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EVALUATION STUDY ON RURAL ELECTRIFICATION PROJECT UNDER IBRD LOAN

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CONTENTS

Evaluation Study of
Rural Electrification Project

INTRODUCTION

1. Purpose:

The purpose of this study was the post evaluation of the rural electrification project which was partially supported by IBRD loan. During 1976-78, 306,497 of rural households in 3,579 sub-project units was actually electrified while 305,000 households in 2,681 sub-project units which was initially planned to supply electricity in 1976, due to increase in project costs and delay in purchase of materials by international bid. The detail proposes included: (1) to measure the cost-benefit of rural electrification, (2) to analyze technical and operational problems of implementing the projects, (3) to measure an improvement in quality of rural life and change in rural attitude to the project, and (4) to analyze the impact of the project on rural economy through the Saemaul Movement.

2. Method:

Most of aggregate data related to the rural electrification was obtained from the Korean Electric Company (KECO) and was

supplemented with field surveys. No availabilitly of systematic studies on effects of rural electrification requires some detail survey on rural households electrified. The sample survey was conducted to interview 200 rural households, of which half of those was electrified during 1976-77 and the other half, during 1970-1975, and 40 village leaders. The sample households and villages were randomly selected from 40 sub-project units in 5 regions, which are mountaineous, in-between, plain, suburban, and coastal regions. The number of sample of 1977 survey was 50 households in 10 such-project units which were resurveyed in 1978 and the rest of the sample was surveyed in 1978. Size of sample in each region is shown in Table 1. In addition, mail survey was conducted for KECO branch offices to find out technical and operational problems for implementation of the project. Answers from 13 branch offices out of total 17 were collected and analyzed. Every local governmental offices concerned was either interviewed or surveyed by mail to check regional problems related to implementation and further progress of rural electrification.

3. Scope and limitations:

The evaluation period was taken as 35 years, corresponding

to the amortization period for the Government's loan to the customers, and considering of possibility of underground cable and recabling for power uses. Economic effects were evaluated on per household basis of 306,497 households which were electrified under partial support of IBRD loan. To find out regional characteristics in use of electricity, analysis of regional effects was carried out. Seldom studies on evaluation of major consumption use of electricity have been made domestically and abroad.

Background for Rural Electrification

4. Long-run prospect of demand for and supply of electricity: Electricity consumption in Korea has been growing at more than 18% per annum over the last decade and reached 19,620 GWh in 1976. By the end of 1976, about 95% of total households have electricity supply and the almost whole household will be electrified by the end of 1978, except about 79,000 households in the remote area and small islands which will reamin uneletrified. About 12.5% of total consumption in 1976 was accounted for by residential users. This is equivalent to a household use of 600 KWh. The growth rate of total electricity consumption is expected to be about 12-15% per annum through the early

1980's (Table 2). On the other hand, the corresponding supply of electricity is expected to increase by about 12-16% per annum. The capacity of generation facilities will be also increased from 4,629 MW in 1977 to 15,985 MW in 1980, so that about 20% of excess capacity is expected to exist through early 1980's.

5. Rural electrification: Rural electrification in Korea started in the early 1960's and accelerated by the Law of Rural Electrification in 1965. It has now reached a final stage. The Law specifies that funds required for rural electrification be provided by a combination of government loan, KECO's own investment and customer's contribution. Government loan financed 80% of total investment during 1965-1978 and are made to customers through the Korean Development Bank (KDB) with conditions of 5 year gestation and 30 year repayment periods and 7.5% of interest rate per annum. KECO is responsible for collecting loan repayments from customers, together with the electricity bill. The customers have no way to pay the bill without loan repayment, due to local government influence and pressure. During 1965-1978, some 1,727,300 households in rural area were electrified, 236,000 households have had electricity supply under loans from IBRD and OECF in 1976, and 120,000 in 1977 and

58,600 in 1978 by government. The government loan, of which some were partially supported by the IBRD loan (Table 3). This will virtually complete the electrification of the country, as the remaining some 79,000 households without electricity which are located in remote mountain areas and on small islands, Korean Government is tring to do its best to find out a possibility to electrify those households.

6. Project implementing mechanism: The Ministry of Energy and Resource (MER) of Korea supervises all activities related to implementing the project and maintenance. KECO is responsible for making the necessary survey and design, preparing procurement for equipments and materials of which tendering have been carried out by Office of Supply (OSROK), and maintenance and repairing. The areas to be electrified have been selected by local government. The lower level of local governments should help KECO implement project, collect loan payment and make maintenance.

7. Rural electrification under partial support of IBRD loan:

The proposed project would help finance the government program for 1976, which aims to electrify 305,000 households. The estimated construction cost of the proposed program was

total of 17,258 million wons (35,583 thousand dollars), not including cost for house wiring. This is equivalent to Won 56,500 per household. The original program was revised. Total construction cost had been increased by 30% and reached Won 22,200 million ($45,773 thousand), due to increase in domestic material cost by 26% and labor charge by 63% the revised program (Table 4). In addition, delay in purchase of materials by international bid and in payment of customer's contribution requires to revise the original program which aims to electrify 305,000 household in 1976 so that 206,860 households were completed to supply electricity and remaining 98,140 households will be, in 1977. The completed program included that total construction costs were increased by 57% and amount to ₩27,433 million ($55,944 thousand), due to increase in domestic material costs by 93% and labor charges by 76%. It also included that total of 306,497 households was electrified in the 3,579 sub-project areas in all provinces in Korea, with an average of 86 households per sub-project.

Total of 136,294 households completed to supply electricity in 1976, 140,257 households in 1977 and 29,315 households in 1978. Average households per sub-project number 128, 80 and 39 in 1976, 77 and 78 respectively (Table 5).

The average construction costper household was Won 88,525 of which the loan took 77%, customer's contribution, 12% and KECO's own investment, 11% (Table 5). There were great differences in the construction cost per household by region. For example, total cost per household was Won 71,355 in Cheonnam Province and Won 178,852 is Jeju Province. The proportion of customer's constribution per household was 0.3% of total in Cheonnam, 21.4% of total in Chungbuk, and 42.2% of total in Jeju (Table 6). These difference in the construction cost would result from difference in geographical conditions, customer's financial situation and number of households per sub-project, and equal share of government loan by provinces.

Situation of Sample Villages and Households

8. The sample villages were located average of 1,500 meters from existing electricity supply, ranged from 200 meters to 5,000 meters. The distance was a main source of increase in loan and/or customer's contribution because of almost constant proportion of KECO's own investment (10-11% of total cost). The sample households were typical households in Korea which

had average of 7 families and 3 laborers, owned 1.0 hectares of farm land and several kinds of engine power equipments. They earned average Won 1,300 thousand ($2,700) of which 22% accounts for agricultural income. The house wiring took average 6.8 days, ranged from 3 days to 9 days. Electricity supply after house wiring took average of 62 days (range of 30-365 days). Average 3.1 electricity bulbs per household were initially installed and they extend extra 2 bulbs which is equivalent to 40W of electric burden.

Project Implementation and Operation

9. Selection of sub-project: The criteria for selection of individual sub-project in 1976 was that the government loan per sub-project must exceed Won 5 million, based on Won 50,000 of loan per household, and that the sub-project includes villages with more than 30 households or villages with 10-20 households which locate on the way of connecting electricity supply. The fact that average of 128 household per sub-project in 1976 was electrified told us that sub-project selection was based on those criteria. Further progress of the project results in electrification in the more remote area and in the

smaller sub-project unit. In 1978, the project selection criteria should extend to the villages which contain more than 10 households and total construction costs per household of ₩300 thousand (about $600). Therefore, economic criteria do not appear to be too significant and the decisions as to which villages should be done first should be made on purely practical grounds.

10. Survey and design: Most of KECO's own investment was used for survey and design. The survey and design had been made for every individual sub-project over time. Therefore, there is a possibility of low voltage and imbalance of power for transmission and distribution. The design should be done considering the balance of transimission and distribution of electricity everywhole rural area and the maximum demand for electricity power use. The design standards followed generally accepted such standards for rural electrification as Construction Standard for Distribution Line, Technical Standard for Electricity Facilities, and Cost Standard.

11. Operational problems: The election of pole and stringing were done by small contractors under KECO's supervision. The

small contractors were mostly selected by competitive bid for construction and house wiring. KECO's branch offices answered the following operational problem: (1) Construction was delayed because of large and deferred contribution of customers in relatively remote area, (2) rearragement of loan to customers according to connecting initially unelectrified households in sub-project area where is already electrified, (3) losses in design cost due to cancel out electrification of some villages after design being made, (4) selection of some villages not to be based on economic criteria, (5) some objection of land lord where pole is elected, (6) difficulties of construction works during crop growing season.

12. Technical Problems:

A typical village was supplied by extending from an existing 22.9Kv or 6.6 Kv primary feeder, a 3 wire single phase or a 2 wire single phase branch on concrete poles to a pole-mounted 5 or 10 KVA transformer . The secondary system within the village was 220V, single phase 2 wire. Contract power is less than 4 Kw. This kind of distribution system is for only domestic use, mainly lightening use. The 3 phase motor can not be utilized for small power use. The single phase motor

can be used, for threshing, pumping and other agricultural use within village transformer capacity, But practically a small capacity of transformer is suitable for only lightening use. The development of Korean agriculture and growing economy needs more and more small or large power in rural area in the future. At that time, distribution lines for power use should be restringed. Other technical problems are: (1) disordered distribution system because of regional base design, (2) difficulty of distribution of tele-cable, (3) too long distribution line with single phase from transmission, (4) high risk of electricity accidence with 220V, (5) difficulty of maintenance and repairment due to long distribution line with poor condition for transportation.

Project costs and benefits

13. Economic costs and benefits per household are measured based on 1976-77 average domestic prices and converted into total costs and benefits of the project. Analysis of project feasibility and internal rate of return of the project carried out by two alternatives; one was that economic benefit was measured by material savings for lightening and warming,

time savings, productivity gain from labor, time and material saving. The other was that economic benefit was measured by "willingness to pay" which included actual payment and consumer surplus.

Alternatives of measurement of project revenue would alter the division of benefit and cost items. Therefore, basic figures of costs and benefit were explained as follows and then the analysis of project feasibility was made.

14. Demand for electricity:

Consumption of electricity can be the basic data to estimate the project cost and benefit. The sample household consumed average of 297 KWh per annum. That was 422 KWh in suburban region, 330KWh in plain region, 279 in in-between region, 258 KWh in coastal region and 196 in mountai neous region.

The electricity consumption per household was increased according to lapse of time after electrification. Average consumption of electricity per household was 243 KWh per annum in the first year after electrification, 334 KWh in the fourth year and 371 KWh in the sixth year (Table 7).

Using annual consumption data, the trend equation of

electricity demand was estimated as

$$Y = \underset{(16.88)}{229.99} + \underset{(3.77)}{20.22}\ x \qquad R^2 = 8516$$

where Y represents average annual consumption of electricity per household and X as the lapse of years after electrification. This estimation has a difficulty to respresent consumption data of the same population over time because of heterogeneous population in the same year, which might partially reflect electricity consumption response to change in income.

The equation estimated was used to predict the future demand for electricity of a household in the national and regional average (Table 8). In the 35th year after electrification, national average consumption of electricity per household per annum will be 936 KWh, and 1062 KWh in suburban and 837 in coastal region.

15. Cost of Project: The following costs were included in the analysis.

a. Direct cost: All costs incurred by the stage of consumption of electricity were included in the direct cost.

(1) Investment: Total cost of construction of distribution line for rural electrification was devided by total number of households, 306,497, to get a investment cost per households. It included the Government loan of Won 67,810, KECO's own investment of Won 9,384 and customer's contribution of Won 11,331, which totaled Won 88,525 per household (Table 6).

(2) Energy supply cost: Supply cost of electricity was estimated by KECO every year (Table 9). The average supply cost in 1977 was utilized to estimate energy cost in 35 years in the furture under assumption that cost and price would be increased by the same rate. The energy cost per KWh of sales divided into two components; generation cost and operation cost. The generation cost per KWh sales included generation cost and operation cost. The generation cost per KWh sales included generation cost of Won 13,221 and cost for losses of trasnsmission and distribution of Won 1,352. The operation cost of Won 3,176 per KWh of sales included transmission cost, distribution cost, service cost for customer and selling costs. The energy cost was composed of material cost, labor cost, depreciation, and maintenance cost for generation and operation. But such costs as non-operation cost, corperate tax, surtax, were excluded from energy supply cost because these costs can

be regarded as social benefit from electricity supply. The energy cost per KWh of sales mutiplied by electricity consumption per household made the energy cost per household.

(3) Customer's costs for house wiring and maintenance: The customer's costs for house wiring in 1976 was estimated as average of Won 9,712 per household. The cost for expansion and maintenance amounted to Won 1,795 per household per annum. Other customer's costs included preparation and negotiation cost for village electrification and reached Won 845 per household (Table 10).

b. Indirect costs: Rural electrification plays a role to create a market for electric appliances, TV and other other electric tools. The production and selling costs of these electric tools were regarded as indirect cost. In addition, cost incurred from electric supply should be included to estimate indirect benefit of the project by providing electricity market.

c. Social costs: The rural electrification project would not cause any significant environmental problems and would have no effect on air and water quality. The low voltage used would not require an exclusive right of way for the distribution lines. Therefore, it was not necessary to estimate any social

cost.

16. Economic benefit: Electricity can be used for residential and productive purposes. The residential uses include lightening and uses for electric appliances. The benefit from residential uses of electricity would be estimated as benefit from material savings for lightening and warming, time savings, life and market informations and good coordinations for life and working. Those benefits of consumptive uses of electricity are regarded to equal to "willingness to pay" which includes actual payment and consumer surplus. Revenue of productive use of electricity can be measured as productivity gain including labor, time and material savings. These kinds of measurement of project revenue would alter the division of benefit and cost items. In addition, rural electrification mainly aims to domestic uses of electricity and small power uses were counted by the same meter. Moreover, power use of electricity for agricultural production needs other electrification project, including restringing of distribution lines.

a. Material savings and productivity gains

It is possible with some limitation to measure the revenue from material savings and productivity gains from

electricity use.

The material savings amount to Won 3,068 per annum per household at average price of 1976 and 1977. Time savings from threshing time extending over night, cooking and water supply by small automatic pumping machine are calculated as 6.43, 14.67 and 162 hours per annum per household respectively. Total value of time saving amounts annually won 25,465 per household.

Productivity gains from threshing and pumping for irrigation are valued at won 21,894 (Won 914 from threshing and won 20,980 from pumping) per household per annum. Table 11 shows the detail of calculation.

b. Electic bill: Electricity tariffs for domestic use in 1976-77 was used to estimate future payment by customers[1] Revenues from sales of electricity were derived by multiplying the estimated average annual consumption per household by the current KECO tariffs for domestic use.

c. Consumer's surplus: The sample survey could not provide enough data to estimate the demand function of electricity for domestic use. Therefore, the demand function of electricity for domestic use, estimated by the Korean Development Institute (KDI), was utilized to compute the consumer's surplus from electricity consumption. It was assumed that area

under demand curve and above the equilibrium price would measure the consumer's surplus and that aggregation or disaggregation of demand function could be measures of aggregation or disaggregation of the consumer's surplus. If the demand function is a linear with respect to price, the consumer's surplus could be computed with relation of $S = (\frac{1}{2})Q_e^2 b$, where S is the consumer surplus Q_e' actual use of electricity, and b, the slope of demand function / /. If the demand function is non-linear or constant price elastic, the consumer's surplus computed by $S = (\frac{1}{2})Q_e^2 b$ would underestimate actual consumer's surplus. The demand function which was utilized to estimate the consumer's surplus was constant price elastic.[2] Therefore, the computed surplus was a minimum of the actual surplus.

d. Loan repayment by customers: The Government made loan to customers through KDB under conditions of repayment with annual interest rate of 7.5% within 30 years after 5 year gestation period. The annual payment ratios of total amount w with interest were fixed ^KECO Loan Repayment Regulation and shown Table 12. Annual amount of loan repayment was computed by multiplying amount of loan per household by these ratios.

17. Indirect benefit: Rural electrification has created new

market for electric appliances. Therefore, extra sales of those were regarded as indirect benefit. The extra sales of electric appliances over time was computed at 1976-77 constant price (Table 13). The indirect net benefit was computed by multiplying the extra sales by rate of operating profit to net sales[3]. Net project of KEO by supply of electricity to rural area is measured as indirect net benefit. It was assumed that rural electrification for only domestic use will not creat new opportunity of employment in industries in the rural area, which use electricity power which was not available by rural electrification project.

18. Social effects

a. Improvement in quality of rural life and change in rural attitude to the project: The descriptive survey about improvement in quality of rural life and change in rural attitude to the project was made. All of the customers heartly welcomed the rural electrification project. They also answered that the rural electrification improved rural living conditions to be easy to live, clean environment, and cooperative atmosphere. The access to such amenities as radio and television provides informations about urban life and rational way of activities.

They try to be economical in ceremonial occassions and are anxious for children to have higher education. It was found that they are satisfying rural life after electrification.

b. Redistributive effects: The rural electrification provides market informations in time and eccelerates technology diffusion so that the relative income level in rural area is increased. There was no evidence that rural electrification itself was able to stem out migration from rural areas. But rural electrification gradually creates opportunity of employment of rural labor in rural industries. It was shown that rural electrification had redistributional effect within rural sector. The customers in the higher income class consumed the more electricity. Consumption of electricity could be regarded as the project revenue. Therefore, the project revenue was distributed more to the higher income classes. Purthermore, electricity demand for agricultural production and processing would be increased more for the larger size of farm.

19. Impacts on rural development

a. Rationalization of rural life by electrification would provides a momentum to encourage economic activity in rural area.

b. Rural electrification would create willingness to develop rural economy because it provide the same living conditions in rural areas as in urban areas.

c. Village common facilities such as watering, public bath etc, were established by rural electrification, which increases rural welfare.

d. Development of rural industries by rural electrification would provide an opportunity to employ idle resources in rural area, if any, and to increase rural income level.

e. Security effects of remote rural and coastal areas was very great by rural electrification.

Analysis of feasibility and rate of return

20. Financial flow of KECO: The Government loan was made to customers through KDB and nothing to do with KECO. But the loan actually converted into KECO's facilities investment. Therefore it is more practical that the loan is regarded as KECO's cash and cost and loan repayment as KECO's cash receipts. The customers' contribution of investment cost has both characteristics of cost and revenue and was excluded from financial flow chart. As a results, cash costs included KECO's own investment, energy cost and sales tax. This energy cost is somewhat different from the energy cost in the direct cost by including corporate

tax, surtax and non-operational costs. The KECO's financial flow chart was shown in Table 14. The financial rate of return was calculated as 12.00% (Table 22).

21. Streams of direct costs and benefits:

Alternature I: Material savings and productivity gains from electricity use. Direct costs of the project include the construction cost, electric bill, house wiring and maintenance cost, and purchasing cost of electric motors (Table 15). Direct revenue is total of material savings, time saving and productivity gains. Material saving and time saving from electricity use is assumed to be constant over time but productivity gain is expected to be increased at the same rate of increase in number of electric motor purchased per household (Table 15).

Regional direct cost and revenue under alternative I could not be calculated due to lack of adquate data.

Alternative II: "Willingness to pay" approach Direct costs include construction costs, house wiring and maintenance costs and energy supply costs. The direct revenue is total of electric bill, loan repayment by customer and consumer's supplus (Table 16).

22. Stream of indirect costs and benefits:

Only net profits of electric appliances manufacturers and KECO are culculated to arrive indirect economic net revenue. The indirect costs and revenue stream can be derived from indirect net revenue concept and shown in Tables 15 and 16.

23. Economic costs and revenue streams by regions are shown in Tables 17-21. They include only direct cost and revenue streams because purchase of electric appliances by year and by region can not be valued exactly and because rate of return from total cost and revenue stream can be approximated from that of direct cost and revenue stream.

24. Rate of return of the project

Internal rate of return (from direct cost and revenue) is 44.26% for Alternative I and associated rate of return (from direct and indirect cost and benefit) is 48.5% for alternative I.

In alternative II, national IRR is 14.2% and ARR, 18.6%. IRR in suburban is 16.2%, 14.6% in plain region, 13.9% in in-between region, 13.5% in coastal region and 11.7% in mountaineous region.

Concluding remarks:

25. Extension of distribution line and expansion of supply area of electricity for domestic and power uses are welcomed by customers and could be done small encouragements such as the Government loan. The main problem seems to be how to meet rapidly increasing demand with reasonable price, expecially in Korea where resources for electricity generation are relatively scarce. Rural electrification contributes to improve rural environment and to enhance living standard. It also solves national and regional security problems but street lightening is very poor. Attention should focus on alternatives to electrify households remaining unelectrified in the remorte area and small islands.

Footnotes

1. Table of rate schedule (Monthly bill)

Tariff 1. General service A.

Applicable to general service of less than 4KW of contracted demand, including residential service.

a. Demand charge: W 234 per household

b. Energy charge:

W 22.12 per KWh for the first 50KWh of total energy used

W 30.50 per KWh for the Second 50KWh of total energy used

W 44.18 per KWh for the Third 50KWh of total energy used

W 44.18 per KWh for the Fourth 350KWh of total energy used

W 53.80 per KWh for the remain energy used.

(Less than W 10 of total bill goes up to W 10)

Sources: Electricity Supply Regulation of KECO, 1977

2. Demand function of electricity for domestic use:

$$\text{Ln } Q = \underset{(-2.06)}{-4.57} + \underset{(1.70)}{0.284}\,\text{Ln } Q\text{-}1 - \underset{(-2.28)}{0.477}\,\text{Ln } P + \underset{(1.82)}{0.679}\,\text{Ln PCE}$$

$$+\underset{(2.84)}{0.451}\,\text{Ln HH} + \underset{(1.83)}{0.445}\,\text{DVD}, \qquad R^2 = .9959, \quad DW = 1.36$$

Q = Quarterly consumption of domestic electricity (MKWh)

Q-1 = Electricity consumption in the previous quarter (MKWh)

P = Quartely average price at 1970 constant price (W/KWh)

PCE = Private consumption at 1970 price (W 100 million)

HH = Number of households

DVM = Dummy variable (0 for limit to supply, 1 for no limit to supply)

Figures in ( ) are t - values.

Source: KDI, Analysis of Demand for and Price of Electricity in Korea 1977

3. Rate of operation profit to net sales, 1976

Radio, television and communication apparatus	9.2%
Electric appliances and housewares	8.8%
Electric wire of cable	9.3%
Electric bulb	6.8%

Source: The Bank of Korea, Financial Statements Analysis for 1976.

Table 1. Samples of Field Survey

(Number of Sample households)

region / Year of electrification	Mountainous		In-Between		Plain		Suburban		Coastal		Total	
1977	10	(2)	5	(1)			5	(1)			20	(4)
1977	15	(3)	20	(4)	20	(4)	5	(1)	15	(3)	75	(15)
1975	10	(2)	10	(2)	5	(1)					25	(5)
1974			5	(1)	10	(2)	5	(1)	5	(1)	15	(3)
1973	10	(2)			5	(1)	5	(1)			25	(5)
1972							5	(1)	10	(2)	20	(4)
1971	5	(1)									5	(1)
1970			5	(1)					5	(1)	10	(2)
1969									5	(1)	5	(1)
Total	50	(10)	49	(9)	40	(8)	25	(5)	40	(8)	200	(40)

Note: Figures in ( ) are Number of Sample Villages

Table 2. Long-run Demand for and Supply of Electricity, 1972-1986

	Demand		Supply	Rate of gross power losses	Capacity (A)	Peak load (B)	Reserve rate $(\frac{A-B}{B})$
	GWH	Growth rate (%)	GWH	(%)	(MW)	(MW)	(%)
1972	9,992	12.4	11,208	10.3			
73	12,367	23.8	13,956	11.4			
74	14,048	13.6	15,912	11.7			
75	16,630	18.4	18,752	11.3			
76	19,620	18.0	21,919	10.8			
1977	22,450	14.4	26,706	10.7	4,629	4,488	3.1
78	26,439	15.1	31,190	10.3	5,998	5,315	12.1
79	30,107	13.9	35,321	9.8	6,701	5,973	12.2
80	34,225	13.7	39,975	9.4	8,120	6,760	20.2
81	38,963	13.8	45,308	9.0	9,340	7,606	22.8
1982	43,794	12.4	50,759	8.7	10,277	8,521	20.6
83	49,150	12.2	56,842	8.5	11,716	9,543	22.8
84	55,174	12.3	63,670	8.3	13,069	10,688	22.3
85	61,947	12.3	71,330	8.1	14,553	11,975	21.5
86	69,269	11.8	79,674	8.0	15,985	13,375	19.5

Source: KECO

Table 3. Number of annual electrified households of rural area, and its costs

Year	No.of electrified household		Rate of electrification (%)	Cost (Million Won)				Total cost per household
	Per year	Cummulative Sum (1,000)		Government loan	KECO's own investment	Customer's contribution	Total	
1964	-	317.9	12.0	-	-	-	-	-
1965	38.7	356.6	14.1	300	133	45	478	12,300
1966	64.8	421.4	16.6	773	320	74	1,172	18,000
1967	45.5	466.9	18.4	584	208	23	815	18,000
1968	53.8	520.7	20.6	854	222	11	1,037	20,000
1969	72.5	593.2	23.4	1,198	357	109	1,664	24,300
1970	90.6	633.8	27.0	1,690	468	28	2,386	26,300
1971	171.9	856.7	33.0	3,380	802	74	4,253	24,700
1972	177.0	1,032.7	40.8	3,600	803	74	4,477	25,300
1973	264.5	1,317.4	52.0	7,390	1,338	195	8,923	31,400
1974	177.1	1,494.3	59.0	6,473	909	589	7,911	45,000
1975	(474) 137.3	2,105.6	81.6	6,090	951	897	7,938	57,800
1976	(235.4) 235	2,576.0	93.5	15,250	2,275	2,256	19,781	73,300
1977	120.0	2,676.0	97.8	13,100	1,428	1,896	16,424	136,900
1978	58.0	2,754.6	100.0	12,953	921	1,327	15,201	259,400
Total	1,727.3	2,754.6	100.0	73,840	11,135	7,598	92,573	53,600

Note: Figures in ( ) are number of electrified households electrified by self-investment of customers

Source: KECO

Table 4. Project Cost of Rural Electrification with IBRD Loan

Item	Original Plan		Revised Plan			Actual Cost		
	Amount ($1,000) (₩Million)	Proportion(%)	Amount ($1,000) (₩Million)	Proportion (%)	Percentage of change in cost(%)	Amount ($1,000) (₩Million)	Proportion (%)	Percentage of change in cost (%)
Material Cost	24,906 (11,080)	70	28,280 (13,765)	62	14	37,146 (18,016)	66	49
Imported materials	11,700 (5,675)	33	11,700 (5,675)	26	0	11,700 (5,675)	21	0
Domestic materials	13,206 (6,405)	37	16,680 (8,090)	36	26	25,446 (12,341)	45	93
Contract cost for construction	10,677 (5,178)	30	17,393 (8,435)	38	63	18,798 (9,117)	34	76
Total	35,583 (17,258)	100	45,773 (22,200)	100	29	55,944 (27,133)	100	57
No. of electrified households	305,000		305,000			306,497		

Note: Cost for design, supervision and others are involved in contract cost for construction

Source: KECO

Table 5. Annual Electrified Households Under Partial Support of IBRD Loan

Year	Project Unit	No. of Customers	No. of Customers per project unit	Total cost per household (₩1,000)	Gov't loan (%)	Customers constribution (%)	KECO's own investment (%)
1976	1,070	136,924	128.0	69.3	78.3	9.7	12.1
1977	1,750	140,257	80.1	79.2	76.3	13.4	10.3
1978	759	29,316	38.6	127.3	73.7	18.3	8.0
Total	3,579	306,497	85.6	88.5	76.6	12.8	10.6

Table 6. Cost of Project by province Completed in 1976 - 78 under Partial Support of IBRD Loan

Province	No. of customers per project unit	Total cost (Won)	Government loan (%)	Customer's contribution (%)	KECO's own investment (%)
Kyunggi	52.8	77,255	10.9	76.5	12.6
Kyungwon	107.9	143,513	8.2	69.3	22.6
Chungbuk	87.9	97,946	9.4	69.1	21.4
Chungnam	64.7	25,807	11.9	78.3	9.8
Cheonbuk	84.8	74,198	12.2	86.3	1.6
Cheonnam	303.2	71,355	11.9	87.9	0.3
Kyongbuk	65.2	87,372	11.2	73.3	15.5
Kyongnam	86.7	88,330	10.8	76.2	13.0
Jeju	31.4	178,852	5.7	52.1	42.2
Total	85.6	88,525	10.6 (9,384)	76.6 (67,810)	12.8 (11,331)

Note: Figures in ( ) are costs per household

Source: KECO

Table 7. Annual Electricity Consumption per Household of 200 Samples, Whole Country

Year after electrified	Consumption (KWH/Year)
1	243
2	273
3	292
4	334
5	301
6	371
7	363

Table 8. Demand Forecast of Electricity per Household, by province

Yeal	Plain	In-Between	Mounta-ihous	Suburban	Coastal	Whole Country
1	285	234	150	375	213	250
2	305	254	170	395	233	270
3	325	275	190	415	253	291
4	346	295	211	436	274	311
5	366	315	231	456	294	331
6	386	335	251	436	314	351
7	406	355	271	496	333	372
8	426	375	291	516	354	392
9	447	396	312	537	375	412
10	467	416	332	557	395	432
11	487	436	352	577	415	452
12	507	456	372	597	435	473
13	527	476	392	617	455	493
14	548	497	413	638	475	512
15	568	517	433	658	496	532
16	588	537	453	678	516	552
17	608	557	473	698	536	573
18	628	577	493	718	556	593
19	649	598	514	739	577	613
20	669	618	534	759	597	633
21	689	638	554	779	618	653
22	709	658	574	799	637	674
23	729	678	594	819	657	694
24	750	699	615	840	678	714
25	770	719	635	860	698	734
26	790	739	655	880	718	754
27	810	759	675	900	738	775
28	830	779	695	920	758	795
29	851	800	716	941	779	815
30	871	820	736	961	799	835
31	891	840	756	981	819	856
32	911	860	776	1,001	839	876
33	931	880	796	1,021	859	896
34	952	901	817	1,041	880	916
35	972	921	837	1k062	900	936

Table 9. Supply Cost of Electricity

	1976 (Won/Kwh)	1977
Generation Cost	12,789	13,221
KECO Cost	12,651	13,125
Steam	13,035	12,986
Water	4,374	7,208
Turbine	30,557	24,952
Cost of purchased electricity	13,912	13,989
Operation Cost	2.549	3.176
Transmission	0.724	0,881
Distribution	1.318	1.651
Service cost for customer	0.454	0.635
Selling cost	0.053	0.009
Non-operation cost	1.446	1.463
Cost of losses	1.499	1.352
Corporate tax and surtax	0.510	0.379
Sale Price	18.445	19.605

Source: KECO, Planning Department,
FY-77 Cost Accounting, 1978

Table 10. Customer's Costs for House Wiring, Expansion and Maintenance, per Household by Year

Unit: Won

	House Wiring Costs	Propelling Cost	Expansion Cost	Maintenance Cost
Mountainous	9,060	912	1,319	1,240
In-Between	9,828	1,236	378	1,348
Plain	10,844	1,095	255	1,520
Suburban	10,440	822	255	1,616
Coastal	8,387	760	155	1,747
Average	9,712	845	547	1,467

Table 11. Material Savings and Increase in Productivity by Electrification, 1977

Item	Amount(Won)	Remarkes	
Material of Sarings	3,068		
Extension and Saving of Working time			
Threshing	965	Save 6.3 hours per year	
Cooking	2,200	Save 14.6 hours per year	
Waterworks	24,300	Save 40.5 hours per year and Save 4 men per hour	
Increase in Productivity		Using time labors saving per hour per year	
Threshing	914	0.87	7.0
Pumping	20,980	14.6	9.6
Cutting	-	0.00	7.6
Dry	-	0.00	2.0

Note: During 76-77, farm wages (in cash) is ₩1,500/day man, working 10 hours per day in rural area, and so farm wages per hour is ₩150. This is equal to 8 working hours per day devided by index numbers of out of peaktime 0.8.

Table 12. Annual Rate of Loan Repayment

Payment Year	Rate	Payment Year	Rate
1	0.1073958333	16	0.0698958333
2	0.1048958333	17	0.0673958333
3	0.1023958333	18	0.0648958333
4	0.0998958333	19	0.0623958333
5	0.0973958333	20	0.0598948333
6	0.0948958333	21	0.0573958333
7	0.0923958333	22	0.0548958333
8	0.0898958333	23	0.0523958333
9	0.0873958333	24	0.0498958333
10	0.0848958333	25	0.0473958333
11	0.0823958333	26	0.0448958333
12	0.0798958333	27	0.0473958333
13	0.0773958333	28	0.0398958333
14	0.0748958333	29	0.0373958333
15	0.0723958333	30	0.0348958333

Table 13. Annual Purchases of Electric Appliances and Motor per Household at 1976-77 Average Price

Year After Electrified	Purchase of electric appliances (Won)	Purchase of motor (Won)	Total (Won)
1	19,632	1,117	20,749
2	37,190	5,841	42,991
3	24,150	3,264	27,414
4	9,945	1,890	11,835
5	8,276	1,117	9,393
6	6,700	601	7,301
7	6,717	601	7,381
8-35	6,700	601	7,300

Table 13. Direct, Indirect Costs and Benefit Flow (Alternative II)

Whole Country, Won Per Household

Table 5. Direct, Indirect Costs and Benefit Flow (alternative II) Whole Country, Won Per Household

Year	Electricity Sales	Consumers Surplus	Loan payment	Diect revenue	Investment	Energy Cost		Customers Cost		Maintenance Cost	Direct Cost
						Operational Cost	Generization Cost	House Wiring	Other		
o					88,525			9,712	845		99,082
1	8,820	3,250	5,086	17,156		794	3,643			2,014	6,451
2	9,330	3,510	5,086	17,926		858	3,935			2,014	6,807
3	9,710	3,784	5,086	18,579		924	4,241			2,014	7,179
4	10,210	4,043	5,086	19,339		988	4,532			2,014	7,534
5	10,710	4,304	5,086	20,099		1,051	4,824			2,014	7,889
6	11,220	4,563	7,283	23,066		1,115	5,115			2,014	8,244
7	11,600	4,836	7,113	23,549		1,181	5,421			2,014	8,616
8	12,100	5,096	6,943	24,139		1,245	5,713			2,014	8,902
9	12,600	5,356	6,774	24,730		1,309	6,004			2,014	9,327
10	12,980	5,616	6,604	25,200		1,369	6,281			2,014	9,634
11	13,490	5,876	6,435	25,801		1,436	6,587			2,014	10,037
12	13,990	6,149	6,265	26,404		1,499	6,878			2,014	10,391
13	14,490	6,409	6,096	26,995		1,563	7,170			2,014	10,747
14	14,870	6,656	5,926	27,452		1,626	7,461			2,014	11,101
15	15,380	6,916	5,757	28,053		1,690	7,753			2,014	11,457
16	15,880	7,176	5,587	28,643		1,756	8,059			2,014	11,829
17	16,260	7,449	5,418	29,127		1,817	8,350			2,014	12,181
18	16,760	7,709	5,248	29,717		1,883	8,642			2,014	12,539
19	17,270	7,969	5,079	30,318		1,947	8,933			2,014	12,894
20	18,020	8,229	4,909	31,158		2,010	9,255			2,014	13,279
21	18,590	8,489	4,740	31,819		2,077	9,531			2,014	13,622
22	19,240	8,762	4,570	32,572		2,141	9,822			2,014	13,977

Directnet benefit	P.V of Direct net benefit		Indirect revence		Total revenue	Indirect costs		Total Costs	Total net benefit	P.V of Total net benefit	
	12%	15%	Benefits of KECD exclu- ding tax	Benefits of electric appliance manufacture		Costs of KECO	Costs of electric appliance manufacture			18%	20%
-99,082	-99,082	-99,082						-99,082	-99,082	-99,082	-99,082
10,705	9,558	9,309	8,400	19,633	45,189	4,901	21,419	29,218	15,971	13,535	13,309
11,119	8,864	8,408	8,886	37,189	64,001	5,293	40,573	45,942	18,059	12,969	12,541
11,400	8,114	7,496	9,248	24,156	51,982	5,705	26,354	34,866	17,117	10,418	9,905
11,805	7,502	6,750	9,724	9,944	39,007	6,097	10,849	22,680	16,327	8,421	7,874
12,210	6,928	6,071	10,200	8,278	38,577	6,489	9,031	21,911	16,666	7,285	6,598
14,822	7,509	6,408	10,686	6,700	40,452	6,881	7,309	21,222	19,230	7,123	6,440
14,933	6,755	5,614	11,048	6,700	41,297	7,293	7,309	22,006	19,291	6,056	5,384
15,167	6,126	4,958	11,524	6,700	42,363	7,685	7,309	22,754	19,609	5,217	4,560
15,423	5,554	4,378	12,000	6,700	43,430	8,077	7,309	23,501	19,929	4,493	3,862
15,536	5,002	3,840	12,362	6,700	44,262	8,469	7,309	24,230	20,032	3,827	3,235
15,764	4,532	3,388	12,848	6,700	45,349	8,861	7,309	24,995	20,354	3,296	2,739
16,013	4,110	2,993	13,324	6,700	46,428	9,273	7,309	25,761	20,667	2,836	2,318
16,248	3,724	2,641	13,800	6,700	47,495	9,665	7,309	26,509	20,986	2,440	1,961
16,351	3,346	2,311	14,162	6,700	48,314	10,038	7,309	27,236	21,078	2,077	1,642
16,596	3,032	2,040	14,648	6,700	49,401	10,429	7,309	27,983	21,418	1,789	1,390
16,814	2,743	1,797	15,124	6,700	50,467	10,822	7,309	28,748	21,719	1,537	1,175
16,946	2,468	1,575	15,486	6,700	51,313	11,234	7,309	29,512	21,801	1,308	983
17,178	2,234	1,388	15,962	6,700	52,379	11,626	7,309	30,262	22,117	1,124	831
17,424	2,023	1,224	16,448	6,700	53,466	12,018	7,309	31,009	22,457	967	703
17,879	1,853	1,092	17,162	6,700	55,020	12,409	7,309	31,785	23,235	848	606
18,197	1,684	967	17,705	6,700	56,214	12,802	7,309	32,521	23,703	733	515
18,595	1,537	895	18,324	6,700	57,596	13,214	7,309	33,288	24,308	637	376

Year	Electricity Sales	Consumers Surplus	Loan Payment	Direct revenue	Investment	Energy Cost		Customers Cost		Maintenance Cost	Direct Cost
						Operational Cost	Generization Cost	House Wiring	Other		
23	19,890	9,022	4,401	33,313		2,204	10,114			2,014	14,332
24	20,510	9,282	4,231	34,023		2,268	10,405			2,014	14,687
25	21,180	9,542	4,602	35,324		2,331	10,697			2,014	15,042
26	21,830	9,802	3,892	35,524		2,398	11,003			2,014	15,415
27	22,480	10,075	3,723	36,278		2,461	11,294			2,014	15,769
28	23,120	10,335	3,553	37,008		2,525	11,586			2,014	16,125
29	23,770	10,595	3,383	37,748		2,588	11,877			2,014	16,479
30	24,420	10,855	3,248	38,523		2,652	12,168			2,014	16,834
31	25,070	11,128	3,044	39,242		2,719	12,474			2,014	17,207
32	25,720	11,388	2,875	39,983		2,782	12,766			2,014	17,562
33	26,350	11,648	2,705	40,703		2,846	13,057			2,014	17,917
34	27,010	11,908	2,536	41,454		2,909	13,349			2,014	18,272
35	27,660	12,168	2,366	42,194		2,973	13,540			2,014	18,627
					1,053,159						538,087

IRR = 14.209

Direct net benefit	P.V of Direct net benefit		Indirect revence		Total revenue	Indirect costs		Total Costs	Total net benefit	P.V of Total net benefit	
	12%	15%	Benefits of KECD excluding tax	Benefits of electric appliance manufacture		Costs of KECO	Costs of electric appliance manufacture			18%	20%
18,981	1,401	763	18,943	6,700	58,956	13,606	7,309	34,035	24,921	554	376
19,336	1,274	675	19,533	6,700	60,256	13,998	7,309	34,782	25,474	480	320
20,282	1,193	616	20,171	6,700	62,195	14,390	7,309	35,529	26,666	426	279
20,109	1,056	531	20,790	6,700	63,014	14,782	7,309	36,294	26,720	361	233
20,509	962	471	21,409	6,700	64,388	15,194	7,309	37,060	27,328	313	199
20,883	874	417	22,019	6,700	65,727	15,586	7,309	37,808	27,919	271	169
21,269	795	369	22,638	6,700	67,086	15,978	7,309	38,554	28,632	235	144
21,689	724	328	23,357	6,700	68,480	16,370	7,309	39,301	29,179	204	123
22,035	657	289	23,876	6,700	69,618	16,782	7,309	40,086	29,732	176	104
22,421	597	256	24,495	6,700	71,178	17,174	7,309	40,833	30,345	152	89
22,786	541	226	25,095	6,700	72,498	17,556	7,309	41,580	30,918	131	75
23,182	492	200	25,724	6,700	73,678	17,958	7,309	42,327	31,551	114	64
23,567	446	177	26,343	6,700	75,237	18,350	7,309	43,074	32,163	98	54
515,072	17,128	-8,257			1,935,721	407,015		1,218,284	718,436	3,369	-7,738

IRR + 14.209 TRR = 18.6%

Table 14. Financial Flow Chart of KECO, Per Household

Unit: Won

Year	Electricity Sales	Loan Payment	Total Cash Receipts	Investment	Energy Cost	Sales Tax	Total Cost	Net Cash Receipts	PV of Net Cash Receipts 10%	12%	15%
0				78,428			78,428	-78,428	-78,428	-78,428	-78,428
1	8,820	5,086	13,906		4,901	441	5,342	8,564	7,785	7,646	7,447
2	9,330	5,086	14,416		5,293	467	5,760	8,564	7,149	6,901	6,545
3	9,710	5,086	14,796		5,705	486	6,191	8,605	6,462	6,125	5,658
4	10,210	5,086	15,296		6,097	511	6,608	8,688	5,934	5,521	4,907
5	10,710	5,086	15,796		6,489	536	7,025	8,771	5,447	4,977	4,361
6	11,220	7,283	18,503		6,881	561	7,442	11,061	6,238	5,604	4,782
7	11,600	7,113	18,713		7,293	580	7,873	10,840	5,561	4,903	4,075
8	12,100	6,943	19,043		7,685	605	8,290	10,753	5,022	4,343	3,515
9	12,600	6,774	19,374		8,077	630	8,707	10,667	4,523	3,847	3,032
10	12,980	6,604	19,584		8,469	649	9,118	10,466	4,040	3,370	2,587
11	13,490	6,435	19,925		8,861	675	9,536	10,389	3,636	2,987	2,233
12	13,990	6,265	20,255		9,273	700	9,973	10,282	3,280	2,639	1,922
13	14,490	6,096	20,586		9,665	725	10,390	10,196	2,957	2,337	1,657
14	14,870	5,926	20,796		10,038	744	10,782	10,014	2,634	2,049	1,415
15	15,380	5,757	21,137		10,429	769	11,198	9,939	2,375	1,816	1,221

Table 14. Financial Flow Chart of KECO, Per Household (2)

	Electricity Sales	Loan Payment	Total Cash Receipts	Invest-ment	Energy Cost	Sales Tax	Total Cost	Net Cash Receipt	PV of net Cash Receipts 10%	12%	15%
16	15,880	5,587	21,467		10,822	794	11,616	9,851	2,148	1,607	1,053
17	16,260	5,418	21,678		11,234	813	12,047	9,631	1,907	1,403	895
18	16,760	5,248	22,008		11,626	838	12,464	9,544	1,718	1,241	771
19	17,270	5,079	22,349		12,018	864	12,882	9,467	1,553	1,099	665
20	18,020	4,909	22,929		12,409	901	13,310	9,619	1,433	997	588
21	18,590	4,740	23,330		12,802	930	13,732	9,598	1,296	888	510
22	19,240	4,576	23,810		13,214	962	14,176	9,634	1,185	796	445
23	19,890	4,401	24,291		13,606	995	14,601	9,690	1,085	715	389
24	20,510	4,231	24,741		13,998	1,026	15,024	9,717	991	640	339
25	21,180	4,602	25,782		14,390	1,059	15,449	10,333	951	608	314
26	21,830	3,892	25,722		14,782	1,092	15,874	9,848	827	517	260
27	22,480	3,723	26,203		15,194	1,124	16,318	9,885	751	464	227
28	23,120	3,553	26,673		15,586	1,156	16,742	9,931	685	416	198
29	23,770	3,383	27,153		15,978	1,189	17,167	9,986	629	373	173
30	24,420	3,248	27,668		16,370	1,221	17,591	10,077	574	336	152
31	25,070	3,044	28,114		16,782	1,254	18,036	10,078	525	300	132
32	25,720	2,875	28,595		17,174	1,286	18,460	10,135	478	270	116
33	26,350	2,705	29,055		17,566	1,318	18,884	10,171	438	242	101
34	27,010	2,536	29,546		17,958	1,351	19,309	10,237	401	217	88
35	27,660	2,366	30,026		18,350	1,383	19,733	10,293	371	195	77
Total	612,530		783,266		407,015		516,078	267,188	14,561	- 40	-15,514

IRR = 11.99

Table 15. Direct, Indirect Costs and Benefits Flow (Alternative I) Whole Country; Won Per Household

Year	Meterial Savings	Time Savings	Productivity Gains	Direct Revenue	Invest-ment	Electric bill	Customer's Cost House-wiring	Others	Expansion & Maintenous Cost	Purchasing Cost of Electric moters	Direct Cost
0					88,525		9,712	845			99,082
1	3,068	27,465	3,899	34,432		8,820			2,014	1,117	11,951
2	3,068	27,465	24,293	54,826		9,330			2,014	5,841	17,185
3	3,068	27,465	35,689	66,222		9,710			2,014	3,264	11,988
4	3,068	27,485	42,288	72,821		10,210			2,014	1,889	14,113
5	3,068	27,465	46,187	76,720		10,710			2,014	1,117	13,841
6	3,068	27,465	48,217	78,750		11,220			2,014	601	13,835
7	3,068	27,465	48,217	78,750		11,600			2,014	601	14,215
8	3,068	27,465	48,217	78,750		12,100			2,014	601	14,715
9	3,068	27,465	48,217	78,750		12,600			2,014	601	15,215
10	3,068	27,465	48,217	78,750		12,980			2,014	601	15,595
11	3,068	27,465	48,217	78,750		13,490			2,014	601	16,105
12	3,068	27,465	48,217	78,750		13,990			2,014	601	16,605
13	3,068	27,465	48,217	78,750		14,490			2,014	601	17,105
14	3,068	27,465	48,217	78,750		14,870			2,014	601	17,485
15	3,068	27,465	48,217	78,750		15,380			2,014	601	17,995
16	3,068	27,465	48,217	78,750		15,880			2,014	601	18,495
17	3,068	27,465	48,217	78,750		16,260			2,014	601	18,875
18	3,068	27,465	48,217	78,750		16,760			2,014	601	19,375
19	3,068	27,465	48,217	78,750		17,270			2,014	601	19,885
20	3,068	47,465	48,217	78,750		18,020			2,014	601	20,635
21	3,068	27,465	48,217	78,750		18,590			2,014	601	21,205
22	3,068	27,465	48,217	78,750		19,240			2,014	601	21,855

Direct Net Benefit	P.V. of Direct Net Benefit		Indirect Costs		Total Costs	Indirect Revenue		Total Revenue	Total Net Benefit	P.V. of Total Net Benefit	
	40%	50%	Costs of KECO	Costs of Electric Appliances Manufactures		Benefits of KECO Excluding Tax	Benefits of Electric Appliances Manufactures			40%	50%
-99,082	-99,082	-99,082			99,082				-99,082	-99,082	-99,082
22,481	16,058	14,987	4,901	17,866	34,718	8,400	19,633	62,465	27,747	18,819	18,498
37,641	19,205	16,729	5,293	33,842	56,320	8,886	37,189	100,900	44,581	22,745	19,814
51,234	18,671	15,180	5,705	21,982	42,675	9,248	24,156	99,625	56,951	20,755	16,874
58,708	15,282	11,597	6,097	9,049	29,259	9,724	9,944	92,489	63,230	16,459	12,490
62,879	11,691	8,280	6,489	7,533	27,863	10,200	8,278	95,198	67,335	12,519	8,867
64,915	8,621	5,699	6,881	6,097	26,813	10,686	6,700	96,136	69,323	9,208	6,086
64,535	6,122	3,777	7,293	6,097	27,605	11,048	6,700	96,498	68,893	6,535	4,032
64,035	6,339	2,499	7,685	6,097	28,497	11,524	6,700	96,974	68,477	4,640	2,672
63,535	30,175	1,653	8,077	6,097	29,389	12,000	6,700	97,450	68,061	3,294	1,770
63,155	2,183	1,095	8,469	6,097	30,161	12,362	6,700	97,812	67,651	2,339	1,103
62,645	1,547	724	8,861	6,097	31,063	12,848	6,700	98,298	67,235	1,660	773
62,145	1,096	479	9,273	6,097	31,975	13,324	6,700	98,774	66,799	1,178	515
61,645	777	317	9,665	6,097	32,867	13,800	6,700	99,250	66,383	836	341
61,265	551	210	10,038	6,097	33,620	14,162	6,700	99,612	65,992	594	226
60,755	391	139	10,429	6,097	34,521	14,648	6,700	100,098	65,577	422	150
60,255	277	92	10,822	6,097	35,414	15,124	6,700	100,574	65,160	299	99
59,875	196	61	11,234	6,097	36,206	15,486	6,700	100,936	64,730	212	66
59,375	139	40	11,626	6,097	37,098	15,962	6,700	101,412	64,314	151	44
58,865	98	27	12,018	6,097	38,000	16,448	6,700	101,898	63,898	107	29
58,115	69	17	12,409	6,097	39,141	17,162	6,700	102,612	63,471	76	19
57,545	49	12	12,802	6,097	40,104	17,705	6,700	103,155	63,051	54	13
56,895	35	8	13,214	6,097	41,166	18,324	6,700	103,774	62,608	38	8

	Materials Savings	Time Savings	Productivity gains	Direct Revenue	Investment	Electric bill	Customer's Cost House-wiring	Customer's Cost Others	Expansion & Maintenous Cost	Purchasing Cost of Electric Meters	Direct Costs
23	3,068	27,465	48,217	78,750		19,890			2,014	601	22,505
24	3,068	27,465	48,217	78,750		20,510			2,014	601	23,125
25	3,068	27,465	48,217	78,750		21,180			2,014	601	23,795
26	3,068	27,465	48,217	78,750		21,830			2,014	601	24,445
27	3,068	27,465	48,217	78,750		22,480			2,014	601	25,095
28	3,068	27,465	48,217	78,750		23,120			2,014	601	25,735
29	3,068	27,465	48,217	78,750		23,770			2,014	601	26,385
30	3,068	27,465	48,217	78,750		24,420			2,014	601	26,385
31	3,068	27,465	48,217	78,750		25,070			2,014	601	27,035
32	3,068	27,465	48,217	78,750		25,720			2,014	601	28,965
33	3,068	27,465	48,217	78,750		26,350			2,014	601	28,965
34	3,068	27,465	48,217	78,750		27,010			2,014	601	29,625
35	3,068	27,465	48,217	78,750		27,660			2,014	601	30,275
	107,380	961,275				612,530			70,490	31,258	813,360

Direct Net Benefit	P.V. of direct Net Benefit		Indirect Costs		Total Costs	Indirect Revenue		Total Revenue	Total Net Benefit	P.V. of Total Net Benefit	
	40%	50%	Costs of KECO	Costs of Electric Appliances Manufactures		Benefits of KECO Excluding Tax	Benefits of Electric Appliances Manufacturers			40%	50%
56,245	24	5	13,606	6,097	42,208	18,943	6,700	104,393	62,185	27	6
55,625	17	3	13,998	6,097	43,220	19,533	6,700	104,983	61,763	19	4
54,955	12	2	14,390	6,097	44,282	20,171	6,700	105,621	61,339	14	2
54,305	9	1	14,782	6,097	45,324	20,790	6,700	106,240	60,916	10	2
53,655	6	1	15,194	6,097	46,386	21,409	6,700	106,860	60,473	7	1
53,015	4	1	15,586	6,097	47,418	22,019	6,700	107,469	60,051	5	1
52,365	3	0	15,978	6,097	48,460	22,638	6,700	108,088	59,628	3	0
51,715	2	0	16,370	6,097	49,502	23,257	6,700	108,707	59,205	2	0
51,065	2	0	16,782	6,097	50,564	23,876	6,700	109,326	58,762	1	0
50,415	1	0	17,174	6,097	51,606	24,495	6,700	109,945	58,339	1	0
49,785	1	0	17,566	6,097	52,628	25,095	6,700	110,545	57,917	1	0
49,125	1	0	17,958	6,097	53,680	25,724	6,700	111,174	57,494	1	0
48,475	0	0	18,350	6,097	54,722	26,343	6,700	111,793	57,071	0	0
	11,474	15,446			1,493,557			2,057,526	24,951		-4,503

TRR = 48.47

Table 17. Direct Costs and Benefit Flow (Alternative II) Mountainous, Won Per Household

Year	Electricity Sales	Consumer's Loan Surplus	Consumer's Loan Payment	Total Revenue	Investment	Energy Cost: Operational Cost	Energy Cost: Generation Cost	Customer's Cost: House Wiring	Customer's Cost: Other	Maintenance Cost	Total Cost	Net Benefit	P.V. of Net Benefit 10%	P.V. of Net Benefit 12%
0					88,525			9,060	912		98,497	-98,497	-98,497	-98,497
1	6,600	1,950	5,086	13,636		476	2,186			2,559	5,221	8,415	7,649	7,513
2	6,840	2,210	5,086	14,136		540	2,477			2,559	5,576	8,560	7,071	6,824
3	7,440	2,470	5,086	14,996		603	2,769			2,559	5,931	9,065	6,808	6,452
4	7,920	2,743	5,086	15,749		670	3,075			2,559	6,304	9,445	6,451	6,002
5	8,280	3,003	5,086	16,369		734	3,366			2,559	6,659	9,710	6,030	5,510
6	8,760	3,263	7,283	19,306		797	3,658			2,559	7,014	12,292	6,933	6,228
7	9,360	3,523	7,113	19,996		861	3,949			2,559	7,369	12,627	6,478	5,712
8	9,600	3,783	6,943	20,326		924	4,241			2,559	7,724	12,602	5,885	5,090
9	10,200	4,056	6,774	21,030		991	4,547			2,559	8,097	12,933	5,484	4,664
10	10,800	4,316	6,604	21,720		1,054	4,838			2,559	8,451	13,269	5,122	4,272
11	11,040	4,576	6,435	22,051		1,118	5,130			2,559	8,807	13,244	4,635	3,807
12	11,640	4,836	6,265	22,741		1,181	5,421			2,559	9,161	13,580	4,332	3,486
13	12,120	5,096	6,096	23,312		1,245	5,713			2,559	9,517	13,795	4,005	3,161
14	12,480	5,369	5,926	23,775		1,312	6,019			2,559	9,890	13,885	3,652	2,841
15	12,960	5,629	5,757	24,346		1,375	6,310			2,559	10,244	14,102	3,370	2,576
16	13,560	5,889	5,587	25,036		1,439	6,602			2,559	10,600	14,436	3,147	2,354
17	13,800	6,149	5,418	25,367		1,502	6,893			2,559	10,954	14,413	2,854	2,099
18	14,400	6,409	5,248	26,057		1,566	7,184			2,559	11,309	14,748	2,655	1,918
19	14,880	6,682	5,079	26,641		1,632	7,491			2,559	11,682	14,959	2,453	1,737
20	15,480	6,942	4,909	27,331		1,696	7,782			2,559	12,037	15,294	2,279	1,585
21	15,720	7,202	4,740	27,662		1,760	8,073			2,559	12,392	15,270	2,061	1,413
22	16,320	7,462	4,570	28,352		1,823	8,365			2,559	12,747	15,605	1,919	1,290
23	16,920	7,722	4,401	29,043		1,887	8,656			2,559	13,102	15,941	1,785	1,176

Table 17. Direct Costs and Benefit Flow (Alternative II) Mountainous, Won Per Household

	Elect-ricity Sales	Consumer's Loan Surplus	Payment	Total Revenue	Invest-ment	Energy Cost Opera--tional Cost	Genera-tion Cost	Customer's Cost House Wiring	Other	Mainte-nance Cost	Total Cost	Net Benefit	P.V. of Net Benefit 10%	12%
24	17,280	7,995	4,231	29,506		1,953	8,962			2,559	13,474	16,032	1,635	1,056
25	18,000	8,255	4,062	30,317		2,017	9,254			2,559	13,830	16,487	1,517	970
26	18,840	8,515	3,892	31,247		2,080	9,545			2,559	14,184	17,063	1,433	896
27	19,200	8,775	3,723	31,698		2,144	9,837			2,559	14,540	17,158	1,304	805
28	19,920	9,035	3,553	32,508		2,207	10,128			2,559	14,894	17,614	1,215	737
29	20,760	9,308	3,383	33,451		2,274	10,434			2,559	15,267	18,184	1,146	680
30	21,120	9,568	3,248	33,936		2,338	10,726			2,559	15,623	18,313	1,044	611
31	21,840	9,828	3,044	34,712		2,401	11,017			2,559	15,977	18,735	976	558
32	22,680	10,088	2,875	35,643		2,465	11,309			2,559	16,333	19,310	915	514
33	23,040	10,348	2,705	36,093		2,528	11,600			2,559	16,687	19,406	836	461
34	23,760	10,621	2,536	36,917		2,595	11,906			2,559	17,060	19,857	777	421
35	24,600	10,881	2,366	37,847		2,658	12,198			2,559	17,415	20,432	736	387
				912,853							494,569	418,284	18,095	-2,688

IRR = 11.74%

Table 18. Direct Costs and Benefit Flow (Alternative II) In-Between, Won Per Household

Year	Electricity Sales	Consumer's Surplus	Loan Payment	Total Revenue	Investment	Energy Cost		Customer's Cost		Maintenance Cost	Total Cost	Net Benefit	P.V. of Net Benefit	
						Operational Cost	Generation Cost	House Wiring	Other				12%	15%
0					88,525			9,828	1,236		99,589	-99,589	-99,589	-99,589
1	8,520	3,042	5,086	16,648		743	3,410			1,736	5,889	10,759	9,606	9,356
2	8,760	3,302	5,086	17,148		807	3,702			1,736	6,245	10,903	8,692	8,244
3	9,360	3,562	5,086	18,008		870	3,993			1,736	6,599	11,409	8,121	7,502
4	9,960	3,835	5,086	18,881		937	4,299			1,736	6,972	11,909	7,568	6,809
5	10,200	4,095	5,086	19,381		1,000	4,590			1,736	7,326	12,055	6,840	5,993
6	10,800	4,355	7,283	22,438		1,064	4,882			1,736	7,682	14,756	7,476	6,379
7	11,280	4,615	7,113	23,008		1,127	5,173			1,736	8,036	14,972	6,773	5,629
8	11,640	4,875	6,943	23,458		1,191	5,465			1,736	8,392	15,066	6,085	4,925
9	12,120	5,148	6,774	24,042		1,258	5,771			1,736	8,765	15,277	5,509	4,343
10	12,720	5,408	6,604	24,732		1,321	6,062			1,736	9,119	15,613	5,027	3,859
11	12,960	5,668	6,435	25,063		1,385	6,354			1,736	9,475	15,588	4,481	3,351
12	13,560	5,928	6,265	25,753		1,448	6,645			1,736	9,829	15,924	4,087	2,975
13	14,040	6,188	6,096	26,324		1,512	6,937			1,736	10,185	16,139	3,699	2,623
14	14,400	6,461	5,926	26,787		1,578	7,243			1,736	10,557	16,230	3,321	2,294
15	14,880	6,721	5,757	27,358		1,642	7,534			1,736	10,912	16,446	3,005	2,021
16	15,480	6,981	5,587	28,048		1,706	7,826			1,736	11,268	16,780	2,737	1,793
17	15,720	7,241	5,418	28,377		1,769	8,117			1,736	11,622	16,757	2,441	1,557
18	16,320	7,501	5,248	29,069		1,833	8,409			1,736	11,978	17,091	2,223	1,381
19	16,920	7,774	5,079	29,773		1,899	8,715			1,736	12,350	17,423	2,023	1,224
20	17,640	8,034	4,909	30,583		1,963	9,006			1,736	12,705	17,878	1,853	1,092
21	18,000	8,294	4,740	31,034		2,026	9,298			1,736	13,060	17,974	1,664	955
22	18,840	8,554	4,570	31,964		2,090	9,589			1,736	13,415	18,549	1,533	857

Table 18. Direct Costs and Benefit Flow (Alternative II) In-Between, Won Per Household

	Electricity Sales	Consumer's Surplus	Loan Payment	Total Revenue	Investment	Energy Cost		Customer's Cost		Maintenance Cost	Total Cost	Net Benefit	P.V. of Net Benefi	
						Operational Cost	Generation Cost	House Wiring	Other				12%	15%
23	19,560	8,814	4,401	32,775		2,153	9,880			1,736	13,769	19,006	1,402	764
24	19,920	9,087	4,231	33,238		2,220	10,187			1,736	14,143	19,095	1,258	667
25	20,760	9,347	4,062	34,169		2,284	10,478			1,736	14,498	19,671	1,157	598
26	21,480	9,607	3,892	34,979		2,347	10,769			1,736	14,852	20,127	1,057	532
27	21,840	9,867	3,723	35,430		2,411	11,061			1,736	15,208	20,222	948	464
28	22,680	10,127	3,553	36,360		2,474	11,352			1,736	15,562	20,798	871	415
29	23,400	10,400	3,383	37,183		2,541	11,658			1,736	15,935	21,378	794	369
30	23,760	10,660	3,248	37,668		2,604	11,950			1,736	16,290	21,398	714	323
31	24,600	10,920	3,044	38,564		2,668	12,241			1,736	16,645	21,919	653	288
32	25,320	11,180	2,875	39,375		2,731	12,533			1,736	17,000	22,375	595	256
33	25,680	11,440	2,705	39,825		2,795	12,824			1,736	17,355	23,470	534	223
34	26,520	11,713	2,536	40,769		2,862	13,130			1,736	17,728	23,041	489	199
35	27,240	11,973	2,366	41,579		2,925	13,422			1,736	18,083	23,496	445	176
	596,880	262,717		1,029,793							519,038	510,755	16,091	-9,152

IRR = 13,91%

Table 19. Direct Costs and Benefit Flow (Alternative II) Plain, Won Per Household

Year	Electricity Sales	Consumer's Surplus	Loan Payment	Total Revenue	Investment	Energy Cost		Customer's Cost		Maintenance Cost	Total Cost	Net Benefit	P.V. of Net Benefit	
						Operational Cost	Generation Cost	House Wiring	Other				12%	15%
0					88,525			10,844	1,095		100,464	-100,464	-100,464	-100,464
1	9,600	3,705	5,086	18,391		905	4,153			1,775	6,833	11,558	12,320	10,050
2	9,960	3,965	5,086	19,011		969	4,445			1,775	7,189	11,822	9,424	8,939
3	10,440	4,225	5,086	19,751		1,032	4,736			1,775	7,543	12,208	9,689	8,027
4	11,040	4,498	5,086	20,624		1,099	5,042			1,775	7,916	12,708	8,976	7,266
5	11,640	4,758	5,086	21,484		1,162	5,334			1,775	8,271	13,213	7,497	6,569
6	11,880	5,018	7,283	24,181		1,226	5,625			1,775	8,626	15,555	7,881	6,725
7	12,480	5,278	7,113	24,871		1,289	5,917			1,775	8,981	15,890	7,188	5,974
8	12,960	5,538	6,943	25,441		1,353	6,208			1,775	9,336	16,105	6,505	5,265
9	13,320	5,811	6,774	25,905		1,420	6,514			1,775	9,709	16,196	5,840	4,604
10	13,800	6,071	6,604	26,475		1,483	6,806			1,775	10,064	16,411	5,284	4,057
11	14,400	6,331	6,435	27,166		1,547	7,097			1,775	10,419	16,747	4,814	3,599
12	14,640	6,591	6,265	27,496		1,610	7,389			1,775	10,774	16,722	4,292	3,125
13	15,240	6,851	6,096	28,187		1,674	7,679			1,775	11,128	17,059	3,909	2,773
14	15,720	7,124	5,926	28,770		1,740	7,986			1,775	11,501	17,269	3,534	2,440
15	16,080	7,384	5,757	29,221		1,804	8,277			1,775	11,856	17,365	3,173	2,134
16	16,560	7,644	5,587	29,791		1,867	8,569			1,775	12,211	17,580	2,868	1,879
17	17,280	7,904	5,418	30,602		1,931	8,860			1,775	12,566	18,036	2,627	1,676
18	17,640	8,164	5,248	31,052		1,995	9,152			1,775	12,922	18,130	2,358	1,465
19	18,480	8,437	5,079	31,996		2,061	9,458			1,775	13,294	18,702	2,171	1,314
20	19,200	8,697	4,909	32,806		2,125	9,749			1,775	13,649	19,157	1,986	1,170
21	19,560	8,957	4,740	33,257		2,188	10,041			1,775	14,004	19,253	1,782	1,023
22	20,400	9,217	4,570	34,187		2,252	10,332			1,775	14,359	19,828	1,639	916
23	21,120	9,477	4,401	34,998		2,315	10,624			1,775	14,714	20,284	1,497	815

Year	Electricity Sales	Consumer's Surplus	Loan Payment	Total Revenue	Investment	Energy Cost		Customer's Cost		Maintenance Cost	Total Cost	Net Benefit	P.V.of net Bene.	
						Operational Cost	Generation Cost	House Wiring	Other				12%	15%
24	21,840	9,750	4,231	35,821		2,382	10,929			1,775	15,086	20,735	1,366	724
25	22,320	10,010	4,062	36,392		2,445	11,221			1,775	15,441	20,951	1,232	636
26	23,040	10,270	3,892	37,202		2,509	11,513			1,775	15,797	21,405	1,124	565
27	23,760	10,530	3,723	38,013		2,573	11,804			1,775	16,152	21,861	1,025	502
28	24,240	10,790	3,553	38,583		2,636	12,096			1,775	16,507	22,076	924	441
29	24,960	11,063	3,383	39,406		2,703	12,402			1,775	16,880	22,526	842	391
30	25,680	11,323	3,248	40,251		2,766	12,693			1,775	17,234	23,017	768	348
31	26,160	11,583	3,044	40,787		2,830	12,985			1,775	17,590	23,197	691	305
32	26,880	11,843	2,875	41,598		2,893	13,276			1,775	17,944	23,654	629	270
33	27,600	12,103	2,705	42,408		2,957	13,567			1,775	18,299	24,109	572	239
34	28,080	12,376	2,536	42,992		3,024	13,873			1,775	18,672	24,320	516	210
35	28,800	12,636	2,366	43,802		3,087	14,165			1,775	19,027	24,775	469	186
				1,102,918							552,958	549,960	23,050	-3,840

IRR = 14.57

Table 20. Direct Costs and Benefit Flow (Alternative II) Suburban, Won Per Household

Year	Electricity Sales	Consumer's Surplus	Loan Payment	Total Revenue	Investment	Energy Cost		Customer's Cost		Maintenance Cost	Total Cost	Net Benefit	P.V. of Net Benefit	
						Operation Cost	Generation Cost	House Wiring	Other					
0					88,525			10,440	822		99,787	-99,787	-99,787	-99,787
1	11,640	4,875	5,086	21,601		1,191	5,465			1,868	8,524	13,077	11,371	11,082
2	12,120	5,135	5,086	22,341		1,255	5,756			1,868	8,879	13,462	10,179	9,668
3	12,720	5,395	5,086	23,201		1,318	6,048			1,868	9,234	13,967	9,184	8,501
4	12,960	5,668	5,086	23,714		1,385	6,354			1,868	9,607	14,107	8,066	7,276
5	12,560	5,928	5,286	24,574		1,448	6,645			1,868	9,961	14,613	7,265	6,387
6	14,040	6,188	7,283	27,511		1,512	6,937			1,868	10,317	17,194	7,433	6,369
7	14,400	6,448	7,113	27,961		1,575	7,228			1,868	10,671	17,290	6,500	5,428
8	14,880	6,708	6,943	28,531		1,639	7,520			1,868	11,027	17,504	5,722	4,657
9	15,480	6,981	6,774	29,235		1,706	7,826			1,868	11,400	17,805	5,070	4,021
10	15,720	7,241	6,604	29,565		1,769	8,117			1,868	11,754	17,811	4,403	3,403
11	16,320	7,501	6,435	30,256		1,833	8,409			1,868	12,110	18,146	3,900	2,938
12	16,920	7,761	6,265	30,946		1,896	8,700			1,868	12,464	18,482	3,454	2,536
13	17,280	8,021	6,096	31,397		1,959	8,992			1,868	12,819	18,578	3,019	2,160
14	18,000	8,294	5,926	32,220		2,026	9,298			1,868	13,192	19,028	2,689	1,875
15	18,840	8,554	5,757	33,151		2,089	9,589			1,868	13,546	19,605	2,409	1,637
16	19,560	8,814	5,587	33,961		2,153	9,880			1,868	13,901	20,068	2,144	1,420
17	19,920	9,074	5,418	34,412		2,217	10,172			1,868	14,257	20,155	1,873	1,209
18	20,760	9,334	5,248	35,342		2,280	10,463			1,868	14,611	20,731	1,675	1,054

Year	Electricity Sales	Consumer's Surplus	Loan Payment	Total Revenue	Investment	Energy Cost		Customer's Cost		Maintenance Cost	Total Cost	Net Benefit	P.V. of Net Benefit	
						Operation Cost	Generation Cost	House Wiring	Other				15%	18%
19	21,480	9,607	5,079	36,166		2,347	10,769			1,868	14,984	21,182	1,488	912
20	21,840	9,867	4,909	36,616		2,411	11,061			1,868	15,340	21,276	1,230	777
21	22,680	10,127	4,740	37,547		2,474	11,352			1,862	15,694	21,853	1,161	676
22	23,400	10,387	4,570	38,357		2,538	11,644			1,868	16,050	22,307	1,031	585
23	23,760	10,647	4,401	38,808		2,601	11,935			1,868	16,404	22,404	900	498
24	24,600	10,920	4,231	39,751		2,668	12,241			1,868	16,777	22,974	803	433
25	25,320	11,180	4,062	40,562		2,731	12,533			1,868	17,132	23,430	712	374
26	25,680	11,440	3,892	41,012		2,795	12,824			1,868	17,487	23,525	621	318
27	26,520	11,700	3,723	41,943		2,858	13,116			1,868	17,842	24,101	554	276
28	27,240	11,960	3,553	42,753		2,922	13,407			1,868	18,197	24,556	490	238
29	27,600	12,233	3,383	43,216		2,989	13,713			1,868	18,570	24,646	428	203
30	28,440	12,493	3,248	44,181		3,052	14,005			1,868	18,925	25,256	381	176
31	29,160	12,753	3,044	44,957		3,116	14,296			1,868	19,280	25,677	337	152
32	29,520	13,013	2,875	45,408		3,179	14,588			1,868	19,635	25,773	294	129
33	30,360	13,273	2,705	46,338		3,243	14,879			1,868	19,990	26,348	262	112
34	31,080	13,533	2,536	47,149		3,306	15,170			1,868	20,344	26,805	231	96
35	31,920	13,806	2,366	48,092		3,373	15,477			1,868	20,718	27,374	206	83
				1,232,775							611,430	621,345	7,770	12,126

IRR = 16.17%

Table 21. Direct Costs and Benefit Flow (Alternative II) Coastal, Won Per Household

Year	Electricity Sales	Consumer's Surplus	Loan Payment	Total Revenue	Investment	Energy Cost		Customer's Cost		Maintenance Cost	Total Cost	Net Benefit	P.V. of Net Benefit	
						Operational Cost	Generation Cost	House Wiring	Other				12%	15%
0					88,525			9,712	845		99,082	-99,082	-99,082	-99,082
1	7,920	2,769	5,086	15,775		676	3,104			1,902	5,682	10,093	9,012	8,777
2	8,280	3,029	5,086	16,395		740	3,396			1,902	6,038	10,357	8,257	7,831
3	8,760	3,289	5,086	17,135		804	3,687			1,902	6,393	10,742	7,645	7,063
4	9,360	3,562	5,086	18,008		870	3,993			1,902	6,765	11,243	7,145	6,428
5	9,960	3,822	5,086	18,868		934	4,284			1,902	7,120	11,748	6,666	5,841
6	10,200	4,082	7,283	21,565		997	4,576			1,902	7,475		7,138	6,091
7	10,800	4,342	7,113	22,255		1,061	4,867			1,902	7,830	14,425	6,525	5,423
8	11,280	4,602	6,943	22,825		1,124	5,159			1,902	8,185	14,640	5,913	4,786
9	11,640	4,875	6,774	23,289		1,191	5,465			1,902	8,558	14,731	5,312	4,187
10	12,120	5,135	6,604	23,859		1,255	5,756			1,902	8,913	14,946	4,812	3,694
11	12,720	5,395	6,435	24,550		1,318	6,048			1,902	9,268	15,282	4,393	3,285
12	12,960	5,655	6,265	24,880		1,382	6,339			1,902	9,623	15,257	3,916	2,852
13	13,560	5,915	6,096	25,571		1,445	6,631			1,902	9,978	15,593	3,574	2,534
14	14,040	6,175	5,926	26,141		1,509	6,922			1,902	10,333	15,808	3,235	2,234
15	14,400	6,448	5,757	26,605		1,575	7,228			1,902	10,705	15,900	2,905	1,954
16	14,880	6,708	5,587	27,175		1,639	7,520			1,902	11,061	16,114	2,629	1,722
17	15,480	6,968	5,418	27,866		1,702	7,811			1,902	11,415	16,451	2,396	1,529
18	15,720	7,228	5,248	28,196		1,766	8,103			1,902	11,771	16,425	2,136	1,327

Year	Electricity Sales	Consumer's Surplus	Loan Payment	Total Revenue	Investment	Energy Cost Operational Cost	Energy Cost Generation Cost	Customer's Cost House Wiring	Customer's Cost Other	Maintenance Cost	Total Cost	Net Benefit	P.V. of Net Benefit 12%	P.V. of Net Benefit 15%
19	16,320	7,501	5,079	28,900	[illegible]	1,833	8,409			1,902	12,144	16,756	1,945	1,177
20	16,920	7,761	4,909	29,590		1,896	8,700			1,902	12,498	17,092	1,772	1,044
21	17,640	8,034	4,740	30,414		1,963	9,006			1,902	12,871	17,543	1,624	932
22	18,000	8,281	4,570	30,851		2,023	9,283			1,902	13,208	17,643	1,458	815
23	18,840	8,541	4,401	31,782		2,087	9,574			1,902	13,563	18,219	1,344	732
24	19,560	8,814	4,231	32,775		2,153	9,880			1,902	13,935	18,670	1,230	652
25	19,920	9,074	4,062	33,056		2,217	10,172			1,902	14,291	18,765	1,104	570
26	20,760	9,334	3,892	33,986		2,280	10,463			1,902	14,645		1,016	511
27	21,480	9,594	3,723	34,797		2,344	10,755			1,902	15,001	19,796	928	455
28	21,840	9,854	3,553	35,247		2,407	11,046			1,902	15,355	19,892	833	397
29	22,680	10,127	3,383	36,190		2,474	11,352			1,902	15,728	20,462	765	355
30	23,400	10,387	3,248	37,035		2,538	11,644			1,902	16,084	20,951	699	316
31	23,760	10,647	3,044	37,451		2,601	11,935			1,902	16,438	21,013	626	276
32	24,600	10,907	2,875	38,382		2,665	12,227			1,902	16,794	21,588	574	247
33	25,320	11,167	2,705	39,192		2,728	12,518			1,902	17,148	22,044	524	219
34	25,680	11,440	2,536	39,656		2,795	12,824			1,902	17,521	22,135	470	191
35	26,520	11,700	2,366	40,586		2,858	13,116			1,902	17,876	22,710	430	170
				1,000,678							511,295	489,383	11,869	--12,463

IRR = 13.46

Table 22. Economic Rates of Return of Rural Electrification Project

	Financial flow (FRR)	Direct beaefit & Ccost		Total benefit & cost	
		Alternative I (IRR)	Alternative II	Alternative I (ARR)	Alternati II
hole country	11.99	44.26	14.20	48.47	18.60
ountainous			11.74		
n-Between			13.91		
lain			14.57		
uburban			16.17		
oastal			13.46		