

2011 Modularization of Korea's Development Experience: Rural Electrification Project for Expansion of Power Supply

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**Rural Electrification Project for Expansion of
Power Supply**

2011 Modularization of Korea's Development Experience
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Power Supply

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Knowledge Sharing Program

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Preface

The study of Korea's economic and social transformation offers a unique opportunity to better understand the factors that drive development. Within one generation, Korea had transformed itself from a poor agrarian society to a modern industrial nation, a feat never seen before. What makes Korea's experience so unique is that its rapid economic development was relatively broad-based, meaning that the fruits of Korea's rapid growth were shared by many. The challenge of course is unlocking the secrets behind Korea's rapid and broad-based development, which can offer invaluable insights and lessons and knowledge that can be shared with the rest of the international community.

Recognizing this, the Korean Ministry of Strategy and Finance (MOSF) and the Korea Development Institute (KDI) launched the Knowledge Sharing Program (KSP) in 2004 to share Korea's development experience and to assist its developing country partners. The body of work presented in this volume is part of a greater initiative launched in 2007 to systematically research and document Korea's development experience and to deliver standardized content as case studies. The goal of this undertaking is to offer a deeper and wider understanding of Korea's development experience with the hope that Korea's past can offer lessons for developing countries in search of sustainable and broad-based development. This is a continuation of a multi-year undertaking to study and document Korea's development experience, and it builds on the 20 case studies completed in 2010. Here, we present 40 new studies that explore various development-oriented themes such as industrialization, energy, human capital development, government administration, Information and Communication Technology (ICT), agricultural development, land development and environment.

In presenting these new studies, I would like to take this opportunity to express my gratitude to all those involved in this great undertaking. It was through their hard work and commitment that made this possible. Foremost, I would like to thank the Ministry of Strategy and Finance for their encouragement and full support of this project. I especially would like to thank the KSP Executive Committee, composed of related ministries/departments, and the various Korean research institutes, for their involvement and the invaluable role they played in bringing this project together. I would also like to thank all the former public officials and senior practitioners for lending their time and keen insights and expertise in preparation of the case studies.

Indeed, the successful completion of the case studies was made possible by the dedication of the researchers from the public sector and academia involved in conducting the studies, which I believe will go a long way in advancing knowledge on not only Korea's own development but also development in general. Lastly, I would like to express my gratitude to Professor Joon-Kyung Kim for his stewardship of this enterprise, and to his team including Professor Jin Park at the KDI School of Public Policy and Management, for their hard work and dedication in successfully managing and completing this project.

As always, the views and opinions expressed by the authors in the body of work presented here do not necessary represent those of KDI School of Public Policy and Management.

May 2012

Oh-Seok Hyun

President

KDI School of Public Policy and Management



Contents | LIST OF CHAPTERS

Summary	12
---------------	----

Chapter 1

Background on Rural Electrification Project.....	15
1. Electrification Status Prior to the Project	16
2. Concept of Rural Electrification Project	17
2.1 Scope of Rural Communities.....	17
3. Background on Rural Electrification Project.....	17
3.1 Rural Electrification Project Prior to the Promotion Act	17
3.2 Legislation and Amendment.....	18
3.3 Nationwide Survey of Rural Electrification Target Households	20
3.4. Securing Project Funding	21

Chapter 2

Implementation of Rural Electrification Project	23
1. Implementation Procedure of Rural Electrification Project	24
1.1 Implementation Schedule	24
1.2 Implementation Procedure	27
1.3 Customer's Payment for Construction Cost	29
1.4 Loan Repayment	31
2. 5-year Rural Electrification Plan (1966~1970)	33
2.1 Criteria of Area Selection	33
2.2 Establishment of Nationwide Electrification Survey Committee	34
2.3 Establishment of Rural Electrification Project Headquarters	35
2.4 Analysis	36
3. Long-Term rural Electrification Project Scheme (1971~1979)	36
3.1 Criteria for Area Selection	37
3.2 Project Funding	38
3.3 Establishment of Electrification Project Scheme	39
3.4 Shinan Region Electrification Project	42
4. Island and Remote Region Electrification Project (Over 1980~)	44
4.1 Implementation Process	44
4.2 Project Overview	46
5. Achievements of Rural Electrification Project	53



Contents | LIST OF CHAPTERS

Chapter 3

Effects of Rural Electrification Project	55
1. Changes in Rural Communities	56
1.1 Electrification Project and Rural Changes	56
1.2 Introduction of Electric Appliances and Rural Changes	57
1.3 Electrification Project and Rural Economy	58
2. Project Achievements	60
3. Implications	62

Chapter 4

KEPCO'S Philippines Electrification Project	65
1. Background	66
2. Project Implementation	66
2.1 Implementation History	67
2.2 History of Philippines Rural Electrification Project	69
2.3 Project Implementation	69
References	76
Annex	77

Contents | LIST OF TABLES

Chapter 1

Table 1-1 Total Number of Households and Electrification Status	16
Table 1-2 Mitigation of Construction Standard for Rural Electrification Project	18
Table 1-3 Total Number of Rural Target Households	21
Table 1-4 Transition of Rural Households	21

Chapter 2

Table 2-1 Implementation Procedure of Electrification Project	28
Table 2-2 Construction Cost Per Household by Funding Source	30
Table 2-3 Status of Rural Electrification Project by Year	31
Table 2-4 Loan Payment Chart for Rural Electrification Project	32
Table 2-5 Construction Status of Rural Electrification Steel Tower by Year	47
Table 2-6 Nationwide Electrification Status of Island Regions	48
Table 2-7 Achievement of Remote Region Electrification Project	49
Table 2-8 Entire Status of Island Regions	52
Table 2-9 Operation and Management Status of Self-Generation Islands	52
Table 2-10 Achievement of Rural Electrification Project by Year	53
Table 2-11 Status of Rural Electrification Project by Year	53
Table 2-12 Rural Electrification Project Support by Year	54



Contents | LIST OF TABLES

Chapter 3

Table 3-1 Average Economical Effects of Agricultural Customers	59
--	----

Chapter 4

Table 4-1 KEPCO's Support for Electrification Project in the Philippines	69
Table 4-2 Target Area of On-Grid Philippines Electrification Project	70

Contents | LIST OF FIGURES

Chapter 1

Figure 1-1 Rural Electrification Project	20
--	----

Chapter 2

Figure 2-1 Implementation Procedure of Rural Electrification Project	27
Figure 2-2 Rural Electrification Project Payment Chart	29
Figure 2-3 Principles of Loan Repayment for Electrification Project	32
Figure 2-4 Supply Power with Systematic Construction	41
Figure 2-5 Electrification Project Construction (Installation of Submarine Cable)	42
Figure 2-6 Shinan Region Rural Electrification Project Construction	43
Figure 2-7 Construction Ceremony for Submarine Transmission and Distribution Facilities in Shinan Island Region	46
Figure 2-8 Supply Grid Diagram of Youngjong Island Electrification Construction	47

Chapter 4

Figure 4-1 Target Area Map of On-Grid (64 villages) Philippines Electrification Project	71
Figure 4-2 Target Area Map of Off-Grid (136 villages) Philippines Electrification Project	72
Figure 4-3 Target Area Map of On-Grid (20 villages) Cebu Electrification Project	73
Figure 4-4 Target Area Map of On-Grid (208 Villages) Philippines Electrification Project	74
Figure 4-5 Target Area Map of Off-Grid (72 villages) Philippines Electrification Project	75

Summary

In the past, Korea adopted high voltage of 3.3kV- Δ and low voltage of 100V single phase two-wire mode for distribution. The Korean War in 1950 made these facilities absolutely obsolete. When restored after the war, electricity was tremendously in short supply, not to mention that equipment and materials were very difficult to acquire. By 1961, the production of electricity was far from meeting the demand, and power supply was severely restricted, according to priority by service areas and distribution lines. At the time, Korea's facilities were significantly worn-out, and the power supply (frequency and duration of blackout) was quite unreliable.

However, when electricity was somewhat stabilized in 1965, the power supply for isolated rural communities became Korea's new agenda. On April 23, 1965, the Ministry of Commerce announced its rural electrification project scheme, and it was implemented with the help of loans totaling 300 million won-100 million won from the government, and 200 million won from the Industrial Bank. Korea Electric Power Corporation (KEPCO) assigned facility criteria for external wiring plans, to fit the situation of each rural community, and it also established the Guidelines for Rural Electrification Project Loan Recovery to prepare for the project.

The National Assembly, the legislative body in Korea, deliberated and voted on the Rural Electrification Promotion Act, announcing its confirmed decision to the public by December 30, 1965. Under this law, rural electrical facilities were financed by the government, galvanizing the electrification project to obtain nationwide electricity in rural areas. However, the loan's repayment period was only 19 years with a one-year grace period, and was widely criticized for being too abbreviated and burdensome considering the income level of ordinary citizens. So the law was revised on March 3, 1967, to enact a five-year grace period with repayment in 30 years, greatly reducing the burden of rural residents.

KEPCO began to execute the Rural Electrification Project by surveying some of the nation's rural communities in 1970, and announcing its long-term plan to designate target areas by December 5, 1970. The main purpose of this project was to achieve the nationwide electrification by offering long-term, low-interest loans, to be used for the construction of distribution facilities (and not large-scale transmission facilities, which would diminish return on investments) to rural residents who were at a regionally and financially disadvantaged. The Rural Electrification Project was a pioneering project intended to upgrade the education, culture, health and hygiene in these areas, and was designed to develop the economy by increasing the productivity of these rural residents. KEPCO surveyed the nation's unelectrified rural areas from April to December in 1970, coming up with a construction scheme. At the time, the government announced its long-term rural electrification plan, scheduled to be completed by 1979. At the end of 1969, the total number of households in South Korea was about four million, with approximately two million without electricity, indicating an unelectrification rate of 59%. There were more electricity-served households than un-served ones.

But within 10 years, the electrification project made incredible progress in Korea and was completed by 1970, as originally planned. Although there still were approximately 50,000 unelectrified households in the island and remote regions, the project was galvanized again from 1983, leading to an electrification rate of 99.8% by 1987, and deemed a huge success. This project has not only generated economic benefits by increasing the incomes of rural residents, but also produced social benefits improving their quality of life and way of thinking.

2011 Modularization of Korea's Development Experience
Rural Electrification Project for Expansion of
Power Supply

Chapter 1

Background on Rural Electrification Project

1. Electrification Status Prior to the Project
2. Concept of Rural Electrification Project
3. Background on Rural Electrification Project

Background on Rural Electrification Project

1. Electrification Status Prior to the Project

When electricity was first introduced to Korea around the end of the Chosun Dynasty, it was supplied to major cities and industrial regions for lighting and industrial power. But in the 1960's, many rural communities were without electricity.

At the end of 1964, prior to the Electrification Project, the total number of houses in Korea was 4,035,000, with 1,382,000 (34.3%) in the cities, and 2,653,000 (65.7%) in the rural areas. From 1898, when the electricity was first introduced to Korea, until the end of 1964, the nation's electrification rate was only 25.5%, reaching 1,027,000 houses, with 709,000 in the cities (51.3%) and 318,000 in the rural regions (12%).

Table 1-1 | Total Number of Households and Electrification Status
(As of the end of 1964)

(Unit: 1000 households)

Distinction	Number of Households	Electrified Households	Electrification Rate (%)
Total	4,035	1,027	25.5%
Rural	2,653	318	12.0%
Urban	1,382	709	51.3%

2. Concept of Rural Electrification Project

2.1 Scope of Rural Communities

Rural Communities refer to areas that are actually engaging in agricultural businesses, regardless of administrative districts, per Article 2 of the Rural Electrification Promotion Act. Making a clear distinction between urban and rural areas was not a simple task. However, most urban areas were electrified, and the surrounding unelectrified areas were included in the Rural Electrification Project's target areas.

Under the Article 2 of the Rural Electrification Promotion Act, Rural Electrification Project means building basic electrical facilities to supply power to the rural areas. At the end of 1964, 88% of the rural residents didn't even have electric lights. Therefore, the purpose of the electrical facility construction was to supply power for lighting—a necessity in everyday life—to rural residents, like cities and industrial regions that used electricity for residential and industrial purposes.

Electrical facility construction meant manufacturing or building power supply facilities, such as generation, transmission and substation, distribution and indoor facilities. As the Article 2 of the Rural Electrification Promotion Act described, the Rural Electrification Project targeted distribution facilities and internal wiring, as well as some transmission and substation facility construction projects.

The reason that generation facility was excluded was because a reserve power of approximately 1,775MW had been secured by 1972, eliminating the need to expand generation facilities with the Rural Electrification Project. Also, since transmission facilities were usually built for expansion of various power facilities, and not necessarily for rural electrification, the project instead focused on building partial transmission facilities.

3. Background on Rural Electrification Project

3.1 Rural Electrification Project Prior to the Promotion Act

Due to continued power shortages since 1945, power supply was restricted, prioritized by service areas and distribution lines. However, in parallel with the active Power Resources Development Project, the transmission restrictions were lifted in April 1964.

As power supply was stabilized in 1965, the issue of bringing electricity to isolated rural area became the new agenda. However, the remote countryside villages were at a disadvantage, with higher investment costs for supply facilities, low profitability and technical problems with distribution. At the time, developing the rural communities, which accounted for over 60% of the total population, was essential for the country's balanced development and economic growth. The rural electrification issue was addressed by government policy, in the name of political, social and economic modernization in these areas.

In May 1964, KEPCO considered implementing the Rural Electrification Project to increase its revenue. Meanwhile, it relaxed its controversial facility construction criteria for external wiring, and took measures to would save construction costs. The new criteria were approved by government authorities and incorporated.

On April 23, 1965, the Ministry of Commerce established the Rural Electrification Project scheme, announcing its intentions to the public; it was implemented loans totaling 300 million Won-100 million Won from the government and 200 million Won from the Industrial Bank. KEPCO then enacted the Guidelines for Rural Electrification Project Loan Recovery, which went into effect on November 6, 1965.

Table 1-2 | Mitigation of Construction standard for Rural Electrification Project

Category	Standard (Regulation)	Revision	Details of Mitigation
Span	60m	70m	Reduce 2 poles per 1 km
Cross-arm	1,800mm	1,400mm	36 Cent per unit
Minimum Height of power line from ground	High voltage: 5m	High voltage: 4m	1m of a pole
	Low voltage: 4m	Low voltage: 3.5m	1m of a pole
Concrete pole Design load	8m·200Kg	8m·150Kg	6~9 Cent per pole
	9m·300Kg	9m·200Kg	
Shift 22kV transmission to 22.9kV distribution line			By using the existing 22.9kV transmission line as a distribution main, 22/3.3kV intermediary substations became unnecessary, saving the cost for distribution line construction with no need to build additional distribution main.

3.2 Legislation and Amendment

While the Rural Electrification Promotion Act was submitted to the National Assembly and deliberated on August 28, 1964, the Commerce Committee forwarded the bill to the Judiciary Committee on December 9, 1965, after an interagency review on feedback and proposed amendments.

On December 23, 1965, the Rural Electrification Promotion Act with 13 articles was passed in the National Assembly’s plenary session and announced to the public on December 30, as Law No. 1737. The key points of the law are as follows:

1. Purpose of the Act: Improvement of productivity and quality of life for rural residents (Article 1)
2. Construction Funding: For electrical facility construction, distribution facilities shall be financed by the electric provider's (KEPCO) own funds, along with financial or other types of loans, and internal wiring shall be financed by the customers (Article 3)
3. Selection of Electrification Target Areas: The head of local government shall select electrical business regions upon the request of customers (Article 4)
4. Construction Loan: Loans will be made to the electric provider, and the customers shall be collectively responsible for the loans and the repayment per unit construction (Article 6)
5. Construction: Upon request for electrical facility construction, the electric provider has to undertake it without delay (Article 8)
6. Loan Repayment Period: The repayment period of principal and interest on the loan is 20 years (Article 11)
7. Collection of Payments: Loan payments will be collectively levied in the monthly electric bills (Article 12)

With government financing of electrical facility construction projects under law, the Rural Electrification Project became accelerated. However, the law needed to be revised, because of harsh repayment conditions for construction loans.

At the time, the repayment period was 20 years, with a one-year grace period for construction, and 19 years of actual repayment. Considering household income levels at the time, they were deemed too short, producing an excessive amount of debtors in Korea. So the government revised the law on March 3, 1967, extending the grace period from one to five-years, and the repayment period from 20 to 30 years, to lessen the burden of low-income rural residents (Article 11 Section 1 of the Law).

The law was revised for a second time on May 22, 1968, enforcing interest payments during the five-year grace period to reduce repayment burdens for 35 years. In addition, the vague article, "Necessary measures for other loans shall be taken in case of lack of funds" was revised to "Loans for financial funds must be included in the estimated expenditures in amounts greater than the projected kerosene tax revenues of the year." As a result, the project regions multiplied, and the project loan amounts became transparent.

<Related Articles of the “Rural Electrification Promotion Act”>

Article 5 (funding measures): 1.---- However, loans for financial funds shall be included in the estimated expenditures in amounts greater than the projected kerosene tax revenues of the year.

Article 11(repayment period): Loans shall be repaid in equal amounts over 30 years with a 5-year grace period.

Figure 1-1 | Rural Electrification Project



3.3 Nationwide Survey of Rural Electrification Target Households

On April 1, 1970, KEPCO established the “Nationwide Rural Electrification Committee” to survey areas without electricity, with a goal of complete rural electrification. From May 1, 1970 until the end of the 1970s, various basic surveys were conducted across unelectrified rural regions in Korea. The surveys showed that the total number of homes was 4,399,000 at the end of 1969; 1,565,000 were in the cities with 35.6%, and 2,834,000 were in the rural regions with 64.4%.

Among rural regions, there were 302,000 houses which were deemed difficult to serve with electricity, such as on islands and remote mountain regions. As a result, the target houses designated for rural electrification numbered only 2,532,000. The total number of target homes was compiled at 3,914,600, with 1,382,600 in the cities and 2,532,000 in the rural regions.

Table 1-3 | Total Number of Rural Target Households

(Unit: 1,000 households)

Distinction	Total Number of Households		Isolated Households	Target Households	
	Number of Households	Proportion		Number of Households	Proportion
Nationwide	4,399.0	100%	302	3,914.6	100%
Rural	2,834.0	64.4%	302	2,532.0	64.7%
Urban	1,565.0	35.6%		1,382.6	35.3%

* The number of target households was estimated with the following facts.

1. The total number of rural households was estimated by adding the 1968 figure to the average annual growth rate of 1.3% between 1964 and 1968.
2. The number of isolated households was calculated based on the assumption that those in the remote mountain and island regions accounted for approximately 10% of the total rural households.
3. It was based on the prediction that the number of rural households was not going to rise after 1969, considering the gradually declining growth rate between 1964 and 1968.

Table 1-4 | Transition of Rural Households

Distinction	1964	1965	1966	1967	1968	Average
Number of Households	2,653.2	2,716.8	2,767.8	2,826.7	2,798.2	2,834.0
(Growth Rate %)	(-)	[2.4%]	[1.9%]	[2.1%]	[△0.1%]	[1.3%]

3.4 Securing Project Funding

The biggest issue with the Rural Electrification Project was financing. At the time, the government made various efforts with KEPCO to secure funding.

In the 1960's, transmission and distribution projects were implemented to supply electricity to rural communities. KEPCO received financial loans from AID (Agency for International Development), and other countries such as Italy and Japan, to build transmission lines. The company also built distribution substations with loans from AID, Japanese Claims Fund, and the Asia Development Bank.

The government made various efforts to finance the Rural Electrification Project, partially with profits from the 25% increase in power rates in 1966, compared to a year earlier.

In addition, the Ministry of Commerce secured 100 million Won from the Korea Development Bank, after announcing its "Rural Electrification Project Scheme."

Implementation of Rural Electrification Project

1. Implementation Procedure of Rural Electrification Project
2. 5-year Rural Electrification Plan (1966~1970)
3. Long-Term rural Electrification Project Scheme (1971~1979)
4. Island and Remote Region Electrification Project (Over 1980~)
5. Achievements of Rural Electrification Project

Implementation of Rural Electrification Project

1. Implementation Procedure of Rural Electrification Project

1.1 Implementation Schedule

August 28, 1964: The Rural Electrification Promotion Act (draft) was introduced to the National Assembly as Bill No.289: Lee, Byungwook and 10 other members.

June 7, 1965: Requested feedback on the Act: (The proposed amendments were submitted to the Finance and Interior Affairs Committee by the Ministry of Commerce.)

November 6: Establishment of Guidelines for Rural Electrification Project Loan Collection (KEPCO)

December 9: Requested deliberation on the Rural Electrification Promotion Act (draft) (from the Ministry of Commerce to the Judiciary Committee)

December 30: Announcement of Rural Electrification Promotion Act (Law No.1737 with complete text of 13 articles)

March 1, 1966: Establishment of executive bureau of KEPCO (Rural Electrification Department)

March 24: The Ministry of Commerce notified the No. 2502 Rural Electrification Project Administrative Processing and Service Application form, Electrification Project Overview, Rural Electrification Project and Financing Plan, Electrical Facility Request Form, and Loan Repayment Report.

November 1: First amendment of Guidelines for Rural Electrification Project Loan Recovery

March 3, 1967: Announcement of first amendment of Rural Electrification Promotion Act (Law No. 1970, enactment of Article 3 Section 2, amendment of Article 11 Section 1), second amendment of Guidelines for Loan Recovery

May 22, 1968: Second amendment of Rural Electrification Promotion Act (Law No. 2015)

January 14, 1969: Third amendment of Guideline for Loan Recovery

March 16, 1970: Establishment of Nationwide Complete Rural Electrification Survey Committee

August 10: Rural Electrification Headquarters' representatives meetings

November 2: Asian Development Bank (ADB) loan application

December 5: Announcement of long-term electrification scheme (Complete rural electrification by 1979, total number of rural households-2,834,000 exclusion-203,000 electrification target-2,532,000)

March 19, 1971: Talks with president: Achieved a rural electrification rate of 70% during the 3rd Economic Development Plan period

June 16: Establishment of executive bureau in the Ministry of Commerce: Rural Electrification Department

August 24: ADB vice minister's international conference resolution

August 26: ADB loan approval

September 13: ADB loan agreement signing

December 21: ADB loan approval

January 18, 1972: Implementation of ADB loan agreement (Borrower- KEPCO Lender: ADB Loan amount-\$10,600,000 Conditions-7.5% annual interest rate with 3-year grace period and 17 years of repayment)

February 1, 1973: Rural Electrification Headquarter was reorganized into New Community Electrification Department with 9 branch offices

March 24, 1974: Talks with president: Complete nationwide electrification by 1977

October 25: Japanese and Korean government's exchange of information memorandum for Japanese Overseas Economic Cooperation Fund (OECF)

December 26: OECF loan Agreement

January 1, 1975: 4th amendment of Guidelines for Loan Recovery

February 14: Effectuation of OECF Loan Agreement (Borrower: Government Lender: OECF Business Proprietor: KEPCO Loan Amount: 360 million Yen (from 19.44 billion Yen) Conditions: 3.25 % annual interest rate with 7-year grace period and 18 years of repayment, equal repayments of principal twice a year), World Bank (IBRD) loan application

April: Preliminary evaluation of IBRD's investigation Committee

July: Appraisal of IBRD

November: Congressional consent for IBRD loan

January 1976: Final discussion on IBRD loan

January 1: 5th amendment of Guidelines for Loan Recovery

March 19: IBRD loan agreement signing

March 26: Merger of New Community Electrification Department and Sales Department (Retention of Rural Electrification Department)

June 4: Announcement of IBRD Loan Agreement: Borrower- Government Lender-IBRD Loan amount-\$18.1 million (from \$80 million) ICB-\$6.4 million, LCB-\$ 11.7 million Conditions-8.5% annual interest rate for general interest loans, 4.5% annual interest rate for intermediate-condition loans with 7-year grace period and 18 years of repayment

January 1, 1978: The Power and Energy Ministry's Electric Department was assigned to nuclear power generation business

April 5: Implemented electrification with little burden on the island and remote communities

August 10: Submarine installation contract and construction for Shinan region electrification project: Contractor: Joowoo (Japan) Contract amount: \$1,847,869.02 Length: 12,186m (66kV T/L 4,865m, 22.9kV D/L 8,321m)

September 26: President's approval of complete electrification measures for island and remote regions (confirmation of plans for 1978 / reexamination of plans after 1979)

June 30, 1979: Completion of Shinan submarine cable construction

August 24: Reported the Shinan region's electrification status to the president

August 31: Reported the Rural Electrification Project status to the Central Council of New Community Movement

September 6: President's approval of rural electrification plans scheduled after 1981

October 2: Submarine installation contract and construction in five regions, including Youngjong Island in Ongjin County: Contractor: Joowoo (Japan) Contract amount: \$4,674,341.99 Length: 25,227m

October 8: Construction ceremony for Shinan region's electrification project with submarine distribution system

January 1, 1980: Elimination of Rural Electrification Department in each branch office

January 12: Increase of rural electrification loan interest rate (government), amendment of Special Accounting Decree of Fund Management (73.3% increase of annual interest rate from 7.5% to 13%)

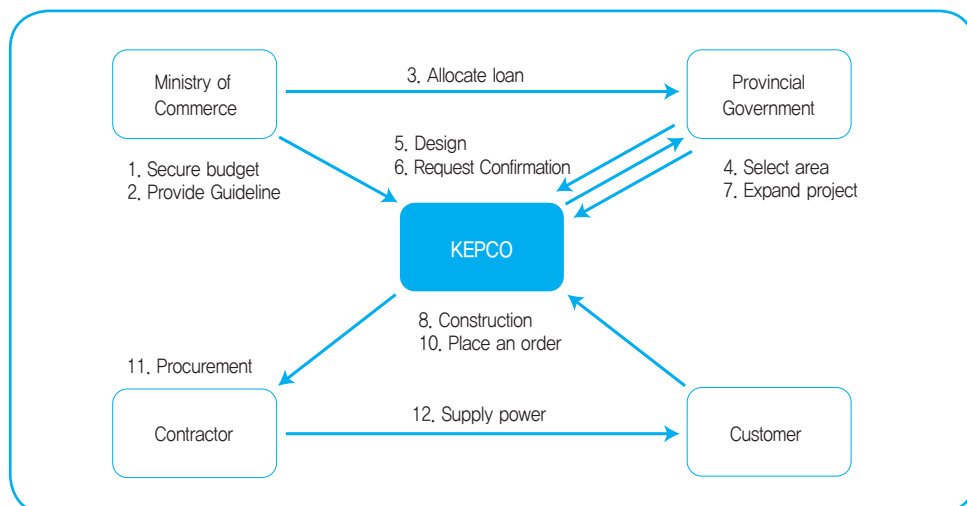
May 1: 6th amendment of Guidelines for Loan Recovery

1.2 Implementation Procedure

The government established a project scheme every year for implementation, secured the budgets, allocated budgets to local governments, and provided project guidelines to KEPCO and provincial governments. Then the local governments prioritized which villages to be served first, in accordance with the guidelines, and selected the project target areas, considering the residents' ability to repay the loan. When the decision was confirmed, the local governments asked KEPCO to design a construction plan.

After completing the necessary technical and economic surveys, KEPCO acquired materials, and proceeded to construction. When KEPCO reported the selected areas for designing to the provincial government, the residents selected an internal wiring contractor to execute construction. Finally, KEPCO conducted a facility survey and supplied electricity.

Figure 2-1 | Implementation Procedure of Rural Electrification Project



The implementation procedure of Rural Electrification Project was as follows: The Ministry of Commerce established a Rural Electrification Project scheme, based on the secured annual budget and financial situation of local governments, and delivered it to the local ministers. Then the ministry established and delivered detailed guidelines for the target number of electrification households, selection criteria for target regions, survey and designs, construction and inspection.

In order to promote regional balance, funds were allocated based on the unelectrified rates of each region at the end of that year. When local governments received the allocated funds, they deliberated on the electrification scheme, based on the area selection criteria, and selected the target regions; the decision was directly related to the quality of life and Income Expansion Project for rural residents. The top priority was placed on outstanding New Community villages, and areas with New Community factories. However, some areas in the following categories were tentatively excluded from the area selection criteria: Low-voltage regions that required the facility reinforcement and construction of new transmission and distribution facilities; areas that required loans of over 40,000 Won per household; and small communities with less than 30 households for unit construction.

The reason of exclusion was to maximize the effects of the project within the allocated budgets, and insufficient funds made it difficult to build new transmission and distribution facilities, in addition to shoring them up. The provincial governors selected electrification target areas, and requested a survey and designs from KEPCO.

When KEPCO finished technical surveys and designs, including distribution line designs and estimates of construction costs, KEPCO selected project areas and reported them to each branch office. Then each branch office acquired the necessary materials, selected a contractor and proceeded to construction. When the construction was completed, electricity was transmitted, indicating the end of the procedure.

Table 2-1 | Implementation Procedure of Electrification Project

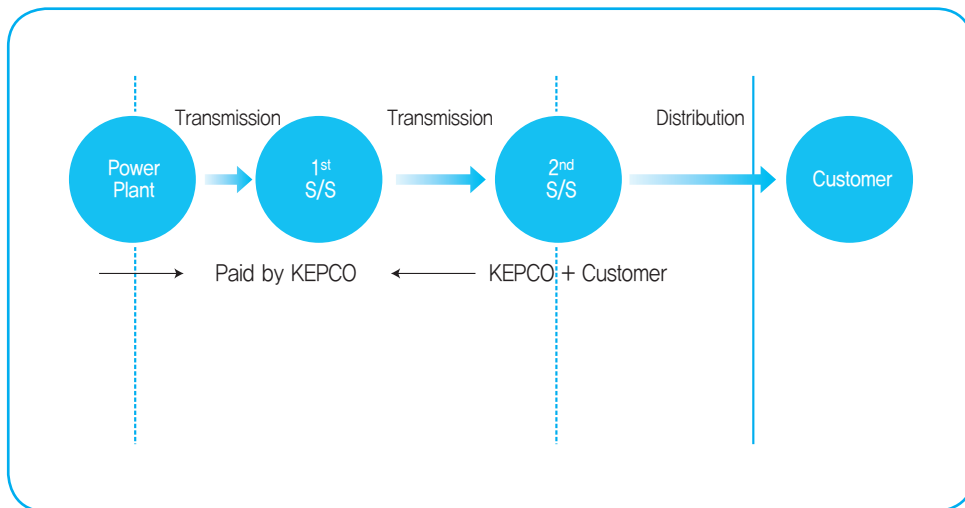
Procedure	Management	Responsibilities
Establishment & implementation of electrification scheme Guidelines	Ministry of Commerce	Secures budgets, allocates funds to local governments, and delivers guidelines
Area selection	Local governments	Selects electrification target areas, based on the criteria
Survey & Design	KEPCO	Surveys and designs the selected areas
Confirmation of project	Local governments	Secures a project scheme for the selected areas and reports it to KEPCO

Procedure	Management	Responsibilities
Acquires materials	KEPCO	Acquires necessary materials
Construction	KEPCO	Selects a contractor and proceeds to construction
Power supply		Power supply

1.3 Customer's Payment for Construction Cost

Delivering electricity from the power plants to the demand regions involved the following steps: First, transmission of electricity to the first substation via 154 kV; and second, transmission from the second substation to the demand regions. The construction of these facilities was financed by KEPCO. The distribution facilities from the second substation to the demand regions are called distribution lines, which were included in the primary construction scope of KEPCO and the Rural Electrification Project. The construction costs for distribution facilities were paid by KEPCO, with approximately 5000 Won per house (as of the 1973), and the remaining expenses were paid by customers. The government offered loans to customers with a five-year grace period and 30 years of repayment to cover the construction costs for distribution facilities.

Figure 2-2 | Rural Electrification Project Payment Chart



The construction costs of distribution facilities, which were paid by the customers, varied depending on the distances between the power resources and the consumer regions, as well as the number of customers, and circumstances of electrification regions. The average annual construction costs from 1965 to 1972 are as follows:

Table 2-2 | Construction Cost Per Household by Funding Source (Average)

(Unit :KRW)

Funding Source	Year								
	1965	1966	1967	1968	1969	1970	1971	1972	
Financial funds	7,895	12,006	12,779	16,083	16,775	20,633	20,000	22,000	
KEPCO	3,500	4,599	4,530	4,181	5,175	3,996	4,800	5,000	
Customers	1,184	1,157	569	282	-	-	-	-	
Total	12,579	17,762	17,878	20,546	21,950	24,629	24,800	27,000	

For the year 1965, the average construction cost per household was 12,579 Won; 7,895 Won was paid with the government's financial loan, 3,500 Won was paid by KEPCO, and the remaining 1,184 Won was paid by the customers (They paid some of the distribution costs by securing electrification funds themselves from sources such as the New Community Savings Account).¹

The construction cost per house was steadily increasing after 1965, reaching 27,000 Won in 1972; 22,000 Won was paid with the government loans, and 5,000 Won was paid by KEPCO. The reason for increase was partially triggered by inflation, but it was mainly due to the increase in construction costs, primarily associated with the long distances from the power resources and to customers during the Rural Electrification Project. They had to install indoor facilities for power usage, and the internal wiring costs ranged from 3,500 to 6,000 Won, which were paid by the customers.

¹ Average monthly income of rural resident was 14,910 Won, statistics by Ministry of Agriculture in 1969.

Table 2-3 | Status of Rural Electrification Project by Year

Year		1973	1974	1975	1976	1977	Total number of electrified houses	
Electrified houses (1000 houses)	Each year	300	300	300	300	320	1,520	
	Total	1,312	1,612	1,912	2,212	2,532	2,532	
Electrification Rate (%)		52	63	75	87	100		
Total Funds		8,930	12,198	13,310	14,760	16,801	65,999	
Funding Source		Loans	7,390	9,600	10,700	11,600	13,700	52,900
		KEPCO	1,540	2,598	2,610	3,160	3,101	13,009
Facilities	Distribution Facilities	Subtotal	8,930	9,600	10,200	11,100	12,800	52,630
		Loans	7,390	8,100	8,700	9,600	11,200	44,990
		KEPCO	1,540	1,500	1,500	1,500	1,600	7,640
	Transmission Facilities	Subtotal		2,598	3,110	3,660	4,001	13,369
		Loans		1,500	2,000	2,000	2,500	8,000
		KEPCO		1,098	1,110	1,660	1,501	5,369

1.4 Loan Repayment

The loan terms for the Rural Electrification Project's financial funds were described in the Rural Electrification Promotion Act. When it was established as Law No.1737, the conditions were a 7.5% annual interest rate, with 20 years of equal payments, but it was revised to a five-year grace period with 30 years of equal payments on May 22, 1968 to lessen the burden on rural residents.

During the five-year grace period, only the interest payments were required and after that, the principal and interest had to be paid in equal payments for 30 years. In addition, the payments were collectively levied in the monthly electric bills by KEPCO, under the Article 12 of the law. The repayment amounts varied, depending on the customer's loan amount and the number of electric lights. For instance, for a loan of 25,000 won per house, the interest payment during the five-year grace period was 40 Won for one light, 80 Won for two, 120 Won for three and 160 Won for four lights, as described in the table below.

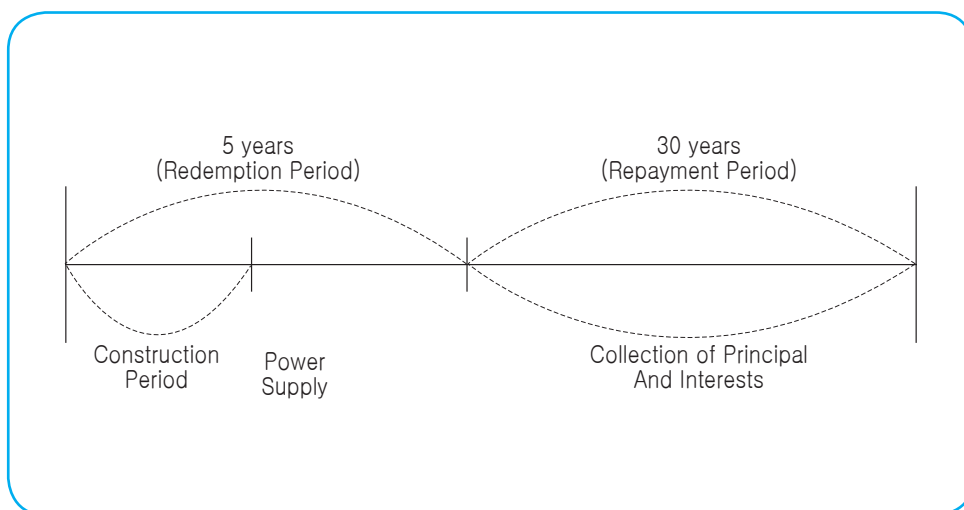
After five years, the principle and interest payment was 44 won for one light, 88 Won for two, 132 Won for three and 176 Won for four lights, which continued for 30 years in monthly payments.

Table 2-4 | Loan Payment Chart for Rural Electrification Project

(Unit: Won/Month)

Loan per household	Interest during the grace period				Principal and interest after grace period			
	1 Electric light	2 Electric lights	3 Electric lights	4 Electric lights	1 Electric light	2 Electric lights	3 Electric lights	4 Electric lights
5,000 Won	8	16	24	32	9	18	27	36
10,000	16	32	48	64	18	36	54	72
15,000	24	48	72	96	27	54	81	108
20,000	32	64	96	128	35	70	105	140
25,000	40	80	120	160	44	88	132	176
30,000	47	94	141	188	53	106	159	212
35,000	55	110	165	220	62	124	186	248
40,000	63	126	189	252	70	140	210	280
45,000	71	142	213	284	80	160	240	320
50,000	79	158	237	316	88	176	264	352

Figure 2-3 | Loan Repayment Plan for Electrification Project



2. Five-year Rural Electrification Plan (1966~1970)

At the end of 1964, prior to the Rural Electrification Project, the nationwide electrification rate was 25.5%, and rural areas only accounted for 12%. This was not much different from the unelectrified areas in the cities. Furthermore, some administrative districts of the cities included rural areas, which blurred the boundaries to properly classify rural electrification targets.

Under the Rural Electrification Promotion Act, the project was implemented by defining “rural communities” as the areas with mostly farmers and fisherman, even when the areas were “cities” in terms of administrative districts. Such circumstances significantly raised the financial burden of the electrification project.

Therefore, in its early stages, the first priority for power supply was placed on the collective villages surrounding cities where construction cost per house would be modest, in an effort to maximize the return-on-investments of project. In the big cities, the project targets were mostly slums, migrants’ settlements destroyed by city planning, or the areas for which local governments wanted electrification; Gyeonggi and Gangwon provinces focused on the reclaimed areas, which were reclaimed after the Korean War due to their geographical characteristics.

2.1 Criteria of Area Selection

- ① Each local government can select at least one area at the governor’s discretion, based on the Regional Society Development Plan with the allocated funds. For this process, Criteria ⑤ should be considered.
- ② Areas where distribution is possible without transmission and substation facilities
- ③ Length of distribution line should range between 1km and 8km.
- ④ Areas that can afford the entire cost of internal wiring
- ⑤ Areas with sufficient demands, exceeding the break-even point of KEPCO
- ⑥ In accordance with the Regional Society Development Plan, local governor’s opinions are taken into account (Example: all-weather farming complex model village).
- ⑦ The first priority in areas with damaged electrical facilities from the war.
- ⑧ For unelectrified areas, locations of village, town and county offices should be well considered (After 1966).

In 1965, the Rural Electrification Project was first established and implemented, but the area selection lasted four months due to various issues, unlike the original plan, which experienced a two-month delay. The primary reason for this delay was a lack of awareness of the project among customers and local workers.

For instance, village residents mistakenly believed that construction would be fully financed by the government, with no knowledge of payment details. In addition, the local community leaders who supervised the area selection ignored the criteria and carelessly selected targets, overlooking the distribution grid or the construction costs; as a result, the construction period and costs exceeded the original plan. Such problems led to a change of project regions or reductions in construction, which wasn't completed by the deadline. Meanwhile, many rural residents mistakenly believed the electrification project only benefited a group of people other than themselves.

Furthermore, there were frequent cases of poor construction by unqualified and unlicensed contractors, degrading the quality of electricity. In order to solve the problems and protect customers, internal writing costs had to be deposited with KEPCO in advance, paid off only after the facility survey was completed.

2.2 Establishment of Nationwide Electrification Survey Committee

At the end of 1969, the nationwide rural electrification rate was only 21%, which meant 79% of the nation's rural communities were without electricity. Complete electrification required surveying target regions, establishing a supply scheme and estimating the construction costs for new installations. But the procedure raised the following issues: First, new employment for field survey personnel; and second, substantial amounts of time and money.

Such issues delayed the KEPCO's nationwide survey of unelectrified regions. However, considering that Rural Electrification Project was a long-term national project, and the urgency to obtain data for planning, KEPCO set up the Nationwide Rural Electrification Survey Committee on March 16, 1970, completing various basic surveys of unelectrified regions nationwide from May 1 to December 1970.

● Survey Criteria

- ① The construction costs were estimated with a nationwide survey of the urban and rural areas in village units (as of December 31, 1969). Then villages with 20 collective houses or less were excluded from the electrification target (555,092 houses were excluded).
- ② For island regions, only Jindo, Wando, Kujaedo, Ulleungdo, Kukumdo, Namhaegun, Ganghwado, and Dolsando were included, and other island regions (approximately 60,000 houses) were excluded from the survey.

● Survey Scheme

- ① The scope of distribution line supply would be extended as follows:
3.3 kV-7 kV, 5.7 kV-14 kV, 6.6 kV-20 kV, 11.4 kV- 22 kV, and 22.9 kV-34 kV
- ② If the installed distribution line length exceeded its supply limit, new transmission and substation facilities would be built.

- ③ The supply limit of installed transmission and substation facilities would be examined, and if they were over the limit, the power line capacity would be increased.
- ④ Total construction costs were estimated, based on the standard unit cost of each construction, and aggregated for all the rural districts.

Such survey methods eliminated the confusion in selecting target villages, and saved a significant amount of time. In addition, the necessary funding, personnel, and amount of equipment and materials were determined accurately and quickly. The nationwide survey of unelectrified regions took seven months, cost 7.6 million Won, and required 11,510 workers annually.

2.3 Establishment of Rural Electrification Project Headquarters

As the scale of Rural Electrification Project was expanding, KEPCO merged the Rural Electrification Department and the National Electrification Survey Committee. KEPCO also established the Rural Electrification Headquarters on August 10, 1970, to implement the project more swiftly and effectively.

Each branch office had a Rural Electrification Promotion Team. In order to execute the Rural Electrification Project as its first priority, the related regulations and organizations were significantly strengthened. Its functions and responsibilities were summarized as follows.

Purpose: Establish Rural Electrification Project Headquarters to complete the massive Rural Electrification Project by the deadline, in close cooperation with the government.

Responsibilities:

- ① Initiate close cooperation with authorities for a swift area selection and decision.
- ② Survey and design electrification project
- ③ Secure and manage necessary personnel
- ④ Secure and manage necessary funds in a timely manner
- ⑤ Establish and implement measures for a rapid supply, and transport of equipment and materials
- ⑥ Establish and implement measures for early construction and equal execution
- ⑦ Examine and implement measures for simplifying procedures for effective and swift construction.
- ⑧ Maintain effective reporting and control
- ⑨ Complete nationwide survey of unelectrified regions
- ⑩ Organize Construction Encouragement Team

Organization:

1. “Headquarters Encouragement Team” with a director, assistant director assumed by a sales director, vice president and executives
2. “Rural Electrification Department” (executive agency) with a material supply liaison officer, and project implementation teams with 18 branch offices, controlled by senior managers

Between 1965 and 1971, 529,689 houses were served in 2,940 regions, with government loans of 8.984 billion won, KEPCO’s funding of 2.524 billion won and customer payments of 361 million won, totaling 11.869 billion won. During this period, the rural electrification rate skyrocketed to 33.5% from 12% at the end of 1964.

2.4 Analysis

The Rural Electrification Project was a major success, greatly increasing the rural electrification rate. However, the project had issues with area selection, when local ministers –who had the rights to select the first target areas–got involved in political turmoil, trying to maintain the electrification benefits. Meanwhile, the customers were becoming increasingly skeptical towards the electrification project, with entire costs of internal wiring and partial costs of external wiring levied on monthly electric bills.

Such problems hampered the Rural Electrification Project, although financial funds of 300 million Won, and KEPCO investment of 2.1 million Won were secured to supply 12,000 electric lamps and power of 6MW to 168 cities and counties. However, 70% of government loans and 30% of KEPCO investments for external wiring notwithstanding, the entire costs of internal wiring and financial funds with 20-year repayment plans had to be encumbered by customers. This led to the rampant discontentment with electricity prices, which were 15 to 20 times higher than petroleum lamps at that time. In response, the government called for measures to raise awareness about Rural Electrification Project and its incentives.

In 1970, the Industrial Bank pointed out in its “Rural Electrification Project Status Report” that rural electrification rate was 20.9%, significantly lower than the nationwide rate of 40.8% at the end of 1969. As a countermeasure, the Industrial Bank called for higher government funding to lessen the burden of rural residents. The bank also suggested prioritized electrification, with top priority to areas with high electricity use and financial benefits, such as sericultural livestock and agricultural processing regions.

3. Long-Term Rural Electrification Project Scheme (1971~1979)

Although the government’s 5-Year Economic Development Plan boosted the economic growth, it also caused a tremendous gap between agriculture and industries, as well as

between cities and rural regions. The Ministry of Health and Society's Social Security Council conducted its a survey on 1,293 rural households nationwide, and pointed out that unbalanced industrial development was hampering national economic development, with an urban concentration of population and wealth.

In particular, a weak rural infrastructure, labor shortages and low productivity caused by urban concentration raised concerns for the rural population. To address these problems, it was imperative to expand farming scales and sidelines, implement a rural area development project, and develop the rural industries. More importantly, it was essential to complete rural electrification.

Based on the profile of unelectrified rural regions compiled by KEPCO, the government established and announced a long-term Rural Electrification Project scheme on December 5, 1970 to achieve complete electrification by 1979. In addition, the "Rural Electrification Department" was established as a task force agency of the Ministry of Commerce on June 16, 1971.

The long-term scheme showed that the electrification project was divided into three stages with target households of 1,850,000, among the total of over 2,800,000 rural households as of the end of 1969, excluding approximately 300,000 households of islands and remote villages, and 682,600 electrified houses in 1970 (survey results on unelectrified rural regions). The goal was complete electrification, starting with 400,000 households (total electrification rate of 42.7%) in the first stage (1971~1973), 650,000 households (68.4%) in the second stage (1974~1976), and 800,000 households (100%) in the third stage (1977~1979).

3.1 Criteria for Area Selection

In order to increase the visible effects of Rural Electrification Project in the 1960s, first priority was given to collective villages around cities with lower construction costs, including reclaimed areas in Kyungki and Kangwon Provinces, big city slums, and demolished housing resident regions in the city areas that were isolated. However, the long-term Rural Electrification Project had different criteria for area selection.

The principle driving area selection during this period was a balanced regional distribution, with priorities placed on the desirable regions for investments, and politically influential areas. The following factors were also taken into account by local governors:

1. The construction shortfall of the areas with the project in 1970 will be covered first
2. Coast guard posts and vulnerable coastal regions
3. Fishing outposts
4. Home industry centers and mining areas
5. Areas with small rural districts (small burg or country town)

-
6. Areas adjacent to expressways and unelectrified train stations
 7. Rural Income Expansion Project regions
 8. Reclaimed areas (after 1972)
 9. All-weather project regions
 10. Island regions
 11. Areas with average loans ranging between 25,000 and 40,000 won per household
 12. Areas with 30 houses or more for unit construction (after 1972)
 13. Areas that wouldn't require reinforcement of installed power lines, with transmission and substation facilities or low voltages
 14. Outstanding New Community villages and New Community factory regions would be selected first (after 1973)
 15. Outstanding New Community villages with average loans of 40,000 Won or less per household for construction (1970~1974)
 16. Outstanding New Community villages with average loans of 70,000 Won or less per household for construction (after 1975)

The government's top priority was the New Community Movement, such as rural income expansion regions, outstanding New Community Villages, and New Community Factory regions. These rural electrification targets had significantly less construction costs of around 10,000 Won, since the government and KEPCO financed 80 to 90% of the costs with long-term, low interest loans; non-target areas had to pay 50,000 to 70,000 Won for construction. However, not all outstanding New Community Villages were selected for electrification construction. The village scales and distances to the power resources were taken into consideration. Also, villages that had less than 30 households, those that were far away from the transmission and substation facilities, or villages with minimal construction loans were excluded from the project.

3.2 Project Funding

The government's original complete electrification scheme excluded 302,000 households, which were difficult to serve with electricity because they were in islands and mountain regions, totaling about 2,834,000. Therefore, the power supply target was 2,532,000 households by 1979. When KEPCO realized that a high percentage of customers were served without government assistance, it surveyed all the unelectrified houses in the country from 1975, expecting a sharp decline in the number of electrification target households in the original plan.

At the end of 1976, KEPCO's survey showed that the actual number of households that needed to be served turned out to be much less than the 302,000 compiled by the

government. The government established the following years' electrification schemes, based on the KEPCO's survey. Such a massive project required foreign loans under the nation's poor financial circumstances. KEPCO invested in the facility reinforcement construction (transmission and substation) for the project after signing a loan agreement with the Asia Development Bank for \$10.6 million in September 1971.

In February 1975, a loan agreement was made with Japan's Overseas Economic Cooperation Fund (OECF) for 360 million Yen. This fund was used for the electrification project of 67,000 households in the Farmland Foundation Region of Sapgyocheon, Gyeheo Island, and Changryeong areas. At the time, the KEPCO's financial situation didn't require the small OECF loan. However, since its annual interest rate of 3.25% was the lowest compared to other loans, the OECF loan was used for the project as a precedent. Also, the government made a loan agreement with the global bank IBRD for \$18.1 million, to cover some of its financial loans from 1976.

3.3 Establishment of Electrification Project Scheme

3.3.1 Top priority on New Community Villages

The purpose of New Community Movement was "To Live a Better Life," and was launched by the President Park Jung-hee on April 22, 1970. He emphasized Korea's local traditions that created financial benefits through collaboration, and ordered that "strategies for stimulating rural development" be created at the nationwide local ministers meeting, based on cooperation between residents, local authorities and government leaders. The president stated that voluntary resident-centered cooperatives will lead to a successful social reform movement, with the "Rural Modernization Promotion Act" being announced on November 1, 1969. This initiative was named the "New Community Movement" in 1971, and was executed nationwide, spreading to urban areas and factories by 1975. A full-fledged promotional effort expanded the movement nationwide. It boosted rural competitiveness in the short term, and restored self-confidence, as well as a sense of collaboration and support through the voluntary participation of citizens. New Community was a driving force behind Korea's modernization, including households and workplaces.

For successful execution of the New Community Movement, the government put emphasis on the "Rural Production Base Project," the "Income Expansion Project," and "Welfare and Environment Industries." To implement these projects, the government actively supported the electrification project, especially for outstanding New Community Villages.

In 1972, the Agricultural Cooperatives selected 150 outstanding New Community Villages, and loaned approximately 1 million Won to each village with medium- or long-term, low-interest loans (annual interest rate of 5%, with a two-year grace period and three-year equal payments), totaling 100 million Won for the Rural Electrification Project. The program was expanded to over 2,100 villages, selected by the government in the following year. In 1974, special funds of 200 million Won were provided to support the

electrification project for outstanding New Community Villages. In 1975, the full-fledged New Community Electrification Project supported over 305,000 households nationwide, with 1.525 billion Won.

3.3.2 Promotion of Rural Electrification

The Rural Electrification Project has been actively implemented by the government since 1965, supplying electricity to more than half of the rural communities by the end of 1973, and to almost all rural regions by the end of 1970s. However, the purpose of the project was not just about improving the quality of life of rural residents by providing electric lights; the fundamental aim was to promote rural modernization by increasing the rural productivity and incomes, with various power utilizations for agricultural management. In addition, the rural labor shortages caused by urban industrialization urgently called for mechanization of agriculture.

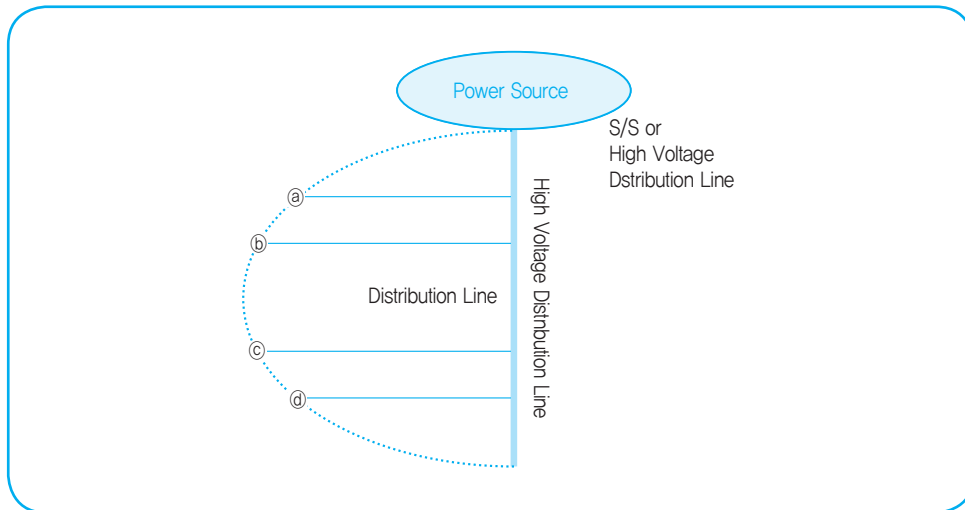
The Rural Electrification Project scheme was focused on providing electric lighting, heating and power for agricultural businesses, and was implemented accordingly. Introducing rural electrification and promoting its steady development require various prerequisites. A lighting-focused project alone requires substantial amount of investment costs; heating and power supply facility construction requires even more time and money. Therefore, comprehensive rural electrification schemes were systematically implemented for rural modernization as follows:

1. Securing technicians to teach rural electrification technology
2. Manufacturing and supplying rural electrification equipment
3. Rural electrification land criteria, cultivation environment, utilization scale and terms of use (expansion of management scale, collaboration, joint use, creation of electrification complex and etc.)
4. Stabilization of power rates for rural electrification
5. Funding measures for power facilities (providing 25% of construction costs for three-phased facility)
6. Establishment of electrification centers that manage rural electrification technology information

3.3.3 Expansion of Electrification Unit Areas

Since the area selection process for the Rural Electrification Project was conducted in village units, including New Community villages, it caused regional voltage drops and higher investment costs, with redundant reinforcement work.

Figure 2-4 | Supply Power with Systematic Construction



For instance, in order to supply power with systematic construction as illustrated above, it is ideal to install a central distribution line (high voltage distribution line) from the power source location, followed by install distribution lines from the central line to towns (a), (b), (c), and (d).

In reality, however, town (a) was electrified first, and then the distribution line would be extended to town (b) for power supply, followed by town (c) and (d). In that case, the town (c) or (d) experienced voltage drops, ending up with low-quality electricity. This scheme called for separate constructions of the town (a), (b), (c) and (d), leading to an ineffective design, supervision, material transport, contract procedure, and loan payment collection. A wider-area project scheme was therefore considered, instead of a small-scale, village-unit electrification system.

As a result, the scale of unit construction expanded to at least a suburb unit, leading to systematic constructions, prevention of redundant power lines and an economical supply of high quality power.

3.3.4 Transmission and Substation Facility Subsidy

In the early stages of Rural Electrification Project, it was executed only by reinforcing transmission facilities, and extending distribution lines. However, as electrification regions expanded to remote mountain villages, and the installed single phase lines were three-phased with New Community factory construction and agricultural motorization, the transmission and substation facilities had to be expanded and reinforced.

Such tasks required an estimated funding of approximately 15 billion Won; each year (1974~ 1977), 2 to 3 billion Won was invested to partially fund these necessary tasks. Rural Electrification Project was not an economical project in the early stages, as pointed out in the evaluation report of ECAFE Region Rural Electrification Project (The 12th ECAFE Energy and Power Division Council Meeting).

In other words, the project was pursued in the best interest of the public, generating indirect benefits for rural residents by improving their living environments and businesses, as well as local industries-rather than direct lucrative benefits. Therefore, the report also emphasized that government subsidies or financing measures with enticing loans were needed to fund rural electrification projects.

3.4 Shinan Region Electrification Project

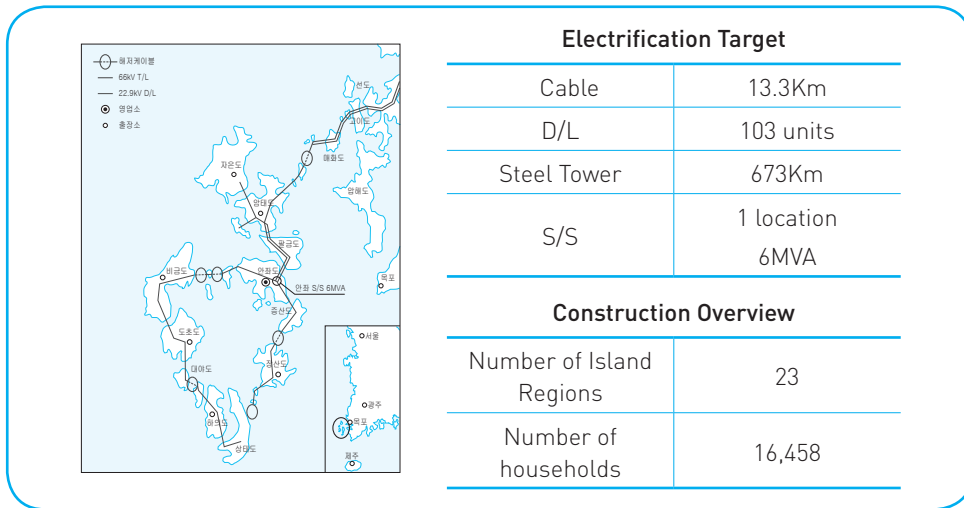
With the development of a lucrative power supply technology for islands, the electrification project for island regions was in full-swing, by developing and using straight transverse wires after revising the original plan of excluding island regions. By the end of 1977, KEPCO's technicians were sent to the U.S., Japan and Taiwan to explore their electrification status.

As electrification of over 16,000 households in 23 Shinan island regions became a new priority, installing a generator in each island region was considered; these regions had a number of customers, but it was difficult to transverse with a steel tower. So various electrification project schemes-such as installing an aerial steel tower for nearby island residents-were considered for a long time. However, after the submarine distribution system was brought under serious discussion, it was eventually incorporated into the electrification project, for the first time in Korea.

Figure 2-5 | Electrification Project Construction (Installation of Submarine Cable)



Figure 2-6 | Shinan Region Rural Electrification Project Construction



Since submarine cable installation had never been undertaken by domestic construction companies, Japan’s Sumitomo Corporation was selected through an international bidding. The construction was completed with a turnkey system and completed on January 30, 1979,- a milestone for electrification projects on island regions. The Shinan region electrification construction cost 5.05 billion won, with 1.83 billion Won for transmission and substation, and 3.22 billion won for distribution construction-the largest single project in the history of Korean rural electrification. The Shinan region electrification project provided electricity from Mooahn Substation to 23 islands across Shinan County in Mokpo, Junnam, by extending 66 kV submarine cable of 4.87 km in two sections, and a steel tower transmission line of 53 km. A substation was then built in Annja Island in Central Shinnan County, followed by 22.9 kV submarine cables of 8.32 km in five sections, and a general distribution line of 358 km. The construction finally electrified Shinnan region-the only remaining county without electricity in the nation.

The completion of Shinan region project finalized the rural electrification Project, which had lasted 14 years from 1965; KEPCO established a Shinan branch office to manage the consumption of electricity in these island regions. At the same time, a ceremony for complete rural electrification was held on October 8, 1979.

4. Island and Remote Region Electrification Project (Over 1980~)

4.1 Implementation Process

4.1.1 Project Implementation

1978 was the final year of the government's Rural Electrification Project. At the time, KEPCO conducted a survey of all rural communities, and executing a project that would target all the inland households with unit construction cost of less than 300,000 Won and island regions with straight transverse capability. The households that exceeded the criteria were excluded from the project, and were listed in a specification prepared for project completion.

The government used the survey as basic data for its complete electrification scheme, suggested after deliberation with the authorities including KEPCO. The proposed scheme was approved by the president, Park Jung-hee on September 26, 1978.

Under this plan, the island and remote region electrification project was introduced as the first follow-up effort to rural electrification. The project target for completion in the year 1979 were as follows: inland villages with at least 10 households and unit construction cost of 500,000 Won or less; 42 island region households with unit construction cost of 1 million Won or less, and connection capability to the KEPCO power grid. The construction costs were estimated by the rural electrification standard, and 10% was designated to be paid by customers. Among the project target of 22,900 households in 1979, 9,545 of them were inland. Approximately 60% or 13,358 of the target households were in island regions, requiring steel towers, or combining both submarine cables and steel towers, a challenging construction scheme.

In Particular, the Youngjong Island electrification project, which encompassed 11 island regions in the West Sea in front of Incheon, was very complex, due to its geographic characteristics. As a result, this particular plan had to be in line with various government planning authorities, including the Incheon City planning, the Kyungin Canal establishment scheme from the Ministry of Construction, and the vessel harboring location planning from the Office of Submarine and Harbor.

Also, building a normal steel tower under the sea would be impossible, so it would operating a submarine vessel, due to the shallow water conditions. Therefore, between Youngjong and Yongyou islands, where these obstacles were located, a so-called "undersea steel tower" was installed by building a special foundation on the bottom of the sea, instead of a traditional submarine underground cable system. This scheme required the most amount of time and personnel during this construction initiative.

The second project for island and remote region electrification was originally scheduled to start in 1980 with the president's approval on September 7, 1979. It was delayed, however, due to budgetary constraints after the October 26 Crisis that year. The power supply for

medium- and large-scale rural communities was completed before 1980, however, and the electrification project for small communities and remote mountain villages with at least 5 households was then put into action.

Starting with 3,100 households in 1983, a total of 19,600 households had been electrified by 1991, with a total cost of 40.497 billion Won, including 6.778 billion Won from KEPCO, increasing the electrification rate from 99.3% to 99.9%. In Heuksan Island (Sinangun, Junnam), Chuja Island (Bukjejugun, Jeju), and Deokjeok Island (Ongjingun, Incheon) where submarine cable connections were difficult due to long maritime distances, a self-generation system was adopted for power supply.

In December 1984, the 4th Amendment of Rural Electrification Promotion Act laid the groundwork for the installation and operation of self-generation facilities in these regions. On October 25, 1987, a 1.5MW power generator was installed in Heuksan Island, electrifying 1,395 households, and on December 14 of the same year, a 1.2MW generator was installed in Chuja Island for 1,016 households.

On May 1, 1989, a 1.8MW generator was installed in Kyumun Island, electrifying 929 households. On August 1, 1989, a 0.9MW generator was installed in Deokjeok Island for 709 households, greatly improving their quality of life and income earnings power. Following the installations, these island regions saw an growth of income through their livestock businesses, refrigeration plants and a growing number of tourists, thereby increasing their power demands by more than 10% every year. As a result, a 2MW generator was added to Heuksan Island, and 0.5MW generators were installed in Kyumun, Chuja, and Deokjeok Islands.

However, continuing growth in demand called for facility expansion and a more comprehensive measure for providing power supply. In accordance with the amended Rural Electrification Promotion Act of December 31, 1984, KEPCO was in charge of regular inspections at power generation facilities of unelectrified islands, and operation personnel training. KEPCO sent professional technicians of each facility sector to the islands once a year to reinforce damaged facilities, and train operation personnel, after receiving requests from local governments for scheduled inspections at their self-generation and distribution facilities. In particular, the West Sea 5 Islands, under the jurisdiction of Ongjingun in Incheon, was noted as a border region between North and South Korea.

On June 25, 1982, KEPCO finalized an agreement with the Kyungki provincial government to absorb 50% of the operation shortfall for self-generation facilities in Baengnyeongdo, thereby strengthening the power supply for North and South border regions. Meanwhile, KEPCO took over the operating responsibilities at some of the generation facilities in eight island regions, Deokjeokdo, Weeddo, Jodo, Chujado, Ulleungdo, Baengnyeongdo, Kyumundo, and Heuksando.

4.1.2 Improvement of Loan Payment Management system

If customers making loan payments since 1985 moved to another city without filling the vacancies, the number of customers at the time of transmission naturally decreased. The remaining customers would then end up with higher amounts of the loan payments. By 1984, 4 billion Won, out of 80 billion Won loaned, were not being repaid.

As a result, the government paid this remaining balance from former customers, starting the following year. Under this system, the active customers paid 5000 Won or less (VAT included) for their monthly electric bills and loan payments, while the balance was covered by KEPCO and the government.

4.2 Project Overview

4.2.1 Electrification Projects Before 1992

To electrify 37 island regions, 433 steel towers were installed between 317 spans, electrifying 61,308 households in 134 islands. Among the 433 steel towers, 427 of them were 100m or less, with six surpassing 100m. Among the 317 spans, 272 spans were 1100 m or less, with 45 spans exceeding 1100m.

Figure 2-7 | Construction Ceremony for Submarine Transmission and Distribution Facilities in Shinan Island Region



Figure 2-8 | Supply Grid Diagram of Youngjong Island Electrification Construction



Table 2-5 | Construction Status of Rural Electrification Steel Tower by Year

Year	Number of Regions	Number of Islands	Number of Customers	Height of Steel tower (m)							Steel tower spans (m)							
				Up to 30	50	70	90	100	Over 100	Total	Up to 500	700	900	1100	1300	1500	Over 1500	Total
1973	1	2	3,190	4		3	1		1	9	4				2	1		7
1974	3	5	5,720	12	6	1		1		20	11	1	2			1		15
1975	1	1	224	2	1	1				4	2		1					3
1976	5	10	6,995	25	3	1	2	2		33	17	2	1	1	3			24
1977	3	3	1,396	6	2	3	4			15	6	1	2	1	2			12
1978	16	75	31,113	138	50	22	12	3	5	230	111	18	19	8	8	2	1	167
1979	7	19	2,632	38	10	6	2			56	23	5	6	3	2			39
1980	3	19	10,138	37	19	6	3	1		66	24	13	3	6	4			50
Total	39	134	61,308	262	91	43	24	7	6	433	198	40	34	19	21	4		317
%				60.5	21.0	9.9	5.6	1.6	1.4	100	62.5	12.6	10.7	6.0	6.6	1.3		100

Table 2-6 | Nationwide Electrification Status of Island Regions (By Province)

Province	Number of Islands				Number of Islands					
	KEPCO Grid Electrification	Self- Generation Electrification	Unelectrified	Total	KEPCO Grid Electrification	Self-generation Electrification			Unelectrified	Total
						Electrified	Unelectrified	Total		
Kyungki	23	33	5	61	30,471	4,627	95	4,722	174	35,367
Chungnam	12	17	17	46	5,609	850	167	1,017	163	6,789
Junbuk	2	15	12	29	295	1,081	690	1,771	212	2,278
Junnam	133	32	199	384	82,918	3,966	2,261	6,227	5,576	94,721
Kungbuk	1		1	2	3,556				3	3,559
Kungnam	42	23	35	100	50,321	1,961	812	2,773	397	53,491
Busan			2	2					122	122
Jeju		6	3	9		2,197	0	2,197	36	2,233
Total	213	126	274	613	173,170	14,682	4,025	18,707	6,683	198,560

Submarine cables were installed in six regions, including the Shinan island region in Junnam Province, Youngjong island region in Kyungji Province, and Nowha and Odo island regions in Chungnam Province. During the electrification project for 28,733 households in 50 islands within these regions, submarine cables were installed in 10 sections, where steel towers were useless for straight transverse construction schemes. Among the 196,560 households in 613 manned islands nationwide, 173,170 households in 213 islands were connected to a KEPCO power grid.

In addition, 111,862 households in 179 islands that had been without electrification were served with distribution poles, instead of steel towers or submarine cables. Meanwhile, in accordance with the Rural Electrification Promotion Act established on January 13, 1990, the first stage of the island region electrification project (1991~1993), which started with 10 unit projects in 1991, completely electrified 2,738 households during the 1990s. 380 of these households were connected to a KEPCO power grid; 711 of them in Weedo, Shickdo, Kurundo and Jungkumdo (Buanngun, Junbuk) were taken over by KEPCO, after being operated by the local government.

The takeover was in accordance with the Rural Electrification Promotion Act, which stipulated that island regions with 500 households or more could be operated by KEPCO. The project achievements for island and remote regions from 1991 to 1993 are as follows.

a. Island Regions

From 1991 to 1993, the electrification project reached 2,527 households in 12 main islands with at least 100 households, and 211 households in eight auxiliary islands with less than 100 households; the project status in 1993 was as follows:

b. Remote Regions

In 1992, a total of 149 households in remote regions with at least five households were electrified; the remote region electrification project reached 45 households in islands with less than five households within 14 counties by 1991; in 1992, 20 households in six counties were electrified. In 1993, the plan was to electrify 115 households in 17 counties.

However, the Rural Electrification Promotion Act and its enforcement ordinance didn't support regions with less than five households-unless they were supported by financial loans. Hence, these regions didn't receive funding from the state and local governments. KEPCO, with residents to giving up on the project, processed electrification for only counties with at least two households.

4.2.2 Electrification Project After 1992

a. Remote Region Electrification Project

In 1991, the nationwide electrification rate had reached 99.9%. Every year, the electrification project was being implemented for villages with at least five households in remote mountain regions, in addition to new villages formed by migrants. The achievements of remote region electrification project between 1992 and 1997 are as follows.

Table 2-7 | Achievements of Remote Region Electrification Project

(Unit: million Won)

Year	Number of villages	Number of Customers	Total Costs	KEPCO Funds
1992	18	149	1,480	1,226
1993	-	-	-	-
1994	8	51	1,688	1,312
1995	8	42	673	351
1996	6	37	865	472
1997	7	36	744	495
1998	-	-	-	-
1999	2	17	209	116
2000	4	104	515	223
Total	53	436	6,174	4,195

b. Island Region Electrification Project

(1) Project Implementation

On January 13, 1990, the government amended the Rural Electrification Promotion Act, and implemented the remote region electrification project with systematic plans in 1991. The project was supervised by local governments that purchased the power plant sites, presided over authorization and licensing matters, and ordered and executed civil engineering and distribution facility construction.

In addition, KEPCO was in charge of forecasting demands, determining generation capacity, designing plans, supplying generation facility equipments, and supervising construction. In 1991, the first project was implemented to electrify 2,738 households in 11 islands, including Jumundo. Among the target households, 380 of them in Bolundo and Jumundo (Kangwhagun, Kyungkido) connected to the KEPCO transmission grid in November 1993; KEPCO supplied electricity by installing a modern internal generator (5.55MW), and launched its commercial operation in February 1993 in Weedo. In 1992, the second project of the first stage was underway to electrify 5,683 households in 22 islands, including Bangnungdo.

This project, which started with a commercial operation in Chudo in Tongyoung, Kyungnam in March 1994, was tentatively completed with an internal power plant construction in Bangnungdo and commercial operation in December 1995. The first project of the second stage was launched in 13 islands, including Jebudo for 960 households in 1994. Located in Whasunggun in Kyungkido, Jebudo saw electrification of 74 households by installing a maritime steel tower and connecting to the KEPCO power grid in November 1995; also, 886 households were electrified by installing an internal self-generator with a commercial operation in February 1996.

The second project of the second stage launched an internal self-generator installation for 810 households in 14 islands, including Pungdo, in 1994; its commercial operation started in Gauido (Taeahngun, Chungnam) in July 1996, and expanded to all other islands by April 1998, with complete installation of self-generators. The project cost a total of 117.6 billion won, with the residents' one-time payment of 140 million won, supplemented by the state government's financial loans of 10.19 billion Won and its subsidies of 26.82 billion won, local government funding of 27.43 billion Won, and KEPCO funds totaling 53.03 billion won.

When the second stage of the project was completed, the government established and executed the year 2000 project, which targeted island regions with at least five households-similar to the previous remote region project. The goal was to electrify 384 households in 15 islands with KEPCO's inland power grid and maritime steel towers. A total of 18.6 billion won was allocated to electrify eight islands by the end of 2000s, and another seven islands with delayed construction, due to site renegotiation. The project was completed in the first half of 2001.

(2) Support for Self-Generation Facilities

KEPCO conducted regular facility inspections on self-generation facilities on unelectrified islands, providing education for operation personnel once a year. As part of the island electrification project, KEPCO funded 50% of the total operation shortfall-except for power revenues-for islands with modern diesel generators until April 1994; it also covered 75% of the shortfall for local governments after April 1994. Under the amended Rural Electrification Promotion Act of 2000, KEPCO funded the entire shortfall after March 30, 2001.

(3) Takeover and Management of Power Grid Facilities

KEPCO was designated to take over self-generators on islands with at least 500 customers at no cost, at the request of county and city officials, and the consent of customers. This guideline was based on Article 20 Section 3 of the Rural Electrification Promotion Act, established in 1965, and amended in 1984 and 1990.

However, the Administrative Reform Committee passed a resolution in 1993 that allowed KEPCO to take over and manage self-generation facilities of islands with 50 customers or more. So the Rural Electrification Promotion Act was amended to target islands with at least 50 households, instead of the 500 prescribed earlier.

After taking effect on March 30, 2001, KEPCO was allowed to take over and manage islands, following discussion with local governments, property inspection and appraisal. According to the government statistics of 1985, there were 518 manned islands nationwide, with eight having at least 500 households. Jeju Island was connected to an inland grid, while six were not equipped with self-generation facilities. For these six islands, generation and distribution facility installation plans were established, starting with Heuksando in 1985, under the Rural Electrification Promotion Act.

The island electrification project was funded by the state government's financial loans, local government subsidies, and customer payments. Meanwhile, technological designs, equipment and material purchase, installation, and trial operations were conducted by KEPCO, under the supervision of local governments. According to the guidelines stated above, Heuksando was taken over by KEPCO in 1987, followed by Dukjukdo, Gumundo and Chujado in 1989.

In 1993, KEPCO took over Weedo after a project delay due to local budget deficits and resident's inability to pay. In 1999, it took over Bangnungdo after paying 50% of its shortfall. Hence, all islands with at least 500 households were taken over and managed by KEPCO.

Table 2-8 | Entire Status of Island Regions

(Unit: Number of Islands)

Manned Islands				Unmanned Islands	Total
Connection to KEPCO's inland grid	Independent Grid		Total		
	Self-generation	Incomplete Electrification			
318	86	114	518	2,683	3,201

Based on the 1985 government statistics (Ministry of Administration and Local Autonomy)

Table 2-9 | Operation and Management Status of Self-Generation Islands

Distinction	Number of Islands	Management Entity	Details
500 households or more	8	KEPCO	The operation of Ullenungdo, Dukjukdo, Weedo, Heuksando, Gumundo, Chodo, Chujado and Bangnungdo was commissioned by Junoo Inc. Ullenungdo's distribution sector was directly managed by KEPCO.
50~Less than 500	55	Local Government	75% of operation shortfall was covered by KEPCO. In March 1998, facility replacement was completed.
Less than 50	114	Residents	The entire operation costs were paid by the residents. Facility replacement was not executed.

5. Achievements of Rural Electrification Project

Table 2-10 | Achievements of Rural Electrification Project by Year

Distinction Year	Number of Electrified households		Electrification Rate (%)	Construction Costs (million Won)			
	Each year	Total		Loans	KEPCO	Customers	Total
1964	0	(317.9)	12.0				
1965	38.7	356.6	13.4	300	133	45	478
1966	64.8	421.4	15.9	778	320	74	1,172
1967	45.5	466.9	17.6	584	208	23	815
1968	53.8	520.7	19.6	854	222	11	1,087
1969	72.5	593.2	23.4	1,198	357	109	1,664
1970	90.6	683.8	27.0	1,890	468	28	2,386
1971	171.9	855.7	33.8	3,380	802	74	4,256
1972	177.0	1,032.7	40.8	3,600	803	74	4,477
1973	284.5	1,317.4	52.0	7,390	1,338	195	8,923
1974	177.1	1,494.3	59.0	6,473	909	589	7,971
1975	137.3	2,105.6	81.6	6,090	951	897	7,938
1976	235.0	2,576.0	93.5	15,250	2,275	2,256	19,781
1977	120.0	2,696.0	97.8	13,100	1,428	1,896	16,424
1978	58.6	2,754.6	100.0	12,953	921	1,327	15,201
Subtotal	1,727.3	2,754.6	100.0	73,840	11,135	7,598	92,573
1979	22.9	2,777.5		9,978	573	1,108	11,659
Total	1,750.2 (709.4)	2,777.5		83,818	11,708	8,706	104,232

Table 2-11 | Status of Rural Electrification Project by Year

(Unit: 1000 households)

Distinction	Total	Electrified	Unelectrified	Electrification Rate (%)	
				Rural Households	Total Households
Total households (1965 ~1979)	2,834	2,777.5	56.5		98.0
Rural households (1965 ~1978)	2,754.6	2,754.6		100	97.2
Island and Remote households (1979)	79.4	22.9	56.5		

Table 2-12 | Support for Rural Electrification Project by Year

Year	Electrified Households (thousand)		Electrification Rate	Construction Costs (million Won)					
	Each year	Total		Total	Loans	Customers	State Government Fund	Local Government Fund	KEPCO
1964		317.9	12.0	-	-	-	-	-	-
1965	38.7	356.6	13.4	478	300	45	-	-	133
1966	64.8	421.4	15.9	1,172	778	74	-	-	320
1967	45.5	466.9	17.6	815	584	23	-	-	208
1968	53.8	520.7	19.6	1,087	854	11	-	-	222
1969	72.5	593.2	23.4	1,664	1,198	109	-	-	357
1970	90.6	683.8	24.0	2,386	1,890	28	-	-	468
1971	171.9	855.7	30.1	4,256	3,380	74	-	-	802
1972	177.0	1,032.7	36.4	4,477	3,600	74	-	-	803
1973	284.5	1,317.2	46.5	8,923	7,390	195	-	-	1,338
1974	177.1	1,494.3	52.7	7,971	6,473	589	-	-	909
1975	611.3	2,105.6	74.3	7,938	6,090	897	-	-	951
1976	470.4	2,576.0	90.0	19,781	15,250	2,256	-	-	2,275
1977	120.0	2,696.0	94.8	16,424	13,100	1,896	-	-	1428
1978	58.6	2,754.6	97.2	15,201	12,953	1,327	-	-	921
1979	23.5	2,778.1	98.0	11,659	9,978	1,108	-	-	573
1980-'82	34.4	2,812.5	99.3	-	-	-	-	-	-
1983	3.1	2,815.6	99.4	3,971	3,000	634	-	186	151
1984	3.2	2,818.8	99.5	3,832	3,042	211	-	28	551
1985	4.1	2,822.9	99.6	6,954	1,845	1,094	-	1,526	2,489
1986	2.7	2,825.6	99.7	4,433	2,198	487	-	1,397	351
1987	4.6	2,830.2	99.8	4,082	1,581	356	-	2,033	112
1988	1.3	2,831.5	99.9	4,878	1,231	1,274	-	1,209	1,164
1990	0.55	2,832.05	99.9	3,345	390	114	-	1,251	1,590
1991	0.05	2,832.1	99.9	9,002	2,471	101	3,030	3,030	370
1992	0.17	2,832.27	99.9	44,938	3,743	171	8,412	8,413	24,199
1993	-	2,832.27	99.9	34,319	2,407	-	9,103	8,103	15,706
Total	2514.37	2,832.28	99.9	223,986	105,726	13,148	19,545	27,176	58,391

2011 Modularization of Korea's Development Experience
Rural Electrification Project for Expansion of
Power Supply

Chapter 3

Effects of Rural Electrification Project

1. Changes in Rural Communities
2. Project Achievements
3. Implications

Effects of Rural Electrification Project

1. Changes in Rural Communities

1.1 Electrification Project and Rural Changes

With increased power generation, transmission, and distribution grids, the Rural Electrification Project was implemented with an electrification rate reaching 98% in 1979. It dramatically changed rural society: At night, every household was lit with electric lights, marking the end of candle lights. Also, the electrification project diversified sources of income for rural residents. The introduction of dryers expanded the cultivation of cigarettes and pepper. The electric motor saved time and labor, adding cultivation of other agricultural items. Chicken farms saw an increase in the amount of eggs produced, and livestock businesses saw higher production of milk with electric milking machines. Furthermore, large-scale ranch management became feasible with feed pulverizers. Indeed, various agricultural machines became widely introduced, saving time and labor, thanks to electric power. As a result, the agricultural businesses were maintained, despite the rural exodus into the cities, and a plunged labor force.

The Rural Electrification Project greatly improved rural incomes with special crop cultivation and livestock businesses, which proved to be commercially successful. But the main crop that accounted for over 60% of rural incomes was rice. In particular, the government promoted a transition to unified rice, a high-yielding variety introduced during the 1970s, which required a steady supply of water for its cultivation. In order to secure water, reservoirs, beams, and irrigation canals were built, and water pumps were secured to bring water to the rice fields. The main power for these water pumps were petroleum and electricity.

The Rural Electrification Project dramatically increased crop yields, significantly contributing to the national development of society, economy and welfare.

1.2 Introduction of Electric Appliances and Rural Changes

Electric lighting in rural areas during the 1970s meant longer working hours, rather than an expansion of cultural activities and/or leisure. In particular, the population, the numbers of which were decreased by a rural exodus, significantly increased the amount of labor for those who were remaining. Working at night was therefore unavoidable, not only during the busy farming seasons, but also during the off- seasons. The electrification project made night work viable, with kettle lights illuminating barns and pig cages, thereby boosting rural productivity.

Television, already popular in the cities, was also in high demand in rural communities. In the early 1970s, owning a TV symbolized wealth on a personal level, and indicated the standards of welfare administration and culture on a national level. In rural communities, the TV was more useful for obtaining production-related information, rather than cultural information, such as entertainment and leisure. At the time, the TV schedule included various agricultural education programs. These programs dealt with a variety of agricultural technologies and information, attracting dedicated daily viewers of 56%, and actual followers of 68%, among all viewers. 85% of farmers benefited from the agricultural programs in 1978, indicating the close link between TV and agricultural productivity.

Television provided simultaneous exposure to domestic and international information, reducing special gaps of information delivery between urban and rural areas. Also, TV contributed to a positive household environment; family members watched TV together, and talked about the shows, creating a different and better atmosphere for all generations.

The Rural Electrification Project also changed female labor. The newly introduced electric pots and rice cookers in rural communities slashed working hours for homemakers. The average working hours of rural women had been 13 hours in the 1960s, including 6.5 hours for cooking (seven hours in 1960, and 6 hours in 1965). The entirety of housework time was cut to 6 hours and 49 minutes by the 1970s-including cleaning, laundry, sewing, and kitchen work combined. The tools that generated more time for housework were kitchen appliances, including rice cookers. The penetration of rice cookers increased from 1 in 5 households in 1977 to 1 in 2 households in 1979. Electric rice cookers saved not only household labor, but also fuel costs. At the time, the main kitchen fuels were rice straw and briquette. Rice straw cost 4,700 Won a month to heat rice for a family of three with 270 bundles. However, the electricity price for rice cooker was only 1,700 Won, a third of the previous amount. In addition, rice cookers eliminated a need to maintain a furnace, adding convenience to housework.

In the modern age, life without a refrigerator is an extreme inconvenience. But during the 1970s, there was a very low penetration of refrigerator use, due to high prices. In the early 1970s, the domestic refrigerators cost six times as Germany, three times as the U.S, and twice as much as Japan, including taxes that comprised 40 to 65% of prices, such as product and special consumption taxes. Also, electric bills made people hesitant to purchase

a refrigerator, which was then considered a luxury rather than a necessity. Even urban areas had very low penetration of refrigerators at 1.6% nationwide. Even in 1976, when electronic products were becoming popular in rural communities, refrigerator penetration remained almost unchanged at 1.8%. In terms of an income-based analysis, one out of 333 small-scale farmers, one out of 48 medium-scale farmers, and only one out of 33 large-scale farmers had refrigerators. It was partially because refrigerators were considered a luxury, and the satisfaction rate was relatively low in rural communities. If the biggest feature of refrigerator is food preservation, rural life styles and eating habits didn't require refrigerators. Perishable meat was not much in use, and side dish ingredients were obtained frequently from gardens, leaving almost no leftovers. Food requiring long preservation was processed with salt, and stored without refrigerators.

Refrigerators were purchased by rural residents for their economic value-just like other appliances-rather than food preservation. Securing extra workers was crucial during the busy farming seasons, because of the rural exodus and the resulting small workforce. The extra workers preferred households with refrigerators that could provide cool drinks and alcohol. In addition, electric irons and fans made lives easier for rural residents.

1.3 Electrification Project and Rural Economy

The electrification project changed not only the labor environment and way of life, but also the economic scales of rural communities. Electricity use required tremendous costs for external distribution, as well as indoor distribution and expansion construction. Total construction costs were quite burdensome for rural individuals.

However, the project targets were supported by long-term, low-interest loans; 80% through government loans, and 10% by KEPCO, levying small payments on rural residents by 1975. But loan payments increased with projects spreading to mountainside and remote villages after 1976. Although KEPCO paid for approximately 87.2% of construction costs after 1976, each customer had to pay 11,331 Won for external wiring. Combined with internal wiring costs of 11,104 Won, the entire construction cost 22,435 Won in total. The loans of 67,810 Won were payable with a five-year grace period and 30-year repayment, at an annual interest rate of 7.5%. Therefore, 5,000 Won of principal and interest had to be paid in monthly electric bills. With an average electric charge of 11,000 Won, each customer paid approximately 16,000 Won every month. Although construction required 20,000 Won in cash up front, along with monthly electric payments, most considered it money well spent; electricity produced economic benefits with agricultural production and increased their incoming earning power. In fact, the financial value was estimated to be around 78,750 won with saved materials, labor time, and better work efficiency. Therefore, each farmer was expected to earn 62,750 Won in total revenues with electricity. Considering the maintenance of electronic products and purchase of motors for 1,610 Won, approximately 61,140 Won of net profits were expected every month.

Table 3-1 | Average Economical Effects of Agricultural Customers after Electrification

(Unit: KRW)

Section	Monthly profit and loss	Value	Remarks
A	Financial value from saving material, labor time and better efficiency with electrification	78,750	
B	Principal and interest of construction	5,000	
	Electric charge	11,000	
	Maintenance of electronic products	1,610	
C	Net profit	61,140	C=A-B
D	Profit for agricultural customers	172,592,000,000	Estimation 2,800,000 Agricultural customers

However, the upfront cost of 20,000 Won was required to begin construction, which was burdensome for farmers who were low on cash. As a result, some farmers were against the project in the beginning, leading to numerous village meetings to persuade them, and requests for more support from KEPCO were also submitted. As a result, the gap in funding was covered with presidential grants, rewards for outstanding New Community Villages, and joint funds from residents. However, the electrification project was still not fully covered, leaving financial burdens on farmers. Nevertheless, the benefits of electrification outweighed the costs, leading to a smooth execution of Rural Electrification Project.

The financial burdens were mostly incurred by electrical appliance purchases, rather than the project itself. Farmers who had electricity started to purchase electronic products, dramatically affecting the nationwide penetration rate. In 1975, the number of electrical appliances increased by 279%, compared to a year earlier. The increase amounted to 340% in 1976, 490% in 1977, 700% in 1978, and soared to 812% in 1979; the average number of appliances per household was seven by this time. In 1970, only one out of 167 households had a TV, but the penetration skyrocketed to 1 out of 1.3 households by 1979, indicating more than a 100-fold increase in less than 10 years. In addition, other electronic products that minimized household labor, such as rice cookers and irons, recorded high penetration rates. In the process, rural communities were becoming capitalistic markets at a fast pace. The corporations hit by the international recession discovered domestic rural markets, and established a nationwide distribution network by following power lines. The network fluctuated according to the characteristics of rural communities. In the early stages of network establishment, agricultural chain stores and discount stores were actively in business, instead of dealerships and door-to-door sales. Since farmers were not able to pay

for electrical appliances all at once, installment purchases were prevalent, although they required high interests, and increased loan payments for rural residents.

Meanwhile, as electric supply was expanding with the Rural Electrification Project, major electronic manufacturers started to establish a nationwide sales network with dealerships. Amid such expansion, sales professionals and wholesalers created new sales strategies for rural communities. One strategy was “financing clubs,” a form of installment purchases, to attract rural consumers without much cash at hand. In parallel with the proliferation of various electronic products, the large-scale farmers had twice as many appliances as the national average in 1976 as the project was completed.

2. Project Achievements

The achievements of Rural Electrification Project can be summarized as economic effects that contributed to rural residents’ income increases, in addition to social effects that improved their quality of life and mental well-being. The economic effects refer to the economic benefits generated through the use of electric power; improvement of agricultural technologies, which led to an increase in labor productivity, and income increases through rural factory operations. Improvements in agricultural productivity achieved through the use of electricity were also noteworthy.

Farming was upgraded by utilizing pumped water and draining pumps during draughts, and all-weather farming became a feasible. In addition, early harvesting and multiple crop yields became possible through seedling nurturing methods and light cultivation.

Widespread electrification allowed small companies involved in the manufacturing of light industrial goods to move into rural areas. These relocations brought positive effects on the rural economy, increasing income and labor utilization during the off-seasons. Introduction of agricultural technologies and rural light industries to rural areas led to higher incomes for rural residents than those of city workers in 1974. Thanks to the success of the Rural Electrification Project, concrete industries that manufactured poles and piles (stakes), and power line industries that produced electrical wires and cables, were booming, leading to domestic market growth; this growth, moreover, laid the foundation of industrial development with successful entry into overseas markets.

Meanwhile, rural income expansion with the project significantly increased the demand for electrical appliances. According to 1975 research by the electronics industry, urban demand for electronics showed a slowdown, with a TV penetration of 40.9% per household for 1974. But rural penetration during the same period was only 8.8%, showing a potential for significant growth, which in turn triggered aggressive promotional efforts for electronic products in rural communities.

The successful implementation of the Rural Electrification Project became a role model for many developing countries, such as Saudi Arabia and Bangladesh, which came to Korea

to explore their own projects, enhancing Korea's national prestige. The project increased employment and revenues of electric equipment manufacturers, spreading similar benefits to their subcontractors and agricultural equipment manufacturers.

Following the successful execution of the project, Hyundai Engineering & Construction Company won a construction project in the ACIR region in Saudi Arabia, for \$120 million. The project began in 1977, lasted two years, and was successfully completed.

The ACIR electrification project in Saudi Arabia was KEPCO's first overseas electrification project. Located in a mountainous region adjacent to South West Coast, and 2500 m above the sea level, ACIR was an underdeveloped region with practically no power facilities-except for small private generators. As contractor, Hyundai Construction Company designed and built the overall power facilities, including power plants, substations, transmission and distribution lines and customer meters, which would accommodate 20,000 households in 500 villages. The company executed a 100% turnkey construction, with continued management and trial operation. The project was offered by the Saudi Arabia Power Agency, and included all of the world's leading competitors, such as European nations and Japan. The construction was completed six months ahead of the original plan, receiving high praises from the king of Saudi Arabia. In 1986, Korea's Hyundai Engineering booked Nepal's Sixth Power Industry Consulting contract, and executed projects of rural electrification, and transmission and distribution line improvements for Nepal's six regions. The project involved basic and detailed designing of facilities, creation of equipment and construction bidding documents, evaluation of documents, construction supervision, and technician training.

The social effects, represented by the impact of electricity on the lives and mindsets of rural residents, were just as influential as the economic effects. The improvement of income and quality of life for rural residents greatly lowered their previous aspirations for city life. The spread of TV and radio not only generated entertainment and cultural benefits for rural residents, but it also allowed for a rapid delivery of market and agricultural information, significantly decreasing a sense of incompatibility between rural and urban residents. The biggest social effect was the rural residents' new sense of pride and reward in their occupations, by allowing them to directly participate in the electrification construction, and cultivating their New Community spirits.

Also, newly-installed street and security lights greatly contributed to providing security in vulnerable water front streets and remote areas. Pertaining to the power project, some people were concerned about the kind of economical efficiencies it would bring.

However, KEPCO's price-earnings ratio was 14.2%, a relatively satisfactory level, according to the Rural Economy Research Institute. Based on the experience of developed economies, once rural electrification reaches a certain level, it plateaus to a stabilized power market, regardless of economic changes, signifying the profitability of almost any rural electrification project.

3. Implications

In modern society, life without electricity isn't just an inconvenience; it can be a form of alienation from mass culture and information. Life without electricity can also mean living without the latest, efficient production tools. This was reality for Korea's rural communities prior to the electrification project. However, the Rural Electrification Project after the mid 1960s began to transform the living environment for these people.

However, the project could not easily produce visible effects in the early stages, since various facilities and technologies, such as transmission and distribution grids, had to be established nationwide. In addition, a rural power supply required proactive resolution of issues by the government with policy, finance and law, as well as technology. The costs amounted to billions of Won-excluding the power plant costs. Such projects could not be carried out with 300 million Won funding for KEPCO, and political negotiations at hand were not producing quick resolutions. Although the Rural Electrification Project was stagnant in its early stage, it was stimulated with the New Community Movement by political regimes, trying to attract support from rural residents in the 1960s and the '70s. The project funding was obtained from Western Europe, the U.S, and Japan through financial loans, commercial loans from IBRD, and New Community Loans. For technology and land-related facility expansion, the relevant laws were revised quickly for smooth implementation.

The Rural Electrification Project, actively supported by the government and KEPCO, produced very visible effects in the 1970s, and is still remembered as a very successful part of the New Community Movement. The divide between urban and rural areas was bridged by improving the rural living environment through electric lighting and TV.

However, electricity was not provided unconditionally to all rural communities. The first priority was given to self-reliant New Community Villages; 90% of their costs were supported by the government and KEPCO. Therefore, an electric supply was a long-awaited project for most unelectrified villages during the mid 1970s, and some executed projects with their own expenses.

Even when the power supply was insufficient amid a domestic economic boom in the mid 1970s, the electrification project continued. When major roadside electrification was close to being completed, the mountainside, remote and island regions were supplied with electricity at much higher costs. Due to significant impact that the electrification project had on political support, obstacles such as long distances to power resources and nationwide power shortages were eventually overcome. The continuation of the electrification project increased the electrification rate to 98% by 1979-with island regions the only exception.

Korea's 5-Year Economic Development Plans achieved huge economic growth, but also created tremendous gaps between agriculture and industries, as well as between urban and rural development. According to the "Rural Society Reform Report"² in 1968, the unbalanced

² Published by Korean Ministry of Health and Society in 1968.

industrial and economic developments were hampering overall national development, with urban concentration of population and wealth. The report prescribed a more balanced national development, by avoiding city-centered investment policies. Also, it noted that regional divide was undermining rural productivity, creating vicious cycles of poverty with poor welfare facilities and labor shortages in rural communities, in addition to urban congestion. Furthermore, the report noted that limited region and industry development was exacerbating the imbalance, creating an uneven distribution of development, and leading to a waste of resources, regional conflicts and distrust, as well as industrial, regional, and financial divides. The project was also necessary to promote balanced development between agriculture and industries by transforming the rural communities. The Rural Electrification Project provided economic effects that contributed to income increases in the rural communities, in addition to social and cultural effects improving the quality of life and mental well-being of rural residents.

The Bank of Korea called for an urgent execution of the electrification project, since it would bring local decentralization of industries and population through modernized agricultural systems and improvements in the living environment. In its “Rural Electrification Project Report,”³ the Bank of Korea predicted that complete rural electrification by the late 1970s with 167 million Won would modernize agricultural systems with various power facilities through irrigation repairs, agricultural processing, and a more effective fishing industry. It also noted that electricity would upgrade the rural living environment, and develop the household industry, accelerating the local decentralization of industries and population in Korea.

Power supply modernized agricultural technologies, and encouraged industries to move to rural communities, leading to higher incomes for rural residents than those of city workers by 1974. The statistics showed that an average rural resident received 114,769 Won a month, compared with 112,330 Won for the average city worker.

In addition, the project stimulated the economic activities of electric equipment manufacturers and construction companies. The project also boosted employment and income for manufacturers of electronics and agricultural products. The social and cultural effects of the Rural Electrification Project were just as dramatic. Improvements in income and quality of life for rural residents decreased their aspirations for city life, and widespread supply of TV and radio revolutionized their cultural lives. By participating in the Rural Electrification Project themselves, rural residents also gained the New Community spirits through collaboration and cooperation.

The Rural Electrification Project played a critical role in establishing the systematic, national power grid, as well as promoting rural development. In the mid 1970s, the project and the concurrent international economic recovery significantly increased power demand, thereby decreasing the power reserve. There were 39 interrupted transmissions during peak

³ Document number 465, published by industrial survey department at Bank of Korea in 1970.

times between October and December in 1974, prompting the government and KEPCO to build power plants early, ahead of the original schedule for expansion of supply capacity. As a result, small hydroelectric power stations were also built in rural areas.

In addition, extensive power supply to rural areas highlighted the importance of power loss management, leading to high voltage transmission, improvements for distribution facilities, and 220V step-up construction. Although the upgrade was continuously delayed from 1967, it was executed for all constructions after 1977, which in turn largely solved power shortages.

Such transmission and distribution grids essentially required tremendous costs; the government introduced commercial loans, mostly from the U.S, West Germany, Japan and France. In addition, rural power grid construction was implemented without much difficulty, thanks to complementary laws and regulations on transmission steel towers, substations, and land use for distribution installations.

The establishment of the national power grid was crucial in developing Korea's national industries and improving the quality of life for the general public. Indeed, Korea's Rural Electrification Project has been a new driving force behind the economic development for half a century. It took 15 years for Korea to achieve complete electrification with the government's strong policies, and KEPCO's outstanding construction and management. Based on its valuable experiences, Korea needs to actively support the world's developing countries with the lowest electrification rate, providing its capabilities for electrification planning, funding, material and design standards, construction and management.

2011 Modularization of Korea's Development Experience
Rural Electrification Project for Expansion of
Power Supply

Chapter 4

KEPCO'S Philippines Electrification Project

1. Background
2. Project Implementation

KEPCO'S Philippines Electrification Project

1. Background

The Philippines' Arroyo government selected rural electrification project as one of its primary projects (10 points agenda) to achieve a balanced national development and eliminate poverty for its citizens. The government requested active participation from domestic private power companies (IPP) including Mirant as a major partner in the electrification project.

Meanwhile, as the Philippines Power Industry Restructuring Act was passed in June 2001, renegotiations for all ITTs were underway. KEPCO's Malaya and Ilijan projects were also included in the IPP renegotiation; the Malaya project was the target of financial sector renegotiation, and the Ilijan project was being reviewed for its financial issues. KEPCO supported the Philippines electrification project as the second IPP, although extra costs were expected upon renegotiation of the Malaya and Ilijan projects.

In November 2002 at the Ilijan Power Plant construction ceremony, KEPCO made a promise to the president Arroyo to support the electrification project for 200 Barangays. On November 2003, the Malaya and Ilijan project renegotiation was finalized, on the condition that KEPCO would provide free support. The electrification project was launched by KEPCO in January 2004, by sending its project manager to the Philippines.

2. Project Implementation

The KEPCO's rural electrification project in the Philippines started with 60 Barangays near Ilijan Power Plant in 2001, with a goal of corporate image enhancement and power demand creation. The project was executed in 760 villages (\$14 million) by 2010. The second rural electrification project was launched in 202 Barangays on four islands (Palawan, Panay, Cebu and Sikwihoeo) in January 2004, which was completed in June 2005 with a total budget of \$3 million (USD).

However, some of the target Barangays were already electrified, and in some cases, other companies were in charge of the same Barangays, which was revealed during the on-site verification and designing process. It led to the renegotiation with the Philippines government to select other Barangays, delaying the electrification project for five months, and was completed in June 2005-instead of January 31, 2005, per the original plan. Also, the initial target of 200 Barangays expanded to 202 with 35 in Palawan, 137 in Panay, 28 in Cebu and 2 in Sikwihoeo.

The third project was launched by KEPHILCO to improve its status as a private power company, with the Department of Energy (DOE) to support the Cebu Power Generation Project via a Memorandum of Understanding (MOU). A key point to this MOU was that KEPCO would be assigned to implement the electrification project in 500 Barangays for five years. The following are the major tasks of the Philippines electrification project.

2.1 Implementation History

November 2003: Selected target Barangays (200)

January 2004: Configuration of Barangay Electrification Project Team (one distribution worker and five local employees)

January~April 2004: On-site verification of Barangays, and the specifications review and confirmation (the first 154 Barangays)

April~July 2004: Estimation of necessary materials and contract commission

July 2004: Ground Breaking Ceremony in Palawan

July~September 2004: Material purchase and transport

September 2004: Launched the first construction (the first 154 Barangays)

September~December 2004: Designed the second construction

January~February 2005: Signed the second construction contract

February 2005: Completed the Solar Home System (22 Barangays in Panay)

March~April 2005: Completed the second construction (the second 48 Barangays)

June 21, 2005: Construction Completion Ceremony

December 2005: KEPHILCO and DOE signed a MOU for electrification project in 500 Barangays (until 2010)

August 2006: KEPHILCO and DOE signed a MOA for electrification project in 200 Barangays

October 2006: KEPHILCO and Cebu government signed a MOA

December 2006: KEPHILCO and DOE signed a MOA for ACCESS Project

January 2007: Received information from DOE regarding electrification project in 198 Barangays

April 2007: Discussed detailed implementation plans for on-grid and off-grid systems

April 2007: Reviewed the basic specifications (staking sheet) for the selected 21 Barangays

April 2007: Made requests to DOE to confirm the target Barangays and to modify the electrification system of some of the Barangays

April 2007: Submitted the review results on SSMP technology specifications to DOE

May 2007: Requested the DOE to obtain and provide information in the process of RRA

June 2007: KEPHILCO signed the amended MOA with Cebu government

December 2007: Completed designing and launched construction in 64 On-Grid villages among 200

December 2008: Completed electrification project construction in 64 On-Grid villages among 200

February 2009: KEPHILCO and DOE signed a MOA for electrification project in 300 Barangays

February 2009: Completed designing and launched construction in 20 On-Grid villages (Cebu) among 300

April 2009: Completed electrification project construction in 24 On-Grid villages (Cebu) among 300

April 2009: Completed designing and launched construction in 136 Off-Grid villages among 200

July 2009: Completed designing and launched construction in 72 Off-Grid villages among 300

November 2009: Completed designing and launched construction in 208 On-Grid villages among 300

January 2010: Completed electrification project construction in 136 Off-Grid villages out of 200, finalizing the construction for all the 200 villages

July 2010: Completed electrification project construction in 72 Off-Grid villages among 300

December 2010: Completed electrification project construction in 208 On-Grid villages, finalizing the construction for all the 300 villages

2.2 History of Philippines Rural Electrification Project

Table 4-1 | KEPCO's Electrification Project in Philippines

Distinction	1st Support	2nd Support	3rd Support
Period	Year 2001	2004~2005	2007~2010
Region	Mindoro Island near Ilijan	Cebu, Palawan and Panay	Luzon, Visayas (includes Cebu)
Target	60 Barangays	200 Barangays	500 Barangays
Cost	Approximately \$1 million	Approximately \$3 million	Approximately \$10 million
System	On-Grid system for all	<ul style="list-style-type: none"> ○ On-Grid: 132 Barangays ○ Off-Grid: 68 Barangays 	<ul style="list-style-type: none"> ○ 200 Barangays <ul style="list-style-type: none"> - On-Grid: 64 Barangays - Off-Grid: 136 Barangays ○ 300 Barangays <ul style="list-style-type: none"> - Includes Sitio of Negro region

2.3 Project Implementation

2.3.1 200 Village Electrification Project (2007~2008)

- Executed electrification project in 64 Barangays, including Cebu, Luzon and Samar regions, selected by the local distribution companies (EC) with On-Grid (power line extension) system
- Executed electrification project in 138 Barangays including Luzon and Visayas regions selected by the Department of Energy (DOE) with Off-Grid (sunlight) system
- Budget: Approximately \$2 million pesos (1 million pesos or less per Barangay)

Table 4-2 | Target Area of On-Grid (64 villages) Philippines Electrification Project

Distinction	Local Distribution Company	Barangay		
		OFF-Grid	ON-Grid	Total
LUZON	Cagelco I (Cagayan)	8	2	10
	Cagelco II (Cagayan)	3	2	5
	Iselco II (Isabela)	27	0	27
	Nuvelco (Nueva Vizcaya)	20	2	22
	Kaelco (Kalinga)	20	0	20
VISAYAS	Norsamelco (Samar)	0	25	25
	Samelco I (Samar)	25	5	30
	Samelco II (Samar)	0	8	8
	Tiselco (Masbate)	8	0	8
	Paleco (Palawan)	25	0	25
	Cebeco I , II , III (Cebu)	0	20	20
Total		136	64	200

2.3.2 300 Village Electrification Project (2008~2010)

- Implemented the electrification project in 72 Barangays of Luzon and Visayas regions with off-grid system, excluding the Barangays that were being electrified.
- The project wasn't implemented in the dangerous Mindanao region, as the president had requested. Instead, On-Grid system electrification was implemented in the selected Sitios, which were equivalent to 228 Barangays, in regions such as Negros and Cebu where KEPCO provided electricity through Cebu Power Plant.

Figure 4-1 | Target Area Map of On-Grid (64 villages) Philippines Electrification Project

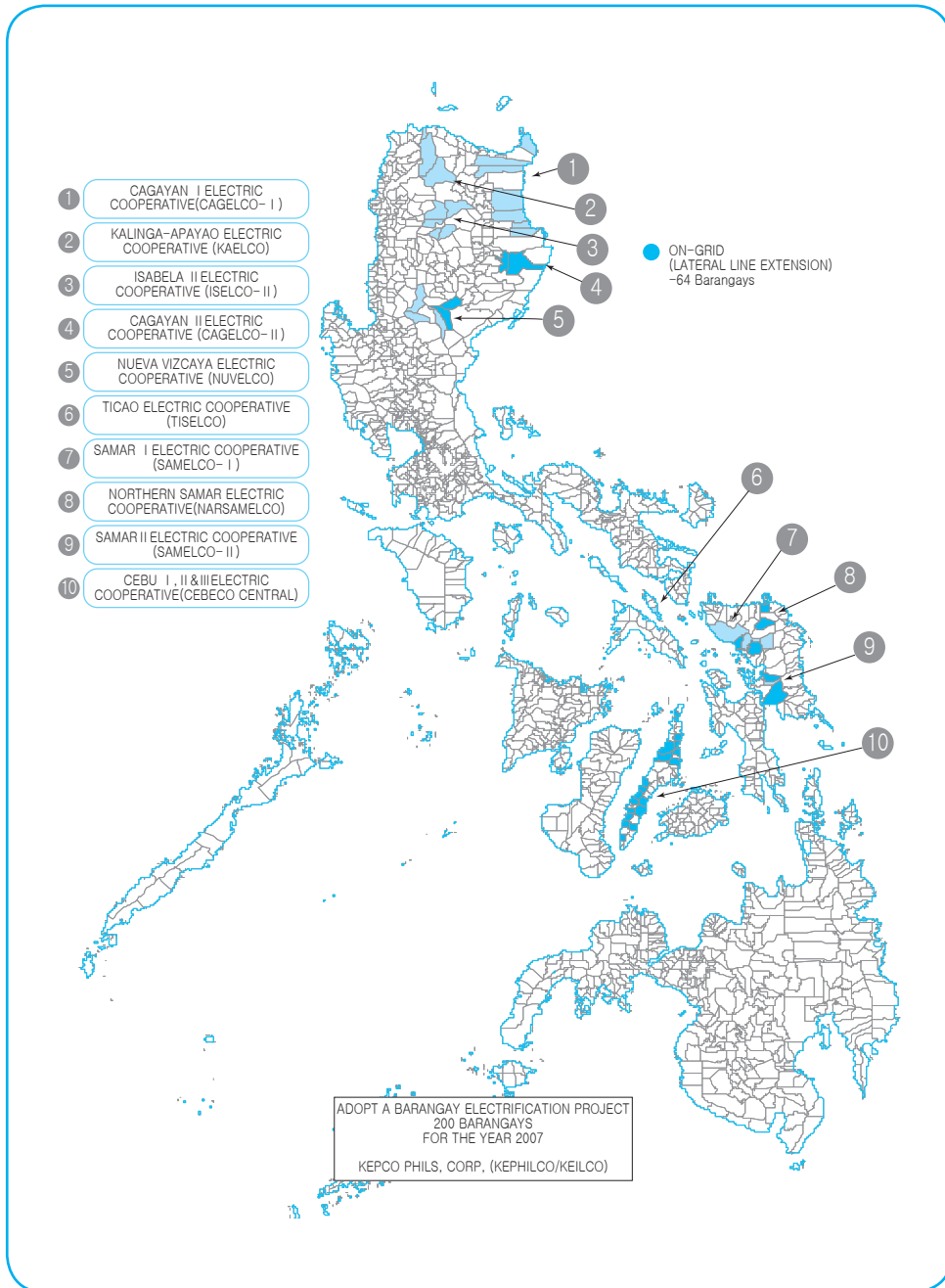


Figure 4-2 | Target Area Map of Off-Grid (136 villages) Philippines Electrification Project



Figure 4-3 | Target Area Map of On-Grid (20 villages) Cebu Electrification Project

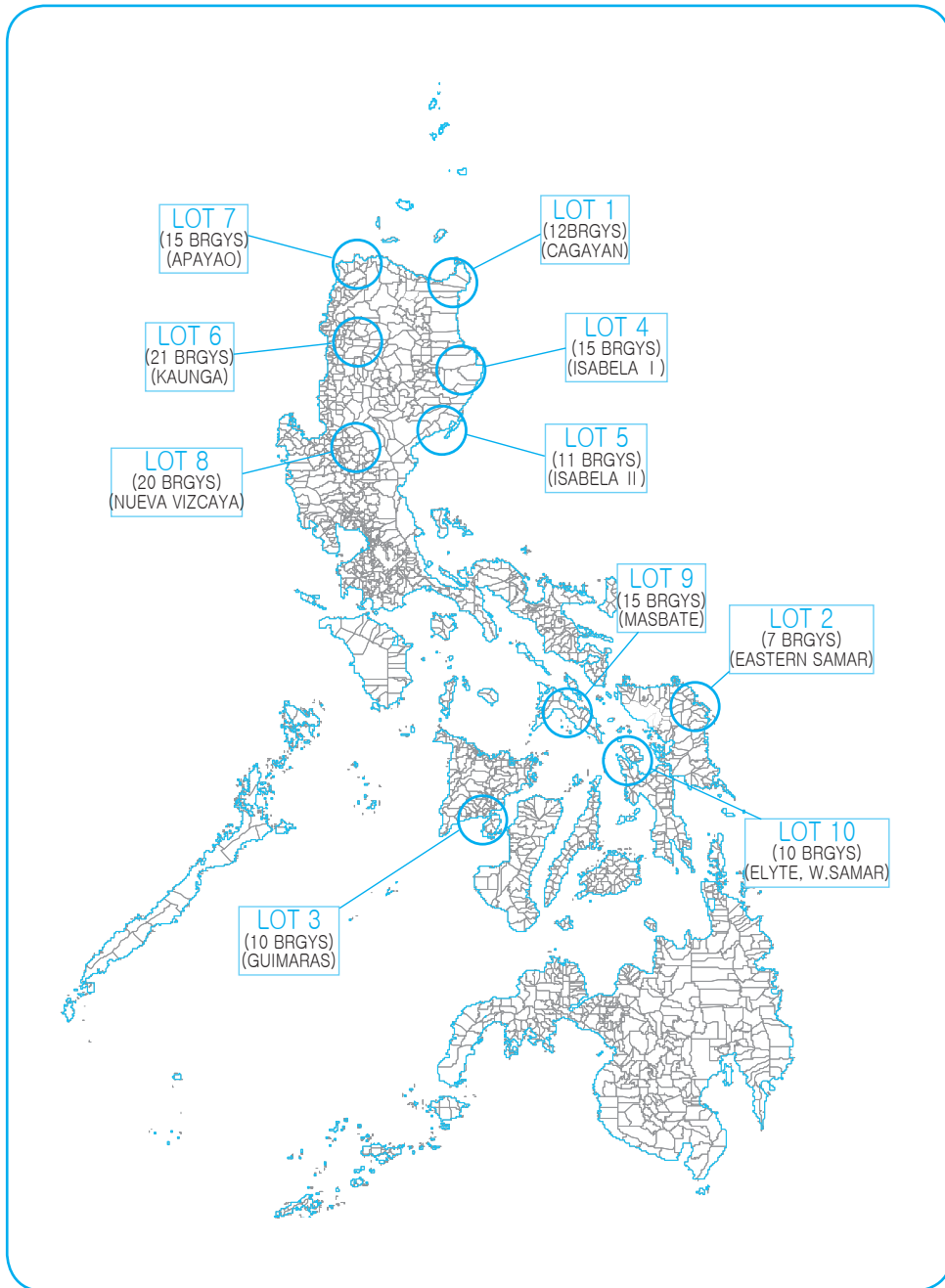


Figure 4-4 | Target Area Map of On-Grid (208 Villages) Philippines Electrification Project

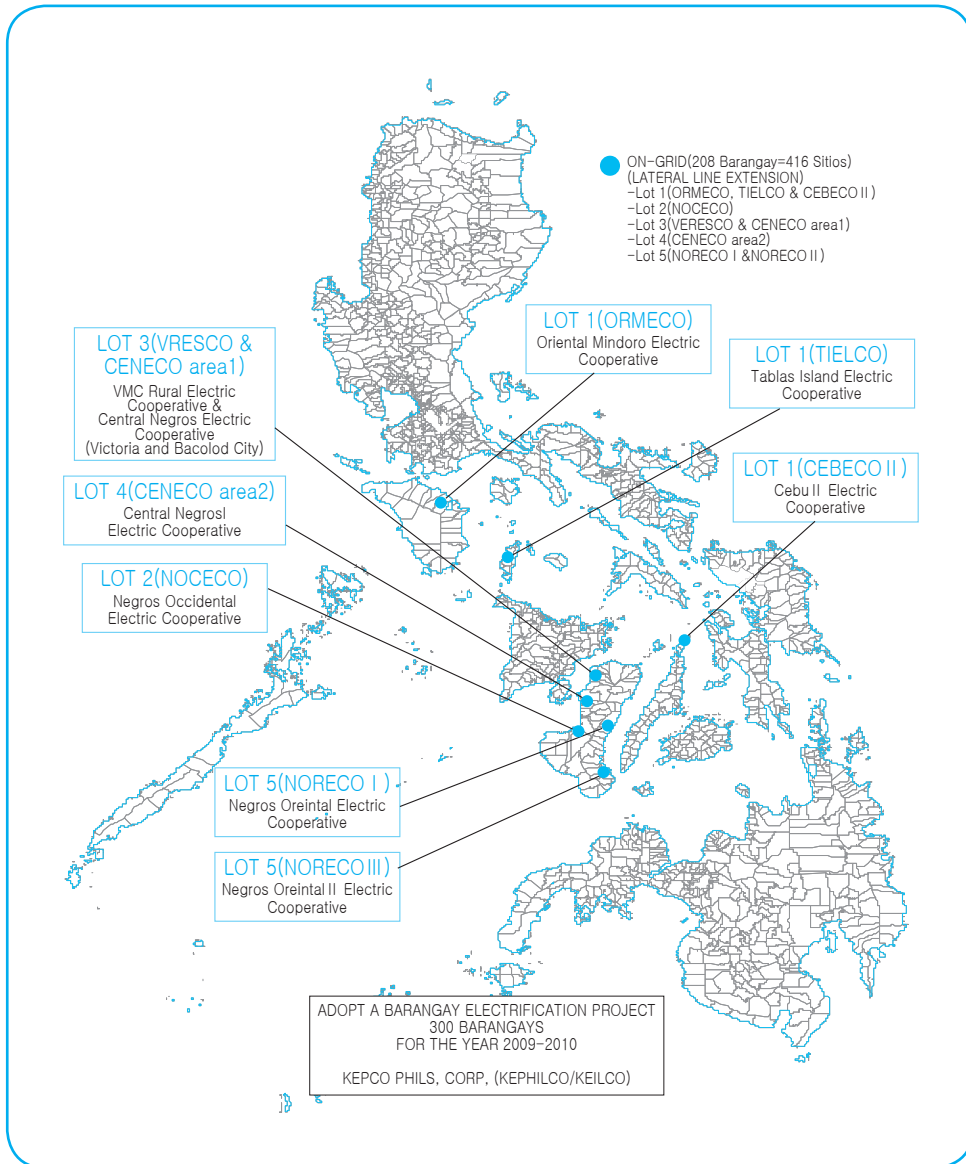
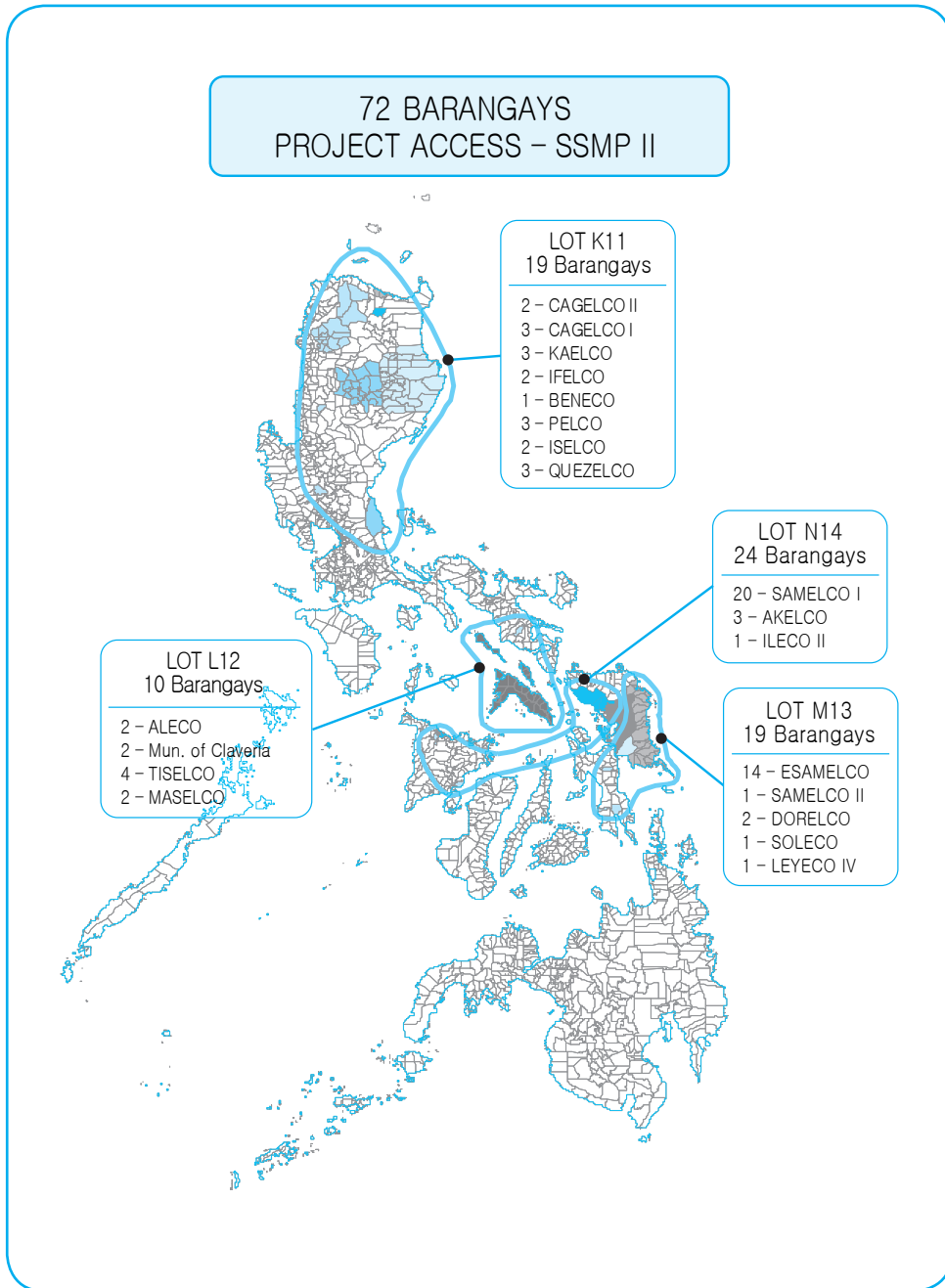


Figure 4-5 | Target Area Map of Off-Grid (72 villages) Philippines Electrification Project



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Annex 1 Rural Electrification Promotion Act

[Effectuated on May 22, 1968] [Law No. 2015. Partially amended on May 22, 1968]

Article 1 (purpose)

This Act is aimed at improving the agricultural productivity and quality of life for rural residents by promoting electrification.

Article 2 (Definitions)

In this Act, a “rural area” refers to a village with the majority of residents engaging

in agriculture, regardless of the administrative district. In this Act, “electrical facility construction” means distribution (excluding transmission and substation) and internal wiring facility construction. In this Act, “electric provider” refers to “Korea Electric Power Corporation”. In this Act, “unit construction” means electrical facility construction, recognized as collective construction by the electric provider. In Article 6 Section 2, Article 7 Section 1 and 2, and Article 10 Section 2, “leader of local government” means Seoul Mayor, Busan Mayor, and provincial governor. In Article 4 and 7, Section 3, and Article 11 Section 2, “leader of local government” means Seoul Mayor, Busan Mayor, mayor and county officer.

Article 3 (Construction Cost Payment)

The electrical facility construction funding shall be determined as the following: Distribution construction costs are covered by the electric provider’s payment (with amount approved by the commerce minister, in accordance with the Electric Business Law Article 19), combined with financial or other types of loans. Internal wiring costs shall be covered by customers.

Article 3 Part 2 (Local government’s Partial Construction Payment)

Local government can pay for part of the electrical facility construction costs.

[Added on March 3 1967]

Article 4 (Project Plan)

The head of local government should collect service application forms and create the next year’s electrification plan for unit construction; it should be submitted to the electric provider via provincial governor by the end of February. However, Seoul and Busan Mayors can directly submit the application forms to the electric provider.

The electric provider should create a rural electrification project and funding plans for the next year, based on the plan of the previous clause, and submit them to the commerce minister by the end of April.

Article 5 (Funding Measures)

The government must deliberate on the rural electrification project and financing plans of the previous clause and appropriate the amount that requires financial loans in the next year's budget. However, the loans must be included in the estimated expenditures with amounts greater than the projected kerosene tax revenues among the petroleum tax of the year.

<Amended on May 22, 1968>

In the financing plan of the previous clause, if the electric provider is not able to pay the allocated amount, the government should introduce loans in order to cover the amount that exceeds the provider's ability to pay.

Article 6 (Construction Loan)

The loans of the Article 3 Section 1 shall be offered to the electric provider. The loan debt of the previous clause is guaranteed by the head of local government. Electric customers subject to this Act have joint obligation for unit construction loan and interest payment to the electric provider. The loans must not be used for purposes other than the ones specified in this Act.

Article 7 (Notice and Funding Measures)

The commerce minister should notify the rural electrification and funding plans to the head of local governments when the budget is finalized, as set forth in Article 5 Section 1. Upon notice of the previous clause, the head of local government should notify the electric customers to collectively deposit their unit construction payments with the electric provider by February. Upon notice of the previous clause, the electric customers should collectively deposit their unit construction payments by the deadline and submit the certificate and service application form for each construction to the head of local government and electric provider.

Article 8 (Construction)

When the electric provider receives loan payments and requests for electrical facility, it must execute the construction of the year without delay, in accordance with the project plan, as set forth in the previous Article Section 3.

Article 9 (Revision of Project Plan)

If the electric provider is not able to complete the facility construction with finalized budget under Article 5 Section 1, the reason should be reported to the commerce minister. If the reason is deemed valid, the commerce minister can change the project plan and transfer the construction cost to another unit construction.

Article 10 (Funding Measures)

The commerce minister can take necessary measures and supervise the loan usage and construction status. The head of local government can order the electric provider to report on the loan usage and construction status when necessary.

Article 11 (Repayment Period)

Loans are payable with a 5-year grace period and 30 years of equal payments.

<Amended on March 3, 1967 and May 22, 1968>

The electric provider must submit the loan repayment status of each customer to the head of local government each month.

Article 12 (Payment Collection)

Loan payment shall be collected by the electric provider in the monthly electric bills. The electric provider must repay the loan 4 times a year with customers' payments and should report it to the commerce minister.

Article 13 (Application of Other Laws)

This Act shall not preclude application of the Electrical Business Law.

Attachment <No. 2015. May 22. 1968>

This Act shall become effective from the day of announcement.

● *Enactment of Rural Electrification Promotion Act*

Due to a lack of power generation and profitability issues with excessive facility cost, the rural electrification project had been delayed. However, since the 5-Year Power Resources Development Plan was expected to expand power supply, the Rural Electrification Promotion Act (Law No. 1737) was established on December 30, 1965 as legal devices to implement the Rural Electrification Project; the estimated budget was 440 million won each year, and there were three important Act amendments. The key points of the initially established law are as follows. Construction cost shall be covered by the electric provider for electrical facility construction, and the government's financial loans. The head of local government and electric provider should submit the following year's rural electrification plan to the state government by the end of February. The government loan shall be provided to the electric provider through financial institutions, and local government must guarantee the payment by obligating the customers to pay the loan as a joint debtor. Government loan repayment period is 20 years. Government loan repayment shall be managed by the electric provider by collectively levying the amount in the monthly electric bills.

● *Amendment of March 3, 1967 (Law No. 1970)*

Although this Act was established to modernize the underdeveloped rural communities, it posed excessive burden on the residents when it was enforced. As a result, the rural electrification plan was rarely implemented, even though the target areas were selected. It

led to the amendment of the Act, extending the grace and repayment periods, and reducing the burden of rural residents to achieve early electrification. The key points are as follows. Part of electrical facility construction can be funded by local government. Loan principal and interest shall be paid with a five-year grace period and 30 years of equal payments.

- *Amendment of December 31, 1984 (Law No. 3781)*

In order to effectively implement the island electrification project, the installation and operation of self-generation facility were supported. Also, the inactive customers' remaining payments were covered by the government, reducing the additional burden of active customers (The inactive customers were past customers who moved to another area or cancelled their electric services). The key points of the amendment are as follows. Installation, management and operation of self-generation facility shall be conducted, supervised by the head of local government; the construction costs shall be covered by financial loans, local government subsidies and the customers. Local government can subsidize the operation costs of self-generation facilities. KEPCO is responsible for designing, supervising and providing technical support for self-generation facility construction; also, regular maintenance and management, and operation personnel education are the responsibilities of KEPCO. It can take over self-generation facilities in regions, based on the criteria, and supply electricity. The inactive customer's remaining loan payments shall be covered by the electric provider, or local and state government.

- *Amendment of January 13, 1990 (Law No.4213)*

The aim was to provide electricity to remote and island region residents who had no or interrupted power supply through self-generation facilities with support from state and local government, and KEPCO. The key points are as follows:

Construction costs for distribution facilities of unelectrified regions and self-generation facilities shall be covered by the following: customer's payments for basic construction cost of 25,000 won, and financial loans of a million won; 50% of the remaining amounts shall be funded by the state and local government, and another 50% by KEPCO. Island regions with at least 50 households and power generation facilities shall be partially supported by KEPCO for the operation costs.

Annex 2 Foreign Examples of Rural Electrification (as of 1995)

Installing electric lights is merely the beginning stage of rural electrification. These days, it encompasses various electrical facilities, including power and cultural facilities as well as lighting. Electricity is a necessity not only in everyday life, but also in modern agricultural management.

Agricultural modernization means replacing human or animal labor with mechanical farming. For such mechanical usage, electricity is the primary source of power. Today, electricity is a comprehensive energy source, ranging from heating, lighting and environment to automated control of tasks; electricity is widely used for various purposes in developed countries around the world, including agricultural management.

This part will examine some developed countries' rural electrification, particularly in agriculture. However, extensive descriptions are not provided, due to the difficulties in collecting relevant references and data.

1. Taiwan

A. Status

The objectives of Taiwan's rural electrification project were as follows: expansion of agricultural production; rural factory construction; reduction of gap between the urban and rural regions; prevention of overpopulation in the cities; and improvement of rural quality of life.

According to a 1953 study, 1.8 million households of 2400 villages were unelectrified with only two to 10 electrified residents in a village. Electrifying such villages required distribution lines of 2 to 40 km. In order to supply power to unelectrified villages, a year-long electrification project scheme was created with funding from the Joint Commission on Rural Reconstruction in 1954 (JCRR). According to "Tai Power", a power company in Taiwan, distribution line construction accounted for 70% of the total construction costs, making it difficult for farmers to pay. So the distribution project was subsidized by the JCRR and the government, reducing the financial burden on farmers.

The 1954 scheme was estimated to cost \$ 5 million (Taiwan dollars), and the repayment plans were as follows: 30% of the cost would be covered by the Taiwanese power company, and 15% would be paid by the JCRR, and 55% by the customers; \$1.3 million (Taiwan dollars) of the 55% would be loaned to the JCRR with 6% annual interest and five years of repayment.

Therefore, customers were only responsible for 25% of the construction cost. The power company borrowed money from the JCRR and offered loans to the customers by issuing a loan certificate, equivalent to 25% of construction costs; also the repayment with interest

was mandated by the designated deadline. During the 13-year plan, from 1954 to 1966, nearly \$270 million in Taiwan dollars was allocated, and \$261 million was spent. In the countryside, a single-phase power line was installed to save construction costs, due to the low load density.

For the single-phase line, a maximum of four horsepower was allowed, but it was later adjusted to 20 horsepower. And as the areas expected to exceed the single-phase capacity, a 3-phase was designed. Since most rural electric lights and heaters were not sensitive to voltage, +5 to-10% fluctuations of rate voltage were considered to be appropriate. For the electrification project, there was a huge gap between the allocated funds and actual costs, allowing the country to prioritize the project. In 1964, the first priority was placed on areas with construction cost of \$300 or less per electric light, and in 1955, it was adjusted to \$325.

In 1961, first priority was given to customers who were near distribution facilities (not any further than 21 m), which was later gradually increased to 55 m by 1967. In 1965, only 181 villages among 6,684 were unelectrified. Electrified rural villages were divided into two categories in Taiwan: villages electrified with direct support from JCRR and the government or villages that received benefits after electrification without any direct support.

In 1966, the total load amounts were 2,397MW with rural customers' loads of 57MW, accounting for only 2.37% of the total, with an average of 328 W for each individual. The rural electrification rates were the same as urban rates; rural installation cost was high, and the average consumption was considerable.

B. Effects

Due to small farming lands and the expected population growth, Taiwan's wanted to encourage industrial development and boost agricultural productivity. Compared to 15 years of population growth at 3.4%, agricultural production increased 6.1% (3.08 % for rice production), fully meeting the demands and securing a surplus of grain for export. Such increased production was achieved by rural electrification project, which allowed mechanized irrigation, thereby improving fertilization and dispersion of insectifuge.

For the irrigation project, the power consumption for 850 wells was 12.5GWh in 1966, accounting for 10.4% of the total power sales. In addition, electricity improved the quality of life with the introduction of home appliances, such as TVs, radios, fans, irons, electric pots, refrigerators, and sanitary facilities.

2. U.S.

By 1920, electricity was provided only to urban residents for power and lighting, leaving rural residents at a disadvantage with weak electrical facilities and oil lamps. By early 1923, a committee was established for the promotion of agriculture and power supply, with members from the government, farmers' representatives and power suppliers.

By 1929, only 9.5% of American rural communities were electrified, climbing only to 10.9% in 1935, in the mist of the Great Depression. In the same year, the president Franklin D.

Roosevelt established the Rural Electrification Administration (REA) as part of the New Deal.

In May 1936, the Congress passed the Rural Electrification Act, and the REA was designated as an agency to provide rural electrification loans. Later, electrification cooperatives were independently established, receiving loans from the REA and increasingly providing power supply for unelectrified rural communities. The REA loans had very favorable conditions, with an annual interest of 2% and 35 years of repayment, which was levied in the monthly electric bills. Meanwhile, there were as many as 930 rural electrification cooperatives nationwide, with resident members who became active shareholders.

The REA provided financial benefits to rural residents and farmers, with total loans of over \$4.9 billion. In addition, the REA provided technical assistance to power companies for management accounting, electric supply business and legal issues, as well as securing loans. But the REA wasn't directly involved in the construction, administration, or management of electrical facilities. Rural electrification in the U.S progressed rapidly, reaching 98% by 1963 and providing cultural benefits. As a result, power consumption doubled every 10 years, and currently the average household is consuming 0.4MWh each month.

3. France

Initially, the power business in France was privately operated, but was later operated and supervised by the government. In any case, generation, transmission and distribution were normally managed independently by each sector; but transmission was often jointly managed with regional distribution operators.

In August 1923, the Rural Technology Committee enacted the Rural Power Supply Financial Act, providing special loans of 1.2 billion Franc to public employee cooperatives and joint cooperatives for rural electrification, supplying power to public facilities and private businesses.

In 1914, the electrification rate was only 15%, but it jumped to 44% by 1926. The electrification rate steadily increased from that point forward, allowing motorized farming with cultivators, drying of grains, and producing crops. Such electrification increased power consumption in France by 10 times from 723,000MWh in 1926 to 7,525 million MWh in 1949. One characteristic of the French system was the “Magne” electrification village of 1939; it allowed customers to use electrical equipment for one year just by paying their electric bills. After one year, the customers were allowed to install or purchase the equipment. The system led to favorable outcomes, and rapidly expanded the rural power consumption in France.

4. U.K.

In the U.K, rural power supply rapidly increased for 10 years following World War II. The importance of rural electrification had been recognized since 1930, and the U.K. enjoys almost complete rural electrification today. It was achieved by the central Electrification Promotion Department, and local power agency.

The central Electrification Promotion Department provided technical assistance for local power agencies, where farmers' representatives participated and strived to increase rural power supply.

In addition, the British Electrification Promotion Committee, a private organization, conducted a protocol education in cooperation with local power agencies, as well as research into agriculture and horticulture, with a number of branch offices in rural areas. For British farms, electricity was used for a wide variety of purposes, such as power, milking, refrigeration, egg production, storing and drying crops, rearing poultry, vegetable horticulture and agricultural processing.

5. Denmark

By 1880, Denmark's major export was grain, but an agricultural reform movement created by young people with good knowledge of agriculture shifted the focus to dairy production. Currently, Denmark exports butter, eggs, bacon and cheese as a world-renowned dairy country. Denmark's rural electrification was implemented around 1910, and currently 245 small power plants with 390 electrification centers are located in rural areas. Also, power generation and transmission is operated by a special power company established through a cooperative organization, and individual power plants are jointly owned by central power plants.

In terms of rural electrification, farmland owners' electric motor penetration was 30.4% in 1932, and 37.1% in 1936. But it skyrocketed to 70% in 1950. For the dairy sector, all farms of more than 10 hectares utilize motorized milking, and the machine penetration rate was at 2% in 1936, 15% in 1944, and 75% in 1955, with complete motorization of all farms. In addition, electricity is widely used for all agricultural tasks, including heating milk for pasteurization and egg production.

6. Rural Electrification in ECAFE Regions

The following is a summary of the Rural Electrification Project Evaluation in ECAFE Regions, as reported to the 12th ECAFE Energy and Power Division Meeting in Bangkok, Thailand. ECAFE stands for Economic Commission for Asia and the Far East, an international alliance agency.

6.1 Electrification Status

Although rural electrification is almost complete in countries such as Japan, Australia, New Zealand and Singapore, it still has some ways to go in most other countries. Rural electrification project is innately a long-term project that takes approximately 20 to 30 years to complete, as Japan and Australia have demonstrated. Rural electrification in developing countries not only allows a more comfortable life, it also boosts agricultural production and gainful employment. Rural electrification project is more complex in developing countries than in developed countries, calling for policy measures aimed at project implementation and goal achievement.

For example, the Philippines, India and Thailand have statutory organizations in charge of rural electrification, and cooperatives that serve their interests to actively implement their projects. The technical sectors are fully managed by state institutions, but project implementation and management progress differently, depending on the farmers' capabilities and educational levels.

Due to limited funding, developing countries has had limited government support. In order to fund the projects, occasional support from international financial institutions and developed countries were also required. Rural electrification is an integral part of economic growth in developing countries, and therefore needs to be promoted with high priority to promote overall national development.

6.2 Rural Electrification Implementation Methods

The following are the implementation methods for rural electrification in developing countries. Statutory organizations need to be established as a key driving force for rural electrification. Since the major obstacle in implementing the project is a lack of financial resources, the government should pay special attention to financial issues.

In the early stages of project, rural electrification is not economical, looking strictly at the correlation between the investment and returns. However, such projects generate indirect benefits such as high agricultural and industrial productivity and improvements in social welfare, along with indirect effects gained from power supply. That explains why government measures, such as subsidies and long-term, low interest loans are justified. In most cases, support from financial institutions and banks with enticing loans will be a requirement for rural electrification.

In addition, cash, materials and labor contributions from residents were also crucial factors. Administrative, managerial and distribution functions for power supply have to be supported, and management skills from technical staff need to be improved. Training facilities for technical and administrative personnel also have to be expanded. For design and materials, standard specifications should be used, in accordance with the International Eletrotechnical Association standard. Also, management and conservation-related rules should be put in place, based on the current standards. Power consumption promotion activities are needed, such as sales promotion services for rural residents, technical advisory services, and repair and maintenance services.

In the early stages of rural electrification project, the losses have to be covered by government grants and subsidies. In order to fund a rural electrification project, local financial institutions and banks must be ready to provide loans with favorable terms, and credit institutions have to be ready to evaluate rural customers. Assistance from international financial institutions and developed countries are also necessary. Rural electrification institutions have to establish 10- to 15-year national plans with technical, economic, and financial feasibility studies.

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