No.

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

Final Report Summary Report

January 2008

Japan International Cooperation Agency
(JICA)

E D
J R
08-004

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

Final Report
Summary Report

Table of Contents

Acronyms

ACSR	Aluminium Conductor Steel Reinforced
AfDB	African Development Bank
CA	Catchment Area
CBR	Crude Birth Rate
CEC	Copperbelt Energy Corporation
CHESCO	Chipata Energy Service Company
CSAA	Client Service Accounts Assistants
CSO	Central Statistics Office
DDACC	Direct Debit and Credit Clearing
DoE	Department of Energy
DWA	Department of Water Affairs
ECZ	Environmental Council of Zambia
EIA	Environmental Impact Assessment
EIRR	Economic Internal Rate of Margin
EIS	Environmental Impact Statement
EPB	Environmental Project Brief
EPPCA	Environmental Protection and Pollution Control Act
ERB	Energy Regulation Board
ESCO	Energy Service Company
ESU	Environment and Social Affairs Unit of ZESCO
FIRR	Financial Internal Rate of Return
FNDP	The Fifth National Development Plan
FY	Fiscal Year
GEF	Global Environmental Facility
GIS	Geographical Information System
GNI	Gross National Income
GRZ	Government of the Republic of Zambia
IEE	Initial Environmental Examination
IMR	Infant Mortality Rate
IPP	Independent Power Producer
JBIC	Japan Bank for International Corporation
JICA	Japan International Corporation Agency
K	(Zambia) Kwacha
KG-PS	Kafue Gorge Power Station
KNB-PS	Kariba North Bank Power Station
KPLC	Kenya Power & Lighting Company
KSh	Kenya Shilling
kW, MW	kilowatt, megawatt
kWh, MWh, GWh	kilowatthour, megawatthour, gigawatthour
LDC	Least Developed Countries
LEB	Life Expectancy at Birth

LESCO	Lundazi Energy Service Company
Mc-HP	Micro-hydropower plant
MEWD	Ministry of Energy and Water Development
MFNP	Ministry of Finance and National Planning
MTENR	Ministry of Tourism, Environment and Natural Resources
NEP	National Energy Policy
NESCO	Nyimba Energy Service Company
NRSE	New and Renewable Source of Energy
PRP	Power Rehabilitation Project
REA	Rural Electrification Authority
REF	Rural Electrification Fund
REMP	Rural Electrification Master Plan
REP	Rural Electrification Programme
RGC	Rural Growth Centre
ROA	Return on Assets
SAPP	Southern African Power Pool
SEA	Strategic Environmental Assessment
TEPCO	Tokyo Electric Power Company, Inc.
TFR	Total Fertility Rate
Tr	Transformer
UNIDO	United Nations Industrial Development Organization
UTM	Universal Transverse Mercator
VF-PS	Victoria Falls Power Station
WB	World Bank
ZAMSIF	Zambia Social Investment Fund
ZCCM	Zambia Consolidated Copper Mines
ZESCO	Zambia Electricity Supply Corporation (Currently “ZESCO Ltd.” is the company’s official name)
ZMD	Zambia Meteorological Department

1. Background

Rural electrification has long been identified as a vehicle to eradicate poverty by stimulating the rural economy in the Republic of Zambia. In 1994, the Government of the Republic of Zambia (GRZ) established the Rural Electrification Fund (REF) by committing the sales tax on electricity, and has been trying to increase the electrification rate in rural area by executing projects funded by REF. The household electrification rate, however, still remains at approximately 20% countrywide, and only 2 –3% in rural area. As a mid-term target, achieving 35% of household electrification rate (50% in urban area and 15% in rural area) by 2010 was set in the Poverty Reduction Strategy Paper published in 2002. For aiming to achieve this goal, GRZ has been strengthening policies and institutions related to rural electrification. In December 2003, the Rural Electrification Act was enacted to establish Rural Electrification Authority (REA) and to improve the management of REF.

In order to enhance rural electrification efficiently, preparation of the Rural Electrification Master Plan in Zambia (REMP) was considered as an urgent issue, and GRZ requested the Government of Japan to assist the development of Master Plan in 2004. Accordingly, Japan International Cooperation Agency (JICA), an official agency responsible for the implementation of the technical cooperation program on behalf of the Government of Japan, sent a study team to Zambia for project formulation in September 2005, followed by the preliminary study team in January 2006. The study team held discussion with GRZ on the Scope of Work of the Master Plan Study, and execution of the study was approved.

JICA selected the Tokyo Electric Power Company, Inc. (TEPCO) as consultant to execute this Master Plan Study. The Study Team of TEPCO commenced the study in May 2006, and accomplished the study in January 2008.

2 Principles and Purpose of Master Plan Development

To execute rural electrification projects in Zambia, a systematic implementation plan that indicates electrification targets, electrification order, electrification method, time schedule, and required budget was necessary. Therefore, a systematic implementation plan was developed as the REMP targeting 2030 along the following principles:

- Develop logical, objective, numerical/quantitative, and convincing Master Plan
- Adopt decentralized planning process
- Provide realistic financial plan to be implemented

The objective of the REMP Development was to formulate the Master Plan for rural electrification in Zambia up to the year 2030 and to bring about technology transfer to counterparts so that they could continue updating and implementing the Master plan by themselves.

The Master Plan consisted of the following items:

1) Rural Electrification Plan up to 2030
   (a) Development of selection criteria for rural electrification projects
   (b) Selection of candidate site for rural electrification considering socio-economic and technical aspects
   (c) Selection of electrification methods
      - Extension of existing grid
      - Isolated mini-grid with renewable energy, such as mini- and micro-hydro power generation
      - Solar home system (SHS)
      - Mini-grid with diesel power generation, if none of the above is feasible
   (d) Case study executions

2) Financial Plan for Rural Electrification
   (a) Study on financing strategy
   (b) Cost estimation of implementing the Master Plan at each phase
   (c) Evaluation of the validity of rural electrification projects (EIRR / FIRR)
3) Policy Recommendations for Acceleration and Dissemination of Rural Electrification
   (a) Organization structure for promoting rural electrification
   (b) Operational management of Rural Electrification Fund
   (c) Framework of promoting the participation of private sector (IPP and ESCO)
   (d) Affordable initial connection fee and sustainable electricity tariff
   (e) Policy on curbing the negative impact of electrification on society and environment
4) Development of Comprehensive Rural Electrification Program
   (a) Implementation procedure of long-term rural electrification plan
   (b) Prioritisation of execution plans
   (c) Consensus-oriented rural electrification plan with donors; ex. Japanese Bank for International Cooperation (JBIC), African Development Bank (AfDB) and World Bank (WB)

3 Master Plan Development Process

The development flow of the REMP is shown in Figure 1.

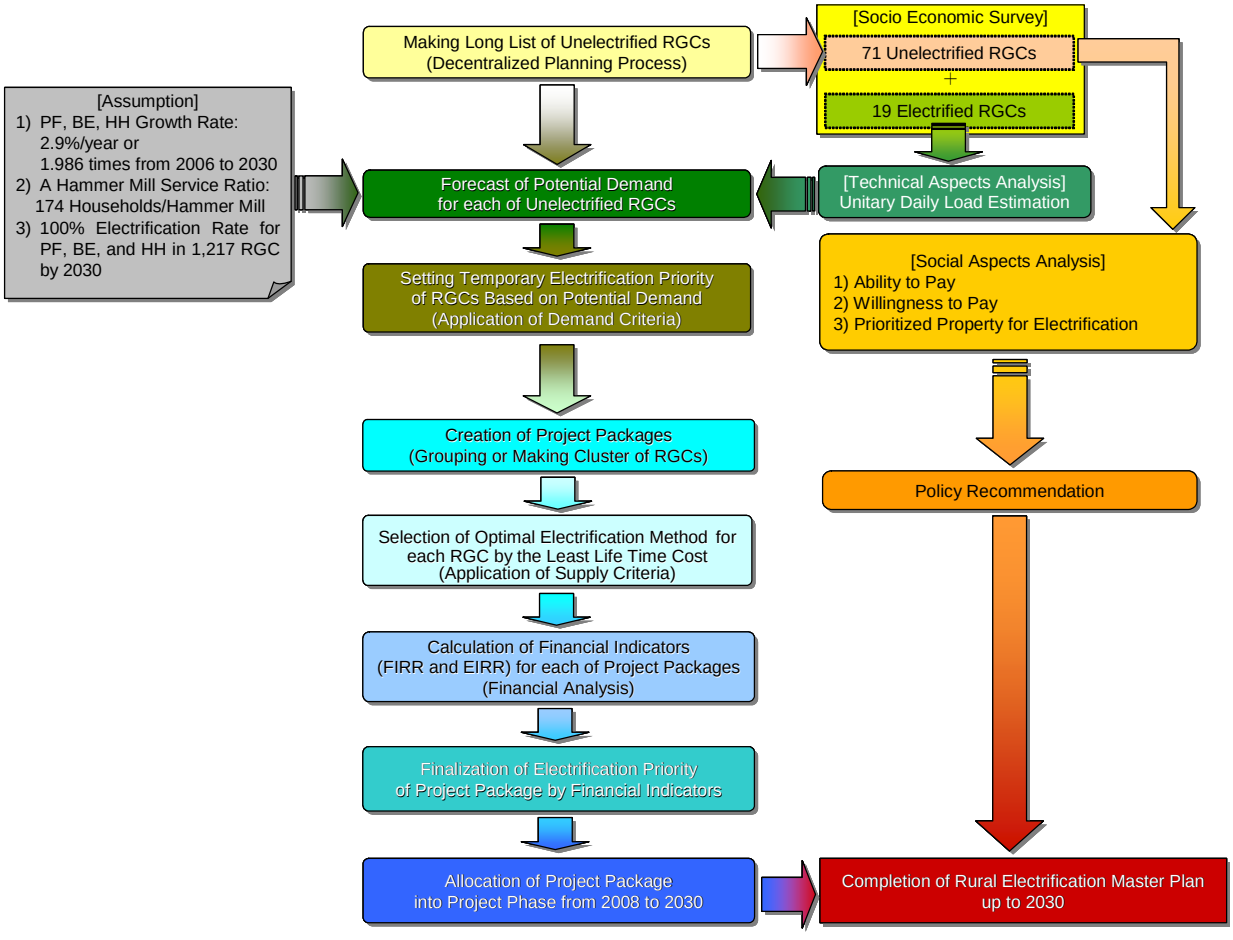

Figure 1 Flowchart of Rural Electrification Master Plan Development

In the REMP, Rural Growth Center (RGC), a rural locality with a high concentration of residential settlements and the centre of rural economic activities, was selected as the electrification target (refer to Figure 2 regarding the concept of RGC). In the process of "Technical Aspect Analysis", the "Decentralized Planning Process" was adopted to identify 1,217 RGCs in rural areas as the electrification target. Next, "Demand Criteria (or potential daily maximum demand in each RGC)" and "Supply Criteria (or the "Unit Life Time Cost in Net Present Value")" were used to cluster (or group) 1,217 RGCs into 180 Project Packages (refer to Figure 3 regarding the concept of Project Package), and to select the optimal electrification mode (among transmission/distribution extension, SHS, mini-hydro, and diesel generator) for each of the 1,217 RGCs. Then, based on the estimated cost for each Project Package, the final electrification priority of 1,217 RGCs in 180 Project Packages was determined by Financial Indicator (FIRR). Finally, these 180 Project Packages were grouped into 22 Annual Project Phases up to 2030, by the uniform annual project cost.

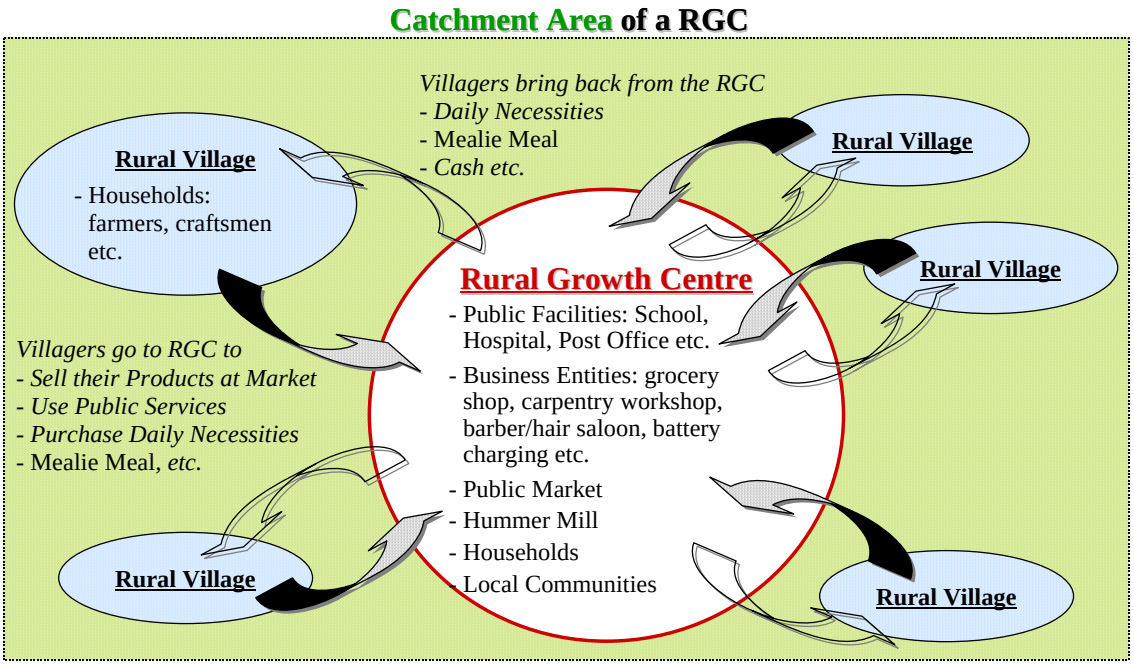

Figure 2 Concept of Rural Growth Centre

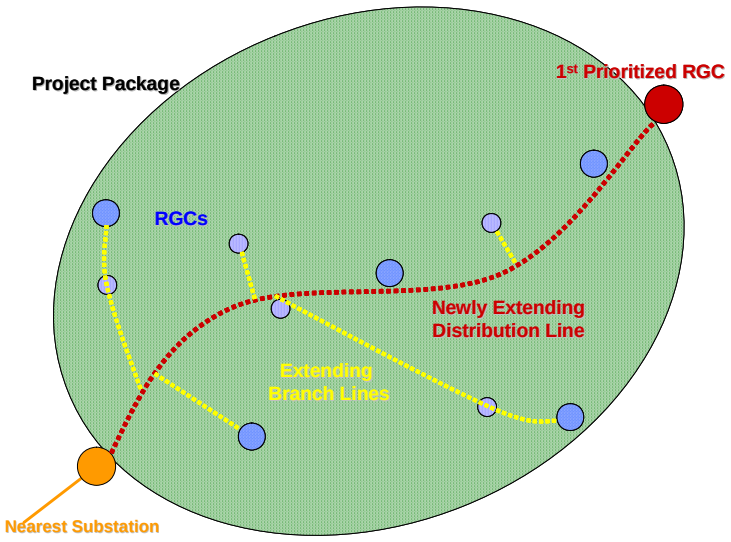

Figure 3 Concept of Project Package

In addition, Socio Economic Survey was carried out, in the process of "Social Aspect Analysis." In the Socio Economic Survey, data were collected more than 1,300 interviewees in 90 RGCs: 71 unelectrified and 19 electrified RGCs. Based on the data collected in the Socio Economic Survey, the ability to pay, willingness to pay, and prioritized property for electrification were analyzed, and these results were used as basic information to elaborate policy recommendation with the involvement of Stakeholders.

The outputs from the Technical and the Social Aspect Analysis were combined to develop a Comprehensive Rural Electrification Program.

4 Results of Master Plan Development

Initial findings, results and outputs of this Study are as follows:

1) 1,217 Unelectrified RGCs were clustered (or grouped) into 180 Project Packages. The electrification priority order of 180 Project Packages and the optimal electrification mode for each of 1,217 RGCs are shown in Table 1, and 2 respectively. In Figure 4, the locations of 1,217 RGCs are also shown by each of 9 Provinces.
2) Although not many Project Packages' FIRR are attractive, considerable number of Project Packages show reasonable EIRR.
3) US$ 1,103 million is required to realize all 180 Project Packages (including 1,217 RGCs) by 2030. This means approximately US$ 50 million per year is needed from 2008 to 2030. The prioritized 180 Project Packages are grouped into 22 Annual Project Phases up to 2030, each requiring US$ 50 million, as shown in Table 3.
4) The target household electrification rate is set as 66.0% nation-wide, requiring a rate of 50.6% for the rural areas. This is achievable if DoE, REA and ZESCO success to increase the household electrification rate at 90% in the urban areas, 100% in 1,217 RGCs in the Master Plan, and 20% in the rural areas other than 1,217 RGCs by 2030 (refer to Table 4). The growth of household electrification rates in urban areas, rural areas, and nation-wide during the REMP period are shown in Figure 5. The cumulative number of electrified RGC and rural electrification rate by 2030 are also shown in Figure 6. It is essential that the Zambian Government makes appropriate investment to the rural electrification projects in the Master Plan to meet these targets.
5) Since the annual amount of Rural Electrification Fund (REF) is much less than the required project cost to realize the Master Plan, in addition to making effort to increase the REF, utilization of the low interest loan from the international donors should be necessary.
6) In the nation wide, 241 RGCs are identified as Solar Home System Market.
7) Although a lot of mini-hydro potential sites exist in Zambia, only 3 sites (Mujila Falls Lower, Upper Zambezi, and West Lunga in North-western Province) were financially feasible. Locations of these mini-hydro potential sites and supplying RGCs are shown in the Map of North-western Province in Figure 4. Brief specification and construction cost of mini-hydro, and potential demand of supplied RGCs are summarized in Table 5.
8) Unelectrified households and business entities pay considerable amount of money to meet their needs using alternative energy sources (K59,141 and K75,315 respectively). In 2006, the estimated ability to pay for electricity monthly bill for households and business entities are K35,485 and K60,252 respectively.
9) The connection fee charged in rural areas by ZESCO (K2,873,000 for 1 Phase and K4,887,000 for 3 Phase) was much higher than the rural households' ability to pay (average monthly income by K910,757) and willingness to pay (K2,508,483).
10) Duration (usable daily hours of electricity) was the most important factor for unelectrified residents, compared to Urgency (years until electrified), Monthly Fee, and Connection/Initial Fee. Although 24 hours usage per day was the most preferred, unelectrified residents were eager to use electricity even for 5 hours per day (such as by SHS).

Table 1 Final Electrification Priority of Project Packages by 2030 (1/2)

FIRR Ranking	Substation	Province	Feeder & Package	Trans./Dist. Line Cost (US$)	SHS Cost (US$)	Hydro Cost (US$)	Total Project Package Cost	Least Life Time Cost	Project Package FIRR	Project Package EIRR
1	Isoka	Northern	1 - 1	673,272	990,123		1,663,395	0.0092	22.0%	59.9%
2	Azele	Eastern	2 - 2	1,899,936			1,899,936	0.0060	20.5%	57.5%
3	Kapiri Mposhi	Central	2 - 2	2,701,296			2,701,296	0.0064	18.1%	50.2%
4	Kansunswa	Copperbelt	1 - 8	4,522,824			4,522,824	0.0078	13.2%	35.1%
5	Azele 2	Eastern	2 - 1	2,596,212			2,596,212	0.0080	12.1%	34.1%
6	Azele	Eastern	1 - 2	1,608,120			1,608,120	0.0060	12.0%	33.9%
7	Azele 3	Eastern	1 - 2	3,388,392			3,388,392	0.0082	11.5%	32.4%
8	Isoka	Northern	2 - 1	747,576	1,243,873		1,991,449	0.0167	11.0%	29.5%
9	Azele 1	Eastern	1 - 5	3,600,612			3,600,612	0.0085	11.0%	31.1%
10	Ndola 1	Copperbelt	1 - 4	3,675,672			3,675,672	0.0087	10.8%	29.5%
11	Lundazi	Eastern	3 - 2	2,733,588			2,733,588	0.0094	9.5%	26.1%
12	Chipata	Eastern	2 - 2	4,280,904	416,277		4,697,181	0.0100	9.2%	26.3%
13	Mbereshi	Luapula	1 - 3	2,620,728	622,820		3,243,548	0.0116	9.1%	22.2%
14	Azele 5	Eastern	1 - 3	7,189,452			7,189,452	0.0096	8.7%	25.6%
15	Kasama 1	Northern	1 - 2	4,137,372	483,813		4,621,185	0.0105	8.7%	24.9%
16	Senanga	Western	1 - 1	2,146,932			2,146,932	0.0102	8.5%	23.3%
17	Mbereshi	Luapula	2 - 1	1,854,468			1,854,468	0.0100	8.4%	23.9%
18	Kitwe	Copperbelt	1 - 3	2,269,080	368,850		2,637,930	0.0114	8.2%	22.6%
19	Azele 2	Eastern	1 - 3	4,538,160			4,538,160	0.0101	8.2%	23.8%
20	Luwingu	Northern	3 - 3	1,395,468			1,395,468	0.0103	7.7%	23.2%
21	Mpongwe	Copperbelt	3 - 2	2,048,868	80,283		2,129,151	0.0107	7.6%	22.8%
22	Mongu 2	Western	2 - 3	5,644,512	460,417		6,104,929	0.0112	7.5%	22.1%
23	Nchelenge	Luapula	1 - 4	2,087,748	364,872		2,452,620	0.0127	7.5%	19.1%
24	Azele 3	Eastern	2 - 1	2,509,596			2,509,596	0.0105	7.5%	22.6%
25	Azele 1	Eastern	2 - 2	3,545,532	1,139,130		4,684,662	0.0130	7.1%	21.9%
26	Mongu 2	Western	1 - 3	4,102,704	219,028		4,321,732	0.0114	7.1%	20.9%
27	Mumbwa	Central	1 - 3	2,034,072	684,666		2,718,738	0.0133	7.0%	21.3%
28	Nchelenge	Luapula	2 - 4	4,227,552	225,395		4,452,947	0.0121	6.8%	19.1%
29	Nakonde	Northern	1 - 2	3,076,272	1,064,965		4,141,237	0.0154	6.7%	16.6%
30	Mongu	Western	1 - 4	3,890,700			3,890,700	0.0119	5.9%	19.0%
31	Muzuma 2	Southern	2 - 1	3,703,968			3,703,968	0.0125	5.6%	17.7%
32	Luwingu 3	Northern	2 - 5	4,202,496			4,202,496	0.0126	5.5%	17.4%
33	Samfya 2	Luapula	2 - 2	2,752,596			2,752,596	0.0139	5.0%	14.4%
34	Luano	Copperbelt	1 - 3	2,387,772	284,120		2,671,892	0.0148	4.9%	15.5%
35	Mbereshi 1	Luapula	2 - 5	6,313,140	559,897		6,873,037	0.0147	4.9%	15.2%
36	Mbala	Northern	2 - 4	5,112,504	2,547,823		7,660,327	0.0174	4.8%	17.1%
37	Pensulo	Central	1 - 1	599,616			599,616	0.0146	4.6%	13.7%
38	Msoro	Eastern	1 - 1	1,486,296			1,486,296	0.0139	4.6%	14.4%
39	Azele 4	Eastern	2 - 3	5,366,628	341,988		5,708,616	0.0140	4.6%	16.4%
40	Kabwe 1	Central	1 - 3	4,443,228			4,443,228	0.0136	4.5%	16.0%
41	Solwezi	North-Western	1 - 1	3,196,692			3,196,692	0.0134	4.5%	16.3%
42	Senanga	Western	3 - 3	4,424,004			4,424,004	0.0138	4.4%	15.6%
43	Luwingu 2	Northern	2 - 5	6,526,008			6,526,008	0.0135	4.4%	16.3%
44	Victoria Falls	Southern	3 - 1	1,662,120	1,365,257		3,027,377	0.0213	4.4%	16.0%
45	Kabwe 2	Central	1 - 2	5,905,008			5,905,008	0.0137	4.3%	15.9%
46	Luano	Copperbelt	2 - 4	2,782,080	512,429		3,294,509	0.0165	4.3%	13.8%
47	Senanga 3	Western	1 - 2	5,513,508			5,513,508	0.0141	4.2%	15.2%
48	Ndola	Copperbelt	1 - 3	4,725,756			4,725,756	0.0143	4.1%	14.6%
49	Kitwe	Copperbelt	2 - 3	2,922,804	314,531		3,237,335	0.0171	4.0%	11.9%
50	Samfya 1	Luapula	2 - 3	4,234,788			4,234,788	0.0153	3.9%	13.2%
51	Samfya	Luapula	1 - 1	1,286,388	293,925		1,580,313	0.0169	3.7%	14.6%
52	Muzuma 1	Southern	2 - 1	2,582,172	2,251,605		4,833,777	0.0243	3.6%	14.0%
53	Mwinilunga 1	North-Western	1 - 0		3,070,610	2,654,970	5,725,580	0.0195	3.6%	14.5%
54	Mporokoso	Northern	2 - 6	7,404,372			7,404,372	0.0148	3.6%	14.3%
55	Kawambwa Tea	Luapula	1 - 6	4,996,188	401,485		5,397,673	0.0183	3.5%	10.4%
56	Mbereshi 1	Luapula	1 - 3	4,493,664	531,461		5,025,125	0.0170	3.4%	12.7%
57	Samfya 2	Luapula	1 - 3	4,748,220			4,748,220	0.0159	3.3%	12.4%
58	Kaoma	Western	4 - 2	3,370,788	397,632		3,768,420	0.0168	3.2%	13.4%
59	Nampundwe	Central	1 - 5	6,327,072	521,627		6,848,699	0.0166	3.1%	13.2%
60	Luwingu 1	Northern	1 - 5	7,400,916			7,400,916	0.0157	2.9%	13.2%
61	Isoka	Northern	3 - 2	4,738,824			4,738,824	0.0160	2.9%	12.9%
62	Kasama 2	Northern	1 - 4	7,680,960			7,680,960	0.0162	2.8%	12.3%
63	Kalabo	Western	1 - 3	6,112,368	723,406		6,835,774	0.0174	2.7%	13.0%
64	Muzuma 3	Southern	1 - 3	4,332,960			4,332,960	0.0166	2.7%	12.1%
65	Pensulo 1	Central	2 - 5	5,346,756			5,346,756	0.0164	2.7%	12.5%
66	Luwingu 3	Northern	1 - 3	3,819,528			3,819,528	0.0161	2.6%	13.0%
67	Lundazi	Eastern	1 - 2	2,785,860	1,479,405		4,265,265	0.0240	2.3%	11.5%
68	Mongu	Western	2 - 5	7,319,376			7,319,376	0.0167	2.3%	12.3%
69	Nchelenge 1	Luapula	1 - 3	4,821,120			4,821,120	0.0185	2.3%	10.1%
70	Luwingu	Northern	1 - 4	7,722,972			7,722,972	0.0168	2.2%	12.3%
71	Senanga 2	Western	2 - 2	2,739,744			2,739,744	0.0171	2.2%	11.8%
72	Kabwe	Central	2 - 5	6,232,788	225,782		6,458,570	0.0180	2.1%	11.5%
73	Senanga 3	Western	2 - 3	7,618,536			7,618,536	0.0174	2.1%	11.6%
74	Kapiri Mposhi	Central	1 - 6	5,497,848	399,856		5,897,704	0.0189	2.0%	11.0%
75	Kalabo	Western	2 - 1	2,756,268	794,187		3,550,455	0.0216	1.8%	11.4%
76	Senanga 2	Western	1 - 3	3,328,452			3,328,452	0.0187	1.8%	10.2%
77	Mporokoso	Northern	1 - 5	4,094,712			4,094,712	0.0182	1.7%	10.6%
78	Muzuma 1	Southern	1 - 4	6,212,484	1,331,379		7,543,863	0.0220	1.7%	10.1%
79	Mongu 1	Western	1 - 4	6,380,748	2,847,936		9,228,684	0.0241	1.6%	11.1%
80	Lundazi 1	Eastern	1 - 3	4,215,024			4,215,024	0.0184	1.5%	10.8%
81	Kaoma	Western	1 - 2	3,539,376	1,801,008		5,340,384	0.0288	1.5%	8.5%
82	Mazabuka	Southern	1 - 3	3,732,048	738,598		4,470,646	0.0279	1.5%	9.5%
83	Luwingu 2	Northern	1 - 5	7,625,988			7,625,988	0.0182	1.5%	11.0%
84	Mfuwe 1	Eastern	1 - 5	4,821,120	175,869		4,996,989	0.0190	1.5%	10.7%
85	Solwezi	North-Western	2 - 4	2,663,712			2,663,712	0.0188	1.5%	10.4%
86	Kafwe Town	Lusaka	1 - 3	1,582,632			1,582,632	0.0199	1.5%	9.2%
87	Mumbwa	Central	3 - 4	6,012,576			6,012,576	0.0191	1.3%	10.2%
88	Lundazi	Eastern	2 - 7	8,256,276			8,256,276	0.0203	1.2%	9.1%
89	Isoka 1	Northern	1 - 1	4,628,988			4,628,988	0.0199	1.2%	9.5%
90	Muzuma 3	Southern	2 - 6	5,251,284			5,251,284	0.0200	1.1%	9.4%

Table 1 Final Electrification Priority of Project Packages by 2030 (2/2)

FIRR Ranking	Substation	Province	Feeder & Package	Trans./Dist. Line Cost (US$)	SHS Cost (US$)	Hydro Cost (US$)	Total Project Package Cost	Least Life Time Cost	Project Package FIRR	Project Package EIRR
91	Luano 2	Copperbelt	1 - 5	6,468,768	109,535		6,578,303	0.0209	1.1%	8.8%
92	Isoka 1	Northern	2 - 1	4,419,792			4,419,792	0.0196	1.1%	9.8%
93	Azele 4	Eastern	1 - 4	11,500,056			11,500,056	0.0193	1.0%	10.1%
94	New SS at Lukulu	Western	1 - 5	8,474,976			8,474,976	0.0228	1.0%	6.9%
95	Mongu 1	Western	2 - 8	10,201,680			10,201,680	0.0193	1.0%	10.2%
96	Mpika	Northern	1 - 1	1,251,288	508,921		1,760,209	0.0260	0.9%	9.5%
97	Mkushi	Central	1 - 7	5,977,476	951,259		6,928,735	0.0257	0.8%	7.1%
98	Nchelenge 1	Luapula	2 - 4	7,155,648			7,155,648	0.0215	0.8%	8.3%
99	Luwingu	Northern	2 - 5	6,742,008	726,748		7,468,756	0.0216	0.7%	9.7%
100	Mfuwe	Eastern	1 - 3	7,515,828			7,515,828	0.0203	0.6%	9.5%
101	Mazabuka 1	Southern	2 - 6	6,055,668			6,055,668	0.0222	0.6%	7.7%
102	Maposa	Copperbelt	2 - 4	3,617,136			3,617,136	0.0221	0.4%	8.1%
103	Chinsali	Northern	2 - 1	1,129,140	1,201,445		2,330,585	0.0438	0.4%	6.3%
104	Senanga	Western	2 - 3	8,819,172			8,819,172	0.0213	0.4%	8.7%
105	Kasama	Northern	2 - 5	7,077,132			7,077,132	0.0217	0.4%	8.5%
106	Kasama	Northern	1 - 3	2,891,484	2,822,026		5,713,510	0.0372	0.3%	8.7%
107	Mpika	Northern	2 - 3	3,820,824	1,316,505		5,137,329	0.0276	0.3%	8.4%
108	Mpika	Northern	3 - 1	2,613,816	1,384,800		3,998,616	0.0311	0.0%	8.2%
109	Azele 6	Eastern	2 - 2	3,756,780			3,756,780	0.0221	0.0%	8.4%
110	Maposa	Copperbelt	1 - 6	9,154,296	37,124		9,191,420	0.0238	-0.3%	7.3%
111	Chipili	Luapula	1 - 4	4,341,060	90,503		4,431,563	0.0255	-0.4%	6.4%
112	Mumbwa	Central	2 - 3	4,442,904			4,442,904	0.0257	-0.5%	5.7%
113	Mpika 1	Northern	1 - 2	7,672,860			7,672,860	0.0240	-0.5%	7.3%
114	Kitwe	Copperbelt	3 - 8	6,919,884	201,447		7,121,331	0.0282	-0.7%	4.7%
115	Sesheke	Western	1 - 4	8,686,008			8,686,008	0.0253	-0.7%	6.4%
116	Chilundu	Southern	1 - 3	3,358,044	296,011		3,654,055	0.0278	-0.8%	6.1%
117	Azele 6	Eastern	1 - 3	7,118,712	142,129		7,260,841	0.0246	-0.8%	7.3%
118	Mkushi Farm Block	Central	1 - 5	7,162,452	665,468		7,827,920	0.0300	-0.8%	5.1%
119	Chipata	Eastern	1 - 4	6,059,016	481,548		6,540,564	0.0267	-0.9%	6.8%
120	Pensulo 1	Central	1 - 4	5,382,180			5,382,180	0.0246	-0.9%	7.1%
121	Mazabuka 1	Southern	3 - 9	6,448,248			6,448,248	0.0262	-1.0%	6.1%
122	Muzuma 2	Southern	1 - 4	7,654,932	254,481		7,909,413	0.0255	-1.0%	7.0%
123	Chinsali	Northern	3 - 1	710,748	813,992		1,524,740	0.0510	-1.0%	5.4%
124	New SS at Kabompo	North-Western	2 - 5	11,671,020			11,671,020	0.0253	-1.1%	6.7%
125	New SS at Lukulu	Western	2 - 2	5,237,244	1,774,905		7,012,149	0.0335	-1.2%	6.1%
126	Sinazongwe	Southern	1 - 8	5,275,908	805,526		6,081,434	0.0320	-1.2%	4.9%
127	Kabwe	Central	1 - 7	6,657,012			6,657,012	0.0265	-1.3%	6.1%
128	New SS at Zambezi	North-Western	2 - 2	5,368,680	334,115		5,702,795	0.0277	-1.6%	6.3%
129	Zambezi 1	North-Western	1 - 4	6,354,180	279,755		6,633,935	0.0275	-1.6%	6.3%
130	New SS at Mwinilunga	North-Western	4 - 0			8,688,211	8,688,211	0.0261	-2.0%	4.6%
131	New SS at Zambezi	North-Western	1 - 6	10,004,364	1,185,245		11,189,609	0.0327	-2.2%	4.7%
132	Luano 1	Copperbelt	1 - 4	4,479,516	134,174		4,613,690	0.0341	-2.4%	3.4%
133	Samfya 1	Luapula	1 - 5	6,764,040			6,764,040	0.0317	-2.4%	4.1%
134	Muzuma 1	Southern	3 - 1	2,671,272	353,962		3,025,234	0.0340	-2.4%	4.6%
135	Pensulo 2	Central	2 - 2	12,876,408	164,406		13,040,814	0.0308	-2.5%	4.8%
136	Mpongwe	Copperbelt	2 - 1	1,717,848	79,938		1,797,786	0.0330	-2.6%	4.1%
137	Senanga 1	Western	1 - 4	17,644,176			17,644,176	0.0308	-2.6%	4.6%
138	Pensulo 2	Central	1 - 5	10,138,284			10,138,284	0.0317	-2.8%	4.4%
139	Luano 1	Copperbelt	2 - 4	6,293,808			6,293,808	0.0347	-2.9%	3.0%
140	New SS at Chilundu	Lusaka	2 - 1	12,229,164	306,618		12,535,782	0.0355	-2.9%	2.9%
141	Coventry	Lusaka	1 - 4	5,448,276	145,637		5,593,913	0.0370	-3.0%	2.2%
142	Mpika 2	Northern	1 - 3	9,631,764			9,631,764	0.0331	-3.1%	4.0%
143	Kaoma	Western	2 - 3	8,182,620	915,627		9,098,247	0.0376	-3.1%	3.4%
144	Mpika 1	Northern	2 - 3	11,886,696			11,886,696	0.0354	-3.4%	3.2%
145	Mazabuka 1	Southern	1 - 4	4,611,924			4,611,924	0.0374	-3.5%	2.4%
146	New SS at Mwinilunga	North-Western	3 - 2	3,620,916			3,620,916	0.0357	-3.5%	3.1%
147	New SS at Mwinilunga	North-Western	2 - 4	9,098,892			9,098,892	0.0360	-3.6%	3.1%
148	New SS at Mwinilunga	North-Western	1 - 1	7,986,492	1,449,173	10,867,131	20,302,796	0.0556	-3.9%	0.4%
149	Fig Tree	Central	1 - 6	7,295,940	262,271		7,558,211	0.0422	-3.9%	1.6%
150	Leopard's Hill	Lusaka	1 - 11	12,860,964			12,860,964	0.0378	-4.0%	2.5%
151	Serenje	Central	1 - 3	7,325,532			7,325,532	0.0388	-4.2%	2.4%
152	Victoria Falls	Southern	2 - 4	5,194,692	287,628		5,482,320	0.0479	-4.2%	0.3%
153	New SS at Mufumbwe	North-Western	1 - 7	13,583,916	342,885		13,926,801	0.0438	-4.5%	1.4%
154	Kalabo	Western	3 - 5	16,060,140	532,911		16,593,051	0.0422	-5.0%	2.1%
155	Kaoma	Western	3 - 3	10,689,516			10,689,516	0.0449	-5.1%	0.8%
156	Mpongwe	Copperbelt	1 - 5	8,589,996	143,027		8,733,023	0.0434	-5.1%	1.7%
157	Muzuma	Southern	2 - 2	4,124,628			4,124,628	0.0434	-5.3%	1.5%
158	Kasempa	North-Western	2 - 4	6,585,084	319,324		6,904,408	0.0499	-5.3%	0.2%
159	Chipili	Luapula	2 - 2	8,145,792	199,099		8,344,891	0.0488	-6.0%	0.7%
160	Solwezi	North-Western	3 - 5	10,115,604			10,115,604	0.0487	-6.0%	0.5%
161	Isoka 1	Northern	3 - 1	5,762,340			5,762,340	0.0482	-6.0%	0.7%
162	Sesheke 1	Western	1 - 5	12,350,988	968,951		13,319,939	0.0531	-6.0%	0.1%
163	Muzuma	Southern	1 - 5	5,281,740			5,281,740	0.0533	-6.1%	-0.7%
164	Mansa	Luapula	2 - 3	1,619,784	203,035		1,822,819	0.0675	-6.1%	-2.5%
165	Chilundu	Southern	2 - 8	8,734,500			8,734,500	0.0525	-6.5%	-0.2%
166	Victoria Falls	Southern	1 - 5	3,954,312			3,954,312	0.0662	-6.6%	-3.1%
167	New SS at Mumbezi	North-Western	1 - 2	6,636,492			6,636,492	0.0523	-6.8%	0.0%
168	New SS at Chavuma	North-Western	1 - 8	6,411,204	357,387		6,768,591	0.0641	-7.0%	-1.7%
169	Muzuma	Southern	3 - 1	2,869,452	213,808		3,083,260	0.0579	-7.0%	-0.5%
170	New SS at Kabompo	North-Western	1 - 4	11,623,500			11,623,500	0.0579	-7.0%	-1.9%
171	New SS at Chama	Eastern	2 - 5	11,377,800			11,377,800	0.0538	-7.0%	-0.1%
172	New SS at Chama	Eastern	1 - 3	14,867,712			14,867,712	0.0609	-7.8%	-1.3%
173	Chinsali	Northern	1 - 4	9,725,076			9,725,076	0.0673	-7.8%	-2.6%
174	New SS at Chilundu	Lusaka	1 - 1	5,460,912	364,872		5,825,784	0.0634	-8.1%	-1.1%
175	New SS at Nyimba	Eastern	1 - 6	6,449,544	421,373		6,870,917	0.0744	-8.2%	-4.4%
176	Kasempa	North-Western	1 - 4	3,180,492	254,357		3,434,849	0.0679	-8.7%	-3.0%
177	Maamba	Southern	1 - 8	15,099,588	71,983		15,171,571	0.0800	-9.8%	-3.8%
178	Sesheke 2	Western	1 - 4	21,945,600			21,945,600	0.0743	-10.2%	-2.7%
179	Mansa	Luapula	1 - 5	7,531,272	738,142		8,269,414	0.1071	-12.6%	-5.6%
180	Mbala	Northern	1 - 2	5,990,868	599,286		6,590,154	0.0964	-13.1%	-4.2%
Total		-	- - -	**1,022,385,240**	**58,489,689**	**22,210,313**	**1,103,085,242**	-	-	-

Table 2 Electrification Priority of Project Packages by Province (1/12)
Central Province

Provincial Ranking	1	2	3	4	5
Substation	Kapiri Mposhi	Mumbwa	Pensulo	Kabwe 1	Kabwe 2
District	Kapri Mposhi	Mumbwa	Serenje	Kapiri Mposhi	Chibombo
RGCs by DL	KPG Market	Mumba	Mukando	Nchembwe	Palace Chipepo Muluni-Ngombe
	Lukanda	Maimwene settlement		Kafulu	Chilwa
	Luashimba	Chiwena		Koni Bunda Community	Kaswende
					Waya
RGCs by SHS		Ngabwe			
		Kapopo			
		Chikonkomene			
		Nambwa			

Provincial Ranking	6	7	8	9	10
Substation	Nampundwe	Pensulo 1	Kabwe	Kapiri Mposhi	Mumbwa
District	Mumbwa	Serenje	Kabwe	Kapri Mposhi	Mumbwa
RGCs by DL	Muchabi	Lukulu HC, Sch, Mkt	Lukali Community School	Chilese	Big Concession
	keezwa	Nakatambo	Joslas Chiwala Farm	Kaloko	Kaindu
	Shibuyunji	Katikululu	Chilumba	Fikola	Mpusu
	Siachele	Musangashi	Katuntulu Com. School	Chankomo	Kamiliambo
	Myooye	Nsala	Likumbo	Lunchu	
	Nalubanda		Mpima Dairy Scheme Shed	Mubalashi	
	Mukulaikwa		Mubofwa		
RGCs by SHS	Chipeso		Chipepo	Nkole	
	Muchenje				
	Mamvule				

Provincial Ranking	11	12	13	14	15
Substation	Mkushi	Mumbwa	Mkushi Farm Block	Pensulo 1	Kabwe
District	Mkushi	Mumbwa	Mkushi	Serenje	Kabwe
RGCs by DL	Chalata	Matala	Old Mkushi	Mailo	Kangomba Health Centre
	Kasalamakanga	Naluvwi	Masansa	C. Saili	Kafumba
	Ndabala	Chibuluma	Makolongo	Kawama	Munwa Basic School
	Malali	Luili	Lubuto	Masase	Kafulamase Basic School
	Nkumbi	Nakanjoli	Masansa	C. Serenje	Kalwelwe Rail Station
	Nshinso	Chikanda	Kanyenshya Resettlement Scheme		Munyama B. School
	Munsakamba	Nalusanga	Mpale_Tuyu		Kapuku Fish Camp
	Lunsemfwa		Chikupili		
	Chitina				
RGCs by SHS	Fibanga		Chikwasha		
	Musofu		Chingombe		
	Kalombe		Fiwila		

Provincial Ranking	16	17	18	19
Substation	Pensulo 2	Pensulo 2	Fig Tree	Serenje
District	Serenje	Serenje	Chibombo	Serenje
RGCs by DL	Talayi	Mpelembe	Shimukuni	Chibale
	Mushili	Machende	Waya	Nchimishi
	Kasanka	Njelele	Mukulushi	Kofi Kunda
	Sokontwe	Chalilo	Chamuka	Mpande
	Chipe	Gibson	Lifwambula	
	Chipundu	Katongo	Kabangala	
	Kapumbu	Chipundu	Momboshi	
RGCs by SHS	Musolo		Kasosolo	
			Kayosha	

Table 2 Electrification Priority of Project Packages by Province (2/12)
Copperbelt Province

Provincial Ranking	1	2	3	4	5
Substation	Kansunswa	Ndola 1	Kitwe	Mpongwe	Luano
District	Mufulira	Ndola	Kitwe	Mpongwe	Chililabombwe
RGCs by DL	Kawama East	Twapia	Musakashi	Mulela	Kafilo
	Murundu	George Camp	Luela	St. Anthony	Mimbula Block
	Mupambe	Sakania	Lungo		Kansoka
	Luansobe	Chichele	Council Farm		
	Mutundu North (Conner Bar)				
	Mokambo				
	Mutamba				
	Kafironda				
	Lukoshi				
RGCs by SHS			Minsenga	Kapili	Chisangwa
				Ipumbu	
				Mushine	
				Machiya	
				Luswishi	
				Munkunpa	
				Munsongwe	

Provincial Ranking	6	7	8	9	10
Substation	Luano	Ndola	Kitwe	Luano 2	Maposa
District	Chililabombwe	Masaiti	Kitwe	Chingola	Luanshya
RGCs by DL	Kamiteta	Mutaba	St. Joseph	Mutenda	Kaf Miss
	Fitobaula	Kambowa	Nkana	Muchinshi	Kamifungo
	Kawama	Kanglonga	Emerald Mining Area	Ipafu	Shombe
	Lubansa	Chondwe	Kambila	Milopa	Chilobwe
	Mingomba	Mupapa	Kabombo	Muchinshi	Kawama
	Kasapa	Chikumbi	Chibuluma Mine Area	Kansoka	Kangalati
			Chapula	Mlulu Mitambo	Lima
				Mlulu Kabamba	
RGCs by SHS	Kanenga		Kandole	Mutenda	
	Chilimina		Chantete		

Provincial Ranking	11	12	13	14	15
Substation	Maposa	Kitwe	Luano 1	Mpongwe	Luano 1
District	Luanshya	Kitwe	Lufwanyama	Mpongwe	Lufwanyama
RGCs by DL	Chifulube	Mukutuma	Mbalango Mine Farm Block	Mukumbo	Kambilombilo
	Maposa	Saw-Mills	Kapilamikwa	Shingwa	Nchakwa
	Kafubu	Kalisha	Kangalati	Kasamba	Lumwana
	Kaf GRZ	Michinka	St. Mary's		Kanyafimbolo
	Kakolo	Kafubu Depot	Kanterede		Mushingashi
	Chinondo	Chamanza Resettlement	Fumbwe		Fungulwe
	Kapupulu	Kameme			Funda
	Misaka	Milopa			Mapunga
		Kansoka			Kalweu Kasakalabwe
		Lumpuma			
		Kapimbe			
		Chimoto			
		Kankunko			
RGCs by SHS	Salati	Chikabuke	Chinemu	Chitabale	
				Luela	

Provincial Ranking	16
Substation	Mpongwe
District	Mpongwe
RGCs by DL	Mpongwe
	Lukanga
	Chowa
	Mukubwe
	Mushipushi
	Chisanga
	Musofu
	Ibenga
	Chibuli
	Kotinteden
RGCs by SHS	Chisapa
	Chinwa
	Mikata
	Matete
	Fidashi

Table 2 Electrification Priority of Project Packages by Province (3/12)

Eastern Province

Provincial Ranking	1	2	3	4	5
Substation	Azele	Azele 2	Azele	Azele 3	Azele 1
District	Katete	Katete	Katete	Petauke	Katete
RGCs by DL	Chindenza School	Mtandaza RHC	Chimutende,	Kapungwe	Chinkhombe
	Chitawe RHC		Kapeya Farms	Chikalawa	Nyembe
					Matunga School
					Chisale
					Kafunka
RGCs by SHS					

Provincial Ranking	6	7	8	9	10
Substation	Lundazi	Chipata	Azele 5	Azele 2	Azele 3
District	Lundazi	Chipata	Petauke	Katete	Petauke
RGCs by DL	Sikatengwa	Kasenengwa Rural Centre	Mwanjawanthu	Kagoro	Nyamphinga
	Mwase	Madimawe Rural Health Centre	Mumbi	Kafumbwe School	
	Mwata	Madzimoyo Sec. Schoo	Matonje	Kapirimphika	
		Chinyaku Palace	Kaulu	Taferansoni	
RGCs by SHS		Maguya			

Provincial Ranking	11	12	13	14	15
Substation	Azele 1	Msoro	Azele 4	Lundazi	Lundazi 1
District	Katete	Mambwe	Petauke	Lundazi	Lundazi
RGCs by DL	Kamphambe	Kasamanda	Nyamphande NSS	Mchereka	Mwimba
	Chilasa	Nkhoko	Monde	Mphamba	Kazonde
			Misolo	Khulamayen	Phikamalaza
				Chasefu	
RGCs by SHS	Zemba		Kalongo Mwape	ZASP	
	Kalimeta		Mulilo	Mapamba	
	Kenje			Lumimba	

Provincial Ranking	16	17	18	19	20
Substation	Mfuwe 1	Lundazi	Azele 4	Mfuwe	Azele 6
District	Mambwe	Lundazi	Petauke	Mambwe	Chadiza
RGCs by DL	Ncheka_	Emusa	Mng'omba School	Chasela	Naviluri
	Kamphasa_	Kapichila	Sasali	Nsefu	Madziayera
	Kamphasa	Egichakeni	Chikowa	Chilanga	Manje
	Ncheka	Kazembe	Ukwimi	Chilanga	
	Chikowa	Nkhanga			
	Chikowa_	M_Mphanga			
		Chikomem			
		Hoya			
		Mtambali			
RGCs by SHS	Nyamaluma				

Provincial Ranking	21	22	23	24	25
Substation	Azele 6	Chipata	New SS at Chama	New SS at Chama	New SS at Nyimba
District	Chadiza	Chipata	Chama	Chama	Nyimba
RGCs by DL	Zingalume	Chinunda	Kaozi Settlement	Muyombe	Chipembe
	Chikonka	Kmgubudu	Mangwere	Kanselele	Mulira
	Chigwe	Mphomwa	Mabinga	Mnauke	Mtilizi Scheme
	Kapachi	Mphomwa Tse-tse	Sitwe	Bulbe	Vizimumba Central
	Kalemba	Kapara	Kalinkhu		Hofmeyre
	Vubwi	Maguya	Chifunda		Ndake
	Mchenjera	Chiparamba	Manga		Mchimadzi Scheme
		Chisengu			Chambula
					Chimphanje
RGCs by SHS	Chiwaula	Lima Com. School			Mbilisao
		Mwanya			Kacholola
					Kalingindi
					Wilison
					Chalubilo

Table 2 Electrification Priority of Project Packages by Province (4/12)
Luapula Province

Provincial Ranking	1	2	3	4	5
Substation	Mbereshi	Mbereshi	Nchelenge	Nchelenge	Samfya 2
District	Nchelenge	Nchelenge	Nchelenge	Nchelenge	Samfa
RGCs by DL	Mwansabombwe	Chipashi Island	Kambwali	Nile Kapambwe	Lubwe
	Chipepa	Shabo (Kapambwe	Mubamba	Kenani	Mbilimamwenge
	Mbereshi	Kanyembo	Kabosha	Mabo Kafutuma	Mundubi
	Mukamba		Nchelenge boma	Mwatishi Farm block 2	
	Salanga		Kashikishi	Kabole	
	Lufubu		Nshinda	Mununga	
	Chipunka		Kampampi (Chipakila)	Kabuta Central	
			Chilongo (Mtepuke)	Kaputa	
RGCs by SHS	Chama		Lukwesa	Kaputo	
	Kalamba				
	Muyembe				

Provincial Ranking	6	7	8	9	10
Substation	Mbereshi 1	Samfya 1	Samfya	Kawambwa Tea	Mbereshi 1
District	Mwense	Samfa	Samfa	Kawambwa	Mwense
RGCs by DL	Mwense	Chinsanka	Mano	Township	Mulundu
	Musangu	Katanhsya		Katungulu	Kashiba
	Lubunda	Mabo-Ninge		Mushota	Mutima
	Mulonga	Twingi		Mukuma	Kanyemba
	Lukwesa			Chama	Chibondo
	Mumpolokoso			Lengwe	Kabila
	Kapala			Mufwaya	
	Mununshi				
RGCs by SHS	Chibwe		Ndoba	Kanengo	Muchinga
			Mibenge	Chibote	Katuta

Provincial Ranking	11	12	13	14	15
Substation	Samfya 2	Nchelenge 1	Nchelenge 1	Chipili	Samfya 1
District	Samfa	Chiengi	Chiengi	Mansa	Samfa
RGCs by DL	Kasaba	Puta	Chienge	Mwenda	Kalimankonde
	Mwansakombe	Kalobwa	Lambwe Chomba	Chipili	Bwalya Mponda
	Mwewa	Kalembwe	Lupiya	Luminu	Kapilibila
	Isandulula Peri-urban C	Mukunta	Kasembe	Mukonshi	Kasomalunga
	Miponda	Kafulwe	Mwabu	Mutipula	Konikalila
		Sambula	Kampinda		Nsamba
RGCs by SHS				Mutwewankoko	

Provincial Ranking	16	17	18
Substation	Chipili	Mansa	Mansa
District	Mansa	Mansa	Mansa
RGCs by DL	Munshinga	Ntoposhi	Mulumbu
	Masonde Farming Bloc	Mutiti	Chintu
	Mano	Kabunda	Mikula
	Kalaba	Kapanda	Kasongwa sub boma
			Milambo
			Kundamfumu
			Mulumbi
RGCs by SHS	Chisunka	Mwanachama	Kasoma Iwela
	Mbaso	Bukanda	Lukola
			Kalasa kando
			Mansa Ressetlement Scheme
			Kalyongo
			Chipete

Table 2 Electrification Priority of Project Packages by Province (5/12)
Lusaka Province

Provincial Ranking	1	2	3	4	5
Substation	Kafwe Town	New SS at Chilundu	Coventry	Leopard's Hill	New SS at Chilundu
District	Kafue	Luangwa	Lusaka	Chongwe	Luangwa
RGCs by DL	Kabweza	Boma	Mwembeshi_mano	Nankaga	Rufunsa
	Manyonyo	Kapoche	Ipongo	Kapongo	Luangwa Bridge
	Tukunka	Mwalilia	Kasupe	Lishiko	
		Katondwe	Kamano	Chinkuli	
		Chitope	Chowa	Katoba	
		Kaunga	Chipapa VC	Shantumbu	
		Mphuka	Chinyongola	Chinyunyu	
		Manuele		Nyamanongo	
		Kakaro		Chiyota	
		Chiriwe		Mwalumina	
		Luangwa Sec		Lwimba	
				Mwachilele	
				Nchute	
RGCs by SHS		Kavalamanja	Muswishi		Nyalugwe
					Shikabeta

Table 2 Electrification Priority of Project Packages by Province (6/12)
Northern Province (1/2)

Provincial Ranking	1	2	3	4	5
Substation	Isoka	Isoka	Kasama 1	Luwingu	Nakonde
District	Isoka	Isoka	Kasama	Luwingu	Nakonde
RGCs by DL	Ntipo	Kafwimbi	Chisanga	Njeke Basic School	Nyela
			Namakwi	Lupili Market	Chilolwa
			Musa	Chipende Basic School and Chief Chipeki's	Iiendela
				Makolongo Basic School	Wulongo
					Kantongo
RGCs by SHS	Muliro	Musanya	Lwabwe		Chisanzu
	Chibale	Peleti			Senka
		Kalulu			Shemu
		Kalela			Sumbi
		Chunga			Kayambi

Provincial Ranking	6	7	8	9	10
Substation	Luwingu 3	Mbala	Luwingu 2	Mporokoso	Luwingu 1
District	Chilubi	Mbala	Chilubi	Mporokoso	Mporokoso
RGCs by DL	Chiwele	Mpulungu Central	Mwiima	Nsama Sub Boma	Mukupakaoma
	Kashitu	Isoko	Kantanta	Chishamwamba	Chitoshi
	Chilamba	Chilumba	Chichile	Katutwa	Mulenga M
	Kambashi	Musende	Chitupila	Malama	Menga Basic School and Clinic
	Mule	Posa, Muzabuwera, Mupata (Ibm	Kawasa	Kambobe	Laurent Chita Basic School and C
	Kapofu	Isunga	Katamba	Mporokoso	
	Mbabala		Chabukasansha	Munwa	
			Maela	Chiwala	
RGCs by SHS		Kasaba Bay			
		Vyamba			
		Tanganyika			
		Mumila			
		Iyendwe			
		Chisha			
		Chitimbwa RHC			

Provincial Ranking	11	12	13	14	15
FIRR Ranking	61	62	66	70	77
Substation	Isoka	Kasama 2	Luwingu 3	Luwingu	Mporokoso
District	Isoka	Mporokoso	Chilubi	Luwingu	Mporokoso
RGCs by DL	Sansamwente	Sikapila	Kawena	Bwalinde	Chalabesa
	Kawngu	Kapatu	Kanama	Tolopa Basic School	Mutotosho
		Malaila	Kanama	Nsanja Basic School	Chewe
		Z Chanda	Nsumbu RH	Chikumanino Market	Kalabwe
			Bukotelo	Chief Tungati s Palace and Scho	Sunkutu
				Kapisha School	
				Ipusukilo Mission	
				Chakungubala Basic School	
				Lwena Basic School and Clinic	
RGCs by SHS					

Provincial Ranking	16	17	18	19	20
Substation	Luwingu 2	Isoka 1	Isoka 1	Mpika	Luwingu
District	Chilubi	Isoka	Isoka	Mpika	Luwingu
RGCs by DL	Matipa	Thendere	Mulekatembo	Mufubushi Resettlement	Kanfinsa
	Mofu R4				Mufili Basic School
	Mubili				Saili Basic School
	Lwata				Chitofwe Basic School
	Isangano				Lwenge Basic School
					Tungati Basic School and Clinic
					Nsombo
RGCs by SHS				Nabwalya	Musungu
					Kalundu

Table 2 Electrification Priority of Project Packages by Province (7/12)
Northern Province (2/2)

Provincial Ranking	21	22	23	24	25
Substation	Chinsali	Kasama	Kasama	Mpika	Mpika
District	Chinsali	Kasama	Kasama	Mpika	Mpika
RGCs by DL	Ketani	Kachuma	Henry Kapata	Katongo Kapala	Katibunga
	Chilanga	Lukulu RR Scheme	Ngoli	Luoembe	
	Mwalala	Chilubula	Mwamba	Kanchibiya Farm Block	
	Nashinga	Chishimba			
	Masongo	Munkonge			
		Chiombo			
		Lukulu North			
RGCs by SHS	Konja		Rosa	Chikakala	Lwanya
	Malekani		Kapolyo	Kopa	Mukwikile
	Kabanda		Chimbola		Mukungule
	Chifulo		M_Mfino		
	Mumba		Chamfubu		
	Nkulungwe		Ndasa		
			Nsampa		
			C_Weyaya		
			Chimba		
			Makasa		
			Chitimukulu		
			Chisau		

Provincial Ranking	26	27	28	29	30
Substation	Mpika 1	Chinsali	Mpika 2	Mpika 1	Isoka 1
District	Mpika	Chinsali	Mpika	Mpika	Isoka
RGCs by DL	Chalabesa Hospital	Kasomo	Muwele	Mbati	Kampumbu (Kamninsu)
	Mpepo HC, Sch, Palace		Mupamadzi Farm Block	Chambeshi Sch, Mkt	
	Mansha Farm Block		Chiunda Ponde	Mayuka	
				Kabinga	
				Fube	
RGCs by SHS		Mbesuma area			
		Chungulo			
		Kampemba			
		Shimwalule			

Provincial Ranking	31	32
Substation	Chinsali	Mbala
District	Chinsali	Mpulungu
RGCs by DL	Lundu	Kavumbo
	Chitimba	Uningi
	Chikanda	Chalele
	Chimbwese	Chimula
	Lameck	Kaka
	Chimbele	St-Pauls
	Lufila	Kawimbe
	Musonko	Mwamba
	Kabangama	
	Chilombo	
	Shiwan'gandu area	
	Mulakupikwa	
RGCs by SHS		Kalukanya
		Matanga
		Kaluluzi
		Mwiluzi
		Mpande

Table 2 Electrification Priority of Project Packages by Province (8/12)
North-western Province

Provincial Ranking	1	2	3	4	5
Substation	Solwezi	Mwinilunga 1	Solwezi	New SS at Kabompo	New SS at Zambezi
District	Solwezi	Mwinilunga	Solwezi	Kabompo	Zambezi
RGCs by DL	Mushindomo		Kimsala	Kaula	Chinyingi
	Tumva		Kamalamba	Kawanda	Liyovu
			Kangwena	Ndunga	Kashona
			Kibanza	Kashinakazhi	Kakoto
			Chikola	Luson'a	
				Manyinga	
				Chiteve	
RGCs by SHS		Salujinga			Lukunyi
		Jimbe			
		Nyakaseya			
		Kafweku			
RGCs by Mini-Hydro		Ikelenge			

Provincial Ranking	6	7	8	9	10
Substation	Zambezi 1	New SS at Mwinilunga	New SS at Mwinilunga	New SS at Zambezi	New SS at Mwinilunga
District	Zambezi	Mwinilunga	Mwinilunga	Zambezi	Mwinilunga
RGCs by DL	Matondo	Ntambu		Dipalata	Kawiku
	Milomboyi	Samuteba		Likungu	Mukangala
	Muyembe	Chisengisengi		Chitokoloki	Lwakela
	Mwange			Ishima	
				Mpidi	
				Kakeki	
				Nyakulena	
				Lwatembo	
RGCs by SHS	Nguvu	Tomu		Lunyiwe Basic School	
	Kayenge	Lumwana		Chisengi	
				Katontu	
				Chizuzu	
RGCs by Mini-Hydro		Kanyama	Mwinilunga BOMA		
		Kakoma			

Provincial Ranking	11	12	13	14	15
Substation	New SS at Mwinilunga	New SS at Mufumbwe	Kasempa	Solwezi	New SS at Mumbezi
District	Mwinilunga	Mufumbwe	Kasempa	Solwezi	Solwezi
RGCs by DL	Chibwika	Mushima	Mateko	Kapiji	Mukumbi
	Mudunyama	Kikonge	Nselauke	Musaka	Mumbezi
	Kanongesha	Lalafuta	Dengwe	Mulonga	Musele
	Kampenba	Matushi	Kamakuku	Kalilele	Shilenda
	Chiwoma	Kashima W	Kalengwa	Sanda	
	Kamapanda	Kaminzeke	Kashima E	Mujima	
		Munyambala	Kalombe	Mumena	
		Miluji			
		Musoniweji			
		Shukwe			
		Kakiakasa			
		Chowwe			
		Kamabuta			
RGCs by SHS		Myamdafuka	Myombe		
			Lunga		
RGCs by Mini-Hydro					

Provincial Ranking	16	17	18
Substation	New SS at Chavuma	New SS at Kabompo	Kasempa
District	Chavuma	Kabompo	Kasempa
RGCs by DL	Sanjongo	Sakandingo	Kabele
	Kakhoma	Samende	Kantenda
	Kalombo	Mukolo	Shivuma
	Lingundu	Nyangwali	Mpungu
	Lukolwe	Chinkonkwelo	
	Kamisamba	Dongwe	
	Chinwandumba	Chiyengele	
	Kambuya		
	Mandalo		
	Chambi		
RGCs by SHS	Chivombo		Kalongwa
	Mukelangombe		Maako
	Nyathanda		Kamakechi
			Lubofu
			Kanogo
RGCs by Mini-Hydro			

Table 2 Electrification Priority of Project Packages by Province (9/12)
Southern Province (1/2)

Provincial Ranking	1	2	3	4	5
Substation	Muzuma 2	Victoria Falls	Muzuma 1	Muzuma 3	Muzuma 1
District	Kalomo	Livingstone	Namwala	Namwala	Namwala
RGCs by DL	Kauwe	Sinde	Baambwe	Mbeza	Moobola
		Mulala	Ngabo	Niko	Namakaka
		Sakurita		Ichila	Itapa
		Majeledi		Bweengwa	Muchila
		Katubia			Chilala
RGCs by SHS		Smachuma	Kalundu		Namusenga
		Chilizya	Shapopa		Luchena
		Kananga	No.57 (Lubanda)		Mbila
		Inonge	Itumbi		Mabombo
		Zimba Hills Settlements			
		Napenzi			
		Malimba			
		Nyawa Central			
		Simango			

Provincial Ranking	6	7	8	9	10
Substation	Mazabuka	Muzuma 3	Mazabuka 1	Chilundu	Mazabuka 1
District	Mazabuka	Namwala	Monze	Siavonga	Monze
RGCs by DL	Ngwezi	Nakamboma (Namakaka)	Njola Camp	Chiawa Central	Namakube
	Nwanachmgurela	Makaba	Kaumba	Mafungautsi	Bbombo
	Naluama	Simaubi	Ntambo Agricultural Camp	Mugula mano	Hakasenke
	Maggobo	Nalutanga	Mujika	Mulila Nsolo	Namilongwe
	Neganega	Kachenge	Chisuwo Agric Camp	Chisakila	Haatontola
		Mangonza	Manungu A	Mulangwa	Malende
			Manungu B		Kazungula
			Lweeta Agric Camp		Hufwa
			Chiyobola Agricultural Camp		Katimba
			Muzuri (Kamuzya East)		Simeweendengwe
			Namateba Agricultural Camp		Silwili
					Hamusankwa
					Sikalinda Resettlement
					Hamapande
RGCs by SHS	Mbaya Musuma			Kanyangala	
	Upper Kaleya				

Provincial Ranking	11	12	13	14	15
Substation	Muzuma 2	Sinazongwe	Muzuma 1	Mazabuka 1	Victoria Falls
District	Kalomo	Sinazongwe	Namwala	Monze	Livingstone
RGCs by DL	Nkandanzovu	Chipepo	Kantengwa	Kayuni	Makunka
	Darphan	Sinakaimbi		Keemba	Ma Hundred
	Kinnertone	Munyati		Chungu Agric Camp	Sekute
	Bbilili	Siacheka		Nteme	Mubalu
	Simakakata	Chiyabi		Malundu	Mambova
	Mutala	Sinamalima		Bankaila	Mahelituna
	Chikoli	Chabulabwambe			Mandia
		Siabwengo			Mayumbelo
		Siambabala			
		Mudonki			
		Mwalede			
		Nangombe			
		Siamejele			
		Hangoma			
		Siampande			
		Malyango			
		Siangwaze			
RGCs by SHS	Nguba	Mwerya	Muwezwa		Sinde
		Mundoza	Makunku		Ngwezi Mataki
		Simuloongo	Banamwaze		
		Nzala			
		Chaposwa			

Table 2 Electrification Priority of Project Packages by Province (10/12)
Southern Province (2/2)

Provincial Ranking	16	17	18	19	20
Substation	Muzuma	Muzuma	Chilundu	Victoria Falls	Muzuma
District	Choma	Choma	Siavonge	Livingstone	Choma
RGCs by DL	Luyaba	Kanchomba	Munyama	Manyemunyemu	Kasukwe
	Kanchele	Moyo	Sikoongo	Siadazya	Kabimba
		Singani	Gwena	Kasiya	
		Mukamunga	Chaanga	Zangala	
		Manyati	Sianyoolo	Siambelele	
		Gamela	Namoomba	Natebe	
			Malengo	Katapazi	
			Ibbwemunyama	Sichilore	
			Syangwemu	Simwizi	
			Dibbwi		
RGCs by SHS					Nachanowe

Provincial Ranking	21
Substation	Maamba
District	Sinazongwe
RGCs by DL	Kabanga
	Napatizya
	Muuka
	Siameja
	Dengera
	Masuku
	Mweemba
	Kafwambila
	Siansalama
	Namafulu
	Siatwiinda
	Chilele
	Sulwegonde
RGCs by SHS	Ngoma

Table 2 Electrification Priority of Project Packages by Province (11/12)
Western Province (1/2)

Provincial Ranking	1	2	3	4	5
Substation	Senanga	Mongu 2	Mongu 2	Mongu	Senanga
District	Senanga	Senanga	Senanga	Mongu	Senanga
RGCs by DL	Lui-mwemba	Sinunga	Nalolo	Nangula	Ngundi
	Liangati	Liliachi	Nangucha	Ikabako	Silumbi
		Nasilimwe	Kataba	Kaande	Songa
		Nasilimwe	Sianda	Mawawa	
				Mweeke	
				Siwa	
				Namitone	
RGCs by SHS		Sumi	Nangoma		

Provincial Ranking	6	7	8	9	10
Substation	Senanga 3	Kaoma	Kalabo	Mongu	Senanga 2
District	Senanga	Kaoma	Kalabo	Mongu	Shangombo
RGCs by DL	Nande	Kazabami	Makuku	Kasheke	Mulele
	Sitoti	Kalumwange	Sishekanu	Likutwe	Mutomena
	Beshe	Shitwa	Lwanda	Ikwiichi	
	Matebele	Namaloba	Mbanga	Ushaa	
	Namatoya		Nangili	Sitoya	
				Mombo	
				Sikusi	
RGCs by SHS		Kabapupu	Malasha		
			Liuwa		
			Mishuwundu		
			Kuuli		
			Munde		
			Mulinga		
			Likapai		

Provincial Ranking	11	12	13	14	15
Substation	Senanga 3	Kalabo	Senanga 2	Mongu 1	Kaoma
District	Senanga	Kalabo	Shangombo	Mongu	Kaoma
RGCs by DL	Likondwana	Ndau	Nangweshi	Mukangu	Shinono
	Kalengola	Kama	Kaanja	Luandui	Namilaugi
	Kaunga Lueti	Ngangu	Sioma	Nalikwanda	Longe
	Keyana	Tapo	Palace	Nakato	Mukandamina
	Namono	Mulundumano		Kalundwana	Kankwanda
				Lukweta	Nkeyama
				Simulumbe	
RGCs by SHS		Mwandi		Litawa	Shishamba
		Lulambo		Liande	Kalale
				Namengo	Lombelombe
					Chiluli
					Mimpongo
					Kandende
					Njonjolo

Provincial Ranking	16	17	18	19	20
Substation	New SS at Lukulu	Mongu 1	Senanga	Sesheke	New SS at Lukulu
District	Lukulu	Mongu	Senanga	Sesheke	Lukulu
RGCs by DL	Lukulu Township	Kaba Hill	Namabuka	SITULU	Simakumba
	Mwanambuyu	Kaungeta	Mata	Mwandi	Namayula
	Mwito	Lukalanys	Mwanamwaiye	Katima	Mitete
	Lishuwa	Miulwe	Sibukali	Mabumbu	Kakulunda
	Winda	Nalwei		Lusinina	
	Muyondoti	Ndondo		Lipumpu	
	Kawaya	Nasange			
	Lukau	Nandombe			
	Naimbu	Loona			
		Ndanda			
RGCs by SHS					Watopa
					Kakwacha
					Lupui
					Chinonwe

Table 2 Electrification Priority of Project Packages by Province (12/12)

Western Province (2/2)

Provincial Ranking	21	22	23	24	25
Substation	Senanga 1	Kaoma	Kalabo	Kaoma	Sesheke 1
District	Shangombo	Kaoma	Kalabo	Kaoma	Sesheke
RGCs by DL	Shangombo	Luamba	Tuuwa	Mayukwayukwa	Magumwi
	Kaunga Mashi	Kahokoto	Sikongo	Kapili	Sichili
	Sipuma	Kafunda	Liumba	Mangango	Loazamba
	Natukoma	Mushiwala	Liumena	Naliele	Bwina
	Nambolomoka	Mbanyutu	Siluwe	Lukena	Mulobezi
		Nkenga	Kalumbu	Lyamunale	
		Namasheshe	Loke West	Nyango	
		Mukunkiki	Salunda		
		Lubuka	LULANUNYI		
		Lui	Nyengo		
RGCs by SHS		Nyambi 2	Mbalala		Senamba
		Afumba	Muyumbana		Mushukula
		Nakayembe	Namatindi		Kasompa
		Namando	Kalenga		
		Mulwa	Lutwi		
			Sihole		
			Lueti		

Provincial Ranking	26
Substation	Sesheke 2
District	Sesheke
RGCs by DL	Nawinda
	Luampungu
	Sinjembela
	Lusu
	Imusho
	Ngweze
	Mazaba
	Silumbu
	Kalobolelwa
RGCs by SHS	

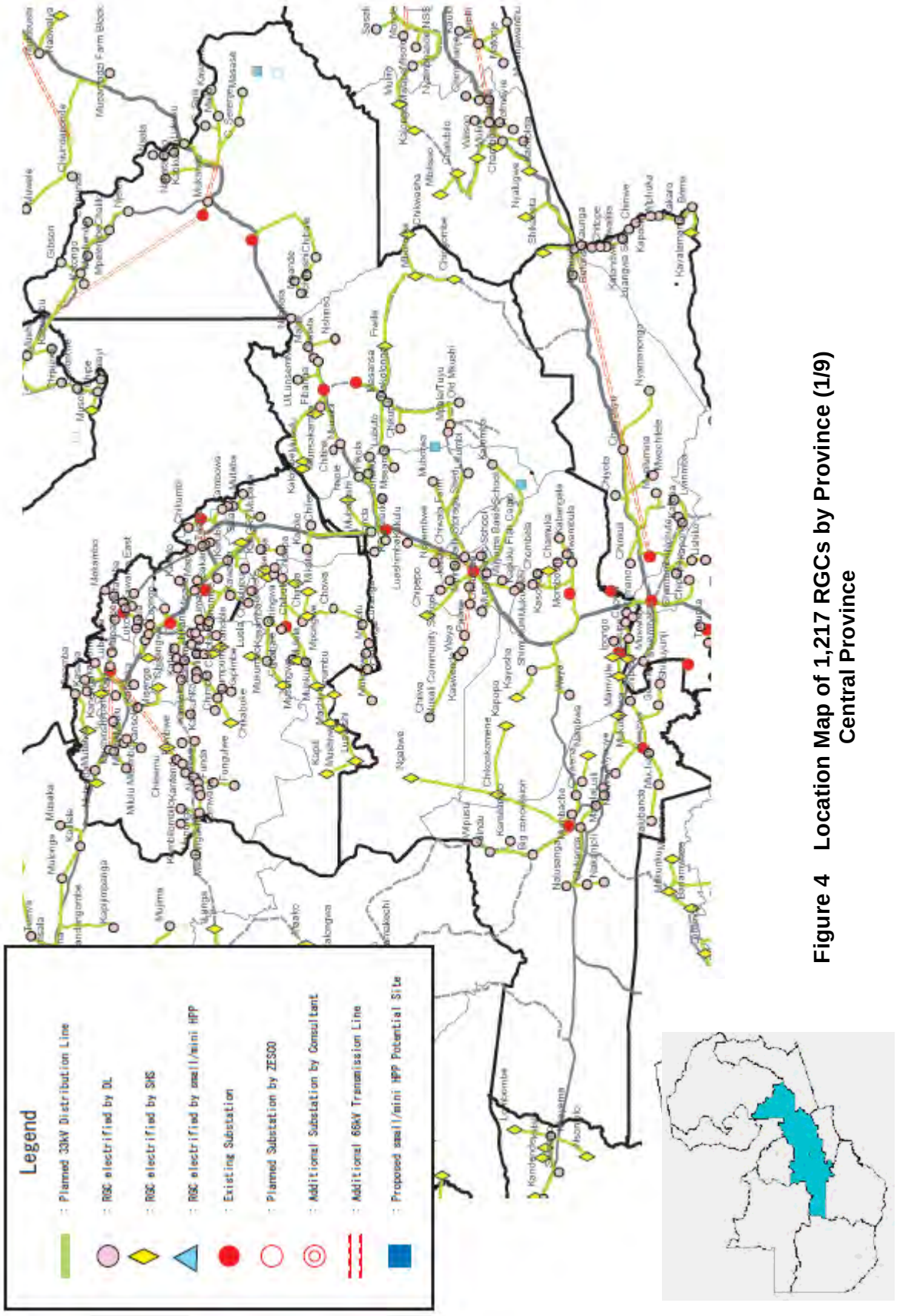

Figure 4 Location Map of 1,217 RGCs by Province (1/9)
Central Province

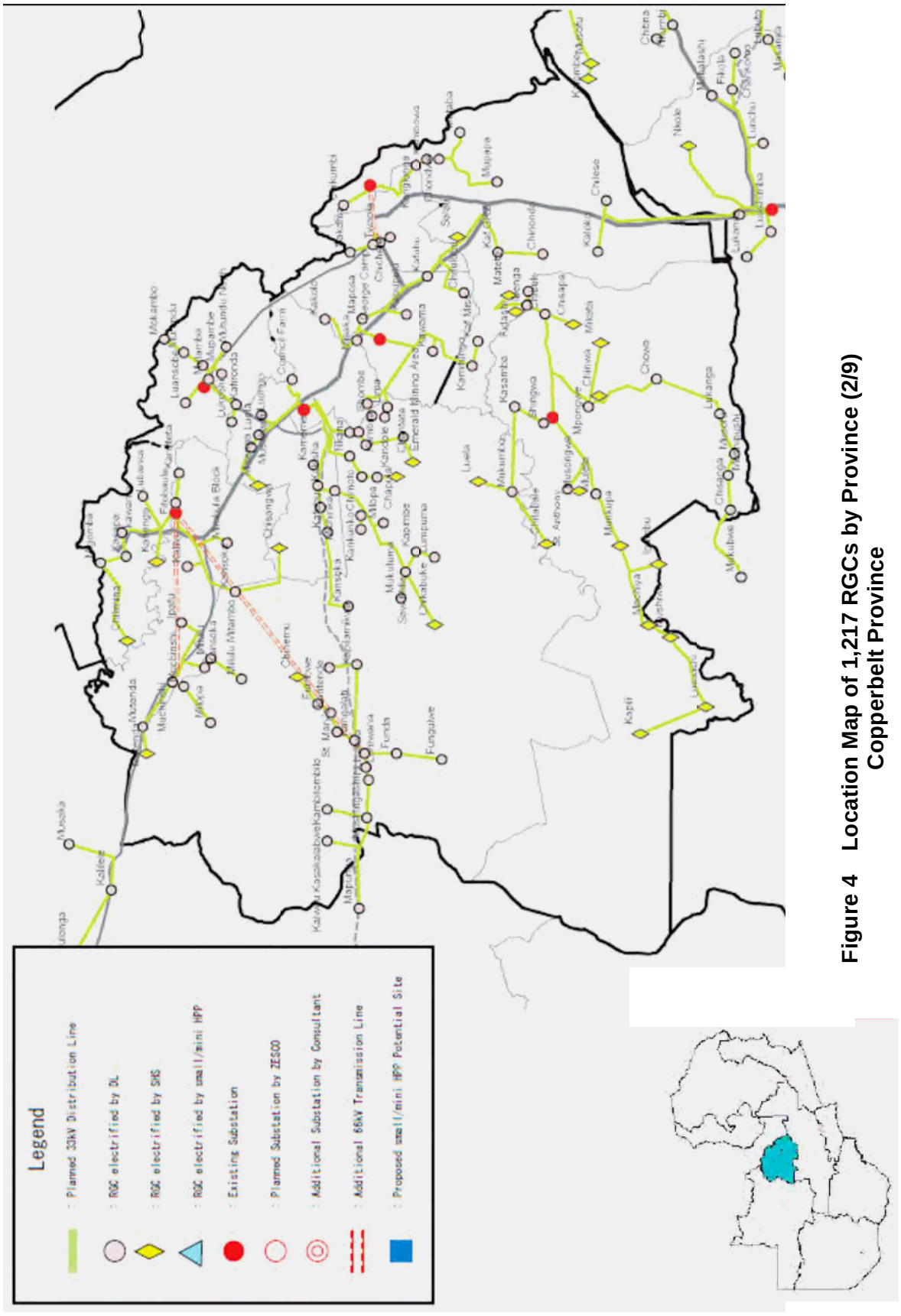

Figure 4 Location Map of 1,217 RGCs by Province (2/9)
Copperbelt Province

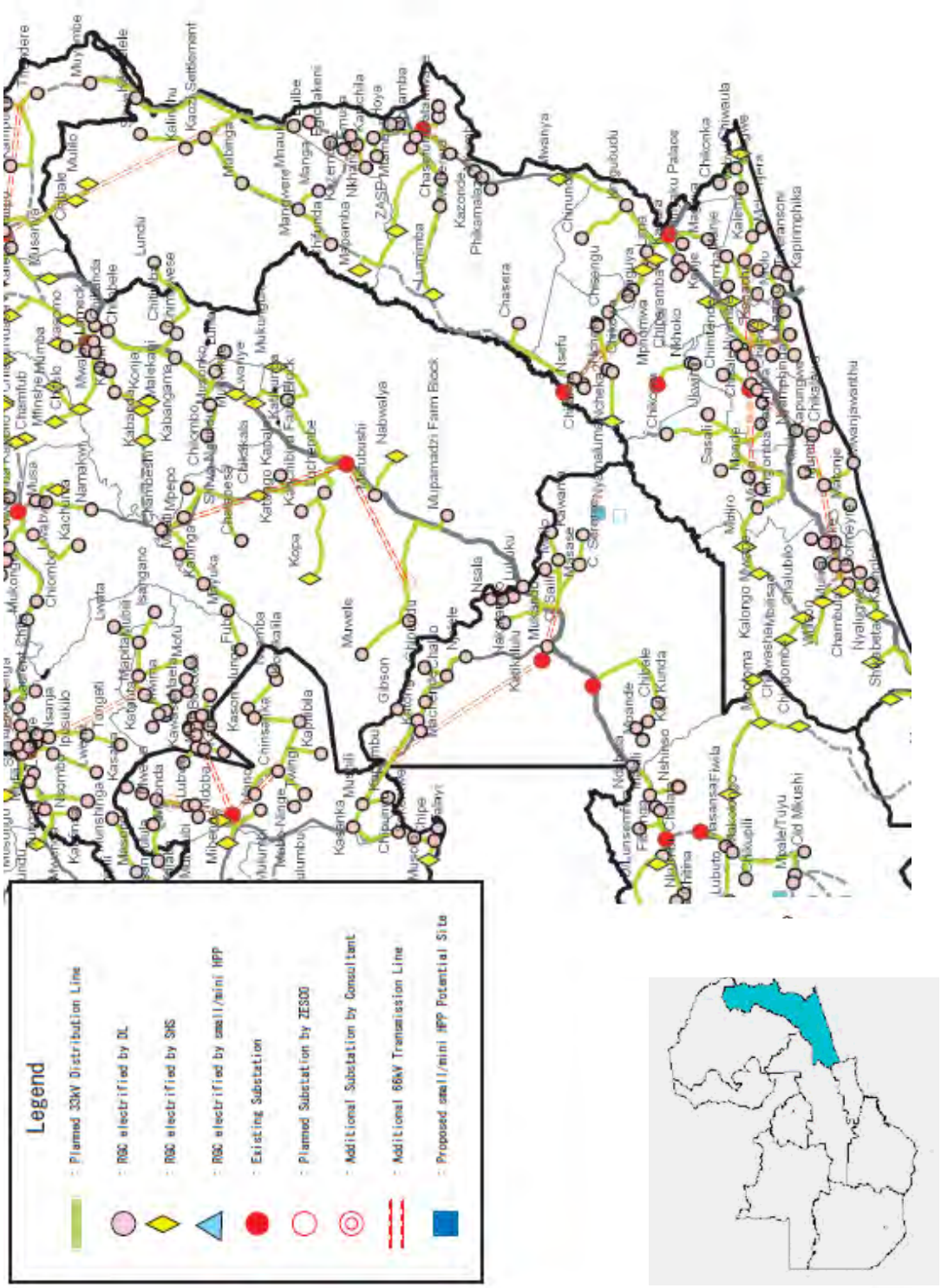

Figure 4 Location Map of 1,217 RGCs by Province (3/9)
Eastern Province

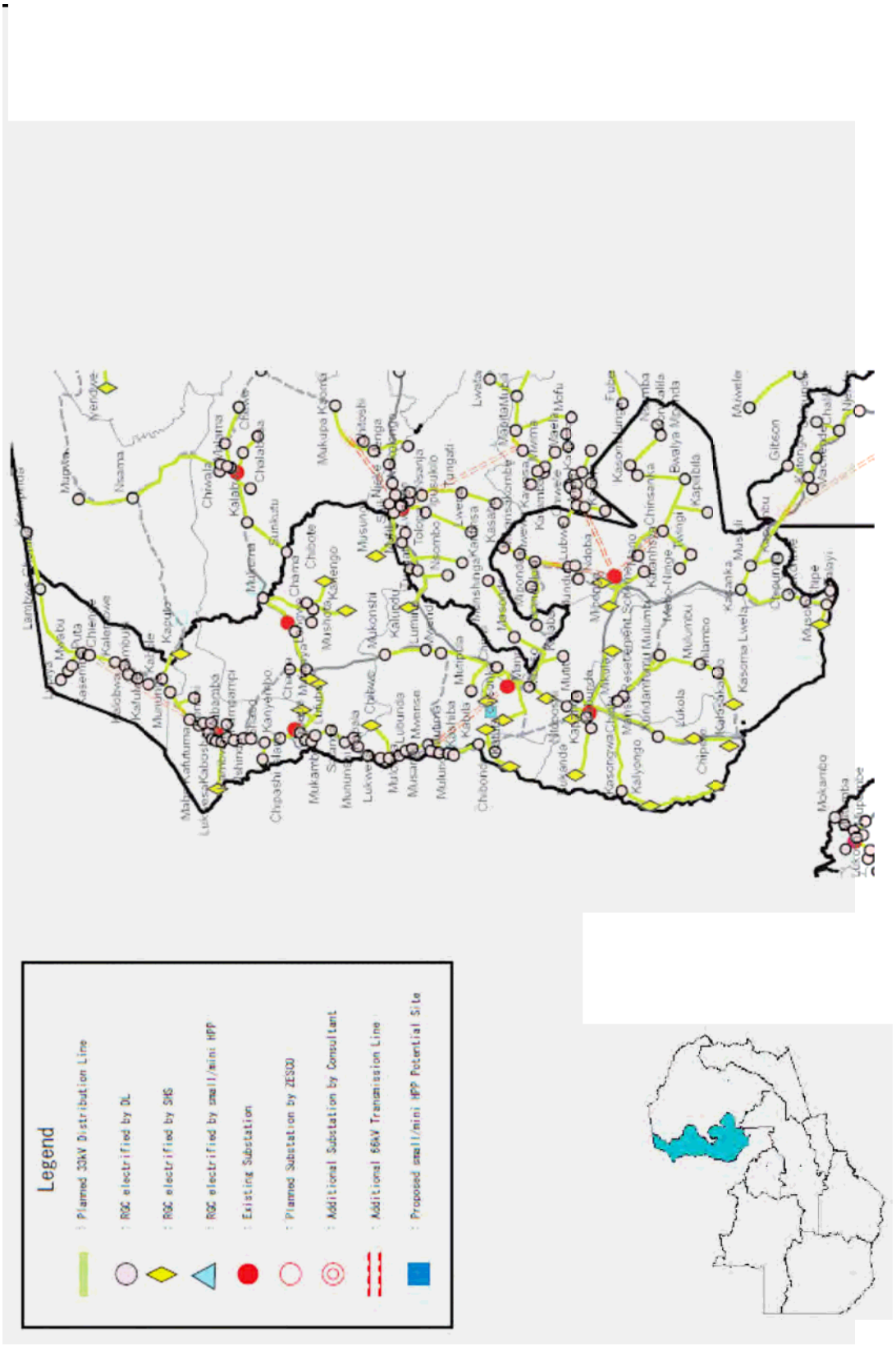

Figure 4 Location Map of 1,217 RGCs by Province (4/9)
Luapula Province

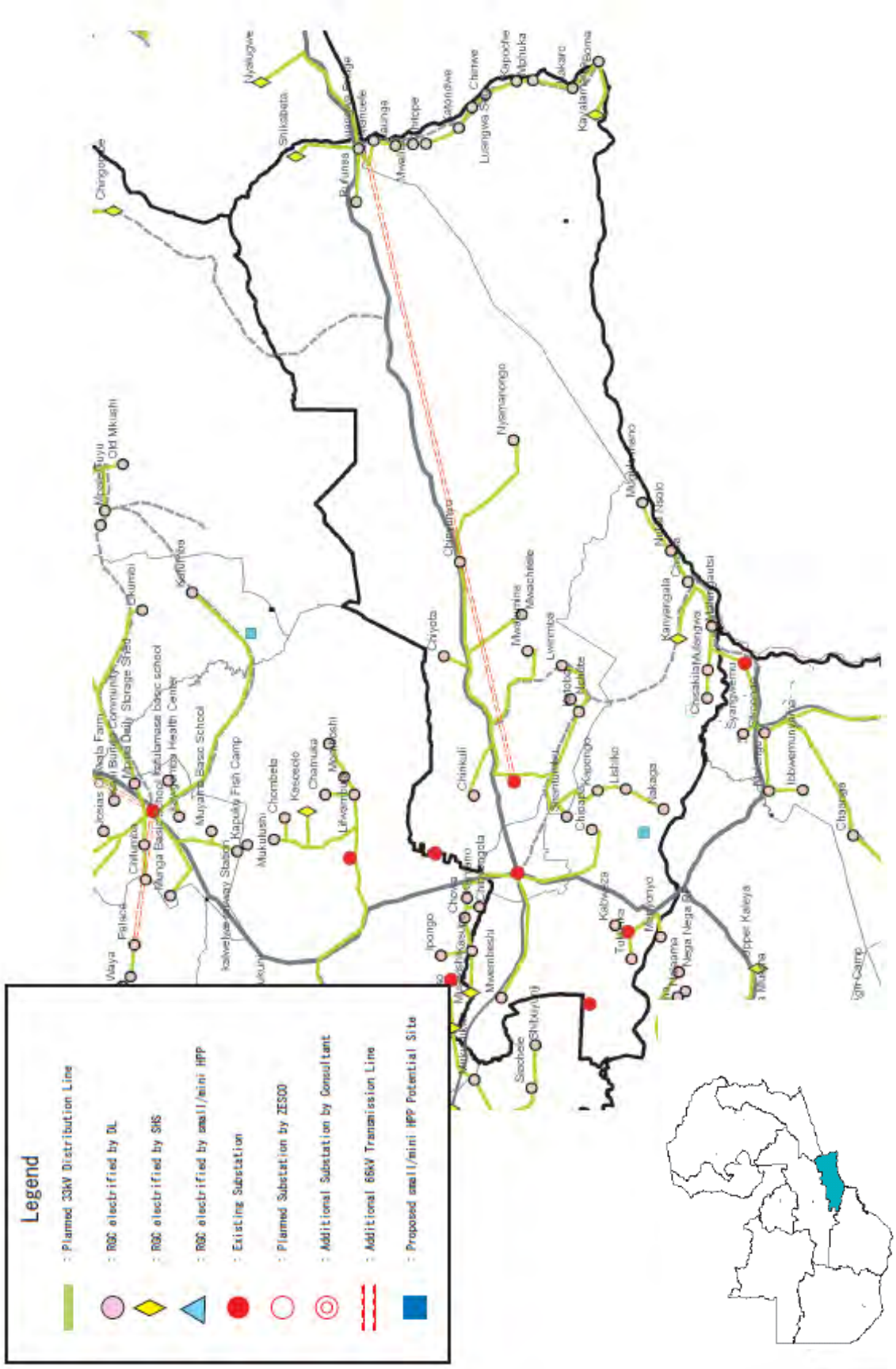

Figure 4 Location Map of 1,217 RGCs by Province (5/9)
Lusaka Province

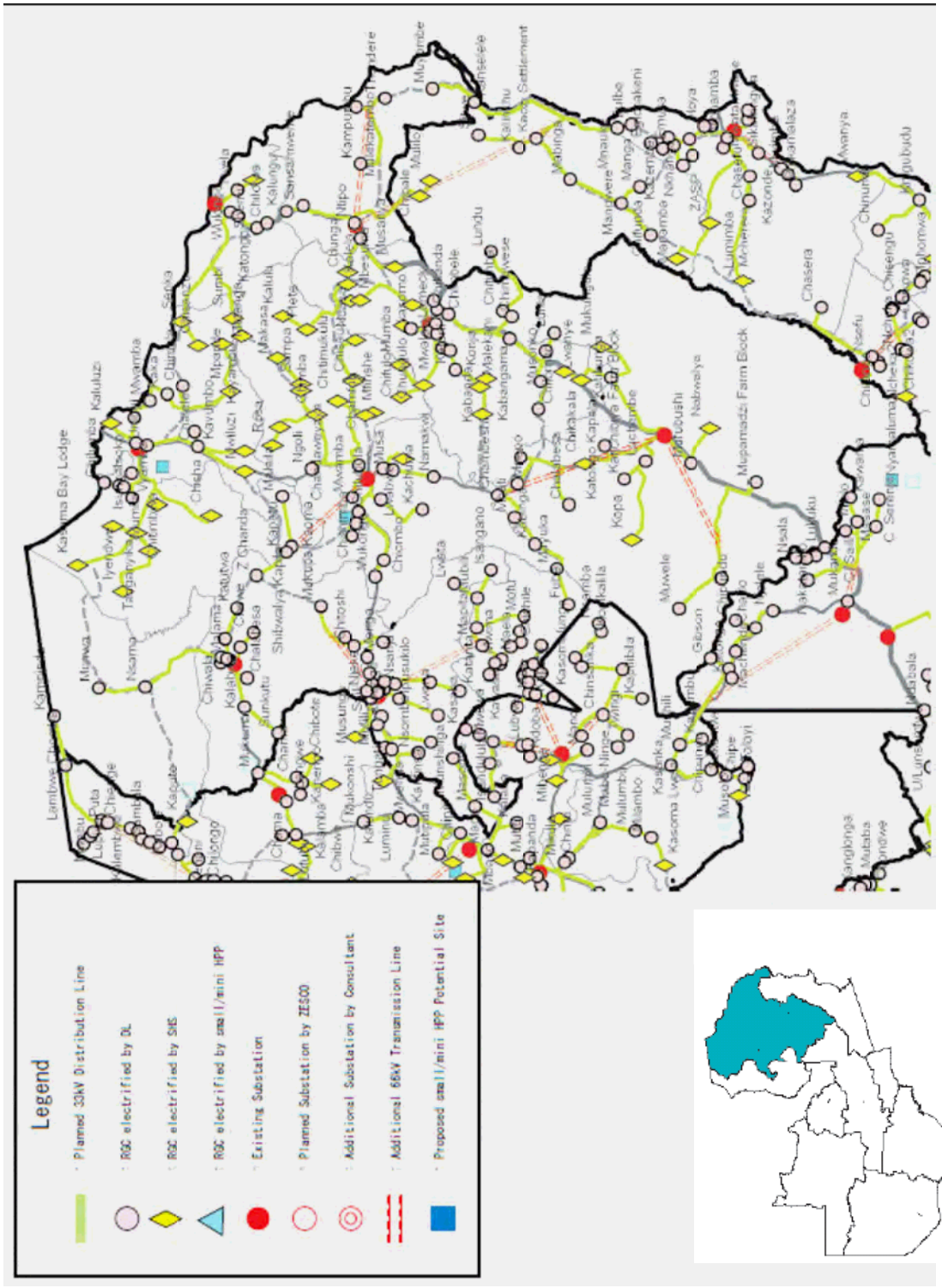

Figure 4 Location Map of 1,217 RGCs by Province (6/9)
Northern Province

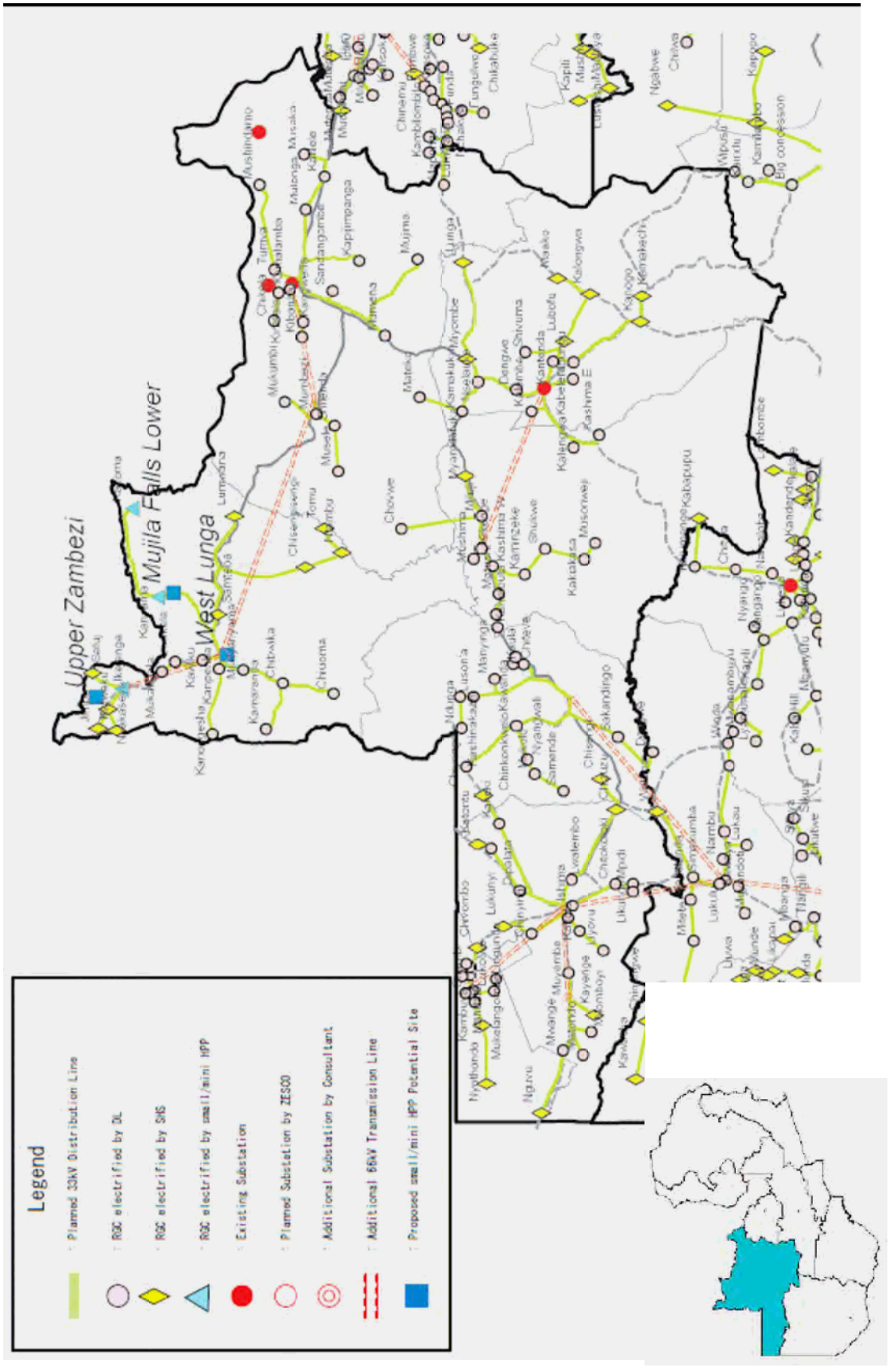

Figure 4 Location Map of 1,217 RGCs by Province (7/9)
Northwestern Province

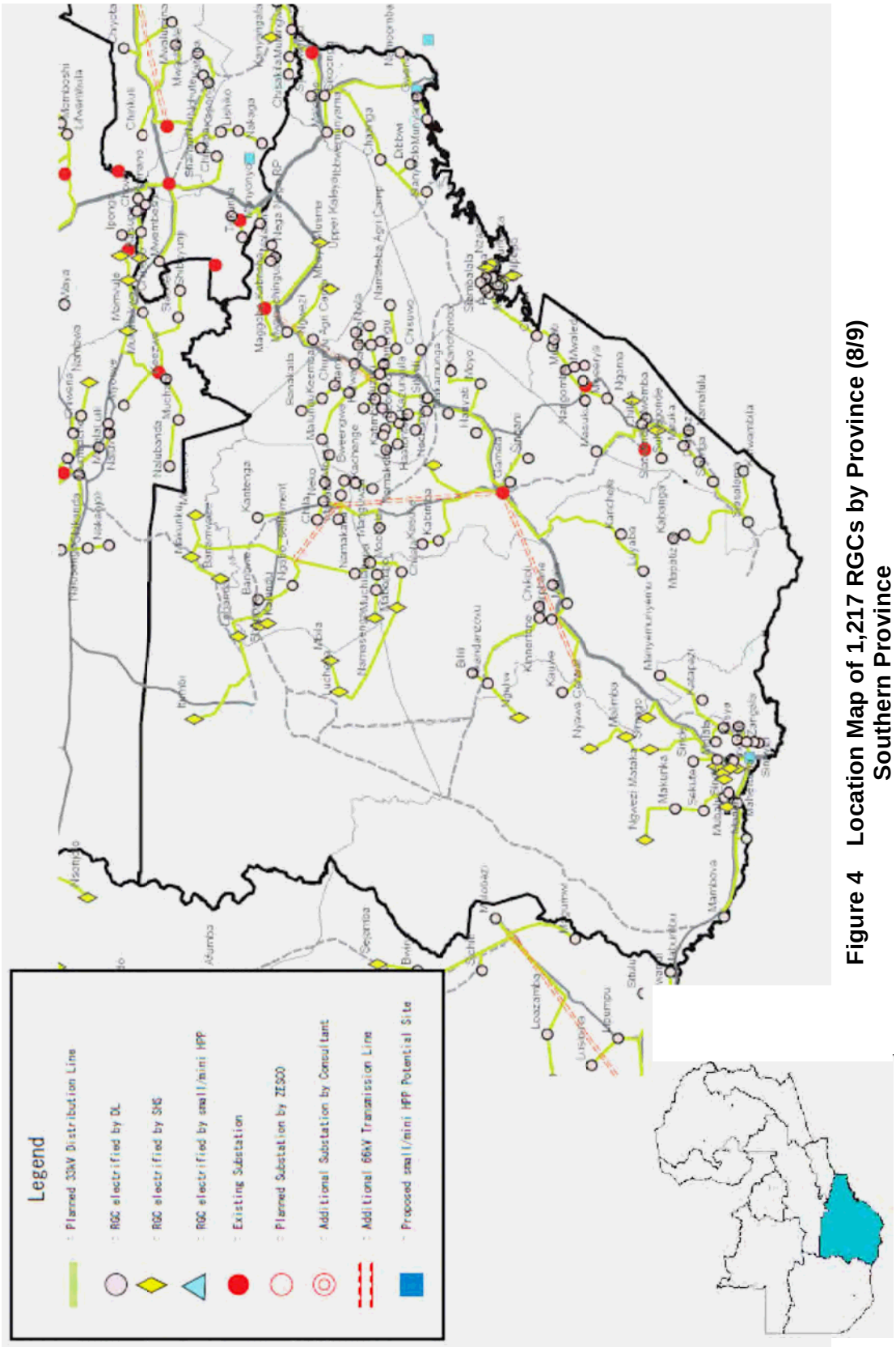

Figure 4 Location Map of 1,217 RGCs by Province (8/9)
Southern Province

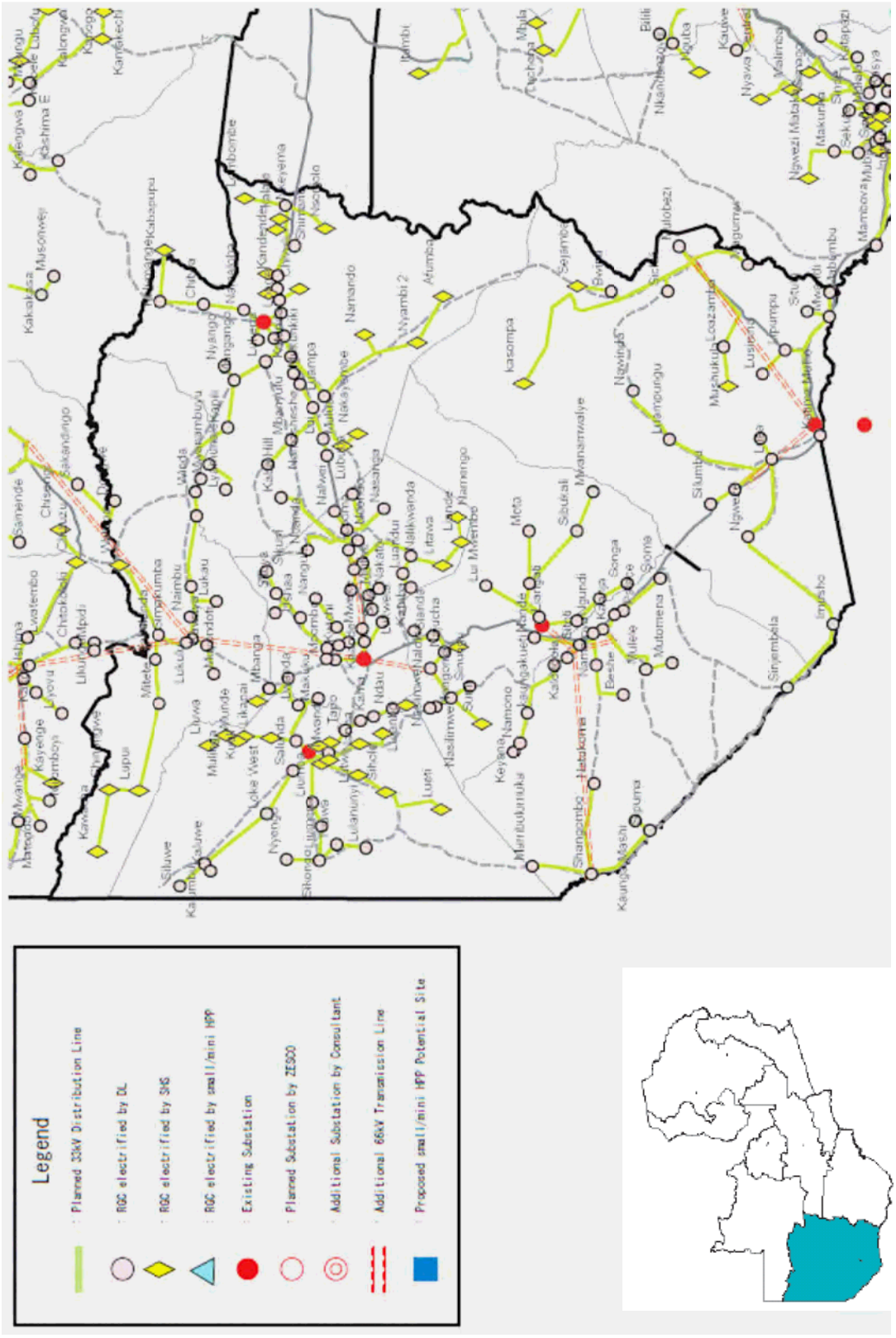

Figure 4 Location Map of 1,217 RGCs by Province (9/9)
Western Province

Table 3 Annual Project Phases by 2030 (1/2)

Annual Project Phase	FIRR Ranking	Substation	Province	Feeder & Package	Project Package Cost (US$)	Cumulative Cost (US$)	Project Package FIRR	Project Package EIRR
	1	Isoka	Northern	1 - 1	1,663,395	1,663,395	22.0%	59.9%
	2	Azele	Eastern	2 - 2	1,899,936	3,563,331	20.5%	57.5%
	3	Kapiri Mposhi	Central	2 - 2	2,701,296	6,264,627	18.1%	50.2%
	4	Kansunswa	Copperbelt	1 - 8	4,522,824	10,787,451	13.2%	35.1%
	5	Azele 2	Eastern	2 - 1	2,596,212	13,383,663	12.1%	34.1%
	6	Azele	Eastern	1 - 2	1,608,120	14,991,783	12.0%	33.9%
	7	Azele 3	Eastern	1 - 2	3,388,392	18,380,175	11.5%	32.4%
2009	8	Isoka	Northern	2 - 1	1,991,449	20,371,624	11.0%	29.5%
	9	Azele 1	Eastern	1 - 5	3,600,612	23,972,236	11.0%	31.1%
	10	Ndola 1	Copperbelt	1 - 4	3,675,672	27,647,908	10.8%	29.5%
	11	Lundazi	Eastern	3 - 2	2,733,588	30,381,496	9.5%	26.1%
	12	Chipata	Eastern	2 - 2	4,697,181	35,078,677	9.2%	26.3%
	13	Mbereshi	Luapula	1 - 3	3,243,548	38,322,225	9.1%	22.2%
	14	Azele 5	Eastern	1 - 3	7,189,452	45,511,677	8.7%	25.6%
	15	Kasama 1	Northern	1 - 2	4,621,185	**50,132,862**	8.7%	24.9%
	16	Senanga	Western	1 - 1	2,146,932	52,279,794	8.5%	23.3%
	17	Mbereshi	Luapula	2 - 1	1,854,468	54,134,262	8.4%	23.9%
	18	Kitwe	Copperbelt	1 - 3	2,637,930	56,772,192	8.2%	22.6%
	19	Azele 2	h	1 - 3	4,538,160	61,310,352	8.2%	23.8%
	20	Luwingu	Northern	3 - 3	1,395,468	62,705,820	7.7%	23.2%
	21	Mpongwe	Copperbelt	3 - 2	2,129,151	64,834,971	7.6%	22.8%
	22	Mongu 2	Western	2 - 3	6,104,929	70,939,900	7.5%	22.1%
2010	23	Nchelenge	Luapula	1 - 4	2,452,620	73,392,520	7.5%	19.1%
	24	Azele 3	Eastern	2 - 1	2,509,596	75,902,116	7.5%	22.6%
	25	Azele 1	Eastern	2 - 2	4,684,662	80,586,778	7.1%	21.9%
	26	Mongu 2	Western	1 - 3	4,321,732	84,908,511	7.1%	20.9%
	27	Mumbwa	Central	1 - 3	2,718,738	87,627,248	7.0%	21.3%
	28	Nchelenge	Luapula	2 - 4	4,452,947	92,080,196	6.8%	19.1%
	29	Nakonde	Northern	1 - 2	4,141,237	96,221,433	6.7%	16.6%
	30	Mongu	Western	1 - 4	3,890,700	**100,112,133**	5.9%	19.0%
	31	Muzuma 2	Southern	2 - 1	3,703,968	103,816,101	5.6%	17.7%
	32	Luwingu 3	Northern	2 - 5	4,202,496	108,018,597	5.5%	17.4%
	33	Samfya 2	Luapula	2 - 2	2,752,596	110,771,193	5.0%	14.4%
	34	Luano	Copperbelt	1 - 3	2,671,892	113,443,084	4.9%	15.5%
	35	Mbereshi 1	Luapula	2 - 5	6,873,037	120,316,122	4.9%	15.2%
2011	36	Mbala	Northern	2 - 4	7,660,327	127,976,449	4.8%	17.1%
	37	Pensulo	Central	1 - 1	599,616	128,576,065	4.6%	13.7%
	38	Msoro	Eastern	1 - 1	1,486,296	130,062,361	4.6%	14.4%
	39	Azele 4	Eastern	2 - 3	5,708,616	135,770,977	4.6%	16.4%
	40	Kabwe 1	Central	1 - 3	4,443,228	140,214,205	4.5%	16.0%
	41	Solwezi	North-Western	1 - 1	3,196,692	143,410,897	4.5%	16.3%
	42	Senanga	Western	3 - 3	4,424,004	**147,834,901**	4.4%	15.6%
	43	Luwingu 2	Northern	2 - 5	6,526,008	154,360,909	4.4%	16.3%
	44	Victoria Falls	Southern	3 - 1	3,027,377	157,388,286	4.4%	16.0%
	45	Kabwe 2	Central	1 - 2	5,905,008	163,293,294	4.3%	15.9%
	46	Luano	Copperbelt	2 - 4	3,294,509	166,587,803	4.3%	13.8%
	47	Senanga 3	Western	1 - 2	5,513,508	172,101,311	4.2%	15.2%
2012	48	Ndola	Copperbelt	1 - 3	4,725,756	176,827,067	4.1%	14.6%
	49	Kitwe	Copperbelt	2 - 3	3,237,335	180,064,402	4.0%	11.9%
	50	Samfya 1	Luapula	2 - 3	4,234,788	184,299,190	3.9%	13.2%
	51	Samfya	Luapula	1 - 1	1,580,313	185,879,504	3.7%	14.6%
	52	Muzuma 1	Southern	2 - 1	4,833,777	190,713,281	3.6%	14.0%
	53	Mwinilunga 1	North-Western	1 - 0	5,725,580	**196,438,861**	3.6%	14.5%
	54	Mporokoso	Northern	2 - 6	7,404,372	203,843,233	3.6%	14.3%
	55	Kawambwa Tea	Luapula	1 - 6	5,397,673	209,240,906	3.5%	10.4%
	56	Mbereshi 1	Luapula	1 - 3	5,025,125	214,266,031	3.4%	12.7%
	57	Samfya 2	Luapula	1 - 3	4,748,220	219,014,251	3.3%	12.4%
2013	58	Kaoma	Western	4 - 2	3,768,420	222,782,671	3.2%	13.4%
	59	Nampundwe	Central	1 - 5	6,848,699	229,631,370	3.1%	13.2%
	60	Luwingu 1	Northern	1 - 5	7,400,916	237,032,286	2.9%	13.2%
	61	Isoka	Northern	3 - 2	4,738,824	241,771,110	2.9%	12.9%
	62	Kasama 2	Northern	1 - 4	7,680,960	**249,452,070**	2.8%	12.3%
	63	Kalabo	Western	1 - 3	6,835,774	256,287,844	2.7%	13.0%
	64	Muzuma 3	Southern	1 - 3	4,332,960	260,620,804	2.7%	12.1%
	65	Pensulo 1	Central	2 - 5	5,346,756	265,967,560	2.7%	12.5%
	66	Luwingu 3	Northern	1 - 3	3,819,528	269,787,088	2.6%	13.0%
2014	67	Lundazi	Eastern	1 - 2	4,265,265	274,052,353	2.3%	11.5%
	68	Mongu	Western	2 - 5	7,319,376	281,371,729	2.3%	12.3%
	69	Nchelenge 1	Luapula	1 - 3	4,821,120	286,192,849	2.3%	10.1%
	70	Luwingu	Northern	1 - 4	7,722,972	293,915,821	2.2%	12.3%
	71	Senanga 2	Western	2 - 2	2,739,744	**296,655,565**	2.2%	11.8%
	72	Kabwe	Central	2 - 5	6,458,570	303,114,135	2.1%	11.5%
	73	Senanga 3	Western	2 - 3	7,618,536	310,732,671	2.1%	11.6%
	74	Kapiri Mposhi	Central	1 - 6	5,897,704	316,630,374	2.0%	11.0%
	75	Kalabo	Western	2 - 1	3,550,455	320,180,829	1.8%	11.4%
2015	76	Senanga 2	Western	1 - 3	3,328,452	323,509,281	1.8%	10.2%
	77	Mporokoso	Northern	1 - 5	4,094,712	327,603,993	1.7%	10.6%
	78	Muzuma 1	Southern	1 - 4	7,543,863	335,147,856	1.7%	10.1%
	79	Mongu 1	Western	1 - 4	9,228,684	344,376,540	1.6%	11.1%
	80	Lundazi 1	Eastern	1 - 3	4,215,024	**348,591,564**	1.5%	10.8%
	81	Kaoma	Western	1 - 2	5,340,384	353,931,948	1.5%	8.5%
	82	Mazabuka	Southern	1 - 3	4,470,646	358,402,594	1.5%	3.5%
	83	Luwingu 2	Northern	1 - 5	7,625,988	366,028,582	1.5%	11.0%
	84	Mfuwe 1	Eastern	1 - 5	4,996,989	371,025,571	1.5%	10.7%
2016	85	Solwezi	North-Western	2 - 4	2,663,712	373,689,283	1.5%	10.4%
	86	Kafwe Town	Lusaka	1 - 3	1,582,632	375,271,915	1.5%	9.2%
	87	Mumbwa	Central	3 - 4	6,012,576	381,284,491	1.3%	10.2%
	88	Lundazi	Eastern	2 - 7	8,256,276	389,540,767	1.2%	9.1%
	89	Isoka 1	Northern	1 - 1	4,628,988	394,169,755	1.2%	9.5%
	90	Muzuma 3	Southern	2 - 6	5,251,284	**399,421,039**	1.1%	9.4%

Table 3 Annual Project Phases by 2030 (2/2)

Annual Project Phase	FIRR Ranking	Substation	Province	Feeder & Package	Project Package Cost (US$)	Cumulative Cost (US$)	Project Package FIRR	Project Package EIRR
2017	91	Luano 2	Copperbelt	1 - 5	6,578,303	405,999,342	1.1%	8.8%
	92	Isoka 1	Northern	2 - 1	4,419,792	410,419,134	1.1%	9.8%
	93	Azele 4	Eastern	1 - 4	11,500,056	421,919,190	1.0%	10.1%
	94	New SS at Lukulu	Western	1 - 5	8,474,976	430,394,166	1.0%	6.9%
	95	Mongu 1	Western	2 - 8	10,201,680	440,595,846	1.0%	10.2%
	96	Mpika	Northern	1 - 1	1,760,209	442,356,055	0.9%	9.5%
	97	Mkushi	Central	1 - 7	6,928,735	**449,284,790**	0.8%	7.1%
2018	98	Nchelenge 1	Luapula	2 - 4	7,155,648	456,440,438	0.8%	8.3%
	99	Luwingu	Northern	2 - 5	7,468,756	463,909,194	0.7%	9.7%
	100	Mfuwe	Eastern	1 - 3	7,515,828	471,425,022	0.6%	9.5%
	101	Mazabuka 1	Southern	2 - 6	6,055,668	477,480,690	0.6%	7.7%
	102	Maposa	Copperbelt	2 - 4	3,617,136	481,097,826	0.4%	8.1%
	103	Chinsali	Northern	2 - 1	2,330,585	483,428,411	0.4%	6.3%
	104	Senanga	Western	2 - 3	8,819,172	492,247,583	0.4%	8.7%
	105	Kasama	Northern	2 - 5	7,077,132	**499,324,715**	0.4%	8.5%
2019	106	Kasama	Northern	1 - 3	5,713,510	505,038,225	0.3%	8.7%
	107	Mpika	Northern	2 - 3	5,137,329	510,175,554	0.3%	8.4%
	108	Mpika	Northern	3 - 1	3,998,616	514,174,170	0.0%	8.2%
	109	Azele 6	Eastern	2 - 2	3,756,780	517,930,950	0.0%	8.4%
	110	Maposa	Copperbelt	1 - 6	9,191,420	527,122,370	-0.3%	7.3%
	111	Chipili	Luapula	1 - 4	4,431,563	531,553,933	-0.4%	6.4%
	112	Mumbwa	Central	2 - 3	4,442,904	535,996,837	-0.5%	5.7%
	113	Mpika 1	Northern	1 - 2	7,672,860	543,669,697	-0.5%	7.3%
	114	Kitwe	Copperbelt	3 - 8	7,121,331	**550,791,028**	-0.7%	4.7%
2020	115	Sesheke	Western	1 - 4	8,686,008	559,477,036	-0.7%	6.4%
	116	Chilundu	Southern	1 - 3	3,654,055	563,131,091	-0.8%	6.1%
	117	Azele 8	Eastern	1 - 3	7,260,841	570,391,932	-0.8%	7.3%
	118	Mkushi Farm Block	Central	1 - 5	7,827,920	578,219,852	-0.8%	5.1%
	119	Chipata	Eastern	1 - 4	6,540,564	584,760,416	-0.9%	6.8%
	120	Pensulo 1	Central	1 - 4	5,382,180	590,142,596	-0.9%	7.1%
	121	Mazabuka 1	Southern	3 - 9	6,448,248	**596,590,844**	-1.0%	6.1%
2021	122	Muzuma 2	Southern	1 - 4	7,909,413	604,500,257	-1.0%	7.0%
	123	Chinsali	Northern	3 - 1	1,524,740	606,024,997	-1.0%	5.4%
	124	New SS at Kabompo	North-Western	2 - 5	11,671,020	617,696,017	-1.1%	6.7%
	125	New SS at Lukulu	Western	2 - 2	7,012,149	624,708,166	-1.2%	6.1%
	126	Sinazongwe	Southern	1 - 8	6,081,434	630,789,600	-1.2%	4.9%
	127	Kabwe	Central	1 - 7	6,657,012	637,446,612	-1.3%	6.1%
	128	New SS at Zambezi	North-Western	2 - 2	5,702,795	643,149,407	-1.6%	6.3%
	129	Zambezi 1	North-Western	1 - 4	6,633,935	**649,783,342**	-1.6%	6.3%
2022	130	New SS at Mwinilunga	North-Western	4 - 0	8,688,211	658,471,554	-2.0%	4.6%
	131	New SS at Zambezi	North-Western	1 - 6	11,189,609	669,661,163	-2.2%	4.7%
	132	Luano 1	Copperbelt	1 - 4	4,613,690	674,274,852	-2.4%	3.4%
	133	Samfya 1	Luapula	1 - 5	6,764,040	681,038,892	-2.4%	4.1%
	134	Muzuma 1	Southern	3 - 1	3,025,234	684,064,126	-2.4%	4.6%
	135	Pensulo 2	Central	2 - 2	13,040,814	697,104,940	-2.5%	4.8%
	136	Mpongwe	Copperbelt	2 - 1	1,797,786	**698,902,726**	-2.6%	4.1%
2023	137	Senanga 1	Western	1 - 4	17,644,176	716,546,902	-2.6%	4.6%
	138	Pensulo 2	Central	1 - 5	10,138,284	726,685,186	-2.8%	4.4%
	139	Luano 1	Copperbelt	2 - 4	6,293,808	732,978,994	-2.9%	3.0%
	140	New SS at Chilundu	Lusaka	2 - 1	12,535,782	**745,514,776**	-2.9%	2.9%
2024	141	Coventry	Lusaka	1 - 4	5,593,913	751,108,689	-3.0%	2.2%
	142	Mpika 2	Northern	1 - 3	9,631,764	760,740,453	-3.1%	4.0%
	143	Kaoma	Western	2 - 3	9,098,247	769,838,700	-3.1%	3.4%
	144	Mpika 1	Northern	2 - 3	11,886,696	781,725,396	-3.4%	3.2%
	145	Mazabuka 1	Southern	1 - 4	4,611,924	786,337,320	-3.5%	2.4%
	146	New SS at Mwinilunga	North-Western	3 - 2	3,620,916	789,958,236	-3.5%	3.1%
	147	New SS at Mwinilunga	North-Western	2 - 4	9,098,892	**799,057,128**	-3.6%	3.1%
2025	148	New SS at Mwinilunga	North-Western	1 - 1	20,302,796	819,359,923	-3.9%	0.4%
	149	Fig Tree	Central	1 - 6	7,558,211	826,918,134	-3.9%	1.6%
	150	Leopard's Hill	Lusaka	1 - 11	12,860,964	839,779,098	-4.0%	2.5%
	151	Serenje	Central	1 - 3	7,325,532	**847,104,630**	-4.2%	2.4%
2026	152	Victoria Falls	Southern	2 - 4	5,482,320	852,586,950	-4.2%	0.3%
	153	New SS at Mufumbwe	North-Western	1 - 7	13,926,801	866,513,751	-4.5%	1.4%
	154	Kalabo	Western	3 - 5	16,593,051	883,106,802	-5.0%	2.1%
	155	Kaoma	Western	3 - 3	10,689,516	893,796,318	-5.1%	0.8%
	156	Mpongwe	Copperbelt	1 - 5	8,733,023	**902,529,340**	-5.1%	1.7%
2027	157	Muzuma	Southern	2 - 2	4,124,628	906,653,968	-5.3%	1.5%
	158	Kasempa	North-Western	2 - 4	6,904,408	913,558,376	-5.3%	0.2%
	159	Chipili	Luapula	2 - 2	8,344,891	921,903,267	-6.0%	0.7%
	160	Solwezi	North-Western	3 - 5	10,115,604	932,018,871	-6.0%	0.5%
	161	Isoka 1	Northern	3 - 1	5,762,340	937,781,211	-6.0%	0.7%
	162	Sesheke 1	Western	1 - 5	13,319,939	**951,101,150**	-6.0%	0.1%
2028	163	Muzuma	Southern	1 - 5	5,281,740	956,382,890	-6.1%	-0.7%
	164	Mansa	Luapula	2 - 3	1,822,819	958,205,709	-6.1%	-2.5%
	165	Chilundu	Southern	2 - 8	8,734,500	966,940,209	-6.5%	-0.2%
	166	Victoria Falls	Southern	1 - 5	3,954,312	970,894,521	-6.6%	-3.1%
	167	New SS at Mumbezi	North-Western	1 - 2	6,636,492	977,531,013	-6.8%	0.0%
	168	New SS at Chavuma	North-Western	1 - 8	6,768,591	984,299,604	-7.0%	-1.7%
	169	Muzuma	Southern	3 - 1	3,083,260	987,382,864	-7.0%	-0.5%
	170	New SS at Kabompo	North-Western	1 - 4	11,623,500	**999,006,364**	-7.0%	-1.9%
2029	171	New SS at Chama	Eastern	2 - 5	11,377,800	1,010,384,164	-7.0%	-0.1%
	172	New SS at Chama	Eastern	1 - 3	14,867,712	1,025,251,876	-7.8%	-1.3%
	173	Chinsali	Northern	1 - 4	9,725,076	1,034,976,952	-7.8%	-2.6%
	174	New SS at Chilundu	Lusaka	1 - 1	5,825,784	1,040,802,737	-8.1%	-1.1%
	175	New SS at Nyimba	Eastern	1 - 6	6,870,917	1,047,673,654	-8.2%	-4.4%
	176	Kasempa	North-Western	1 - 4	3,434,849	**1,051,108,503**	-8.7%	-3.0%
2030	177	Maamba	Southern	1 - 8	15,171,571	1,066,280,073	-9.8%	-3.8%
	178	Sesheke 2	Western	1 - 4	21,945,600	1,088,225,673	-10.2%	-2.7%
	179	Mansa	Luapula	1 - 5	8,269,414	1,096,495,087	-12.6%	-5.6%
	180	Mbala	Northern	1 - 2	6,590,154	**1,103,085,242**	-13.1%	-4.2%

Table 4 Targeting Electrification Rate in 2030

	2006				2030		
	# of HH	HH Ratio	# of Elec. HH	Elec. Rate	# of HH	# of Elec. HH	Elec. Rate
Urban	896,234	(39.0%)	426,608	47.6%	1,779,880	1,601,892	90.0%
Rural	1,403,408	(61.0%)	43,506	3.1%	2,787,102	1,411,604	50.6%
a) 1,216RGCs	*535,717*	*(23.4%)*	*0*	-	*1,067,729*	*1,067,729*	*100.0%*
b) Others	*867,691*	*(37.6%)*	*43,506*	*3.1%*	*1,719,373*	*343,875*	*20.0%*
Total	**2,299,642**	**(100.0%)**	**470,113**	**20.4%**	**4,566,982**	**3,013,496**	**66.0%**

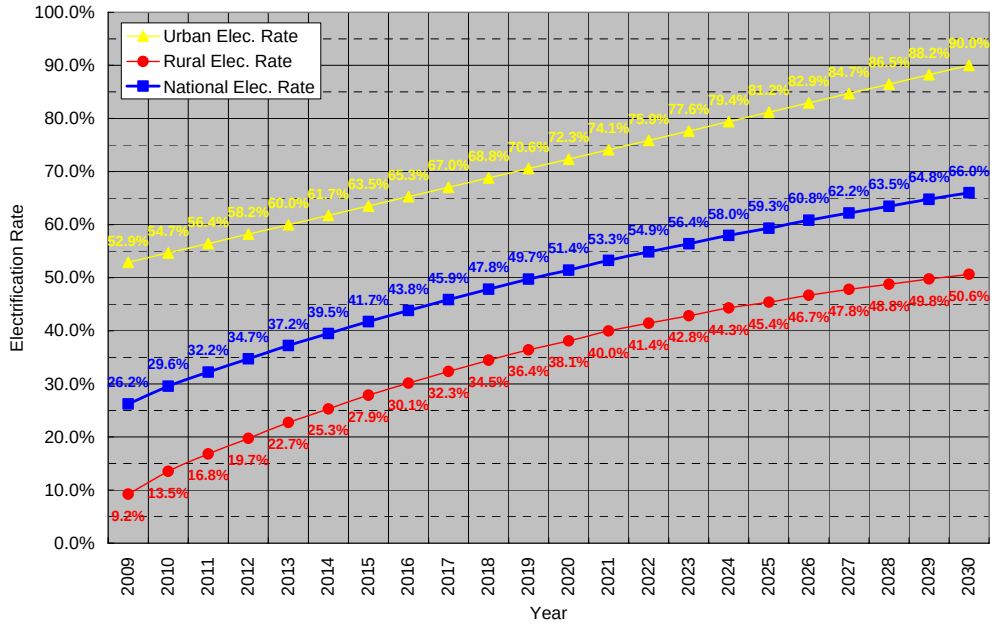

Figure 5 Transition of Household Electrification Rates by 2030

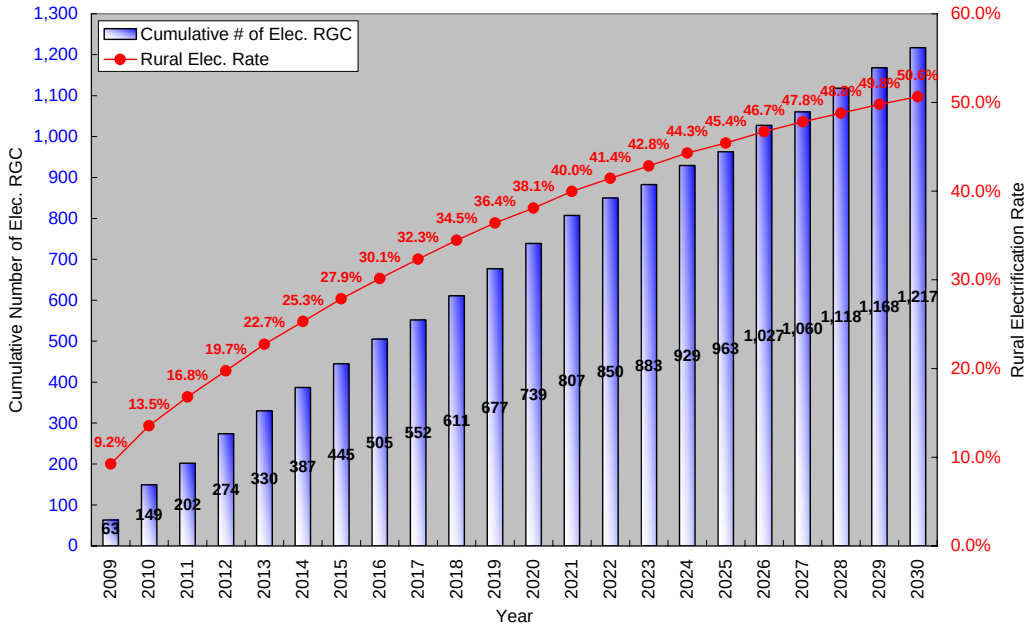

Figure 6 Transition of Cumulative Number of Electrified RGCs and Rural Electrification Rate by 2030

Table 5 Brief Specifications of Mini-Hydro Power Plants (1/2)

1. Mujila Falls Lower

[Design Result]

Province	Northwestern
District	Mwinilunga
Name of the Site	Mujila Falls Lower
Name of the River	Mujila River
Latitude	S11:30:52
Longitude	E24:46:24
Catchment Area	1,146 km^2
80% available discharge	9.21 m^3/s
Design Discharge	10.0 m^3/s
Gross Head	18.0 m
Effective Head	17.1 m
Generation Capacity	1,400 kW
Volume of Powerhouse	596 m^3
Volume of Weir	450 m^3
Length of Channel	210 m
Length of Penstock	23 m
Length of Tailrace	20 m
Length of Spillway	36 m
Length of Distribution Line	98 km

[Electrified Area]

Kanyama RGC	598 kW
Kakoma RGC	350 kW
Mujila Village	234 kW
Kapundu Village	233 kW
Total	1,415 kW

[Project Cost Estimation]

I. Construction Cost	6,393,200 US$
i) Temporary Works	404,070 US$
ii) Civil Engineering	1,070,230 US$
iii) Turbine, Gen and Main Transform	1,158,000 US$
iv) Distribution Line & Transformer	3,760,900 US$
II. Engineering Service Cost	511,456 US$
III. Overhead Cost	1,598,300 US$
IV. Profit Margine	1,278,640 US$
Grand Total	9,781,596 US$

2. Upper Zambezi

[Design Result]

Province	Northwestern
District	Mwinilunga
Name of the Site	Upper Zambezi
Name of the River	Zambezi River
Latitude	S11:06:18
Longitude	E24:13:41
Catchment Area	698 km^2
80% available discharge	6.44 m^3/s
Design Discharge	6.0 m^3/s
Gross Head	9.0 m
Effective Head	8.0 m
Generation Capacity	380 kW
Volume of Powerhouse	362 m^3
Volume of Weir	216 m^3
Length of Channel	142 m
Length of Penstock	47 m
Length of Tailrace	30 m
Length of Spillway	60 m
Length of Distribution Line	4.5 km

[Electrified Area]

Ikelenge RGC	1995 kW
Nyakaseya RGC	483 kW

[Project Cost Estimation]

I. Construction Cost	1,496,720 US$
i) Temporary Works	224,360 US$
ii) Civil Engineering	677,860 US$
iii) Turbine, Gen and Main Transform	364,000 US$
iv) Distribution Line & Transformer	230,500 US$
II. Engineering Service Cost	119,738 US$
III. Overhead Cost	374,180 US$
IV. Profit Margine	299,344 US$
Grand Total	2,289,982 US$

Table 5 Brief Specifications of Mini-Hydro Power Plants (2/2)

3. West Lunga

[Design Result]

Province	Northwestern
District	Mwinilunga
Name of the Site	West Lunga
Name of the River	West Lunga
Latitude	S11:47:37
Longitude	E24:26:56
Catchment Area	5,460 km^2
95% available discharge	35 m^3/s
Design Discharge	20.0 m^3/s
Gross Head	-
Effective Head	14.5 m
Generation Capacity	2,500 kW
Volume of Powerhouse	1130 m^3
Volume of Weir	- m^3
Length of Channel	1500 m
Length of Penstock	- m
Length of Tailrace	- m
Length of Spillway	- m
Length of Distribution Line	6.5 km

[Electrified Area]

Mwinilunga BOMA	2,093 kW

[Project Cost Estimation]

I. Construction Cost	5,746,043 US$
i) Temporary Works	178,524 US$
ii) Civil Engineering	2,385,271 US$
iii) Turbine, Gen and Main Transform	3,023,918 US$
iv) Distribution Line & Transformer	158,330 US$
II. Engineering Service Cost	498,890 US$
III. Others	1,227,703 US$
Grand Total	7,472,636 US$

5 Recommendation

5.1 Practical Use of Master Plan

Although the final electrification priority of Project Packages were determined by Financial Indicator (FIRR) in the REMP, the priority should be modified in practice and updated by taking into account the opinions of Zambian Government and Financial Organization, such as in the financial coordination with International Development Partners. For example, Zambian Government may wish to pay attention to the balance of development among areas/Provinces. Some of Financial Organizations may also wish to apply some project selection criteria as their loan conditions. Therefore, the staff members of DoE and REA need skills to merge the new criteria with the original Master Plan in a flexible way. Such skills and techniques could be transferred under the JICA Technical Cooperation Project scheduled to commence in 2008.

Since financial evaluation for SHS portion in each Project Package was excluded in the REMP, International Donors may not be willing to provide financial assistance for SHS projects. They may, for instance, wish to finance a Project Package with high priority ranking but excluding RGCs electrified by SHS in a Package. Even in such a case, however, maintaining an electrification priority order of SHS portion according to the priority of a Project Package, by providing subsidy utilising Rural Electrification Fund (REF) for SHS installation to households and business entities, is suggested. Regarding public facilities (such as school and hospital/clinic) in RGCs electrified by SHS, the installation cost is assumed to be provided from the Government Authorities (such as Ministry of Education and Ministry of Health).

5.2 Management of Rural Electrification Fund

The REF as currently funded is not sufficient to implement the REMP, and thus measures are needed to increase REF and methods of efficient and effective utilization of funds need to be considered. Firstly, the Zambian Government should allocate an adequate budget every year toward the REF as it does for other infrastructures, such as health and road sector. Secondly, the Rural Electrification Levy should be charged to the mining sector (which consumes 50% of the national total) and to the export of electricity. At the time of writing, it was uncertain what percentage of levy should be charged to the mining sector, other industries and electricity export, but the Zambian Government was considering 5% electricity levy for them as a measure towards social responsibility, while the levy by the domestic consumers would remain at 3%. Thirdly, the REF needs to be efficient and effective in its management in order to ensure that the program runs smoothly. Such measures are also likely to attract the interest of Development Partners. Therefore, more transparency, accountability and efficiency are required in the process of electrification project selection and utilization of the REF. Fourthly, the electrification levy should be paid directly to REA, not through the Ministry of Finance and National Planning. Otherwise, the possibility remains that the rural electrification levy will be used for other purposes by the Government (such as a general account budget). Finally, electrification facilities funded by the REF (such as mini-hydro, but exclude SHS) should be owned by either REA or ZESCO, and leased to other private companies or local communities for O&M, if necessary.

5.3 Increase of Electricity Access Rate

A high initial connection fee is one of the hindrances to increase electricity access, even in areas where distribution line has been extended. The tariff charged by utility companies should be capital cost reflective and thus reduction of the initial connection fee should be considered. In addition, the payment of initial connection fee by the consumers to the electricity network should be spread over a period of 3 to 5 years.

Setting up a technical standard for appropriate low cost electrification method could also contribute to increase the electrification rate in rural areas. Moreover, exemption of import tax for equipments used for rural electrification gives the advantage of reduced project cost and connection fee.

Finally, to create a price competitive market, supporting capacity development and formation of new companies to undertake rural electrification business, such as construction and operation & maintenance is recommended.

5.4 Supporting Sustainable Electrification Business in Rural Area

Development of local capacity in simple operation and maintenance of electricity systems, such as SHS and mini-hydro, through a mobile training program provided by DoE and REA could contribute to making the rural electrification business sustainable. Development of the mobile training programs could be supported by JICA Technical Cooperation Project scheduled to commence in 2008.


JICA