARY UNDERBUILD-KMS | | | | 1.0 | | | |
| 14 | a) #1/0-AAAC-2wire | 220327 | 1089.70 | 1620.60 | 1.0 | 220,327 | 1,089.70 | 1620.39 |
| 15 | b) #2-AAAC-2 wire | 194941 | 817.68 | 1287.42 | | | | |
| 16 | SERVICES & METERS-EACH | | | | 477 | | | |
| 17 | a) 1Ø-2 WIRE | 7929 | 30.59 | 49.46 | 450 | 3,523,050 | 13765.50 | 22254.78 |
| 18 | b) 1Ø-3 WIRE | 12998 | 57.50 | 88.83 | 25 | 324.50 | 1437.50 | 2220.51 |
| 19 | c) 3Ø-4 WIRE | 26117 | 183.77 | 246.70 | 2 | 52234 | 367.57 | 493.40 |
| 20 | TRANSFORMERS-KVA | 1132 | 27.51 | 30.25 | 165 | 187,935 | 4539.15 | 4992.01 |
| 21 | SECURITY LIGHTS-EACH | 9529 | 78.38 | 101.33 | 96 | 914784 | 7524.48 | 9728.78 |
| 22 | VOLTAGE REGULATORS-EACH | | | | | | | |
| 23 | a) 1Ø-50 Amp | 242303 | 6340.00 | 6924.00 | | | | |
| 24 | b) 3Ø 3X100 Amp | 778644 | 22903.00 | 24779.00 | | | | |
| 25 | SECTIONALIZING - EA | | | | | | | |
| 26 | a) 1Ø FUSED C O | 10299 | 61.86 | 86.68 | 1 | 10,799 | 61.86 | 86.68 |
| 27 | b) 1Ø OCR W/SW | 37794 | 994.00 | 1075.00 | | | | |
| 28 | c) 3X1Ø OCR W/SW | 121899 | 2974.00 | 3268.00 | | | | |
| 29 | d) 3Ø ABS | 94444 | 1304.00 | 1532.00 | | | | |
| 30 | R/W CLEARING-KMS. | 39249 | - | 94.57 | | | | |
| 31 | SUB-TOTAL | | | | | | | |
| 32 | ADJUSTED FOR LOCATION | | | | | | | |
| 33 | SUB-TOTAL | | | | | 6619230 | 31935.01 | 47884.96 |
| 34 | ENGINEERING AT 5 % | | | | | 993613 | - | 2394.25 |
| 35 | TOTAL COST | | | | | 7,612,843 | 31,935.01 | 50279.21 |

# DISTRIBUTION SYSTEM COST-OPERATING YEAR 15 LOCATION: KLATEN C.JAVA

| | DESCRIPTION | UNIT COST RUPIAH | UNIT COST US $ | UNIT COST EQUIV US $ | QUANTITY | EXTENSION RUPIAH | EXTENSION U.S $ | EXTENSION EQUIVALENT U.S $ |
|---|---|---|---|---|---|---|---|---|
| 1 | PRIMARY LINES - KMS | | | | 1.0 | | | |
| 2 | a) 477Kcmil-AAC-3Ø | 1585638 | 6833.84 | 10654.66 | | | | |
| 3 | b) #4/0-AAC-3Ø | 1204397 | 3960.98 | 6863.14 | | | | |
| 4 | c) #1/0-AAAC-3Ø | 1093604 | 3179.66 | 5814.85 | | | | |
| 5 | d) #2-AAAC-3Ø | 1055525 | 2771.63 | 5315.06 | | | | |
| 6 | e) #1/0-AAAC-"V"Ø | 981771 | 2504.70 | 4870.42 | | | | |
| 7 | f) #2-AAAC-"V"Ø | 956385 | 2232.68 | 4537.22 | | | | |
| 8 | g) #2-AAAC-1Ø | 652136 | 1392.07 | 2963.48 | | | | |
| 9 | h) #4-AAAC-1Ø | 606915 | 1240.88 | 2703.33 | 1.0 | 606915 | 1240.88 | 2703.33 |
| 10 | SECONDARY LINES-KMS | | | | 1.0 | | | |
| 11 | a) #1/0 AAAC-3wire | 778236 | 1908.37 | 3783.63 | 1.0 | 778236 | 1908.37 | 3783.64 |
| 12 | b) #2-AAAC-3 wire | 752850 | 1636.35 | 3450.45 | | | | |
| 13 | SECONDARY UNDERBUILD-KMS | | | | 2.0 | | | |
| 14 | a) #1/0-AAAC-2wire | 220327 | 1089.70 | 1620.60 | 1.0 | 220327 | 1089.70 | 1620.39 |
| 15 | b) #2-AAAC-2 wire | 194941 | 817.68 | 1287.42 | 1.0 | 194941 | 817.68 | 1287.42 |
| 16 | SERVICES & METERS-EACH | | | | 277 | | | |
| 17 | a) 1Ø-2 WIRE | 7829 | 30.59 | 49.46 | 220 | 1,722,380 | 6729.80 | 10880.11 |
| 18 | b) 1Ø-3 WIRE | 12998 | 57.50 | 88.83 | 55 | 714890 | 3162.50 | 4885.13 |
| 19 | c) 3Ø-4 WIRE | 26117 | 183.77 | 246.70 | 2 | 52234 | 367.57 | 493.40 |
| 20 | TRANSFORMERS-KVA | 1139 | 27.51 | 30.25 | 100 | 113900 | 2751.00 | 3025.46 |
| 21 | SECURITY LIGHTS-EACH | 9529 | 78.38 | 101.33 | 96 | 914784 | 7524.48 | 9728.78 |
| 22 | VOLTAGE REGULATORS-EACH | | | | | | | |
| 23 | a) 1Ø-50 Amp | 242303 | 6340.00 | 6924.00 | | | | |
| 24 | b) 3Ø 3X100 Amp | 778644 | 22903.00 | 24779.00 | | | | |
| 25 | SECTIONALIZING - EA | | | | | | | |
| 26 | a) 1Ø FUSED C O | 10299 | 61.66 | 86.68 | | | | |
| 27 | b) 1Ø OCR W/SW | 37794 | 994.00 | 1075.00 | | | | |
| 28 | c) 3X1Ø OCR W/SW | 121899 | 2974.00 | 3268.00 | | | | |
| 29 | d) 3Ø ABS. | 94444 | 1304.00 | 1532.00 | | | | |
| 30 | R/W CLEARING-KMS. | 39248 | - | 94.57 | 1.0 | 39248 | - | 94.57 |
| 31 | SUB-TOTAL | | | | | | | |
| 32 | ADJUSTED FOR LOCATION | | | | | | | |
| 33 | SUB-TOTAL | | | | | 5,357,855 | 25,591.98 | 38,502.47 |
| 34 | ENGINEERING AT 5 % | | | | | 798,926 | - | 1925.12 |
| 35 | TOTAL COST | | | | | 6,156,781 | 25,591.98 | 40,427.59 |

# ANNEX D

TABLE 17.

# PROJECT ASSUMPTIONS

LOCATION: KLATEN

| | ITEM | INITIAL PROJECT | YEAR OF OPERATION 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1. | NUMBER OF DESAS | | 96 | 96 | 96 | 96 | 96 | 96 | 96 | 96 | 96 | 96 | 96 | 96 | 96 | 96 | 96 |
| 2 | NO OF NEW RESIDENTIAL CONSUMERS | 2,000 | 8,000 | 8,000 | 7,000 | 5,500 | 4,200 | 2,700 | 2,000 | 1,400 | 1,200 | 1,000 | 800 | 600 | 400 | 200 | 200 |
| 3. | NUMBER OF CONSUMERS | | 10,000 | 18,000 | 25,000 | 30,500 | 34,700 | 37,400 | 39,400 | 40,800 | 42,000 | 43,000 | 43,800 | 44,400 | 44,800 | 45,100 | 45,300 |
| 4 | AVERAGE NUMBER OF CONSUMERS | | 6,000 | 14,000 | 21,500 | 27,750 | 32,600 | 36,050 | 38,400 | 40,100 | 41,400 | 42,500 | 43,400 | 44,100 | 44,600 | 44,950 | 45,100 |
| 5. | AVERAGE KWH / MONTH | | 22 | 22 | 22 | 22 | 26 | 30 | 35 | 39 | 43 | 46 | 50 | 53 | 57 | 60 | 61 |
| 6 | NO OF NEW COMMERCIAL CONSUMERS | 250 | 500 | 400 | 300 | 200 | 100 | 100 | 90 | 90 | 90 | 90 | 80 | 80 | 75 | 50 | 25 |
| 7 | NUMBER OF CONSUMERS | | 750 | 1,150 | 1,450 | 1,650 | 1,750 | 1,850 | 1,940 | 2,030 | 2,120 | 2,210 | 2,290 | 2,370 | 2,445 | 2,495 | 2,520 |
| 8 | AVERAGE NUMBER OF CONSUMERS | | 500 | 950 | 1,300 | 1,550 | 1,700 | 1,800 | 1,895 | 1,985 | 2,075 | 2,165 | 2,250 | 2,330 | 2,40[illegible] | 2,470 | 2,508 |
| 9 | AVERAGE KWH / MONTH | | 132 | 132 | 132 | 132 | 156 | 180 | 210 | 234 | 255 | 276 | 300 | 318 | 342 | 360 | 366 |
| 10 | NUMBER OF STREET LIGHTS / DESA | | 7 | 9 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 |
| 11 | NO OF NEW IRRIGATION CONSUMERS | - | | | | | | | | | | | | | | | |
| 12 | NUMBER OF PUMPS | | | | | | | | | | | | | | | | |
| 13 | AVERAGE NUMBER OF PUMPS | | | | | | | | | | | | | | | | |
| 14 | AVERAGE KW / MONTH | | | | | | | | | | | | | | | | |
| 15 | NUMBER OF HOURS / MONTH | | | | | | | | | | | | | | | | |
| 16 | NO OF NEW GRAIN MILLS | 10 | 10 | 5 | 3 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 |
| 17 | NUMBER OF MILLS | | 20 | 25 | 28 | 30 | 32 | 34 | 36 | 37 | 38 | 40 | 42 | 44 | 46 | 48 | 50 |
| 18 | AVERAGE NUMBER OF MILLS | | 15 | 22 | 27 | 28 | 31 | 33 | 35 | 36 | 37 | 39 | 41 | 43 | 45 | 47 | 49 |
| 19. | AVERAGE KW / MONTH | | 12 | 12 | 13 | 13 | 14 | 14 | 15 | 15 | 16 | 16 | 17 | 17 | 18 | 18 | 18 |
| 20 | NUMBER OF HOURS / MONTH | | 250 | 255 | 200 | 205 | 270 | 275 | 280 | 285 | 290 | 295 | 300 | 305 | 310 | 315 | 320 |
| 21 | NO OF NEW WATER SYSTEMS | - | 48 | 48 | 48 | 48 | 48 | 48 | 48 | 48 | 48 | 48 | 48 | 48 | 48 | 48 | 48 |
| 22 | NUMBER OF SYSTEMS | | 48 | 96 | 144 | 192 | 240 | 288 | 336 | 384 | 432 | 480 | 528 | 576 | 624 | 672 | 720 |
| 23 | AVERAGE NUMBER OF SYSTEMS | | 24 | 72 | 120 | 168 | 216 | 264 | 312 | 360 | 408 | 456 | 504 | 552 | 600 | 648 | 696 |
| 24. | AVERAGE KW / MONTH | | 0.4 | 0.4 | 0.4 | 0.4 | 0.4 | 0.4 | 0.4 | 0.4 | 0.4 | 0.4 | 0.4 | 0.4 | 0.4 | 0.4 | 0.4 |
| 25 | NUMBER OF HOURS / MONTH | | 90 | 90 | 90 | 90 | 90 | 90 | 90 | 90 | 90 | 90 | 90 | 90 | 90 | 90 | 90 |
| 26 | NO OF NEW MISCELLANEOUS | - | 2 | 2 | 2 | 2 | 3 | 3 | 3 | 3 | 3 | 4 | 4 | 4 | 4 | 4 | 4 |
| 27 | NUMBER OF CONSUMERS | | 2 | 4 | 6 | 8 | 11 | 14 | 17 | 20 | 23 | 27 | 31 | 35 | 39 | 43 | 47 |
| 28. | AVERAGE NUMBER OF CONSUMERS | | 1 | 3 | 5 | 7 | 9 | 13 | 16 | 19 | 22 | 25 | 29 | 33 | 37 | 41 | 45 |
| 29. | AVERAGE KWH / MONTH | | 6,250 | 6,250 | 6,250 | 6,250 | 6,250 | 6,250 | 6,250 | 6,250 | 6,250 | 6,250 | 6,250 | 6,250 | 6,250 | 6,250 | 6,250 |

ANNEX D. FINANCIAL FORECAST

TABLE 18.

# CONSUMER USAGE, SALES & POWER REQUIREMENTS

LOCATION: KLATEN

| ITEM | YEAR OF OPERATION 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 NUMBER OF CONSUMERS | | | | | | | | | | | | | | | |
| a Residential | 6,000 | 14,000 | 21,500 | 27,750 | 32,500 | 36,000 | 38,600 | 40,100 | 41,600 | 42,500 | 43,400 | 44,100 | 44,600 | 44,950 | 45,100 |
| b Commercial | 500 | 950 | 1,300 | 1,550 | 1,700 | 1,800 | 1,885 | 1,915 | 2,000 | 2,165 | 2,250 | 2,330 | 2,405 | 2,470 | 2,500 |
| c Street Lights | 672 | 764 | 1,056 | 1,152 | 1,248 | 1,344 | 1,440 | 1,536 | 1,632 | 1,728 | 1,824 | 1,920 | 2,016 | 2,112 | 2,208 |
| d Water Systems | 24 | 72 | 120 | 168 | 216 | 264 | 312 | 360 | 408 | 456 | 504 | 552 | 600 | 648 | 696 |
| POWER CONSUMERS | | | | | | | | | | | | | | | |
| e Grain Mills | 15 | 27 | 27 | 29 | 31 | 33 | 35 | 36 | 37 | 39 | 41 | 43 | 45 | 47 | 49 |
| f Irrigation Pumps | - | | - | - | | | - | | | | - | | | | - |
| g | | | | | | | | | | | | | | | |
| h | | | | | | | | | | | | | | | |
| i | | | | | | | | | | | | | | | |
| j Misc Power Consumers | 1 | 2 | 3 | 7 | 9 | 13 | 16 | 19 | 27 | 25 | 29 | 33 | 37 | 41 | 45 |
| TOTAL | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] |
| 2 AVERAGE MONTHLY USAGE KWH | | | | | | | | | | | | | | | |
| a Residential | 22 | 32 | 32 | 32 | 36 | 30 | 35 | 39 | 43 | 46 | 50 | 53 | 57 | 60 | 63 |
| b Commercial | 132 | 132 | 132 | 132 | 156 | 180 | 210 | 234 | 258 | 276 | 300 | 318 | 342 | 360 | 366 |
| c Street Lights | 45 | 45 | 45 | 45 | 45 | 45 | 45 | 45 | 45 | 45 | 45 | 45 | 45 | 45 | 45 |
| d Water Systems | 36 | 36 | 36 | 36 | 36 | 36 | 36 | 36 | 36 | 36 | 36 | 36 | 36 | 36 | 36 |
| POWER CONSUMERS | | | | | | | | | | | | | | | |
| e Grain Mills | 3,000 | 3,360 | 3,360 | 3,445 | 3,780 | 3,960 | 4,200 | 4,275 | 4,845 | 4,770 | 5,170 | 5,185 | 5,340 | 5,970 | 5,760 |
| f Irrigation Pumps | | | | | | | | | | | | | | | |
| g | | | | | | | | | | | | | | | |
| h | | | | | | | | | | | | | | | |
| i | | | | | | | | | | | | | | | |
| j Misc Power Consumers | 6,250 | 6,250 | 6,250 | 6,250 | 6,250 | 6,250 | 6,250 | 6,250 | 6,250 | 6,250 | 6,250 | 6,250 | 6,250 | 6,250 | 6,250 |
| 3 TOTAL MONTHLY SALES KWH | | | | | | | | | | | | | | | |
| a Residential | [illegible] | [illegible] | 473,000 | 610,500 | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] |
| b Commercial | [illegible] | [illegible] | [illegible] | 204,600 | [illegible] | 324,000 | 397,950 | 444,600 | [illegible] | 597,540 | 675,000 | 740,940 | 823,536 | [illegible] | [illegible] |
| c Street Lights | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] |
| d Water Systems | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] |
| POWER CONSUMERS | | | | | | | | | | | | | | | |
| e Grain Mills | 45,000 | 87,320 | 91,260 | 99,905 | 117,180 | 127,050 | 147,000 | 153,900 | 180,960 | 184,050 | 209,100 | [illegible] | 251,100 | 266,490 | 297,360 |
| f Irrigation Pumps | | | | | | | | | | | | | | | |
| g | | | | | | | | | | | | | | | |
| h | | | | | | | | | | | | | | | |
| i | | | | | | | | | | | | | | | |
| j Misc Power Consumers | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] |
| TOTAL | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] |
| 4 ANNUAL POWER REQUIREMENTS MWH | | | | | | | | | | | | | | | |
| a MWH SOLD | 3,364 | 6,731 | 9,837 | 12,200 | 16,202 | 20,205 | 24,740 | 29,397 | 32,666 | 35,815 | 40,027 | 43,344 | 47,749 | 50,728 | 53,283 |
| b SYSTEM LOSS | 23 | 23 | 21 | 20 | 19 | 18 | 17 | 16 | 15 | 14 | 13 | 12 | 12 | 11 | 11 |
| c MWH ~~[illegible]~~ PURCHASED | 4,369 | 8,829 | 12,439 | 15,250 | 20,002 | 24,647 | 29,844 | 34,044 | 38,431 | 41,840 | 46,028 | 49,278 | 53,892 | 56,997 | 58,745 |
| d SYSTEM LOAD FACTOR | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 24 | 26 | 28 | 29 | 30 | 31 | 32 | 33 |
| e SYSTEM PEAK DEMAND MW | 3.12 | 5.79 | 7.89 | 9.16 | 11.42 | 13.36 | 15.49 | 16.19 | 16.87 | 16.99 | 18.11 | 18.79 | 19.77 | 20.33 | 20.95 |

TABLE 19.

# STATEMENT OF OPERATIONS
(U.S. $ 1,000)

LOCATION : KLATEN

| ITEM | PLANNING YEAR -2 | -1 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **ACCURAL BASIS** | | | | | | | | | | | | | | | | | |
| 1 OPERATING REVENUE | | | 373 | 775 | 1,144 | 1,423 | 1,886 | 2,319 | 2,823 | 3,235 | 3,581 | 4,000 | 4,428 | 4,763 | 5,151 | 5,459 | 5,597 |
| 2 LESS Cost of Power | | - | 232 | 466 | 684 | 856 | 1,140 | 1,454 | 1,791 | 2,077 | 2,385 | 2,626 | 2,990 | 3,252 | 3,597 | 3,876 | 4,112 |
| 3 Dist - A&G Expenses | - | - | 43 | 48 | 53 | 72 | 77 | 82 | 100 | 102 | 104 | 122 | 128 | 130 | 148 | 149 | 151 |
| 4 Dst - O&M Expenses | | - | 51 | 58 | 64 | 86 | 92 | 98 | 120 | 123 | 125 | 146 | 154 | 156 | 178 | 179 | 181 |
| 5 Dst - Cons Expenses | | | 69 | 76 | 86 | 115 | 122 | 131 | 160 | 164 | 166 | 195 | 205 | 208 | 237 | 239 | 241 |
| 6 Sales Expenses | - | - | 9 | 10 | 11 | 14 | 15 | 16 | 20 | 20 | 21 | 24 | 26 | 26 | 30 | 30 | 30 |
| 7 Dst - Depreciation | | | 122 | 136 | 150 | 162 | 173 | 182 | 187 | 190 | 193 | 200 | 207 | 209 | 210 | 212 | 216 |
| 8 Dst - Interest | - | - | 81 | 91 | 100 | 108 | 111 | 111 | 111 | 111 | 163 | 160 | 155 | 151 | 147 | 146 | 142 |
| 9 TOTAL OPER EXPENSES | - | - | 607 | 885 | 1,148 | 1,411 | 1,730 | 2,074 | 2,489 | 2,787 | 3,157 | 3,473 | 3,865 | 4,132 | 4,547 | 4,831 | 5,073 |
| 10 OPERATING MARGIN | - | - | (234) | (110) | (4) | 12 | 156 | 245 | 334 | 448 | 424 | 527 | 563 | 631 | 604 | 628 | 524 |
| 11 PLUS Membership Fees (US $ ) | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| 12 Interest Income | | | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| 13 TOTAL ACCURAL MARGIN | - | - | (234) | (110) | (4) | 12 | 156 | 245 | 334 | 448 | 424 | 527 | 563 | 631 | 604 | 628 | 524 |
| **CASH BASIS** | | | | | | | | | | | | | | | | | |
| 14 TOTAL ACCURAL MARGIN | - | - | (234) | (110) | (4) | 12 | 156 | 245 | 334 | 448 | 424 | 527 | 563 | 631 | 604 | 628 | 524 |
| 15 PLUS Dst - Depreciation | | | 122 | 136 | 150 | 162 | 173 | 182 | 187 | 190 | 193 | 200 | 207 | 209 | 210 | 212 | 216 |
| 16 Gen - Depreciation | | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| 17 Dst - Interest | - | - | 81 | 91 | 100 | 108 | 111 | 111 | 111 | 111 | 163 | 160 | 155 | 151 | 147 | 146 | 142 |
| 18 Gen - Interest | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| 19 GROSS CASH MARGIN | - | - | (31) | 117 | 246 | 252 | 440 | 538 | 632 | 749 | 780 | 887 | 925 | 991 | 961 | 986 | 882 |
| 20 LESS Debt- Service | | | 51 | 91 | 100 | 108 | 111 | 111 | 111 | 111 | 273 | 273 | 273 | 273 | 273 | 284 | 284 |
| 21 CASH - (After Debt Service) | | | (.12) | 26 | 146 | 174 | 329 | 427 | 521 | 638 | 507 | 614 | 652 | 718 | 688 | 702 | 598 |
| **RATIOS** | | | | | | | | | | | | | | | | | |
| 22 T I E R | | | (1.19) | (0.21) | 0.95 | 1.11 | 2.41 | 3.21 | 4.01 | 5.04 | 3.60 | 4.29 | 4.63 | 5.18 | 5.11 | 5.30 | 4.69 |
| 23 D S C. | | | | | | | | | | | 2.86 | 3.25 | 3.39 | 3.63 | 3.52 | 2.47 | 3.11 |

TABLE 20.

# BALANCE SHEET & SYSTEM RATIO ANALYSIS
(US $ 1,000)

LOCATION: KLATEN

| ITEM | PLANNING YEAR 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **ASSETS** | | | | | | | | | | | | | | | |
| 1. GENERATING PLANT | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| 2. DEPRECIATION RESERVE | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| 3. DISTRIBUTION PLANT | 4,306 | 4,779 | 5,206 | 5,564 | 5,957 | 6,143 | 6,291 | 6,397 | 6,498 | 6,849 | 6,927 | 6,985 | 7,035 | 7,085 | 7,329 |
| 4. DEPRECIATION RESERVE | 122 | 258 | 408 | 570 | 743 | 925 | 1,112 | 1,302 | 1,495 | 1,695 | 1,902 | 2,111 | 2,321 | 2,533 | 2,749 |
| 5. NET PLANT | 4,184 | 4,521 | 4,748 | 4,994 | 5,214 | 5,218 | 5,179 | 5,095 | 5,003 | 5,154 | 5,025 | 4,874 | 4,714 | 4,552 | 4,580 |
| 6. WORKING CAPITAL + RESERVE FUNDS | 38 | 64 | 210 | 234 | 170 | 411 | 784 | 1,316 | 1,722 | 1,985 | 2,559 | 3,279 | 3,857 | 4,509 | 4,863 |
| 7. TOTAL ASSETS + DEBITS | 4,222 | 4,585 | 5,008 | 5,228 | 5,384 | 5,629 | 5,963 | 6,411 | 6,725 | 7,139 | 7,584 | 8,093 | 8,571 | 9,061 | 9,443 |
| **LIABILITIES** | | | | | | | | | | | | | | | |
| 8. MEMBERSHIP FEES (US $ ) | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| 9. INTEREST INCOME | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| 10. PAT CAPITAL + OPER. MARGINS | (23[illegible]) | (344) | (348) | (336) | (180) | 65 | 399 | 847 | 1,271 | 1,793 | 2,361 | 2,992 | 3,596 | 4,224 | 4,748 |
| 11. 2% LONG-TERM DEBT | 4,305 | 4,779 | 5,206 | 5,564 | 5,564 | 5,564 | 5,564 | 5,564 | 358 | 358 | 358 | 358 | 358 | - | - |
| 12. 3% LONG-TERM DEBT | - | - | - | - | - | - | - | - | 5,096 | 4,983 | 4,865 | 4,743 | 4,617 | 4,837 | 4,695 |
| 13. OPERATING LOANS | 150 | 150 | 150 | - | - | - | - | - | - | - | - | - | - | - | - |
| 14. TOTAL LIABILITIES + CREDITS | 4,222 | 4,585 | 5,008 | 5,228 | 5,364 | 5,629 | 5,963 | 6,411 | 6,725 | 7,139 | 7,584 | 8,093 | 8,571 | 9,061 | 9,443 |
| **RATIOS** | | | | | | | | | | | | | | | |
| 15. GENERATION PLANT US $/KWH | - | | | | - | | | | | - | | | | | - |
| 16. AVG. POWER COST US ¢/KWH | 5.3 | | | | 5.7 | | | | | 6.3 | | | | | 7.0 |
| 17. SYSTEM LOAD FACTOR % | 16 | | | | 20 | | | | | 28 | | | | | 32 |
| 18. AVG. SELLING PRICE US ¢/KWH | 11.1 | | | | 11.6 | | | | | 11.2 | | | | | 10.7 |
| 19. CONNECTIONS/KM PRIMARY LINE | 11.7 | | | | 61.7 | | | | | 79.3 | | | | | 83.4 |
| 20. DISTRIBUTION PLANT US $/CONN | 658 | | | | 172 | | | | | 152 | | | | | 147 |
| 21. DISTRIBUTION PLANT US ¢/KWH | 128 | | | | 29 | | | | | 19 | | | | | 14 |
| 22. CONTROLABLE EXPENSES US $/CONN | 26.30 | | | | 8.86 | | | | | 10.78 | | | | | 12.46 |
| 23. RETURN ON 11X NET PLANT % | (3.32) | | | | 4.66 | | | | | 12.19 | | | | | 13.18 |
| 24. EQUITY LEVEL % | (5.5) | | | | (0.3) | | | | | 25.2 | | | | | 50.3 |

TABLE 21.

# OPERATING REVENUES

(U.S $1,000)

LOCATION: KLATEN

| ITEM | PLANNING YEAR 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **RESIDENTIAL** | | | | | | | | | | | | | | | |
| 1. AVG MO KWH. PER CONSUMER | 22 | 22 | 22 | 22 | 26 | 30 | 35 | 39 | 43 | 46 | 50 | 53 | 57 | 60 | 64 |
| 2. CHARGE PER RATE SCHEDULE | 3.00 | 3.00 | 3.00 | 3.00 | 3.47 | 3.95 | 4.54 | 5.01 | 5.48 | 5.84 | 6.31 | 6.66 | 7.13 | 7.49 | 7.81 |
| 3. ANNUAL REVENUE PER CONSUMER | 36.00 | 36.00 | 36.00 | 36.00 | 41.64 | 47.10 | 54.48 | 60.12 | 65.76 | 70.08 | 75.72 | 79.92 | 85.56 | 89.88 | 93.72 |
| 4. AVG. NUMBER OF CONSUMERS | 8,000 | 14,000 | 21,500 | 27,750 | 32,500 | 36,000 | 38,600 | 40,100 | 41,400 | 42,500 | 43,400 | 44,100 | 44,600 | 44,950 | 45,100 |
| 5. ANNUAL REVENUES | 288 | 504 | 774 | 999 | 1,357 | 1,696 | 2,102 | 2,411 | 2,722 | 2,978 | 3,286 | 3,524 | 3,816 | 4,040 | 4,119 |
| **COMMERCIAL (under 2KW)** | | | | | | | | | | | | | | | |
| 6. AVG MO KWH PER CONSUMER | 132 | 132 | 132 | 132 | 156 | 180 | 210 | 234 | 253 | 276 | 300 | 318 | 342 | 360 | 366 |
| 7. CHARGE PER RATE SCHEDULE | 14.79 | 14.79 | 14.79 | 14.79 | 16.76 | 18.72 | 21.16 | 23.15 | 25.11 | 26.59 | 28.55 | 30.51 | 30.78 | 31.73 | 32.05 |
| 8. ANNUAL REVENUE PER CONSUMER | 177.48 | 177.48 | 177.48 | 177.48 | 201.12 | 224.64 | 254.16 | 277.80 | 301.32 | 319.08 | 342.60 | 354.12 | 369.36 | 380.76 | 384.60 |
| 9. AVG. NUMBER OF CONSUMERS | 500 | 950 | 1,300 | 1,550 | 1,700 | 1,800 | 1,895 | 1,985 | 2,075 | 2,165 | 2,250 | 2,330 | 2,405 | 2,470 | 2,508 |
| 10. ANNUAL REVENUES | 88 | 168 | 231 | 275 | 342 | 404 | 482 | 551 | 625 | 691 | 770 | 825 | 889 | 940 | 965 |
| **STREET LIGHTING** | | | | | | | | | | | | | | | |
| 11. AVG MO KWH PER CONNECTION | 45 | 45 | 45 | 45 | 45 | 45 | 45 | 45 | 45 | 45 | 45 | 45 | 45 | 45 | 45 |
| 12. CHARGE PER RATE SCHEDULE | 4.00 | 4.00 | 4.00 | 4.00 | 4.00 | 4.00 | 4.00 | 4.00 | 4.00 | 4.00 | 4.00 | 4.00 | 4.00 | 4.00 | 4.00 |
| 13. ANNUAL REVENUE PER CONNECTION | 48.00 | 48.00 | 48.00 | 48.00 | 48.00 | 48.00 | 48.00 | 48.00 | 48.00 | 48.00 | 48.00 | 48.00 | 48.00 | 48.00 | 48.00 |
| 14. AVG. NUMBER OF CONNECTIONS | 672 | 844 | 1,056 | 1,152 | 1,248 | 1,344 | 1,440 | 1,536 | 1,632 | 1,728 | 1,824 | 1,920 | 2,016 | 2,112 | 2,208 |
| 15. ANNUAL REVENUES | 32 | 41 | 51 | 55 | 60 | 65 | 69 | 74 | 78 | 83 | 88 | 92 | 97 | 101 | 106 |
| **IRRIGATION PUMPS** | | | | | | | | | | | | | | | |
| 16. AVG. MO. KWH. PER CONSUMERS | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — |
| 17. CHARGE PER RATE SCHEDULE | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — |
| 18. ANNUAL REVENUE PER CONSUMER | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — |
| 19. AVG. NUMBER OF CONSUMERS | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — |
| 20. ANNUAL REVENUES | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **GRAIN MILLS** | | | | | | | | | | | | | | | |
| 21. AVG. MO. KWH. PER CONSUMER | 3,000 | 3,060 | 3,380 | 3,445 | 3,780 | 3,850 | 4,200 | 4,275 | 4,640 | 4,720 | 5,100 | 5,185 | 5,580 | 5,670 | 5,760 |
| 22. CHARGE PER RATE SCHEDULE | 166.44 | 169.52 | 184.54 | 187.43 | 207.14 | 210.26 | 228.63 | 231.96 | 250.89 | 254.56 | 276.25 | 281.04 | 298.61 | 307.42 | 308.43 |
| 23. ANNUAL REVENUE PER CONSUMER | 2,095.04 | 2,034.24 | 2,238.48 | 2,273.36 | 2,245.68 | 2,523.12 | 2,741.56 | 2,783.52 | 3,011.68 | 3,054.72 | 3,293.00 | 3,372.48 | 3,580.92 | 3,629.04 | 3,677.16 |
| 24. AVG. NUMBER OF CONSUMERS | 13 | 22 | 27 | 29 | 31 | 33 | 35 | 36 | 37 | 39 | 41 | 43 | 45 | 47 | 49 |
| 25. ANNUAL REVENUES | 30 | 45 | 61 | 66 | 77 | 83 | 96 | 100 | 111 | 119 | 135 | 145 | 161 | 171 | 180 |
| **WATER SYSTEMS** | | | | | | | | | | | | | | | |
| 26. AVG. MO. KWH PER CONSUMER | 34 | 36 | 36 | 36 | 36 | 36 | 36 | 36 | 36 | 36 | 36 | 36 | 36 | 36 | 36 |
| 27. CHARGE PER RATE SCHEDULE | 4.66 | 4.66 | 4.66 | 4.66 | 4.66 | 4.66 | 4.66 | 4.66 | 4.66 | 4.66 | 4.66 | 4.66 | 4.66 | 4.66 | 4.66 |
| 28. ANNUAL REVENUE PER CONSUMER | 53.92 | 53.92 | 53.92 | 53.92 | 53.92 | 53.92 | 53.92 | 53.92 | 53.92 | 53.92 | 53.92 | 53.92 | 53.92 | 53.92 | 53.92 |
| 29. AVG NUMBER OF CONSUMERS | 24 | 73 | 122 | 168 | 216 | 264 | 312 | 360 | 408 | 456 | 504 | 552 | 600 | 648 | 696 |
| 30. ANNUAL REVENUES | 1 | 4 | 7 | 9 | 12 | 15 | 17 | 20 | 23 | 26 | 28 | 31 | 34 | 37 | 39 |
| 31. AVG. MO. KWH PER CONSUMER | | | | | | | | | | | | | | | |
| 32. CHARGE PER RATE SCHEDULE | | | | | | | | | | | | | | | |
| 33. ANNUAL REVENUE PER CONSUMER | | | | | | | | | | | | | | | |
| 34. AVG. NUMBER OF CONSUMERS | | | | | | | | | | | | | | | |
| 35. ANNUAL REVENUES | | | | | | | | | | | | | | | |
| 36. AVG. MO. KWH PER CONSUMER | | | | | | | | | | | | | | | |
| 37. CHARGE PER RATE SCHEDULE | | | | | | | | | | | | | | | |
| 38. ANNUAL REVENUE PER CONSUMER | | | | | | | | | | | | | | | |
| 39. AVG. NUMBER OF CONSUMERS | | | | | | | | | | | | | | | |
| 40. ANNUAL REVENUES | | | | | | | | | | | | | | | |
| 41. AVG. MO. KWH PER CONSUMER | | | | | | | | | | | | | | | |
| 42. CHARGE PER RATE SCHEDULE | | | | | | | | | | | | | | | |
| 43. ANNUAL REVENUE PER CONSUMER | | | | | | | | | | | | | | | |
| 44. AVG. NUMBER OF CONSUMERS | | | | | | | | | | | | | | | |
| 45. ANNUAL REVENUES | | | | | | | | | | | | | | | |
| **MISC POWER CONSUMERS** | | | | | | | | | | | | | | | |
| 46. AVG. MO. KWH PER CONSUMER | 6,250 | 6,250 | 6,250 | 6,250 | 6,250 | 6,250 | 6,250 | 6,250 | 6,250 | 6,250 | 6,250 | 6,250 | 6,250 | 6,250 | 6,250 |
| 47. CHARGE PER RATE SCHEDULE | 347.61 | 347.61 | 347.61 | 347.61 | 347.61 | 347.61 | 347.61 | 347.61 | 347.61 | 347.61 | 347.61 | 347.61 | 347.61 | 347.61 | 347.61 |
| 48. ANNUAL REVENUE PER CONSUMER | 4,171.32 | 4,171.32 | 4,171.32 | 4,171.32 | 4,171.32 | 4,171.32 | 4,171.32 | 4,171.32 | 4,171.32 | 4,171.32 | 4,171.32 | 4,171.32 | 4,171.32 | 4,171.32 | 4,171.32 |
| 49. AVG. NUMBER OF CONSUMERS | 1 | 3 | 5 | 7 | 9 | 13 | 16 | 19 | 22 | 25 | 29 | 33 | 37 | 41 | 45 |
| 50. ANNUAL REVENUES | 4,271 | 12,514 | 20,857 | 29,199 | 37,542 | 54,227 | 66,741 | 79,255 | 91,769 | 104,283 | 120,948 | 137,614 | 154,279 | 171,024 | 187,706 |
| **TOTAL ANNUAL REVENUE** | 273 | 775 | 1,144 | 1,423 | 1,886 | 2,319 | 2,823 | 3,235 | 3,581 | 4,000 | 4,426 | 4,763 | 5,151 | 5,459 | 5,947 |

TABLE 22.

# PLANT INVESTMENT DEPRECIATION & COST OF POWER

(US $1,000)

LOCATION KLATEN

| ITEM | CONSTRUCTION PERIOD -2 | -1 | PLANNING YEAR 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **DISTRIBUTION PLANT** | | | | | | | | | | | | | | | | | |
| 1 LINE ADDITIONS | 2,218 | 915 | 496 | 473 | 427 | 358 | 284 | 186 | 148 | 106 | 101 | 82 | 78 | 58 | 50 | 50 | 40 |
| 2 GENERAL PLANT | 423 | 164 | - | - | - | - | 109 | - | - | - | - | 269 | - | - | - | - | 204 |
| 3 OTHER | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| 4 CAPITALIZED EXPENSE | - | - | | | | | | | | | | | | | | | |
| 5 INT DURING CONSTRUCTION | 26 | 64 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| 6 TOTAL INVESTMENT | 2,667 | 1,143 | 496 | 473 | 427 | 358 | 393 | 186 | 143 | 106 | 101 | 351 | 78 | 55 | 50 | 50 | 244 |
| 7 CUMULATIVE INVESTMENT | 2,667 | 3,810 | 4 306 | 4 779 | 5 206 | 5 564 | 5 957 | 6 143 | 6,291 | 6,397 | 6,498 | 6 849 | 6,927 | 6,985 | 7,035 | 7,085 | 7 329 |
| 8 AVERAGE INVESTMENT | 1 334 | 3,239 | 4 058 | 4 543 | 4 993 | 5 385 | 5 761 | 6,050 | 6 217 | 6 344 | 6 [illegible] | 6,674 | 6,896 | 6,956 | 7,010 | 7 060 | 7,207 |
| 9 DEPRECIATION EXP (3 %) | - | - | 122 | 136 | 150 | 162 | 173 | 182 | 187 | 190 | 93 | 200 | 207 | 209 | 211 | 212 | 216 |
| **GENERATION PLANT** | | | | | | | | | | | | | | | | | |
| 10 PLANT ADDITIONS | | | | | | | | | | | | | | | | | |
| 11 CAPITALIZED EXPENSE | | | | | | | | | | | | | | | | | |
| 12 INT DURING CONSTRUCTION | | | | | | | | | | | | | | | | | |
| 13 TOTAL INVESTMENT | | | | | | | | | | | | | | | | | |
| 14 CUMULATIVE INVESTMENT | | | | | | | | | | | | | | | | | |
| 15 AVERAGE PLANT INVESTMENT | | | | | | | | | | | | | | | | | |
| 16 DEPRECIATION EXP ( %) | | | | | | | | | | | | | | | | | |
| **COST OF POWER** | | | | | | | | | | | | | | | | | |
| 17 DEPRECIATION EXPENSE | | | | | | | | | | | | | | | | | |
| 18 INT EXPENSE | | | | | | | | | | | | | | | | | |
| 19 PLANT O&M EXPENSE ( %) | | | | | | | | | | | | | | | | | |
| 20 PLANT A&G EXPENSE ( %) | | | | | | | | | | | | | | | | | |
| 21 TOTAL FIXED COSTS | | | | | | | | | | | | | | | | | |
| 22 PLANT FACTOR | | | | | | | | | | | | | | | | | |
| 23 DEMAND COST/KWH (US CENTS) | | | | | | | | | | | | | | | | | |
| 24 FUEL COST/KWH (US CENTS) | | | | | | | | | | | | | | | | | |
| 25 POWER COST/KWH (US CENTS) | - | - | 5 3 | 5 4 | 5 5 | 5.6 | 5.7 | 5.9 | 6 0 | 6 1 | 6 2 | 6 3 | 6 5 | 6 6 | 6.7 | 6.8 | 7.0 |
| 26 KWH PURCHASED | - | | 4 309 | 8 629 | 12 437 | 15 230 | 20 002 | 24 640 | 29 655 | 34 044 | 38 43 | 41 680 | 46 008 | 49,278 | 53 692 | 56,997 | 58,745 |
| 27 ANNUAL POWER COST | | | 222 | 466 | 684 | 854 | 1,140 | 1 454 | 1,791 | 2,077 | 2 385 | 2 626 | 2,990 | 3,252 | 3,597 | 3,876 | 4,112 |
| 28 | | | | | | | | | | | | | | | | | |
| 29 INSTALLED CAPACITY MW | | | | | | | | | | | | | | | | | |

TABLE 23.

# GENERAL FUNDS & EXPENDITURE SUMMARY

(US. $ 1,000)

LOCATION: KLATEH

| | ITEM | CONSTRUCTION PERIOD -2 | -1 | PLANNING YEAR 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | GENERAL FUNDS ALLOCATION | | | | | | | | | | | | | | | | | |
| 1 | FUNDS-BEGINING OF YEAR | | - | 150 | 38 | 64 | 210 | 234 | 170 | 411 | 784 | 1,316 | 1,722 | 1,985 | 2,559 | 3,219 | 3,857 | 4,509 |
| 2 | CASH MARGINS (AFTER DEBT SERV) | - | - | (112) | 26 | 146 | 174 | 329 | 427 | 521 | 638 | 507 | 614 | 652 | 718 | 688 | 702 | 595 |
| 3 | OPER LOANS – DISTRIBUTION | - | 150 | - | - | - | (150) | - | - | - | - | - | - | - | - | - | - | - |
| 4 | OPER LOANS – GENERATION | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| 5 | TOTAL FUNDS AVAILABLE | - | 150 | 38 | 64 | 210 | 234 | 563 | 597 | 1,932 | 1,422 | 1,823 | 2,336 | 2,637 | 3,277 | 3,907 | 4,559 | 5,107 |
| 6 | 10 % GENERAL FUNDS LEVEL | | | | | | 539 | 596 | 614 | 629 | 640 | 650 | 685 | 693 | 699 | 704 | 709 | 713 |
| 7 | PLANT INVEST RQMTS | | | | | | - | 393 | 236 | 148 | 106 | 101 | 351 | 78 | 58 | 30 | 50 | 244 |
| 8 | FUNDS AVAILABLE END OF YEAR | | 150 | 38 | 64 | 210 | 234 | 170 | 411 | 784 | 1,316 | 1,722 | 1,985 | 2,559 | 3,219 | 3,857 | 4,509 | 4,863 |
| | PROPOSED INVESTMENT | | | | | | | | | | | | | | | | | |
| 9 | GENERAL FUNDS AVAILABLE FOR INVEST | | | | | | | | | | | | | | | | | |
| 10 | PLANT INVEST RQMTS | | | | | | | | | | | | | | | | | |
| 11 | % RCMD W.C LEVEL | | | | | | | | | | | | | | | | | |
| 12 | G F. INTEREST IN % YEAR. | | | | | | | | | | | | | | | | | |
| 13 | INTEREST ON SECURITIES | | | | | | | | | | | | | | | | | |

TABLE 24

# DISTRIBUTION PLANT LOANS FUNDS, INTEREST & REPAYMENTS

(US $ 1,000)

LOCATION: KLATEN

| | ITEM | CONSTRUCTION PERIOD -2 | -1 | PLANNING YEAR 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | LOAN FUND DETERMINATION | | | | | | | | | | | | | | | | | |
| 1 | PLANT INV RQMTS | 2,641 | 1,079 | 496 | 473 | 427 | 358 | 393 | 186 | 148 | 106 | 101 | 351 | 78 | 58 | 50 | 50 | 244 |
| 2 | GIF INV IN PLANT | | | | | | - | 393 | 186 | 144 | 106 | 101 | 351 | 78 | 5- | 50 | 50 | 244 |
| 3 | PLANT LOANS RQRD | 2,641 | 1,079 | 496 | 473 | 427 | 358 | - | - | - | - | - | - | - | - | - | - | - |
| 4 | EXPENSES CAPITALIZED | - | - | - | - | - | - | - | - | - | - | | - | - | - | - | - | - |
| 5 | OTHER LOANS RQRD | - | - | 150 | | | - | - | - | - | - | | - | - | - | - | - | - |
| 6 | TOTAL LOANS RQRD (LINE 5 EXCLUDED) | | | 496 | 473 | 427 | 358 | - | - | - | - | - | - | - | - | - | - | - |
| 7 | INTEREST CAPITALIZED | 26 | | | | - | - | - | - | - | - | - | | | | - | | |
| 8 | LOAN AMOUNT | 2,667 | - - | 496 | 473 | 427 | 358 | - | - | - | - | - | - | - | - | - | - | - |
| 9 | 2 % CUMULATIVE DEBT (A LOAN) | 2,667 | 3,310 | 4,306 | 4,779 | 5,206 | 5,206 | 5,206 | 5,206 | 5,206 | 5,206 | | | | | | | |
| 10 | 2 % CUMULATIVE DEBT (B LOAN) | | | | | | 358 | 358 | 358 | 358 | 358 | 358 | 358 | 358 | 358 | 358 | | |
| 11 | 2 % CUMULATIVE DEBT (C LOAN) | | | | | | | | | | | - | | - | - | - | - | - |
| 12 | 2 % CUMULATIVE DEBT (TOTAL) | 2,667 | 3,310 | 4,306 | 4,779 | 5,206 | 5,564 | 5,564 | 5,564 | 5,564 | 5,564 | 358 | 358 | 358 | 358 | 358 | | - |
| 13 | INT ON AVG 2% DEBT | - | | 91 | 91 | 100 | 108 | 111 | 111 | 111 | 111 | - | - | - | - | - | | |
| | 3 % A | | | | | | | | | | | | | | | | | |
| 14 | INTEREST FACTOR | | | | | | | | | | | 0300 | 0294 | 0 285 | 0277 | 0269 | 0260 | 0253 |
| 15 | LEVEL PAYMENT ( 05'0) | | | | | | | | | | | 266 | 266 | 266 | 266 | 266 | 266 | 266 |
| 16 | DEBT BEGINING YEAR | | | | | | | | | | | 5,206 | 5,096 | 4,983 | 4,865 | 4,743 | 4,617 | 4,486 |
| 17 | INTEREST | | | | | | | | | | | 156 | 153 | 148 | 144 | 140 | 135 | 132 |
| 18 | AMORTIZATION | | | | | | | | | | | 110 | 113 | 118 | 122 | 126 | 131 | 134 |
| 19 | DEBT END OF YEAR | | | | | | | | | | | 5,096 | 4,983 | 4,865 | 4,743 | 4,617 | 4,486 | 4,352 |
| | 3 % B LOAN | | | | | | | | | | | | | | | | | |
| 20 | INTEREST FACTOR | | | | | | | | | | | | | | | | 0300 | 0294 |
| 21 | LEVEL PAYMENT (0510) | | | | | | | | | | | | | | | | 18 | 18 |
| 22 | DEBT BEGINING YEAR | | | | | | | | | | | | | | | | 358 | 351 |
| 23 | INTEREST | | | | | | | | | | | | | | | | 11 | 10 |
| 24 | AMORTIZATION | | | | | | | | | | | | | | | | 7 | 8 |
| 25 | DEBT END OF YEAR | | | | | | | | | | | | | | | | 351 | 343 |
| 26 | 3 % DEBT TOTAL (A+B LOANS) | - | - | - | - | - | - | - | - | - | - | 5,096 | 4,983 | 4,865 | 4,743 | 4,617 | 4,837 | 4,695 |
| 27 | TOTAL INTEREST LINES (13 - 17 - 23) | - | - | 91 | 91 | 100 | 108 | 111 | 111 | 111 | 111 | 153 | 160 | 155 | 151 | 147 | 153 | 149 |
| 28 | DEBT SERVICE PAYMENT LINES (13-15-21) | - | - | - | - | - | - | - | - | - | - | 278 | 275 | 275 | 275 | 275 | 284 | 284 |