

The Study
for
Development
of
the Rural Electrification Master Plan
in
Zambia

Final Report
Appendices

January 2008

Japan International Cooperation Agency
(JICA)

**The Study
for
Development
of
the Rural Electrification Master Plan
in
Zambia**

**Final Report
Appendices**

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Appendix A

Scope of Work

**for the Study for Development
of the Rural Electrification Master Plan
in Zambia**

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SCOPE OF WORK
FOR
THE STUDY FOR
DEVELOPMENT OF THE RURAL ELECTRIFICATION MASTER PLAN
IN ZAMBIA

AGREED UPON BETWEEN
MINISTRY OF ENERGY AND WATER DEVELOPMENT
AND
JAPAN INTERNATIONAL COOPERATION AGENCY

LUSAKA, 2nd Mar., 2006



Mr. Adam Hussen
Acting Permanent Secretary
Ministry of Energy and Water
Development



Mr. Eiji Inui
Resident Representative,
Zambia Office
Japan International Cooperation
Agency



Mrs. Petronela Mwaangala
Permanent Secretary-
(Budget and Economic Affairs)
Ministry of Finance and
National Planning

1. INTRODUCTION

In response to the request of the Government of Republic of Zambia (hereinafter referred to as "the Government of Zambia"), the Government of Japan decided to conduct the Study for Development of the Rural Electrification Master Plan in Zambia (hereinafter referred to as "the Study").

Accordingly, the Japan International Cooperation Agency (hereinafter referred to as "JICA"), the official agency responsible for the implementation of the technical cooperation programmes of the Government of Japan, will undertake the Study in close cooperation to the authorities concerned of the Government of Zambia.

The present document sets forth the Scope of Work with regard to the Study.

2. OBJECTIVE OF THE STUDY

The Study aims at preparing the Rural Electrification Master Plan that shall be practical and comprehensive.

3. STUDY AREA

The Study will cover un-electrified rural areas throughout the country including district centers supplied with power by diesel plants.

4. SCOPE OF THE STUDY

4.1 Data Collection and Investigation

(1) Data Collection

-Collect the necessary data such as District Development Plan, village data including population density, ZESCO data, public facilities, environmental data including legal framework from relevant organizations.

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(2) Rural Investigation

-Investigate the social and economic situation in some un-electrified rural areas to identify affordability for electricity; and

-Investigate power demand and social impacts after electrification in some electrified areas.

(3) Renewable Energy Study

-Collect the necessary data such as hydrological data, topographical data from relevant organizations;

-Clarify the potential sites for mini-grid electrification using mini/micro hydro power;

-Clarify the potential sites for mini-grid electrification using other renewable energy at desk study level; and

-Carry out some site survey for some potential sites of mini/micro hydro power with counterpart personnel.

4.2 Decentralized Process for Target Site Selection

In order to select the target sites for electrification, decentralized process will be taken as follows:

-Hold an initial workshop at Lusaka inviting representatives from nine (9) provinces to share the knowledge of rural electrification technologies, and discuss and agree on the criteria for initial target site selection;

-Hold workshops at nine (9) provincial centers inviting district representatives to identify initial target sites and collect corresponding data and information; and

-Hold a workshop at Lusaka inviting representatives from 9 (nine) provinces to present the interim report and the selected target sites.

4.3 Preparation of Optimal Plan

(1) Integration of GIS Map

-Prepare database containing necessary data for rural electrification; and

-Integrate the database into GIS map including social facilities that will be necessary to prepare the long-term

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rural electrification plan.

(2) Consolidation of Target Sites

- Consolidate the target sites considering social facilities such as schools and rural health centers, and economic activities at initial target sites.

(3) Demand Forecast

-Forecast power demand for respective target sites.

(4) Cost Estimate for Alternative Electrification Methods

-Study the existing conditions of transmission lines, sub-stations and distribution lines for grid extension, and prepare basic design;

- Prepare basic design of mini-grid for other selected sites; and

-Estimate the cost of alternative electrification methods for respective target sites.

(5) Least cost Analysis

- Based on the power demand forecast and cost estimate, carry out least cost analysis to select electrification method for respective target sites.

(6) Criteria Setting

-Establish the criteria for electrification method and prioritization of target sites, considering not only economic aspects but also environmental and social aspects.

(7) Preparation of Long-term Rural Electrification Plan

-Based on the criteria for electrification method, decide electrification method for respective target sites, either by extension of distribution lines, construction of mini-grid, or installation of Photovoltaic (hereinafter referred to as "PV") systems;

-Based on the criteria for prioritization of target sites, prioritize these target sites;

-Prepare dissemination program for Solar Home System, Battery Charging Station and Community Solar System for PV target sites;

-Prepare the long-term rural electrification plan for twenty years; and

-Prepare the financial plan clarifying how to utilize

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Rural Electrification Fund and other financial resources, based on the long-term rural electrification plan.

(8) Case Study

-Choose four (4) target sites with different characteristics for grid extension and one (1) site for mini-grid powered by mini/micro hydro with higher priority;

-Carry out site survey of pre-feasibility study level at these sites with counterpart personnel; and

-Assess the survey result with the provisional parameters used to prepare the long-term electrification plan, and feed back the assessment result to the long-term plan for optimization.

(9) Technology Transfer

-Transfer the technology to Ministry of Energy and Water Development (hereinafter referred to as "MEWD") and Rural Electrification Authority (hereinafter referred to as "REA") for updating the long-term rural electrification plan based on GIS; and

- Transfer technology to MEWD and REA for planning and implementing electrification projects through site survey.

4.4 Policy Analysis and Recommendation

(1) Planning and Implementation Procedure

-Review the present rural electrification planning and implementation procedure, and analyze the institutional arrangement and their capacity;

-Examine planning and implementation procedure, and institutional arrangement and their capacity, based on the practical experience obtained in the case study;

-Recommend alternative procedure including the management of Rural Electrification Fund, and the participation of local governments and private sector; and

-Clarify the roles and necessary capacity of MEWD and REA for planning, implementing and monitoring rural electrification projects under the alternative procedure.

(2) Business Models

-Analyze investment and recurrent costs, and tariff for

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different rural electrification projects;

-Prepare business models including private sector participation and subsidy schemes; and

-Recommend policy alternatives for promoting such business models.

(3) Promotion Policy

-Assess the present power tariff based on the willingness to pay investigation, the business models and other relevant factors;

-Recommend alternative tariff policy for promoting rural electrification;

-Analyze the present practices such as capital contribution and initial payment for connecting electricity through the rural investigation;

-Identify impediments to the increase of electrification rate; and

-Recommend alternative policy for increasing electrification rate.

(4) Implementation Program

-Prepare implementation program for the long-term rural electrification plan including the financial schemes and strategy, the promotion policy, the business models, and the capacity development for MEWD, REA, and other relevant organizations and stakeholders.

(5) Environmental and Social Considerations

-Based on the rural investigation and analysis, identify environmental and social impacts envisaged by rural electrification;

-Recommend mitigation measure for adverse impacts; and

-Recommend strategy for enhancing favorable impacts.

4.5 Preparation of Rural Electrification Master Plan

-Integrate the long-term rural electrification plan, the financial plan and strategy, the policy recommendation, and the implementation program into Rural Electrification Master Plan.

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5. STUDY SCHEDULE

The Study will be conducted in accordance with Tentative Time Schedule as shown in Appendix I attached herewith.

6. REPORTS

JICA shall prepare and submit the following reports in English to the Government of Zambia:

- (1) Inception Report (20 copies)
- (2) Progress Report (20 copies)
- (2) Interim Report (20 copies)
- (3) Draft Final Report (20 copies)
- (4) Final Report (20 hard copies and a soft copy)

7. DIVISION OF TECHNICAL UNDERTAKING

The division of technical undertakings by JICA and the Government of Zambia is detailed in Appendix II attached herewith.

8. UNDERTAKING OF GOVERNMENT OF ZAMBIA

(1) To facilitate smooth conduct of the Study, the Government of Zambia shall take necessary measures:

a) to permit the members of JICA study team to enter, leave and sojourn in Zambia for the duration of their assignment therein, and exempt them from foreign registration requirements and consular fees.

b) to exempt the members of JICA study team from taxes, duties, fees and other charges on equipment, machinery and other materials brought into Zambia for the implementation of the Study.

c) to exempt the members of JICA study team from income tax and charges of any kind imposed on or in connection with any emoluments or allowances paid to the members of JICA study team

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for their services in connection with the implementation of the Study.

d) to provide necessary facilities to JICA study team for remittance as well as utilization of the funds introduced into Zambia from Japan in connection with the implementation of the Study.

(2) The Government of Zambia shall bear claims, if any arises, against the members of JICA Study Team resulting from, occurring in the course of, or otherwise connected with the discharge of their duties in the implementation of the Study, except when such claims arise from gross negligence or willful misconduct on the part of the members of JICA study team.

(3) MEWD and REA shall act as a counterpart agency to JICA study team and also as coordinating body in relation to other governmental and non-governmental organizations concerned for the smooth implementation of the Study.

(4) MEWD and REA shall, at its expense, provide JICA study team with the following in cooperation with other organizations concerned:

- a) Security-related information on as well as measure to ensure the safety of JICA study team;
- b) Information on as well as support in obtaining medical services;
- c) Available data and information related to the Study;
- d) Counterpart personnel;
- e) Suitable office space with necessary equipment; and
- f) Credentials or identification cards

9. UNDERTAKING OF JICA

For the implementation of the Study, JICA shall take the following measures:

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- (1) to dispatch, at its own expense, study team to Zambia.
- (2) to pursue technology transfer to the Zambian counterpart personnel in the course of the Study.

10. OTHERS

JICA, MEWD and REA shall consult with each other in respect of any matter that may arise from or in connection with the Study.

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The Study for Development of the Rural Electrification Master Plan in Zambia
Tentative Schedule

APPENDIX I

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
Data Collection and Investigation																		
Data Collection	■	■																
Rural Investigation	■	■	■	■	■													
Renewable Energy Study	■	■	■	■	■													
Decentralized Process for Initial Target Sites Selection																		
Preparation of Optimal Plan																		
Integration of GIS Map	■	■																
Consolidation of Target Sites																		
Demand forecast																		
Cost Estimate for Alternative Electrification Methods																		
Least cost Analysis																		
Criteria Setting																		
Preparation of Long-term Rural Electrification Plan																		
Case Study																		
Technology Transfer																		
Policy Analysis and Recommendation																		
Planning and Implementation Procedure																		
Business Models																		
Promotion Policy																		
Implementation Program																		
Environmental and Social Considerations																		
Preparation of Rural Electrification Master Plan																		
Reports																		
Workshop																		
Seminar																		

Legend :
 □ Work in Japan
 ■ Work in Zambia

Reports:
 IC/R : Inception Report
 Pr/R : Progress Report
 It/R : Interim Report
 Df/R : Draft Final Report
 F/R : Final Report

1st Seminar
 Initial Workshop
 Workshop
 Pr/R
 2nd Seminar
 Workshop
 It/R
 3rd Seminar
 Df/R
 F/R

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The Study for Development of the Rural Electrification Master Plan in Zambia
 Division of Technical Undertaking

	Undertaking of JICA	Undertaking of DOE	Undertaking of REA
Data Collection and Investigation			
Data Collection	Review	Coordinate and discuss	Collect data
Rural Investigation	Study	Coordinate and discuss	Study
Renewable Energy Study	Study	Coordinate and discuss	Study
Decentralized Process for Initial Target Sites Selection			
Preparation of Optimal Plan			
Integration of GIS Map	Study	Discuss	Study
Consolidation of Target Sites	Study	Discuss	Study
Demand forecast	Study	Discuss	Study
Cost Estimate for Alternative Electrification Methods	Study	Discuss	Study
Least cost Analysis	Study	Discuss	Study
Criteria Setting	Study	Discuss	Study
Preparation of Long-term Rural Electrification Plan	Study	Discuss	Study
Case Study	Study	Discuss	Study
Policy Analysis and Recommendation			
Planning and Implementation Procedure	Study	Discuss	Discuss
Business Models	Study	Discuss	Discuss
Promotion Policy	Study	Discuss	Discuss
Implementation Program	Study	Discuss	Discuss
Environmental and Social Considerations	Study	Discuss	Discuss
Preparation of Rural Electrification Master Plan			
	Study	Discuss	Discuss

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Appendix B

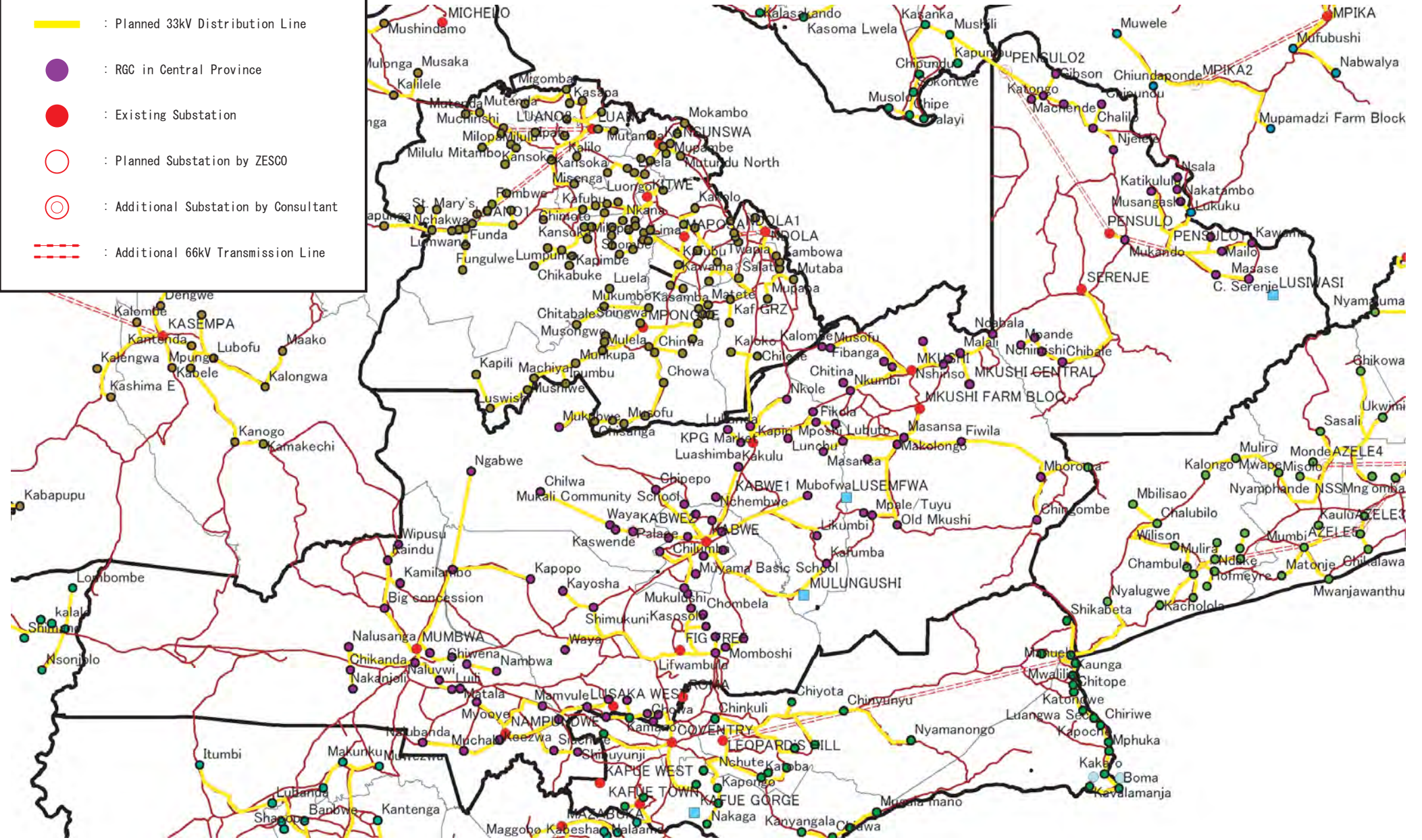
Map of Distribution System



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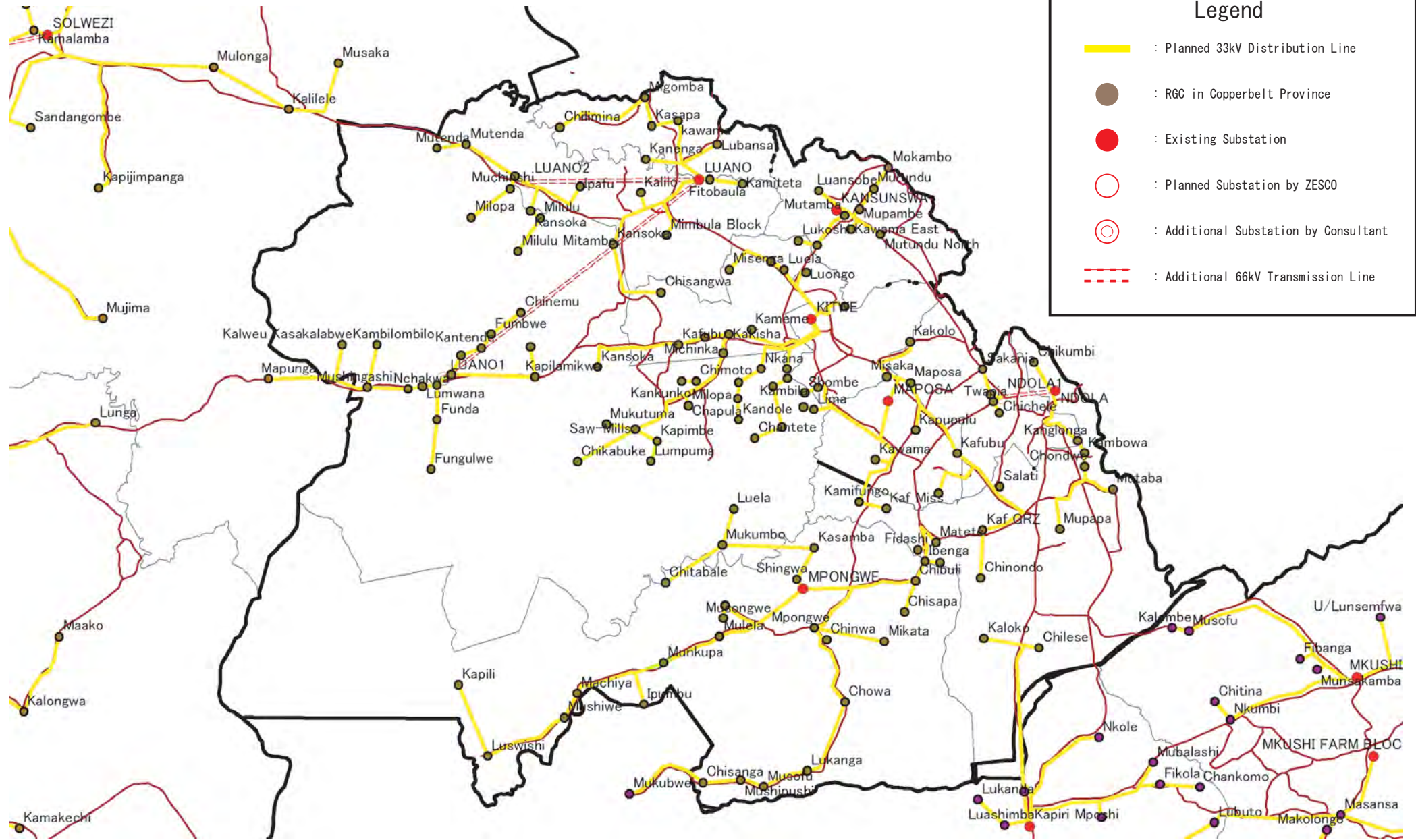
Distribution System by Province

Legend

-  : Planned 33kV Distribution Line
-  : RGC in Central Province
-  : Existing Substation
-  : Planned Substation by ZESCO
-  : Additional Substation by Consultant
-  : Additional 66kV Transmission Line





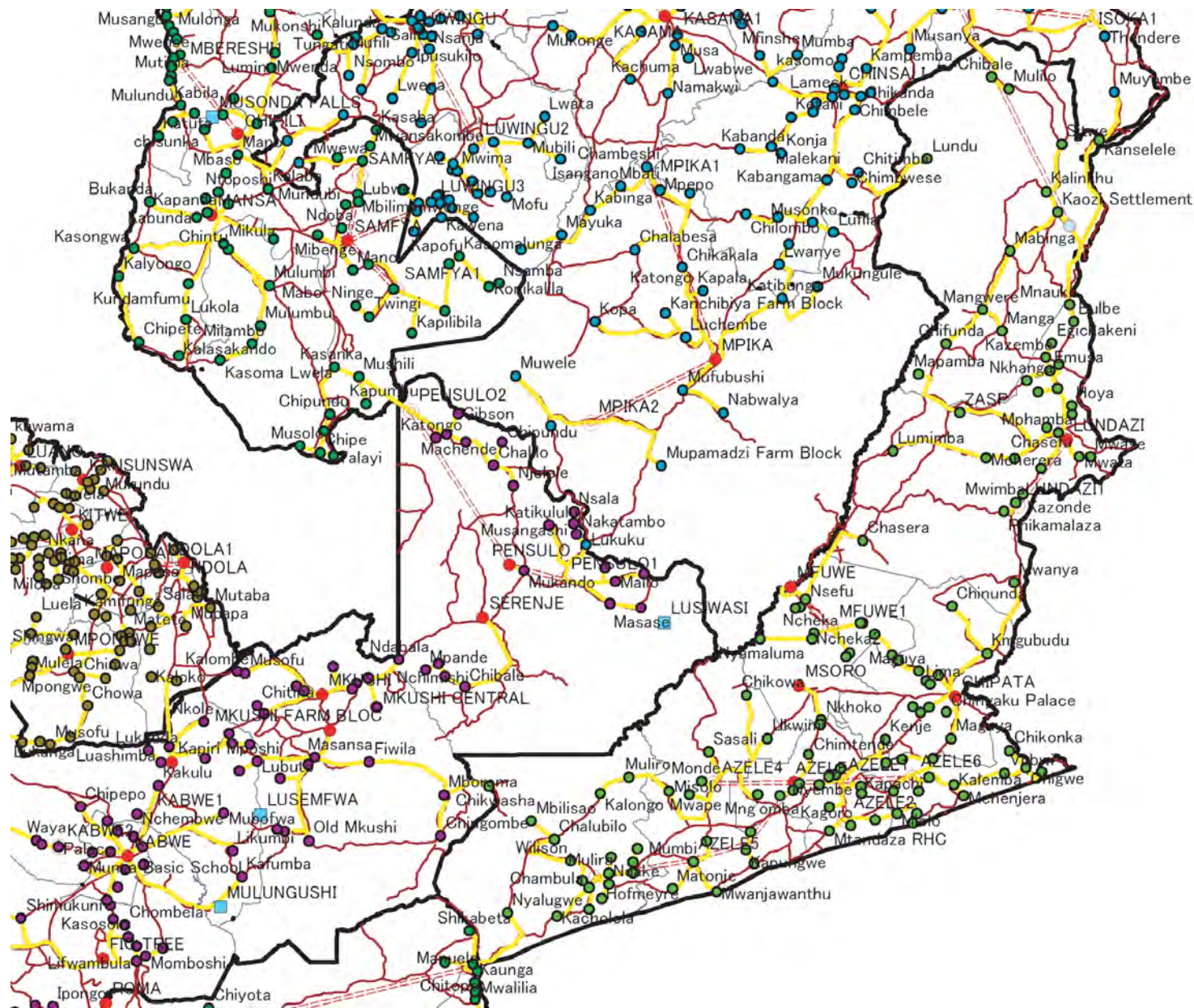
 ZESCO	The Study for Development of the Rural Electrification Master Plan in Zambia	Drawing No.
	 Tokyo Electric Power Company	Title DL System in Central Province



Legend

- : Planned 33kV Distribution Line
- : RGC in Copperbelt Province
- : Existing Substation
- : Planned Substation by ZESCO
- : Additional Substation by Consultant
- : Additional 66kV Transmission Line

 ZESCO	The Study for Development of the Rural Electrification Master Plan in Zambia	Drawing No.
	 Tokyo Electric Power Company	Title DL System in Copperbelt Province



Legend

- : Planned 33kV Distribution Line
- : RGC in Eastern Province
- : Existing Substation
- : Planned Substation by ZESCO
- : Additional Substation by Consultant
- : Additional 66kV Transmission Line



The Study for Development of
the Rural Electrification Master Plan in Zambia




Tokyo Electric Power Company

Drawing No.

Title


DL System in Eastern Province

Legend

 : Planned 33kV Distribution Line

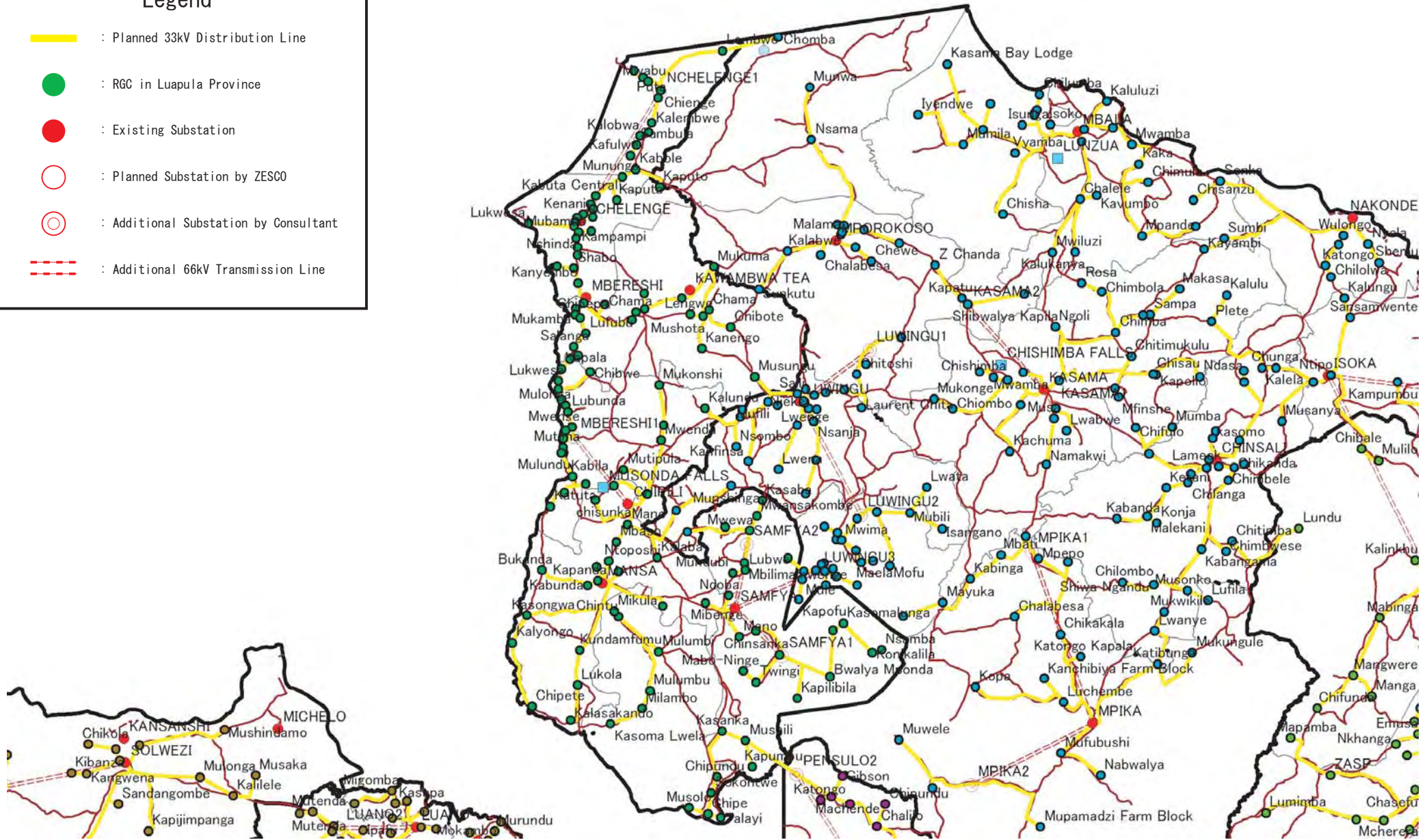
 : RGC in Luapula Province



 : Existing Substation

 : Planned Substation by ZESCO







 : Additional Substation by Consultant

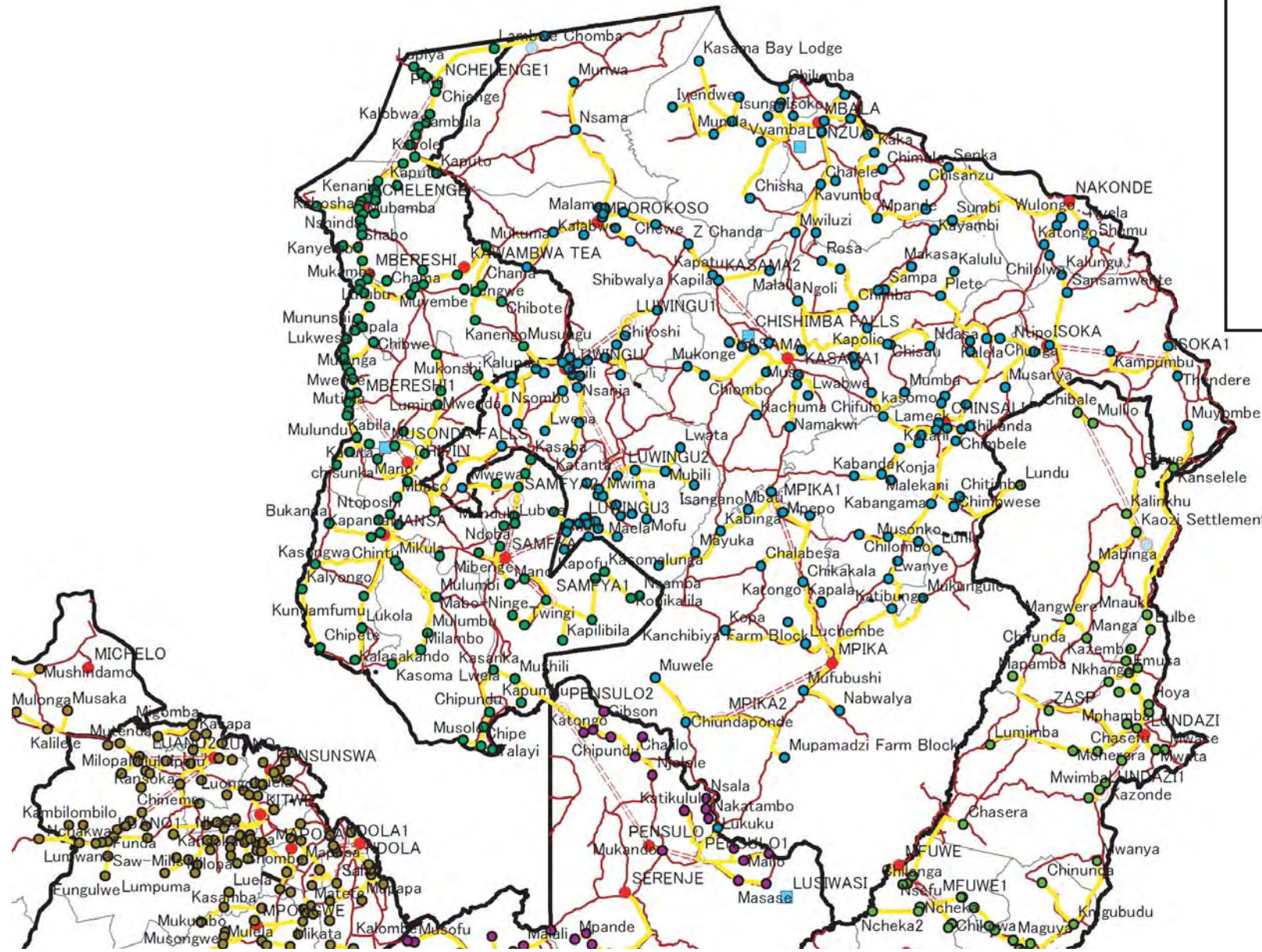
 : Additional 66kV Transmission Line





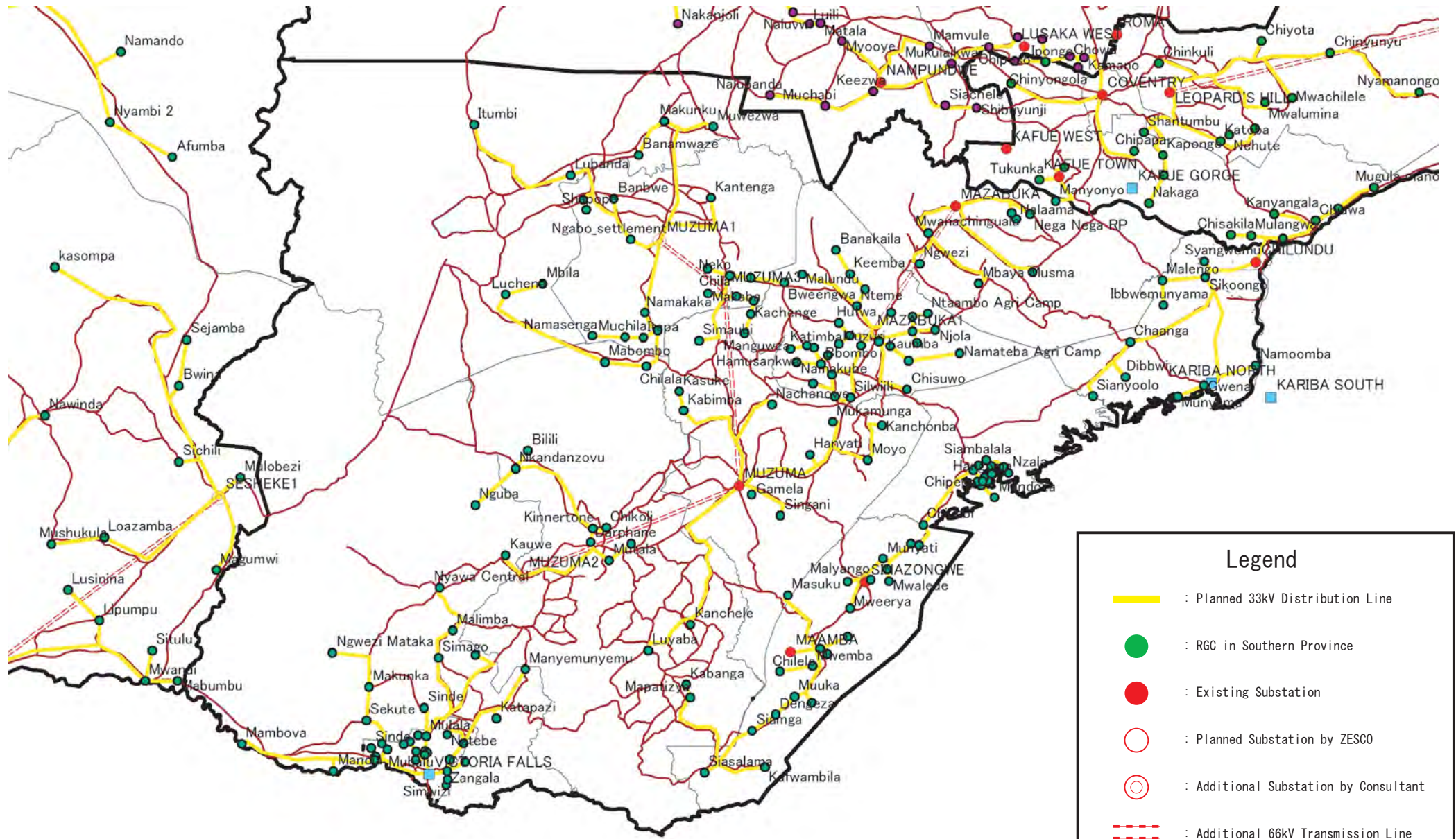
 ZESCO	The Study for Development of the Rural Electrification Master Plan in Zambia	Drawing No.
	 Tokyo Electric Power Company	Title DL System in Luapula Province

Legend

-  : Planned 33kV Distribution Line
-  : RGC in Northern Province
-  : Existing Substation
-  : Planned Substation by ZESCO
-  : Additional Substation by Consultant
-  : Additional 66kV Transmission Line

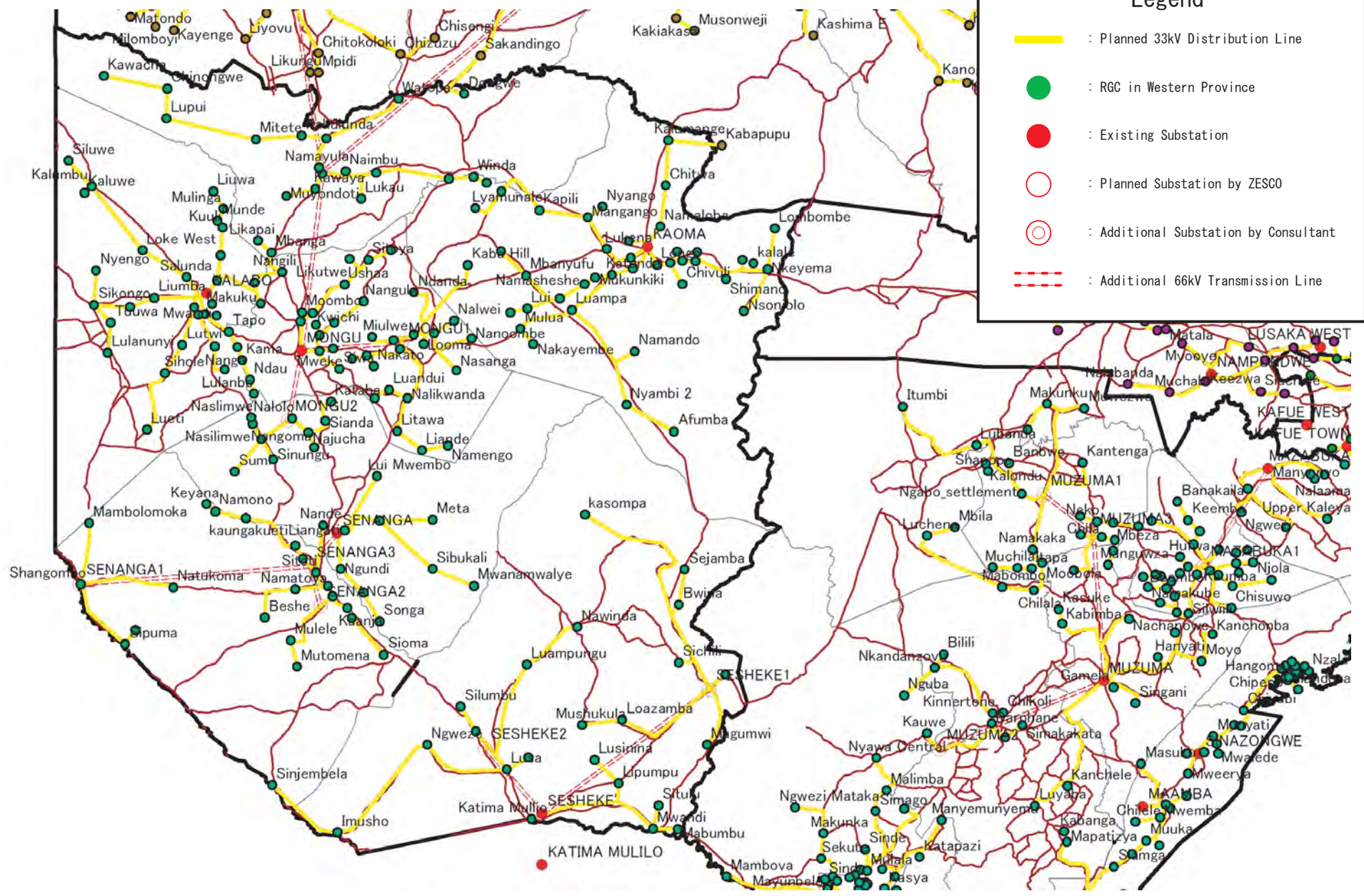


 ZESCO	The Study for Development of the Rural Electrification Master Plan in Zambia	Drawing No.
	 Tokyo Electric Power Company	Title DL System in Northern Province



Legend

- : Planned 33kV Distribution Line
- : RGC in Southern Province
- : Existing Substation
- : Planned Substation by ZESCO
- : Additional Substation by Consultant
- : Additional 66kV Transmission Line



Legend

- : Planned 33kV Distribution Line
- : RGC in Western Province
- : Existing Substation
- : Planned Substation by ZESCO
- : Additional Substation by Consultant
- : Additional 66kV Transmission Line

 ZESCO	The Study for Development of the Rural Electrification Master Plan in Zambia	Drawing No.
	 Tokyo Electric Power Company	Title DL System in Western Province