

5-YEARS PERFORMANCE IMPROVEMENT PLAN: 2020 - 2024

*A submission to the Nigerian Electricity Regulatory Commission
(NERC) in requirement of the Development of Performance
Improvement Plans for the Power Sector Reform Program*

DRAFT V3 - Sept 2019



Kaduna Electricity Distribution Plc
September 2019

Copyright in the Contents, typographical arrangement and design rests with Kaduna Electric (and respective referenced parties herein). This publication (excluding logos) may not be re-used in any format or medium without express written content of the company.

NET V3 - Sept 2019



For further information on this document, contact: Strategy & Business Excellence Unit of Kaduna Electricity Distribution Plc, Electricity House, 1-2 Ahmadu Bello Way, CBD, Kaduna, Kaduna State, PMB 2283, Nigeria.

Telephone: +234-817-4035711, Email: spd@kadunaelectric.com

© Published by Kaduna Electric, 2019

Contents

Executive Summary	5
Chapter 1 - Introduction	6
Vision, Mission and Core Values	8
Vision	8
Mission	8
Core Values	9
Achievement Over the Last Tariff Period	10
GIS Based Customer Enumeration and Asset Tagging	10
Transformation Capacity	12
Grid and Customer Metering.....	12
Deployment of New Billing and CRM System.....	12
Office Upgrade and Provision of Working Tools.....	13
An Overview of Current Service Deficits.....	13
Stakeholder View and Aspiration	15
Strategic Approach	18
Market Segmentation	18
Strategic Goals.....	19
Kaduna Electric and Konexa Partnership.....	21
Pilot Phase.....	21
Zaria Road Pilot	22
Kudenda Pilot	22
Structure of the Report	23
Chapter 2 – Load Flow Analysis and Energy Demand Forecast.....	24
Load Flow Analysis.....	24
Energy Demand Forecast.....	25
Macroeconomic Factors.....	27
Chapter 3 – State of Infrastructure Review	30
Review of Current State of Infrastructure.....	30
Current Limitations and Analysis of Infrastructural Deficit	32
Nature and Magnitude of Improvement needed for Optimal Performance	32
IT Infrastructure, Metering and Automation.....	40
Chapter 4 – Proposed Output.....	42
Chapter 5 – Detailed Progress Plan	44
Distribution Management Plan	44
ATC&C Loss Reduction Plan.....	44

Customer Service Improvement Plan	46
Management Improvement Plan	46
Management Systems Certification Programmes	48
Chapter 6 – Financing Plan	49
Costing of the Proposed Plans	49
Description of Financing Strategy	49
Franchising	49
Konexa KE Partnership	50
West Africa Power Pool (WAPP) / German Corporation for International Cooperation (GIZ)	50
Vendor Financing	50
International Finance Corporation (IFC)	50
World Bank (PSRP)	51
Siemens (National Electrification Project – NEP)	51
Other Sources	51
Tariff Impact	51
Approved Capex Cases and Resultant Tariffs and Profitability	52
Chapter 7 – Risk Assessment and Mitigation	53
Chapter 8 – Operational KPIs	56
Operational KPIs – Manageable Areas	56
Operational KPIs – Difficult to Manage Areas	57
Companywide ATC&C Loss Reduction Target	57
Chapter 9 – Conclusion	59
Appendix I – Extract from ETAP Software on New Injections	62
Appendix II – Estimate of Improvements in Non-Manageable Areas	65
MV Line Upgrade in Difficult to Manage Areas	65
LV Line Upgrade in Difficult to Manage Areas	67
Appendix III – Preliminary Costing of Konexa Pilot Project	69

LIST OF TABLES

Table 1: Metering Data for Kaduna Electric	12
Table 2: Market Segmentation for Kaduna Electric	18
Table 3: Strategy for Each Market Segments	19
Table 4: Summary Distribution Assets in Manageable and Difficult to Manage Areas	20
Table 5: Konexa Performance Metrix	22
Table 6: Technical Specifications of Proposed Injection Substations	25
Table 7: Energy Demand Projection	27
Table 8: Energy Gap Analysis	29
Table 9: Transmission Capacity Details	30
Table 10: Feeder Details of the Company	30
Table 11: Public Distribution Transformers	31
Table 12: Private Distribution Transformers	31
Table 13: Proposed New Injection Substation	33
Table 14: Rehabilitation/Upgrade of Injection Substations	33
Table 15: MV Line Rehabilitation in Manageable Areas	35
Table 16: DT and LV Line Upgrade/Rehabilitation	38
Table 17: Proposed Output for Manageable Areas	42
Table 18: Proposed Output for Difficult to manage Area	43
Table 19: Breakdown of Distribution Mgt Plan	44
Table 20: Breakdown of ATC&C Loss Reduction Plan	45
Table 21: Breakdown of Customer Service Improvement Plan	46
Table 22: Breakdown of Management Improvement Plan	47
Table 23: Summary of 5-Year Investment Plan (Million Naira)	49
Table 24: Summary of Tariff Impact	52
Table 25: Risk Analysis	53
Table 26: Operational KPIs for Manageable Areas	56
Table 27: Operational KPIs for Difficult to Manage Areas	57

List of Figures

Figure 1: Basic Statistics of Kaduna Electric.....	6
Figure 2: Kaduna Electric System Map	7
Figure 3: Kaduna Electric’s MV Grid Map	10
Figure 4: Kaduna Electric’s Grid Map with Transformer Points	11
Figure 5: Growth in Customer Number.....	11
Figure 6: Cross-section of Working Tools	13
Figure 7: PIP Engagement with Stakeholders.....	16
Figure 8: Customer Number and Energy for the Market Segments	19
Figure 9: Single Line Diagram of Kaduna Electric Network.....	24
Figure 10: Energy Demand Forecast.....	28
Figure 11: Energy Supply Projections	28
Figure 12: System Architecture for Management Systems	40
Figure 13: Companywide ATC&C Loss Reduction Target.....	58
Figure 14: Poverty Intensity Map.....	61

Executive Summary

The Kaduna Electric Performance Improvement Plan (PIP) report was developed to meet the expected outcomes as outlined in the NERC PIP guidelines. Due to the nature of our customer spread, network and landmass, it is important to adequately segment the market as a means to prioritize areas of investment/focus in our capital deployment program for the next 5-years. The KE market area is segmented into 4 different classes – Premium Customer Group (PCG), Manageable Urban and Rural Areas (MU&RAs), Difficult to Manage Rural Areas (DMRAs) and Informal Settlement in Peri-Urban Areas (ISPAs). The 4 market segments are further broken down to two broad categories of Manageable Areas (PCG and MU&RAs) and Difficult to Manage Areas (DMRAs and ISPAs). Most of CAPEX deployment in the PIP, particularly those related to technical improvements and ATC&C investment plans, are focused in the manageable areas.

Accordingly, the CAPEX requirement for the various plans over the period 2020 – 2024 is estimated to be N117.8Bn with *Distribution Management Plan* (technical upgrade and substations and feeders) taking 60% of the total CAPEX value followed by ATC&C loss reduction plan with 25%, *Management Improvement Plan* (deployment IT system and automation including SCADA) with 11% and finally *Customer Service Improvement Plan* with 4% of the total CAPEX value.

Investment Plan	2020	2021	2022	2023	2024	Total
Distribution Management Plan	14,076	21,114	17,515	10,557	7,038	70,300
ATC&C Loss Reduction Plan	5,824	8,736	7,280	4,368	2,912	29,120
Customer Service Improvement Plan	994	1,492	1,243	746	497	4,972
Management Improvement Plan	2,692	4,036	3,363	2,018	1,345	13,454
Total	23,586	35,378	29,401	17,689	11,792	117,846

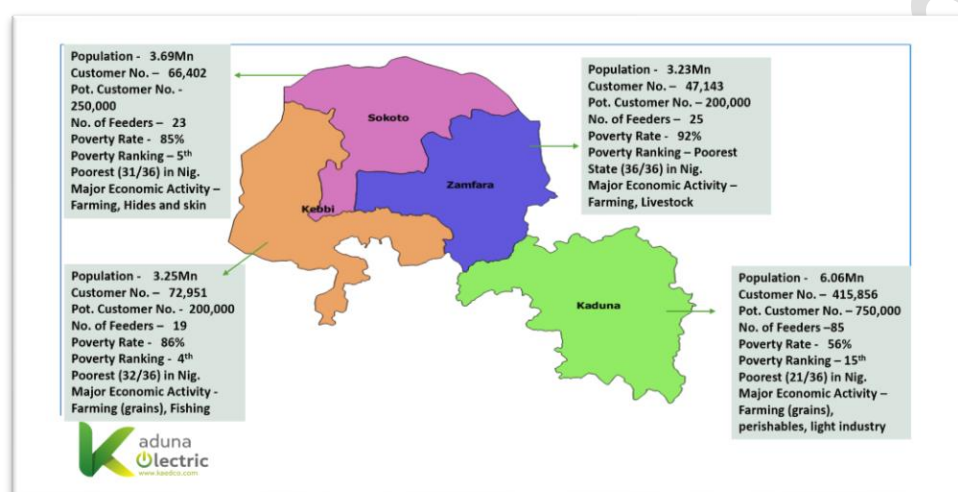
Following the upgrades, we expect ATC&C loss level to reduce from around 55% in the manageable areas now down to 17% in 2024 while in the difficult to manage areas, we expect the ATC&C loss level to reduce from around 78% now to 45% in 2024. Companywide, we target an ATC&C loss level of 19% by 2024.

Chapter 1 - Introduction

The Board and Management of Kaduna Electric took over operation of the company on the 4th of December 2014, 13 months after other DisCos. The Company is responsible for distributing electricity within the areas of Kaduna, Kebbi, Sokoto, and Zamfara States in the North-Western part of Nigeria.

Kaduna Electric covers approximately 148,588 km² area, with a total population of 16.23 million (based on the last census exercise in 2006) and a customer number of around 560,000.

Figure 1: Basic Statistics of Kaduna Electric

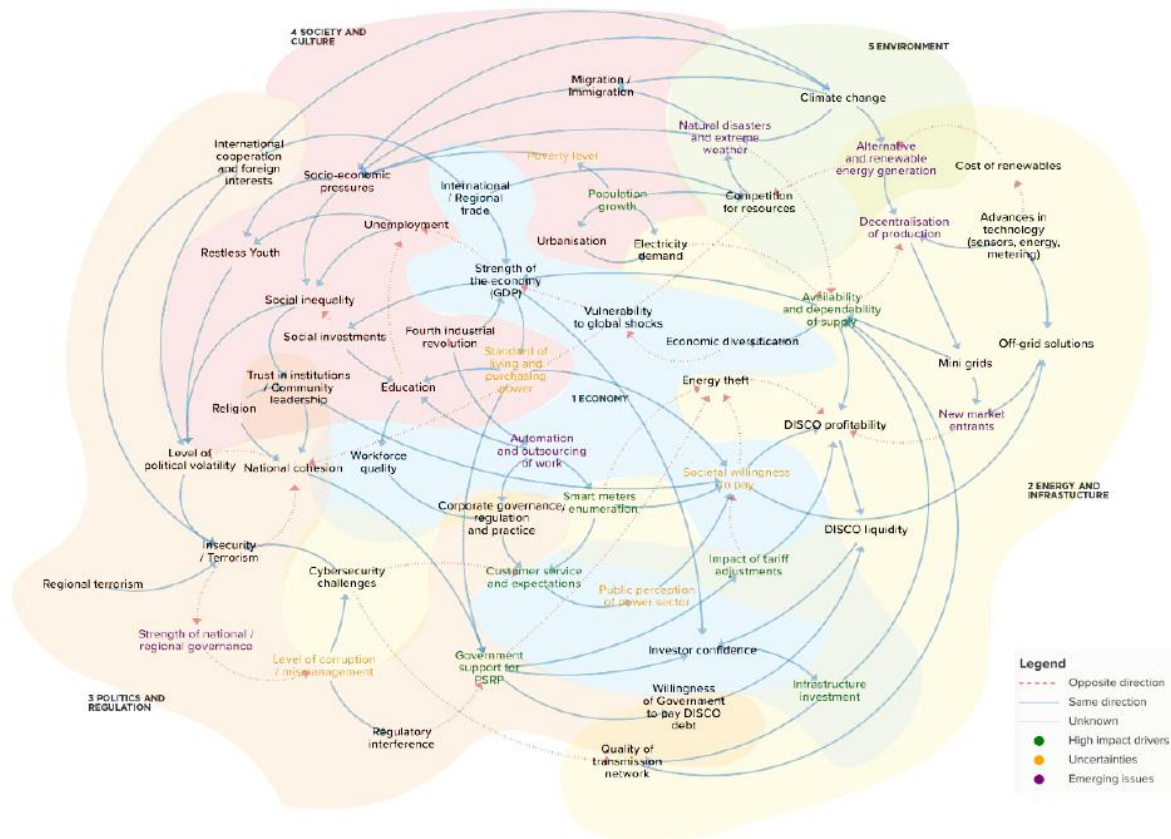


Kaduna Electric consists of 143 Service Centres, covered under 9 Area Offices, supplied via 11 transmission in-feeds. Kaduna Electric's load allocation is about ±8% from the National Grid.

Kaduna Electric (KE) like other distribution companies are faced with several challenges such as electricity theft, vandalization of distribution equipment, poor maintenance regime aggravated by lack of a centralized and automatized control system, inadequate funding, inadequate metering, meter bypass, poor quality customer database, inadequate IT infrastructure and low willingness to pay by customers, distribution and transmission interface issues, inefficient revenue collection, among others leading to high ATC&C loss levels.

As outlined in the "Guidelines for the Preparation of Performance Improvement Plans" released by NERC in April 2019, the Performance Improvement Plans (PIP) developed by DisCos shall cover the period 2020 – 2024 tariff period. Upon approval by NERC, the PIP shall form the basis for prioritizing and monitoring the capital investment initiative of Kaduna Electric and also be the basis for defining performance standards/KPIs for the next 5-year tariff period, with emphasis on improvement in service delivery and reduction in ATC&C loss levels.

Figure 2: Kaduna Electric System Map



Some of the key priority areas and action points in the performance improvement plan will cover, amongst others:

- Clearly defined broad market segmentation within Kaduna Electric in an effort to identify 'manageable' and 'difficult to manage' areas for investment prioritization
- Clearly defined performance standards/KPIs across the different customer segments and the whole DisCo
- Identify investment requirements and other initiatives in distribution network rehabilitation and upgrade aimed at resolving existing constraints limiting availability and quality of electricity supply
- Identify eventual constraints in meeting electricity demand arising from issues affecting high and medium voltage network infrastructure
- Regularization of consumers in manageable areas
- Incorporation of an Incidents Recording and Management System (IRMS) to identify location and analyze extent of an interruption in electricity supply to enable fast resolution and service restoration

- Incorporation of Commercial Management System (CMS) to manage all commercial processes; revenue cycle and customer relationship management
- Incorporation of Enterprise Resource Planning (ERP) information system to support corporate planning and management of shared services (accounting, finance, HR, procurement, logistics etc.)
- Mapping of customers and network infrastructure on GIS
- Implementation of Revenue Protection Project (RPP) supported by Advanced Metering Infrastructure (AMI) to systematically record and monitor consumption of large and medium customers
- Incorporation of Supervisory Control and Data Acquisition System (SCADA) to operate and control HV and MV infrastructure
- Implementation of improvements in customer services and management of requests for new service connections
- Incorporation of Works Management System (WMS) to manage all construction/installation works for network infrastructure
- Identification of TCN-DisCo interface projects
- Network re-engineering to support economic dispatch of electricity
- Customer debt collection program
- Brand management and office refurbishment among others.

These action points would be classified under four (4) broad plans/components – (i) ATC&C loss reduction plan; (ii) Network expansion, reliability and availability plan; (iii) Customer service improvement plan; and (iv) Management improvement plan.

Vision, Mission and Core Values

Vision

“To be a world class supplier of electricity and related services to its esteemed customers”.

Mission

- To adapt and deploy technologies, innovations and best practices towards stakeholders’ delight.
- To create and maintain a highly reliable network with zero tolerance for electricity interruption & faults.
- To build and sustain high standards of customer relationship and service delivery.
- To attract, groom and nurture talents across levels that are able and willing towards vision actualization.

- To manage changes towards creation of an organizational culture that supports and encourages high performance, fairness, safety, continuous improvements and trust amongst all stakeholders.
- To contribute towards nation building and quality of lives as a responsible corporate organization.

Core Values

Teamwork - We must respect diversity of individuals and thoughts. We must care about the consequences of our decisions and actions – large and small—on those around us. We must work as a cohesive team to delight our stakeholders.

Integrity - We must conduct our business fairly and honestly. Each one of us must be ethical in our conduct while dealing with (serving) any stakeholder. We must be dutiful and accomplish the results we are accountable for.

Excellence - We must always be learning and achieve the highest possible standards of work. We must embrace change, and face challenges boldly and intelligently. We must nurture innovation and work for continuous improvements.

Achievement Over the Last Tariff Period

The current tariff period (MYTO 2015) took effect in February 2016 following an extra-ordinary tariff review by NERC. Upon taking over operations in December 2014, the Management inherited a myriad of issues such as old and dilapidated network, equipment and offices, unskilled staff and dysfunctional structure, non-availability of accurate and reliable data/records related to customers, employees and network, among others.

The new management was therefore immediately focused on development of appropriate systems, policies and processes as well as enforcing cultural and attitudinal change towards performance orientation and customer centricity. This formed the baseline for the several initiatives that were executed over the last 4 years.

GIS Based Customer Enumeration and Asset Tagging

Kaduna Electric has successfully mapped all MV lines (33KV and 11KV feeders) and associated substations and distribution points within our network. The company has also achieved 80% mapping of 415 lines up to customer premises.

Figure 3: Kaduna Electric's MV Grid Map

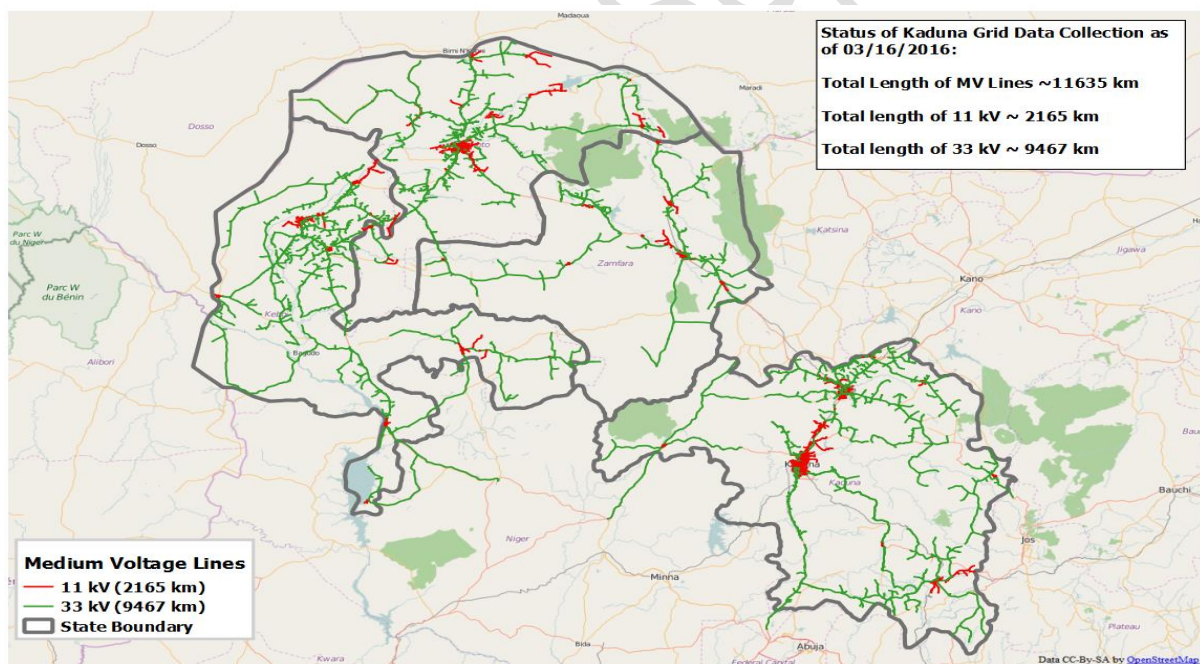
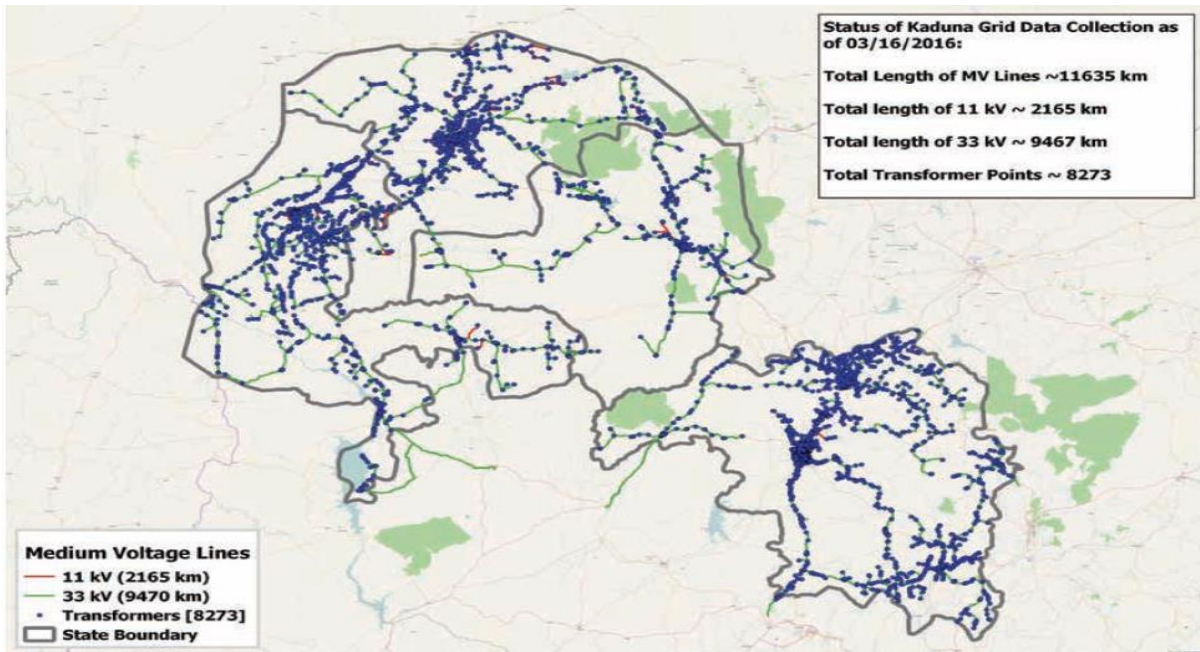
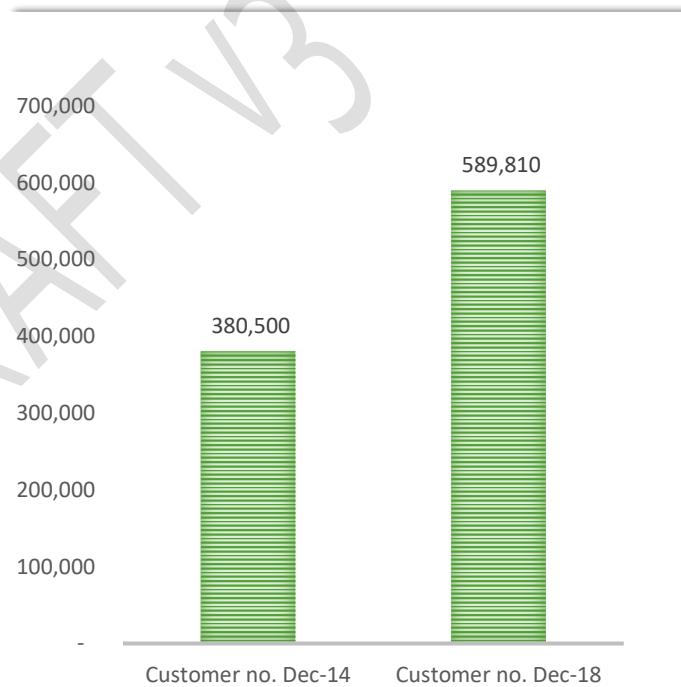


Figure 4: Kaduna Electric's Grid Map with Transformer Points



As a result of the customer enumeration exercise conducted by the company over the past two years, customer number has increased from 380,500 at the time of takeover in December 2014 to 589,810 by December 2018, representing a growth of 55%.

Figure 5: Growth in Customer Number



The company targets a total customer number of around 800,000 by the end of 2019 and more than a million by the end of 2020.

Transformation Capacity

TRX 330/132KV transmission capacity has increased from 850 MVA in 2014 to 1,125 MVA in 2018. The transmission upgrade at Power-House TS has greatly increased capacity within the Kaduna Metropolis. During the same period, capacity of the 33/11KV MV distribution line has increased from 996 MVA in 2014 to 1,176 MVA in 2018 while the DT has increased from 1,729 MVA in 2014 to 2,453 MVA in 2018.

Grid and Customer Metering

At the time of takeover, there was virtually no grid metering other than the DisCo interface meters. Over the past 4 years, a lot has been achieved in terms of grid metering – all 33KV and 11KV feeders are fully metered, most of which are AMR compliant meters. The company has also achieved 100% metering on Maximum Demand customers.

Table 1: Metering Data for Kaduna Electric

S/No	Meter Category	Total Count	Metered	Percentage Metering
1	33KV Metering	58	58	100%
2	DisCo Interface Meter	5	5	100%
3	11KV Metering	150	149	99%
4	Public Distribution Sub-Station	5,832	23	0.39%
5	MD Metering	1,787	1,765	98%
6	PPM	149,588	149,588	100%
7	Credit Customers (NMD)	234,886	4,000	0.02%

All the 11KV meters and about 40% of MD customer have AMR compliant meters are active on the company's AMR platform. Realtime monitoring of MD customers consumption via AMR has significantly reduced electricity theft and improved collections.

Deployment of New Billing and CRM System

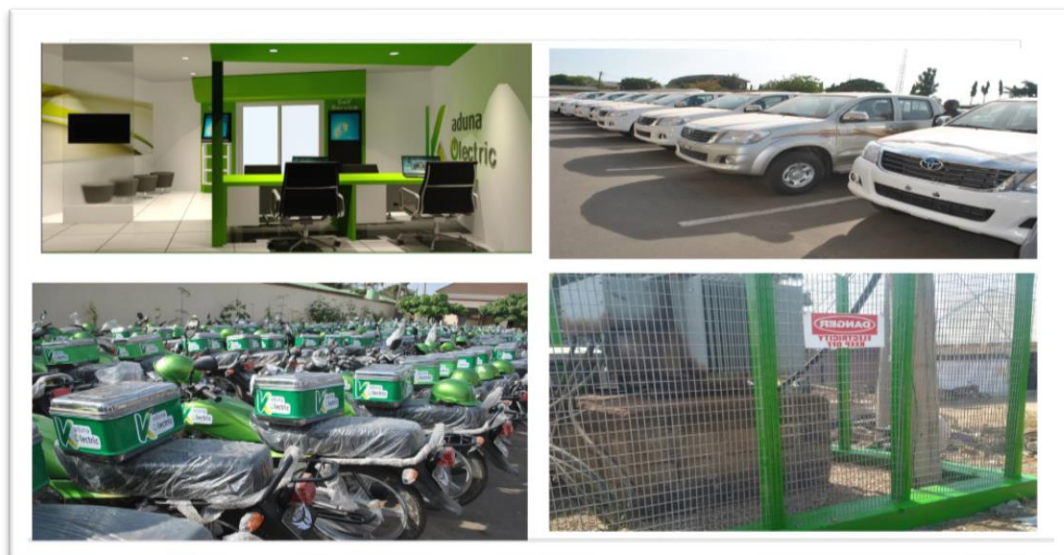
Upon takeover in December 2014, the company inherited a system that runs its billing operations on Spectrum, a UNIX based application that was developed in the 1980s. The system had a lot of limitations (Non-centralized database, Offline and inflexible, inadequate system security, poor analytics among others) which results in poor outputs in terms of inaccurate billing of customers and poor quality of bills produced resulting in high level of commercial losses.

In 2016, the company deployed a billing system capable of meeting basic business needs. The features of the new system include; web-based system with integrated CRM functionality, real-time processing of payments to customer account, data quality and integrity check, scalable and customized reporting and data analytics, easy tracking of energy flow and consumption among others.

Office Upgrade and Provision of Working Tools

Among the several challenges inherited are poor and dilapidated office infrastructure as well as inadequate working tools to conduct basic operations across our franchise area. Kaduna Electric has been able to upgrade around 40% of our offices, procured over 80 operational vehicles and 1,500 motorcycles and also secured most of our distribution sub-stations with fortified fences.

Figure 6: Cross-section of Working Tools



Despite the modest achievement recorded over the past 4 years, there is huge investment required in terms of network infrastructure upgrade and automation, SCADA system, smart metering and back-end infrastructure and also having the right IT, management and staffing structure to meet the challenges of a modern utility.

An Overview of Current Service Deficits

Kaduna electric is faced with many challenges, largely due to the state of infrastructure inherited upon takeover. Several measures have been put in place to overcome these challenges, which have begun yielding results, albeit in a slow manner. These challenges have negatively affected service delivery within the Disco franchise area, issues ranging from technical/metering, commercial, ICT and customer care have seen some level of improvements. However, more is required in order to bridge the identified gaps in these areas;

Technical/ Metering

The Disco is faced with a myriad of problems in respect of its technical/metering infrastructure as highlighted below;

- Absence of automation of power management systems poses operational challenges due to vast network coverage area.
- Bare/open nature of power lines is susceptible to breakdowns, accidents, energy theft, and technical losses.
- Huge Capex investments required for network upgrade to improve reliability and efficiency.
- Lack of Smart Metering and AMI/AMR infrastructure.
- Low penetration of DT metering.
- Lengthy network, ageing undersized conductors and cables, overloaded power and distribution transformers, poor network design.

Commercial

The most challenging issue in Commercial is the high incidences of energy theft leading to low Billing Efficiency with adverse effect on ATC&C losses. With a household population estimate of over 4 million, a sizable number of power consumers within Kaduna Electric franchise area are not captured on the Company's database. However, this is gradually being corrected based on data from the recently concluded Enumeration exercise. Other issues affecting service delivery include;

- Non-availability of a full-scale commercial management system for end-to-end execution of all commercial processes.
- Inadequate working tools and skill sets for personnel managing commercial processes
- Wrong customer tariff classification; this results in non-optimal revenue billing and cash collection from these set of customers
- Energy theft; in the form of illegal connections to the network without being captured on the billing platform
- Meter tampering; which involves breaking of seal and tinkering with the functionality of meter and by-passing the meter to tap the energy.
- Inaccurate customer database; customers that are active are recorded as inactive and resulting in non-billing of the customers. Also having non-existing customers in our database and bills being printed and unable to deliver.
- Large metering gap; some of the Company Feeders, significant number of DTs, and even customers are not metered, hence a lot of energies are unaccounted for at different stages. Kaduna Electric has more than 70% metering gap.

ICT

Despite various efforts in investment in building a robust ICT infrastructure, the company is faced with many challenges such as;

- Lack of robust hybrid network to handle network and connectivity issues of the company
- Non-deployment of customer information management system that would encompass network mapping, billing system, payment system, energy audit system for both pre-paid and post-paid customers.
- Continuous GIS enumeration and tagging of all customers and network infrastructure within Kaduna Electric franchise.

Stakeholder View and Aspiration

When Kaduna Electric took over operations in late 2014, the state of managing customers was far from appalling. Customer issues were done manually and unprofessional; payment platforms were limited, and billing was not centralized to aid easy tracking of customer data from everywhere. Kaduna Electric devised a strategy to create customer care hubs and upgrade the state of commercial operations. We now have numerous payment channels such as buypower, irecharge, bank transfers, POS and online payment.

This has helped the company tremendously in providing quick response to billing and payment related issues bothering customers.

On the other hand, customer engagement activities have continuously been carried in all the 11 Area Offices of Kaduna Electric. This has helped us to determine areas of concerns for our stakeholders and clarify misconceptions on numerous issues.

Inputs from stakeholders

In our quest to provide tailored services for our categories of customers, we have had engagements with various stakeholders such as the Premium customers, Manufacturers Association of Nigerian workers and Non-Maximum Demand customers (see pictures below) to get inputs of way forward and expectations they hope to see realized in the coming years.

Manufacturers (majorly represented by MAN)

The Manufacturers Association of Nigeria (MAN) belong to the group of customers that have rejected MYTO 2.1 order and continued to pay the previous while the case is in court. We engaged this group of customers to understand their concerns and they had this to say:

- MAN would like Kaduna Electric to upgrade technical operations in regard to detecting faults automatically
- Field officers should be closely monitored to ensure prompt response to issues.
- Stable supply on the network
- Customer service relations should be looked into
- Too many monitoring officials visit the promise and each time unfamiliar faces are seen. Kaduna Electric should stick with particular persons for security reasons
- Would like to see improved relationship in terms of getting updates on what plans or decisions are taken that will affect them.

Premium Customers

Even though this customer category occupies only about 0.2% of our customer database, their importance to the business is enormous. Below are the key takeaways from the engagement with the customer segment which held in Kaduna and Sokoto:

- A lot of the customers raised issues relating to technical where, unstable supply and power quality issues affects their operations and creates losses for them.
- Another input was to keep them informed of the tariff formulation process before NERC approves any new one.
- Further, prompt attendance and resolution to fault clearing issues was raised as major areas for improvement for the company.

Non-Maximum Demand Customers

This category takes up the largest percentage of our customers and sadly, are the lowest paying. In the past, we have had engagements merging a couple of communities into one engagement and we have discovered that the information does not always cascade down to the members of the community. We have also tried the social media approach, but the customer reach is very limited as a lot under this category are not very techy and accustomed to giving feedbacks or laying complaints online. Below are the key inputs from the engagement:

- Insufficient energy supply;
- Inaccurate (mostly unmetered customers) issues;
- Delay in complaint resolution;
- Inadequate meter stock;
- Power quality issues

Cross section of various engagements with stakeholders

Figure 7: PIP Engagement with Stakeholders





Strategies for the next 10 years

- We are looking at creating a reasonable portfolio of Premium Customers and assigning them to dedicated officers to provide quick and professional support to any issues or clarifications that maybe required. We are looking at enhancing our customer services here because these categories of customers contribute significantly to the success of our business and help create more jobs to the economy which also aids payment of Non-Maximum demand bills. As per the number of Premium Customers in an Area office, we would provide adequate officers to promptly investigate complaints and resolve in the speediest of time.
- Where you have inadequate meter, those with meter frequently complaint of fast consuming units. With the launch of MAP regulation, Kaduna Electric is devising measures to thoroughly monitor meter deployment and use, and to ensure energy consumed matches unit purchased. We are hopeful that the deployment of meter will put a stop to overbilling complaints.
- While meter deployment is ongoing, we intend to launch a massive outreach engagement to cover the whole franchise locations for the next 10 years. We have already began collecting data from all the communities and the leaders, youths and influential persons. This will enable us reach out to the right persons who can spread awareness in their community and help clarify misconceptions about Kaduna Electric. The more aware our customers are the

more we stand a chance of success. Each Area Office will have dedicated officers skilled in community engagement with a portfolio of communities under their radar, to ensure channeled and measured techniques are deployed to get stakeholder feedback. This will prove useful in conducting future analysis and formulating strategies to penetrate communities.

- Prompt technical complaints requires rehabilitation of existing network and increase in manpower which has been discussed in the technical section of this paper.

Strategic Approach

Given the nature and spread of our network, it is difficult for Kaduna Electric to normalize and fully take control of 100% of the market in the 5 – year period. As such, working on strategic market segmentation is critical for the PIP. This market segmentation will guide prioritization for investments and other initiatives to be implemented in the performance improvement plan. Different customer segment will have different strategic approach while ensuring minimum requirement as stipulated in the NERC PIP guidelines.

Market Segmentation

In order to define different customized strategies over the next five years, 4 key market segments within our customer base are identified. Characteristics of the different market segments are outlined in the table below.

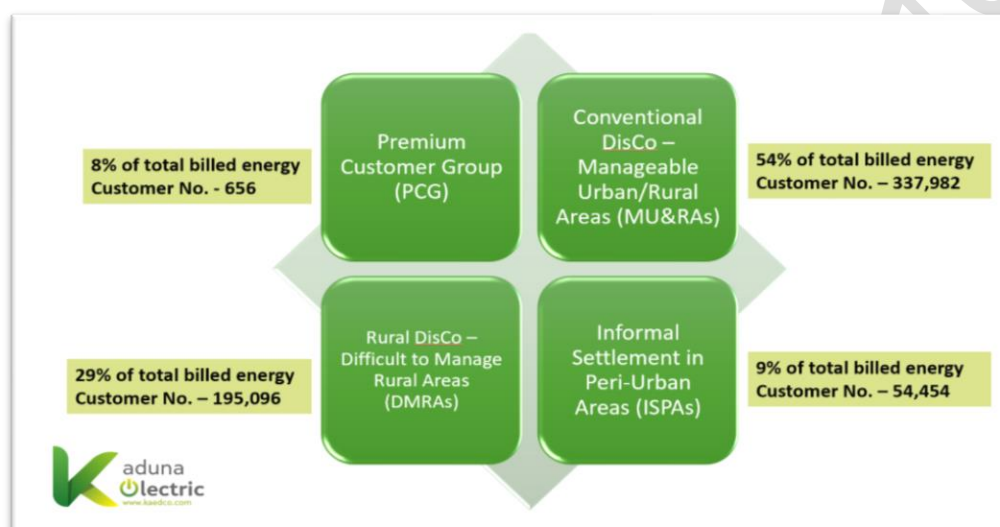
Table 2: Market Segmentation for Kaduna Electric

<p>1. Premium Customer Group (PCG)</p> <ul style="list-style-type: none"> • High energy consuming group, some of which are potential eligible customers, usually contribute a large share of the revenue collection • Quality and reliability of supply is currently not good enough, and consequently all of them use diesel/gas captive generation • Customer service challenges exist • Collection efficiency is less than 100% 	<p>2. Manageable Urban & Rural Areas (MU&RAs)</p> <ul style="list-style-type: none"> • Large concentration of R2 and C1 customers • Network reliability is poor and captive generation is high • More than 65% customers unmetered • Technical and commercial losses quite uncertain or wrongly accounted for due to high number of estimated billing • Collection efficiency is generally low
<p>3. Difficult to Manage Rural Areas (DMRAs)</p> <ul style="list-style-type: none"> • Vast geographical area and many customers dispersed in a few thousand communities/villages • Network reliability is very bad • DisCo presence is low and customer service is deficient • Most of the customers are unmetered • Collection efficiency is extremely low 	<p>4. Informal Settlement in Peri-Urban Areas (ISPAs)</p> <ul style="list-style-type: none"> • Huge concentration of very low-income families • Many unknown customers • ATC is humongous • Network reliability is very bad and very unsafe • Collection efficiency is extremely low

In a wider grouping, the PCG and MU&RA make up the Manageable areas while the DMRAs and ISPAs make up the Non-Manageable areas.

As shown in the Figure below, Kaduna Electric has 656 customers under the premium customer group taking 8% of the total energy billed, 337,982 customers in the MU&RAs taking 54% of billed energy, 195,096 customers in DMRAs taking 29% of billed energy and 54,454 customers in the ISPAs taking 9% of total energy.

Figure 8: Customer Number and Energy for the Market Segments



Strategic Goals

As described earlier, each customer segment has a different strategic approach in the PIP. The table below provides a summary of the different approaches.

Table 3: Strategy for Each Market Segments

Customer Segment	Strategy
Premium Customer Group (PCG)	<ul style="list-style-type: none"> • Excellent customer service • Ensure excellent quality and reliability of supply, including creating redundancies where necessary • Ensure zero energy theft and 100% collection efficiency • Dedicated technical and customer service team • Deployment of full automation for system monitoring and control
Manageable Urban & Rural Areas (MU&RAs)	<ul style="list-style-type: none"> • Excellent customer service • Network regularization leading to enhanced quality and reliability of supply • 100% smart metering for all customers, including DT metering • Network optimization and loss reduction investment

	<ul style="list-style-type: none"> • Strict enforcement activities towards eradicating energy theft • Deployment of full automation and system monitoring control • Adequate and well-equipped workforce
Difficult to Manage Rural Areas (DMRAs)	<ul style="list-style-type: none"> • Identification of Integrated Mini-grid sites within long rural feeders and working with developers to improve supply and related services utilizing the mini-grid regulation • Partnering with potential Franchisees to outsource billing and collection activities • Working with local communities to improve service delivery collections • Outsourcing technical maintenance activities • Working with government on improved energy access and grid expansion
Informal Settlement in Peri-Urban Areas (ISPAs)	<ul style="list-style-type: none"> • Short-term strategy is to bulk bill at DT level and work with the communities to improve collections and services • Partnering with potential Franchisees to outsource billing and collection activities • Long-term strategy is to normalize area using ABC cables and theft resistant meters

The strategic approach is to focus on the Manageable areas (PCG and MU&RAs) first before deploying any major capital investment in the other customer segments. The ultimate objective of Kaduna Electric is to fully normalize our entire franchise area, however, given that the scope of activities covers a 5-year period and given that we have to be mindful of the overall CAPEX and its impact on tariff, it is important to have a clear methodology and approach for investment prioritization.

Details of the asset within the two broad customer segments are as follows:

Table 4: Summary Distribution Assets in Manageable and Difficult to Manage Areas

Description	Manageable Areas	Difficult to Manage Area
33KV Feeder	27	31
11KV Feeder	90	60
LT Line	34	63
Distribution Substations	2,386	6,942

Kaduna Electric and Konexa Partnership

As part of its strategic initiatives to reduce ATC&C losses and deliver reliable energy across its franchise area, Kaduna Electric is partnering with Konexa, a UK based Shell Foundation and Industry Capital (IC) incubated energy company with a mission to serve customers in Nigeria with a reliable integrated utility business.

Konexa, in partnership with Kaduna Electric, is deploying significant investment to improve service delivery to commercial and industrial clusters, small and medium enterprises and communities, in order to improve quality and reliability of power supply and extend electricity access with the ultimate aim of promoting business activities and improving socio-economic prosperity of the populace.

Over the past 18 months, Kaduna Electricity Distribution Company (Kaduna Electric) has been working with Konexa on strategic planning towards achieving these objectives;

- Accelerate the path to Universal Energy Access (SDG7) in the concession areas by introducing technologies and business models that can deliver power for all (commercial, industrial, small businesses, urban and rural household customers) in an affordable yet viable way;
- Make the DISCO and the broader sector a World-Class investment case where institutions and households across the region will want to invest in its growth because of its customer centric approach and performance track record;
- Deliver increased impact on income growth for underserved communities through job creation, access to productive uses of energy, de-carbonation of the energy system, create a pathway to electricity mobility and value for all stakeholders including low income communities and customers
- Address the challenges of the sector that arise from the lack of investment, collection and billing inefficiencies, overall technical and commercial losses and a focus only therefore on the high demand customers leading to 'cherry picking' and leaving many customers behind
- Develop a revised and technically robust Performance Improvement Plan that aligned to a revised Performance Agreement and unlocks long term, low cost capital investment in the sector.

Pilot Phase

Given the innovative nature of the partnership and the urgency to validate the model before a full scale up and the significant investment it would require; Kaduna Electric and Konexa are proposing a pilot in two concession areas within the Disco. The initial investment requirement for the two pilot

areas is about USD55m. The investment will include; smart metering, investment in the network infrastructure, adding embedded generation, serving customers through mini-grids and standalone systems and provide other products and services to accelerate energy demand.

Zaria Road Pilot

Below, we have set out the interventions and targets we expect to realise with our investment and operations strategy. We have used the Zaria road feeder as the example of the capex interventions and performance targets which we would roll out for 2 feeders in total. The estimated capex requirement for Zaria Road is \$15 million which we will disburse over 6 months and will achieve the following performance targets within 12 months from disbursement:

Table 5: Konexa Performance Metrix

KONEXA Performance Metric	Current	Zaria Road Post Investment
Reliability	<40%	<ul style="list-style-type: none"> - 95% - Grid Infrastructure Upgrades* - Embedded Generation
Electrification for all	4,000 connections	<ul style="list-style-type: none"> - 6,000 connections - 1,500 connected via Mini-Grid - 500 connected via Solar Home Systems
Collection Efficiency	<30% Estimated Billing	<ul style="list-style-type: none"> - 80% - Metering for all connections - Anti-theft cabling - Community engagement

The investment shall cover; metering network upgrades Solar Home System new technology, other products and services. All shall be implemented within six months' period to ensure reliability and efficiency. On successful pilot, the scale up commences immediately with an estimated investment in the region of 1.2 billion USD subject to completion of PIP and investment plan and associated regulatory approvals and associated cost reflective tariff.

Kudenda Pilot

The Kudenda pilot area consist mostly of Commercial & Industrial customers. Currently, Kaduna Electric has over 90% Collection Efficiency from the area. The interventions targeted will be around improving power quality and reliability to serve customers' suppressed demand optimally. Investments will focus on building redundancies to ensure uninterrupted supply to sensitive load centres, this will be achieved through signing power purchase agreements, embedded generation, building new Injection Substations and general improvement on the distribution infrastructure. The objective is to ensure a reliable and uninterrupted power supply to the industrial cluster which will sprout growth of local industries. A total investment of around \$40 million is targeted to the Kudenda Industrial area.

Structure of the Report

In Chapter 2 of the report, the load flow analysis and energy demand forecast are reported, the chapter seeks to establish present distribution capacity and projected demand within our franchise area over the next 5 years. Chapter 3 reviews the state of the infrastructure and the improvements required. Chapter 4 reports the proposed output expected from the PIP based on several key indicators while Chapter 5 reports the detailed project plans. Chapter 6 reports the financing plan of the project while Chapter 6 reviews/analyses the potential risk to successful implementation of the PIP and mitigation plans. Chapter 7 reports 5-year KPIs for the company while Chapter 6 concludes.

Chapter 2 – Load Flow Analysis and Energy Demand Forecast

The aim of this study is to determine the total energy demand for Kaduna Electric Franchise areas through the load flow analysis and make forecast for the next five years using econometric factors in an effort to determine the investment required to improve the performance of the company.

Load Flow Analysis

KE network was modelled using Electrical Transient Analyzer Program (ETAP) and all corresponding equipment / loads parameters were entered in the model. Equipment data was collected from TCN and maximum short circuit value was used as a generation swing bus source. While Kaduna Electric equipment data was collected from field, some assumptions were made during the analysis by using default software values.

The load flow was simulated to determine the corresponding losses (energy loss) within the network and overloaded injection substations and feeders were also analyzed for possible expansion to mitigate the losses.

Town I and Town II have a common source (Mando TS) and is modelled separately and Kebbi network (Kebbi, Sokoto and Talata Mafara) and other load centers connected to Kaduna were also modelled alongside Kaduna in order to get the overall present load demand. The overall demand was calculated to be **669.172MW**.

In order to resolve the problems associated with the network as observed in the load flow analysis, a number of relief injection substations and new 33KV feeders and 11KV feeders are proposed and modelled in the network analysis. The table below shows a summary of the new projects as modelled in the simulation.

Figure 9: Single Line Diagram of Kaduna Electric Network

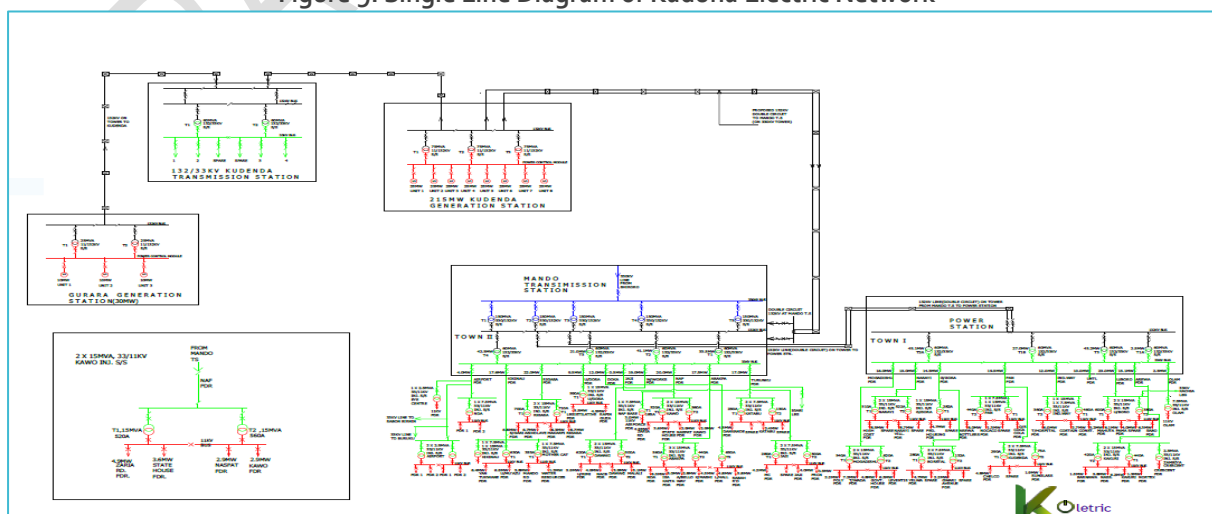


Table 6: Technical Specifications of Proposed Injection Substations

Name of Inj. S/S	Feeder Source	Outgoing Feeders	Expected load (MW)	Inj. S/S to be Relieved
Danmani 2 x 15MVA	New 33KV Feeder	3 Nos 11KV Feeders	24	
Railway Rigasa 2 x 15MVA	New 33KV Feeder	4 Nos 11KV Feeders	12	Rigasa Inj. S/S
New Mahuta 1 x 15MVA	33KV Kachia Leg	2 Nos 11KV Feeders	12	U/Boro Inj. S/S
Millennium City 2 x 15MVA	New 33KV feeder	4 Nos 11KV Feeders	24	Dawaki inj. S/S
Kalambaina 2 x 7.5MVA	New 33KV feeder	2 Nos 11KV feeder	8	
Zuru 1 x 7.5MVA	Existing 33KV feeder	1 No 11KV feeder	2	
Tamaje 2 x 7.5MVA	Existing 33KV feeder	2 Nos 11KV feeders	8	
Gidan Dare 1 x 2.5MVA	Existing 33kv feeder	1 No 11kv feeder	2	

Energy Demand Forecast

The load demand is the sum of the operational load (including any tactical load) and non-operational demand loads. It is determined by applying the proper demand factor to each of the connected loads and a diversity factor to the total.

The daily load demand pattern in Nigeria is divided into OFF-PEAK and PEAK periods. The off-peak period lasts for about (15hrs) fifteen hours and this is the period of minimum load demand of the day. The *first off-peak* periods occur in the morning between 00:00hrs- 05:00hrs during this period most of the commercial centres, homes and other recreational places are shut down for the day. The *second off-peak* period occurs between 08:00hrs-18:00hrs, during this period the residential power consumption drops as most have all left for offices and industries, the commercial and industrial loads predominates at this period.

The *first peak* period occurs between 0500hrs-0800hrs when people wake up in preparation for the day 's activities and as such so many home appliances are switched ON. The *second peak* period occurs between 1800hrs-2400hrs and this is the period that people return from their respective places of work and put so many electrical appliances into use.

Economic growth and structure of the economy are the major driving parameters, in order to have a sustainable economy in the Kaduna Electric franchise states, there must be a set of scales between the energy demand and supply. This study aimed to find out the overall energy demand and forecast in Kaduna Electric, by analysing the peak load readings of all the 33KV and suppressed load of all the 11KV feeders. Furthermore, in order to have comprehensive information about Kaduna Electric Energy Demand, the suppressed and potential loads are included in the study.

The terms formulae used in this report are defined as follows:

- *Suppressed Load*: corresponds to a demand not served, in the past or in the future, for operational reasons (insufficient capacity, tripping of lines, etc.) or for structural reasons.
- *Potential load*: is the load that does not exist presently or that is located in an area far from the system. E.g. rural area not yet connected.

The following are the formulae used in this report:

POWER:

$$KVA = \frac{KW}{pf}$$

$$P = I \times V_L \sqrt{3}$$

$$I = \frac{P}{\sqrt{3} \times V_L}$$

Where,

P = Power

V_L = Line Voltage

I_L = Line current

KVA = Kilo Volt Ampere

KW = kilo Watt

pf = Power Factor (0.8)

Square Root of three, $\sqrt{3} = 1.7321$

PERCENTAGE LOADING:

$$\% \text{ Loading} = \frac{\text{Load Current}}{\text{Rated Current}} \times 100\%$$

Where,

Load Current is the recorded current by the operator & **Rated Current** is the Full Load current of a particular transformer (15MVA, 7.5MVA or 2.5MVA).

15MVA Rated Current = 787.3Amps

7.5MVA Rated Current = 393.7Amps

2.5MVA Rated Current = 131.2Amps

ESTIMATED AND FORECASTED VALUES:

Correction factor = 1.3

Contingency value = 20%

Macroeconomic Factors

Macroeconomic variables such as GDP (franchise states-specific), population, electricity tariffs, cost of alternative sources of power among others are key determinants of energy demand, which ordinarily are supposed to be factored in when making projections for demand for energy if projection is to be robust enough. Since there is no enough data for these variables, we have simply resulted to the use of simple trend analysis based on the scanty data at our disposal. The trend equation is stated thus:

$$Y_t = 5071.5t - 5069.5$$

Where: Y_t = Energy demand at time t

t = time in years

With this, the initial rate of change helped us to project for the next five year as shown in the table below.

Table 7: Energy Demand Projection

Year	Population Growth Rate of Four Franchise States	Projected Population of the Four Franchise States	National GDP Growth Rate-	Energy Demand (GWh)
2019	3.1	24,341,490	2.8	4,396.46
2020	3.1	25,098,076	3.0	5,073.51
2021	3.1	25,878,195	3.5	5,854.84
2022	3.1	26,682,580	3.5	6,756.48
2023	3.1	27,511,986	3.5	7,796.98
2024	3.1	28,364,857.57	3.5	8,997.71

Source: CBN statistical Bulletin, World Bank Online database Kaduna electric Planning Department and Author's Computation

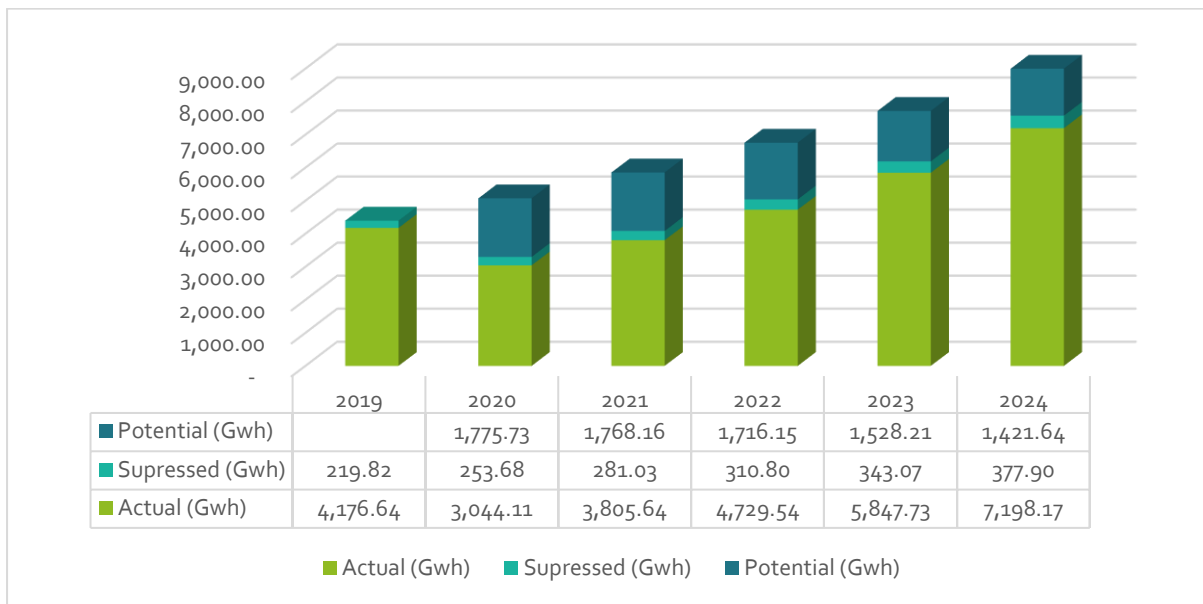
Load flow analysis for the entire company was conducted using the engineering software - ETAP

The study considered four key energy demand indices:

- Peak load readings on all 33KV feeders
- Suppressed loads on 11KV and 33KV feeders
- Potential loads
- Economic factors

Result reveals maximum annual peak readings on 33KV feeders to be 676MW and 33KV and 11KV suppressed load estimated to be around 270MW. Kaduna Electric overall energy demand is estimated to be 669.17 .MW or (4,396 GWh assuming average daily supply of 75%) 8,998 in 2019, is projected to grow to 1,369.52 MW or (8,998GWh assuming average daily supply of 75%) by 2024.

Figure 10: Energy Demand Forecast

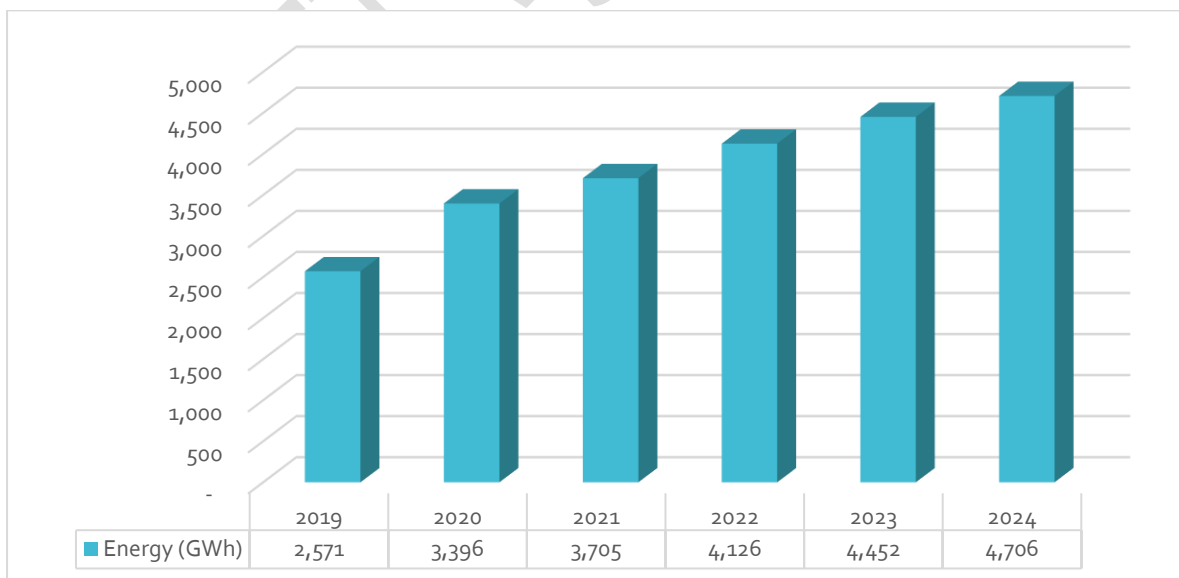


From the above figure, total energy demand is broken into actual suppressed and potential. While actual energy is expected to grow annually, both suppressed, and potential are expected to diminish in percentage share of total energy demand all through the years in focus.

Energy Supply Projections

The chart below shows the MYTO energy supply projections for the years 2019-2024 to Kaduna Electricity Distribution Company.

Figure 11: Energy Supply Projections



A steady growth was projected in the supply of energy to Kaduna Electric based on the MYTO projection running through the five-year period. Projection at the end of the five-year period is about 100% higher than what it is at the moment.

Energy Supply Gap Analysis

The table/chart below shows the comparison between MYTO energy projections from 2019 to 2024 and energy demand forecast by Kaduna Electric within the same period in GWh. The projected figures for supply at the end of the five-year period is almost the same with what Kaduna Electric has the capacity to absorb now, hence, off grid options to bridge the gap might be imperative.

Table 8: Energy Gap Analysis

Year	Energy Supply Projections (GWh)	Energy Demand forecast (GWh)	Supply as a % of Demand
2019	2,571	4,396	58%
2020	3,396	5,074	67%
2021	3,705	5,855	63%
2022	4,126	6,756	61%
2023	4,452	7,797	57%
2024	4,706	8,998	52%

The energy supply projection is based on a projected available national generation capacity of 5,287MW, 5,736MW, 6,348MW, 6,823MW and 7,193MW for the periods 2020 to 2024. Some of the key generation projects (Mambilla project, AKK gas pipeline and associated thermal power plants etc.) are expected to come on stream before 2024 which could significantly change the supply projections to between 10,000MW and 15,000MW. Furthermore, it is expected with the generation cost from solar coming down and improvement in battery technology, the contribution renewables in our energy mix will increase and will be connected to the grid. The supply gap will surely look a lot different, more towards balancing the projected demand.

The strategy for Kaduna Electric is to ensure additional energy allocation is channeled to the manageable areas to ensure we meet the reliability targets. Also, we plan to bridge any supply constraint within the manageable area through bi-lateral contracts from nearby hydro plant or embedded generation from Solar.

Chapter 3 – State of Infrastructure Review

Review of Current State of Infrastructure

The 12 transmission in-feeds within the Kaduna Electric franchise area has 27 power transformers with a total installed capacity of 1,385 MVA. The two transmission stations in Kaduna (Mando and Kaduna Town) and Kebbi have the highest capacity with 240 MVA each.

Table 9: Transmission Capacity Details

S/No	Transmission Station	Voltage Level	No. of Power Transformer(s)	Total Capacity MVA
1.	Suleja TS	132/33 KV	1	60
2.	Kafanchan TS	132/33 KV	1	40
3.	Mando TS	330/132/33 KV	4	240
4.	Kaduna Town TS	132/33/11 KV	4	240
5.	Zaria TS	132/33 KV	4	200
6.	Gusau TS	132/33 KV	2	45
7.	Talata Mafara TS	132/33 KV	1	30
8.	Sokoto TS	132/33 KV	3	120
9.	Birnin Kebbi TS	330/132/33 KV	3	240
10.	Yawuri TS	132/33 KV	2	80
11.	Tegina TS	132/33KV	1	30
12.	Jos TS	132/33KV	1	60
	Total		27	1,385

As at end of 2018, KE has a total number of 58 33KV feeders with a total route length of 8,268 KM and 150 11KV feeders with a total route length of 2,706 KM within its network.

Table 10: Feeder Details of the Company

Description	Nos	Length (KM)
33KV Feeder	58	8,268
11KV Feeder	150	2,706
LT Line	-	19,938
Total Length	-	30,913

KE has a total of 5,851 public distribution transformers, both 11KV/415V and 33KV/415V, with a total installed capacity of 1,834 MVA. The public DTs predominantly connect residential areas and small businesses within the urban and rural locations.

Table 11: Public Distribution Transformers

Rating (KVA)	Count	Total Capacity (KVA)
25	43	1,075
50	523	26,150
100	114	11,400
200	1021	204,200
300	2,373	711,900
315	61	19,215
500	1,711	855,500
750	2	1,500
800	1	800
1,000	2	2,000
Grand Total	5,851	1,833,740

Similarly, the company has a total of 3,111 private distribution transformers within the network, mainly connecting Maximum demand customers, shopping plazas and office complexes, big residential customers among others. Again, the dedicated DTs connects both at 11KV/415V and 33KV/415V level with a total capacity of 770 MVA.

Table 12: Private Distribution Transformers

Rating (KVA)	Count	Total Capacity (KVA)
25	5	125
50	603	29,900
100	662	66,200
200	673	134,400
240	1	240
250	2	500
300	560	168,000
315	16	5,040
400	7	2,800
500	483	241,500
515	1	515
630	1	630
700	1	700
750	15	11,250
800	9	7,200
1,000	42	42,000
1,250	4	5,000
1,500	6	9,000
1,600	5	8,000
2,500	15	37,500
	3,111	770,500

While KE has a total installed transmission capacity of 1,275 MVA, the total distribution capacity is 2,604 MVA. It is important to note that more 50% of the DTs are operating at less than 60% capacity while 10% of the DTS are at full capacity level, and in some cases over loaded.

Current Limitations and Analysis of Infrastructural Deficit

Based on the Load Flow report it was observed that there are a lot of overloaded 33KV lines, 11KV lines and injection substations. Furthermore, due to rapid increase in infrastructural development across our franchise area, the existing injection substations and DTs are far below the required number to cover the rapid developing areas like Millennium City, Kamazo, Marabar Rido, Rigachikun, Gonin Gora, and so on. Similarly, due to current potential demand within the industrial area, there is need to expand capacity, particularly in locations such as Kalambaina, Olam area (along Abuja-Kaduna express way) and Kudenda.

As a result of limitations observed from the load flow analysis (overloaded equipment and lines inadequate number of injection substations to supply ever increasing population and industrial growth), KE network was modelled again with the intention of simulating new injection substations and new medium voltage lines to supply the new load demand and relief the overloaded equipment. This further will give guide on the fund required to make necessary improvement in the system. Refer to Table 12 above.

Consequently, in addition to the detailed improvement requirement at the distribution level that is highlighted in the next subsection, a number of critical transmission projects will be required to be implemented by the TCN to free up suppressed and potential load in some key areas.

- 132/33KV TS at Millennium City in Kaduna
- 132/33KV TS at New Industrial Zone along Kaduna – Abuja express way
- 330/132/33KV TS in Sokoto as well as reconduction the current 132KV transmission line from Birnin Kebbi to Sokoto

Nature and Magnitude of Improvement needed for Optimal Performance

The nature of improvement needed is to construct the injection substations as outlined in table 1 above this will ensure access of electricity supply to underserved and unserved customers both residential and industries within the franchise and rehabilitation / upgrade of existing injection substations to address issue of low voltage as well rehabilitation of 33KV and 11KV feeders. Constructing these substations is associated with huge investment in both equipment and human resource. The table below gives breakdown of the cost of constructing these injection substations for the optimal performance of Kaduna DisCo.

Table 13: Proposed New Injection Substation

PROJECT	CAPACITY	SUBTOTAL (NGN)
ARGUNGU	1 X 15MVA	1,095,412,500
KALAMBAINA	2 X 7.5MVA	1,024,075,000
ZURU	1 X 7.5MVA	716,852,500
GIDAN DARE (UNMANNED)	1 X 7.5MVA	716,852,500
TAMAJE	2 X 7.5MVA	1,024,075,000
HAYIN DANMANI	2 X 15MVA	1,564,875,000
NEW-MAHUTA	1 X 15MVA	1,095,412,500
MILLENIUM CITY	2 X 15MVA	1,564,875,000
RIGASA RAILWAY	2 X 7.5MVA	1,024,075,000
SHIKA	2 X 15MVA	1,564,875,000
GRAND TOTAL		11,391,380,000

Within the Manageable areas, there are 29 injection substations to be upgraded. Most of the injection substations are not compatible to modern SCADA systems as a result the panels and other sensitive equipment (incl. protection) will have to be replaced/upgraded. Details of the substations and the associated cost for the rehabilitation work is reported in the table below.

Table 14: Rehabilitation/Upgrade of Injection Substations

PROJECT	CAPACITY	SUBTOTAL (NGN)
KAFANCHAN	1X7.5MVA	325,188,500
NARAYI	2X15MVA	788,385,000
U/BORO	2X15MVA	788,385,000
ABAKPA	3X15MVA	970,320,000
AIRFORCE BASED	1X7.5MVA	716,852,500
KAWO	2X15MVA	788,385,000
DAWAKI	2X15MVA	788,385,000
ARGUNGU	1X7.5MVA	325,188,500
NNPC	1X7.5MVA	325,188,500
POWERHOUSE	1X7.5MVA	325,188,500
KAKURI	2X15MVA	788,385,000
GONIN GORA	1 X15MVA	606,450,000
BOSTAL	2 X7.5MVA	464,555,000
PAN	1 X15MVA	606,450,000
KUDENDA	2X7.5MVA	464,555,000

KINKINAU	1 X15MVA	606,450,000
MOGADISHU	2X15MVA	788,385,000
WAMAKO	1X7.5MVA	325,188,500
RUNJIN SAMBO	1X7.5MVA	325,188,500
ILAILA ROAD	2X7.5MVA	464,555,000
GUSAU ROAD	2X15MVA	788,385,000
GAGI	1 X15MVA	606,450,000
POWER STATION	1X7.5MVA	325,188,500
TOWNSHIP	2X15MVA	788,385,000
AVIATION	1X7.5MVA	325,188,500
ZARIA TS	1 X15MVA	606,450,000
HANWA	1 X15MVA	606,450,000
KOFAR DOKA	2X15MVA	788,385,000
MAIN OFFICE	2X7.5MVA	464,555,000
GRAND TOTAL		16,881,065,500

Furthermore, the medium voltage (MV) line also requires rehabilitation/upgrade to attain the level of reliability desired as well as reduce technical losses to global acceptable standard. As defined in our strategic approach, the focus in the PIP would be on feeders in the manageable area which has a total estimated upgrade requirement of N18.48Bn. The upgrade covers MV line rehabilitation, deployment of fault path indicators, auto reclosers and sectionalisors. The estimated MV line upgrade for the Unmanageable areas is N25.21Bn, which is more than the MV investment requirement in the manageable areas.

Table 15: MV Line Rehabilitation in Manageable Areas

FEEDER NAME	KM	MV LINE REHABILITATION
11KV BANK KAFANCHAN	20	55,900,000.00
11KV HIGH COST	18	50,310,000.00
11KV GARAGE KAFANCHAN	19	53,105,000.00
11KV KAFANCHAN (TOWNSHIP)	42	117,390,000.00
11KV MAHUTA	7	20,124,000.00
11KV PAMA	6	15,931,500.00
11KV SABON TASHA	9	25,155,000.00
11KV VILLAGE	12	33,540,000.00
33KV KAFANCHAN	157	437,599,175.00
33KV NARAYI VILLAGE	12	33,540,000.00
33KV UNGUWAN BORO	362	1,011,790,000.00
11KV AHMADU BELLO WAY	12	33,540,000.00
11KV CONSTITUTION ROAD	8	22,360,000.00
11KV COSTAIN	7	19,565,000.00
11KV DAWAKI	10	27,950,000.00
11KV ISA KAITA	11	30,745,000.00
11KV KAWO	11	30,745,000.00
11KV KURMIN MASHI	13	36,335,000.00
11KV LEGISLATIVE QUARTERS	17	47,515,000.00
11KV LUGGARD HALL	19	53,105,000.00
11KV MALALI	8	22,360,000.00
11KV MC (DEDICATED)	7	19,565,000.00
11KV NACB	12	33,540,000.00
11KV NASFAT	19	53,105,000.00
11KV NAFBASE	12	33,540,000.00
11KV NDA	14	39,130,000.00
11KV NTA (DEDICATED)	3	8,385,000.00
11KV RABAH ROAD	12	33,540,000.00
11KV RAFIN GUZA	20	55,900,000.00
11KV STATEHOUSE	19	53,105,000.00
11KV TEACHING HOSPITAL DKA	12	33,540,000.00
11KV UNGUWAN RIMI	8	22,360,000.00
11KV ZARIA ROAD	27	75,465,000.00
33KV ABAKPA	10	27,950,000.00
33KV DOKA	8	22,360,000.00
33KV NAF	4	11,459,500.00
33KV WATER WORKS	14	39,130,000.00
11KV ARGUNGU CITY	20	55,900,000.00
11KV BULASA	19	53,105,000.00
11KV GRA ARGUNGU	13	36,335,000.00
11KV GRA KBI	14	39,130,000.00
11KV GWADANGWAJI	30	83,850,000.00
11KV NASSARAWA KBI	25	69,875,000.00
11KV TUDUN WADA KBI	29	81,055,000.00
33KV ARGUNGU	440	1,229,800,000.00

33KV LABANA (DEDICATED)	6	17,329,000.00
33KV UNIVERSITY (DEDICATED)	6	16,770,000.00
11KV DAMBA	11	30,745,000.00
11KV FGGC	15	41,925,000.00
11KV GADA BIYU	17	47,515,000.00
11KV GRA ZAM	19	53,105,000.00
11KV INDUSTRIAL ZAM	17	47,515,000.00
11KV POLY GATE	12	33,540,000.00
11KV SABON GARIN ZAM	19	53,105,000.00
11KV WATER BOARD	21	58,695,000.00
11KV ZAMTEX	19	53,105,000.00
33KV NNPC GUSAU	220	614,900,000.00
33KV POWERHOUSE	15	41,925,000.00
11KV AREWA BOTTLERS	12	33,540,000.00
11KV BARNAWA MKR	17	47,515,000.00
11KV CHELCO	17	47,515,000.00
11KV FEDERAL HOUSING	19	53,105,000.00
11KV GWARI AVENUE	12	33,540,000.00
11KV KAKURI	12	33,540,000.00
11KV NASSARAWA MKR	9	25,155,000.00
11KV NOCACO	12	33,540,000.00
11KV NORTEX	15	41,925,000.00
11KV SUNGLASS	9	25,155,000.00
11KV UNGUWAN YELWA	8	22,360,000.00
33KV AREWA	16	44,720,000.00
33KV GONIN GORA	260	726,700,000.00
33KV PAN	19	53,105,000.00
33KV UNTL (DEDICATED)	12	34,378,500.00
11KV ASIKOLAYE	11	30,745,000.00
11KV GOVERNMENT HOUSE KADUNA	14	39,130,000.00
11KV LEVENTIS	15	41,925,000.00
11KV POLY ROAD	17	47,515,000.00
11KV UNGUWAN MUAZU	11	30,745,000.00
11KV WATER RESOURCES (DEDICATED)	11	30,745,000.00
11KV YANTUKWANE	14	39,130,000.00
33KV KINKINAU	20	55,900,000.00
33KV MOGADISHU	28	78,260,000.00
11KV ARKILLA	22	61,490,000.00
11KV ARMY BARRACK	12	33,540,000.00
11KV DIORI HAMMANI	12	33,540,000.00
11KV DURBAWA	8	22,360,000.00
11KV FARFARU	19	53,105,000.00
11KV GWADABAWA	28	78,260,000.00
11KV INDUSTRIAL SOK	25	69,875,000.00
11KV KADUNA ROAD	18	50,310,000.00
11KV KUEPPERS	16	44,720,000.00

11KV LODGE ROAD	18	50,310,000.00
11KV MABERA	15	41,925,000.00
11KV NTA SOK	8	22,360,000.00
11KV SULTAN PALACE	9	25,155,000.00
11KV TOWN	16	44,720,000.00
11KV WATERWORKS SOK	7	19,565,000.00
33KV CCNN (DEDICATED)	8	22,360,000.00
33KV KWARE/UNIVERSITY	859	2,400,225,815.00
33KV NEW INJECTION	11	31,863,000.00
33KV POWER STATION	16	44,720,000.00
33KV TOWNSHIP	7	19,565,000.00
11KV ABU	8	22,360,000.00
11KV CANTEEN	9	25,155,000.00
11KV DAM	10	27,950,000.00
11KV GRA ZAR	15	41,925,000.00
11KV KOFAN KIBO	9	25,155,000.00
11KV NNPC ZAR	15	41,925,000.00
11KV RLY/NTC	16	44,720,000.00
11KV SAMARU	19	53,105,000.00
11KV TEACHING HOSPITAL ZAR	12	33,540,000.00
33KV AVIATION	9	25,155,000.00
33KV HANWA	9	25,155,000.00
33KV KOFAN DOKA	10	27,950,000.00
33KV PZ	13	36,335,000.00
33KV ZARIA WATER WORKS (DEDICATED)	9	25,155,000.00
GRAND TOTAL		18,485,789,490

The upgrade on the LV lines within the manageable areas is estimated to cost N21.31Bn covering LV line upgrades, LV pillars, DT protection upgrade, DT replacement (where necessary), DT additions, conductor replacement etc. It is worth noting should KE choose to overhaul the LV line using Ratline Conductor (ABC Cables), it will cost the company around N40Bn. See table below for details of DT and LV line upgrade within the manageable areas.

Table 16: DT and LV Line Upgrade/Rehabilitation

Feeder Name	No of Bad DTs on the Feeder	Cost for Overhaul
11KV HIGH COST	3	33,952,800
11KV KAFANCHAN (TOWNSHIP)	3	33,952,800
11KV MAHUTA	14	158,446,400
11KV PAMA	5	56,588,000
11KV SABON TASHA	17	192,399,200
11KV VILLAGE	25	282,940,000
33KV KAFANCHAN	32	362,163,200
33KV NARAYI VILLAGE	1	11,317,600
33KV UNGUWAN BORO	72	814,867,200
11KV AHMADU BELLO WAY	10	113,176,000
11KV CONSTITUTION ROAD	22	248,987,200
11KV COSTAIN	8	90,540,800
11KV DAWAKI	22	248,987,200
11KV ISA KAITA	27	305,575,200
11KV KAWO	12	135,811,200
11KV KURMIN MASHI	16	181,081,600
11KV LEGISLATIVE QUARTERS	16	181,081,600
11KV LUGGARD HALL	12	135,811,200
11KV MALALI	27	305,575,200
11KV MC (DEDICATED)	4	45,270,400
11KV NACB	25	282,940,000
11KV NASFAT	18	203,716,800
11KV NAFBASE	12	135,811,200
11KV NDA	14	158,446,400
11KV RABAH ROAD	20	226,352,000
11KV RAFIN GUZA	22	248,987,200
11KV STATEHOUSE	15	169,764,000
11KV TEACHING HOSPITAL DKA	23	260,304,800
11KV UNGUWAN RIMI	27	305,575,200
11KV ZARIA ROAD	45	509,292,000
11KV DAMBA	7	79,223,200
11KV FGGC	3	33,952,800
11KV GADA BIYU	19	215,034,400
11KV GRA ZAM	6	67,905,600
11KV INDUSTRIAL ZAM	12	135,811,200
11KV POLY GATE	4	45,270,400
11KV SABON GARIN ZAM	10	113,176,000
11KV ZAMTEX	2	22,635,200
33KV POWERHOUSE	1	11,317,600
11KV AREWA BOTTLERS	13	147,128,800
11KV BARNAWA MKR	1	11,317,600
11KV CHELCO	12	135,811,200
11KV GWARI AVENUE	5	56,588,000
11KV KAKURI	7	79,223,200
11KV SUNGLASS	1	11,317,600

11KV ASIKOLAYE	9	101,858,400
11KV GOVERNMENT HOUSE KADUNA	19	215,034,400
11KV LEVENTIS	42	475,339,200
11KV POLY ROAD	19	215,034,400
11KV UNGUWAN MUAZU	15	169,764,000
11KV YANTUKWANE	15	169,764,000
33KV KINKINAU	12	135,811,200
11KV ARKILLA	40	452,704,000
11KV ARMY BARRACK	34	384,798,400
11KV DIORI HAMMANI	35	396,116,000
11KV DURBAWA	25	282,940,000
11KV GWADABAWA	7	79,223,200
11KV INDUSTRIAL SOK	44	497,974,400
11KV KADUNA ROAD	18	203,716,800
11KV KUEPPERS	31	350,845,600
11KV LODGE ROAD	19	215,034,400
11KV MABERA	36	407,433,600
11KV NTA SOK	39	441,386,400
11KV SULTAN PALACE	26	294,257,600
11KV TOWN	31	350,845,600
11KV WATERWORKS SOK	19	215,034,400
33KV KWARE/UNIVERSITY	216	2,444,601,600
33KV NEW INJECTION	123	1,392,064,800
33KV POWER STATION	45	509,292,000
33KV TOWNSHIP	121	1,369,429,600
11KV ABU	29	328,210,400
11KV CANTEEN	17	192,399,200
11KV DAM	20	226,352,000
11KV GRA ZAR	10	113,176,000
11KV KOFAN KIBO	29	328,210,400
11KV NNPC ZAR	23	260,304,800
11KV SAMARU	21	237,669,600
11KV TEACHING HOSPITAL ZAR	22	248,987,200
TOTAL	1,883	21,311,040,800

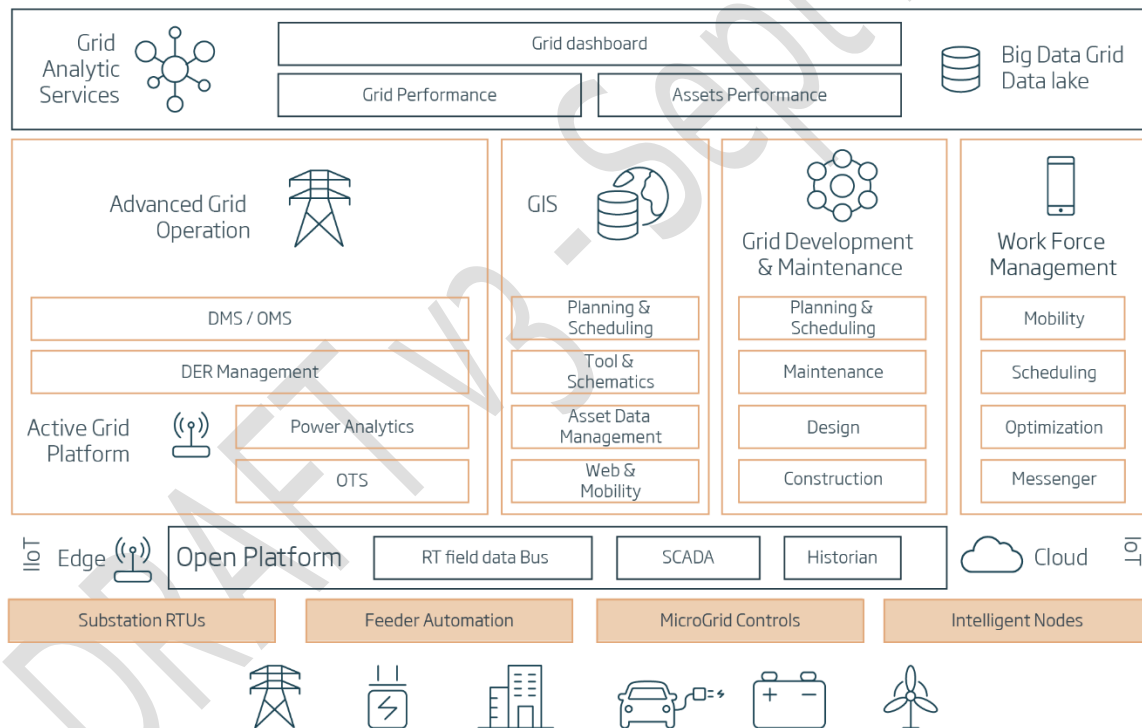
Analysis done on DT and LV line upgrade for the Un-manageable areas reveals an investment requirement of N23.8Bn using Aluminum Conductor and N45Bn using Ratline Conductor (see Appendix II for breakdown of LV rehabilitation in the Unmanageable areas).

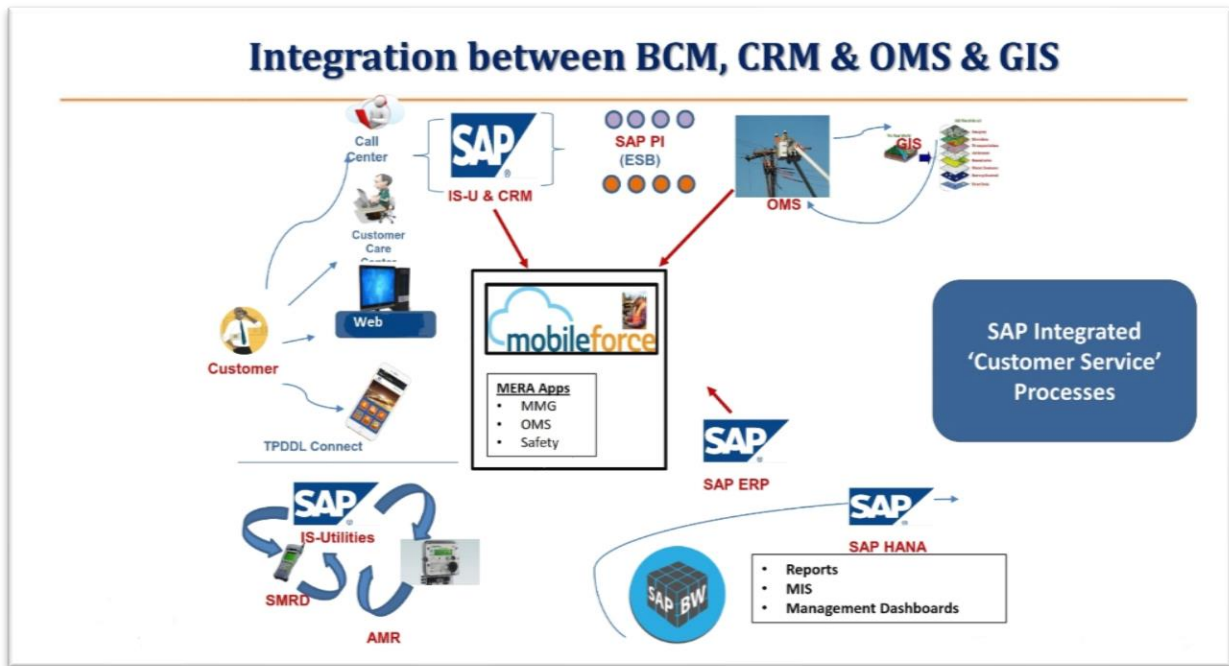
IT Infrastructure, Metering and Automation

In terms of IT and network infrastructure, KE has made modest progress, particularly in the area of deployment of new postpaid and prepaid billing system, Advanced Metering Infrastructure (AMI) and numerous applications. Within the last 4 years, the ICT department has been able to develop its own in-house apps covering almost every aspect of the Company's operations, which has been a huge cost saving for the company. Some of these apps include; meter reading, enumeration, payment tracking, bill distribution, CRM, disconnection/enforcement among others.

While a lot of in-house assessment and preliminary developments have been carried out often using opensource software to bridge the huge automation gaps that exist, going forward the company would require robust ISO certified systems to successfully run the complexities of a modern utility. The figure below shows the interplay amongst different systems in an ideal modern utility.

Figure 12: System Architecture for Management Systems





On metering, the company has been able to meter all its feeders, about 98% of its MD customers and 2% of its DTs. The 11KV Feeders and a good number of MD meters are currently on the AMR platform. The non-MD customers have, however, not had it smooth with the Company in terms of metering. Out of the 600,000 customers, 136,366 representing 23% are metered while 463,640 representing 77% are unmetered. Of the metered customers, 94% are on prepaid while the remaining 6% are on credit meter.

Chapter 4 – Proposed Output

Managing stakeholder expectations is very crucial to the success of the distribution business. Kaduna Electric has outlined key strategies to ensure the company meets its commitments and provide value for our various stakeholders. As outlined in the Chapter 1, the strategic approach for investment is based on two broad customer segmentation – those within the manageable and unmanageable areas. The target output based on a number of KPIs for the different customer segment is going to be slightly different as reported in the tables below.

Table 17: Proposed Output for Manageable Areas

KEY AREAS	MANAGEABLE AREAS
Reliability/availability	Following implementation of the planned interventions within the manageable areas, the target is to achieve 95% reliability and availability of supply. The company currently operates at an average reliability of around 60%.
Metering	100% AMR compliant meters for grid, DT and MD customers to closely monitor consumption and effectively conduct energy audit. Furthermore, we shall achieve 100% smart metering for all customers within the manageable areas.
Loss reduction	Significant reduction in losses to less than 15% on aggregate loss levels
Customer satisfaction	Achieving Customer Satisfaction Score (CSAT) of at least 90%
New connection/network expansion	Achieve quick turnaround time in new connection and also ensure every process of new connection is fully automated and customer can track status/stage of his/her application online
Safety	Since Kaduna Electric took over, our safety indices have consistently remained positive where, near misses and deaths rates were very low. We intend to achieve zero accidents/deaths or near misses in the next 5years by provision of adequate PPEs and effective channel of reporting HSE related issues.
Corporate Social Responsibility	Significantly improve the scale of CSR covering support to schools and sporting activities

Table 18: Proposed Output for Difficult to manage Area

KEY AREAS	DIFFICULT TO MANAGE AREAS
Reliability/availability	To achieve 70% reliability across all the difficult areas
Metering	Metering of all distribution substations; achieve 75% customer metering using cheap/basic postpaid or prepaid meters under the MAP scheme.
Loss reduction	Significant loss reduction through Franchising and other initiatives from more than 75% now to less than 35%.
Customer satisfaction	Achieving Customer Satisfaction Score (CSAT) of at least 65%
New connection/network expansion	Achieve quick turnaround time for new connection
Safety	Since Kaduna Electric took over, our safety indices have consistently remained positive where, near misses and deaths rates were very low. We intend to achieve zero accidents/deaths or near misses for the next 5years by provision of adequate PPEs and effective channel of reporting HSE related issues.
Corporate Social responsibility	Significantly improve the scale of CSR covering support to schools and hospitals, donations to less privileged homes, provision of water supply, feeding and clothing programs, provision of energy efficient bulbs and appliances to communities, support to security agencies (where we improve the security of our assets and discourage electricity theft in peri-urban areas). Others include support for Science Clubs in Primary and Secondary Schools, as well as to Engineering Departments in Polytechnics and Universities.

Chapter 5 – Detailed Progress Plan

Distribution Management Plan

The Distribution Management Plan (DMP) covers three broad investment areas; (i) implementation of investments and other initiatives in distribution network rehabilitation and upgrade aimed at resolving existing constraints limiting availability and quality of energy supply, (ii) identification of eventual constraints to meeting electricity demand arising from issues affecting high and medium voltage network infrastructure, and (iii) TCN-DisCo interphase project required in resolving existing constraints and meeting electricity demand.

Details of most of these investments have been captured in Chapters 2 and 3, as such we shall provide a summary of the activities here and cost implication.

Table 19: Breakdown of Distribution Mgt Plan

Investment Area	Details	Project Cost (NGN)
Investment in construction of new injection substation	The recommended new injection sub-station required to stabilize the network and meet the demand capacity following the outcome of the simulation model from ETAP. The proposed injection substations are going to be SCADA ready and all located in the manageable areas	11,391,380,000
Upgrade of existing injection substation	Upgrade of existing injection substations in the manageable areas to meet the automation plans and efficiency level.	16,881,065,500
MV line rehabilitation (33KV and 11KV)	Upgrade covering MV line rehabilitation, deployment of fault path indicators, auto reclosers and sectionalizers. This is required to attain the target reliability and efficiency levels within the manageable areas.	18,485,789,490
LV line rehabilitation (o.415KV) and DT upgrade	Upgrade/Overhaul of LV lines and distribution transformer to meet the reliability level required. Again, the upgrades are mostly in the manageable areas.	21,311,040,800
HSE	Purchase of PPEs, technical tools, installation of isolators at strategic network points on the network for safety purposes, installation of CCTVs at injection substations, safety enlightenment programs for communities	2,311,940,000
		70,381,215,790

ATC&C Loss Reduction Plan

Investment related to ATC&C loss reduction include; installation of metering systems to capture all electrical parameters involved in commercial transactions with NBET and TCN, regularization of consumers in manageable areas, implementation of revenue protection project supported by smart metering infrastructure and AMI among others.

Table 20: Breakdown of ATC&C Loss Reduction Plan

Investment Area	Details	Project Cost
Installation of modern metering system at interface points	While all 33KV feeders emanating from the transmission point are metered, the metering system are quite basic non-AMI compliant meters that will need to be replaced with modern AMI compliant meters that allows for real-time monitoring of electricity consumption as well as remote reading.	325,000,000
Deployment of DT metering systems	For efficient operations and commercial loss reduction drive, DT metering is required to be done 100%. The company current has over 6,000 unmetered public DTs and additional 1,000 DTs are expected over the next 5 years. A total of 7,351 DT meters is required to be deployed.	3,675,500,000
Replacement of MD meters with AMI compliant meters	Around 40% of Maximum Demand customers have AMI compliant meters while the remaining 60% have basic MD meters that will have to be replaced with AMI compliant meters.	954,000,000
Regularization of consumers in manageable areas	All customers within the manageable areas will have a clean standard connection at their premises – this will entail using the right kind/size of service cables as well as fuses and other protective devices (where necessary). Furthermore, while the cost of meters is covered by the customer under MAP, the cost of the backbone infrastructure to support deployment of smart metering systems will have to be borne by the company. Meter tampering and bye-pass on PPMs has been a huge revenue drain to DisCos and implementing smart customer metering would address the leakage. On average, regularizing the customers in the manageable areas including deploying the smart metering infrastructure will cost 220USD/customer.	24,165,713,000
		29,120,213,000

Customer Service Improvement Plan

Customer service improvement is critical to achieving the success of every aspect of the performance improvement plan. This is reflected in all the stakeholder engagement conducted on the development of PIP. The key customer service improvement initiatives to be implemented are outlined below:

Table 21: Breakdown of Customer Service Improvement Plan

Investment Area	Details	Project Cost (NGN)
Implementation of improvements in customer services	Kaduna Electric shall implement a full-scale contact center able to attend to all request from customers related to quality of electricity supply as well as commercial matters. The contact center would ensure all customer request are logged in the CRM platform and treated timely with a feedback mechanism back to the customer. Customers will be able to reach the contact center via phone, SMS, web or social media. Similarly, all customer queries received at our customer care points at the service center level will also be logged in the CRM and tracked/monitored by the contact center.	842,400,000
Implementation of improvements in management of request for new connection	Kaduna Electric shall implement clear and transparent procedure to attend to any request for new service connection, including online application, providing customers with web access to record of GIS, and integrating to the contact center to enable customers call and track the progress of their application.	Covered under the Commercial Mgt. System
Building new commercial service offices and refurbishment of existing ones	Ensure sufficient and conducive Service Centers and Area Offices equipped with the right working tools and also refurbishing existing ones to meet the right standards. Due to huge recurrent cost from annual rent payments, the company has a plan of building Service Centers and Area Offices with the premises of our Injection Sub-stations as ample land is available at most the sub-stations. Currently, around 35% of our offices have been upgraded with the right working tools and the remaining 65% will have to be upgraded/built over the next three years.	4,130,237,500
		4,972,637,500

Management Improvement Plan

The table below reports details of the management improvement plans that the company plans to undertake over the 5-year period. It is important to note that deployment of right systems is critical to support the operationalization and value addition of investment done in other areas.

Table 22: Breakdown of Management Improvement Plan

Investment Area	Details	Project Cost (NGN)
Deployment of Commercial Management System	Incorporation of a Commercial Management System (CMS) to manage all commercial processes: revenue cycle management, attending to customer activities, etc.	1,140,000,000
VHF Radio Communication	Faster and efficient means of communication. It provides broadcast communication use by the technical to enable one-time communication to all the personnel. This enables effective communication of outage request and restoration of supply which in return encourages safety compliance.	750,000,000
Deployment of Enterprise Resource Planning (ERP)	Incorporation of an Enterprise Resource Planning (ERP) information system to support corporate planning and management of shared services. The ERP system will have the following modules accounting, finance, human resources, procurement, asset inventory, logistics and incidence recording management. The system enhances productivity, provide information for better decision making, streamline processes and automates workflow. It also provides information on how to plan for a better maintenance schedule of the company's' asset and equipment.	2,387,500,000
Geographic Information System (GIS)	Setting up of a standard GIS lab and deployment of software/hardware including subscription for 5 years. This allows the company to have a visual view of its network and customers, location, payment status etc. on a satellite map, resulting in better tracking and monitoring of operational activities for enhanced efficiency. Furthermore, the GIS will be integrated to the ERP system.	543,750,000
SCADA	Incorporation of a Supervisory Control and Data Acquisition System (SCADA) to operate and control HV & MV infrastructure. All injection sub-stations and feeders within the manageable areas would have a SCADA system deployed for remote network monitoring and control.	8,232,000,000
Deployment of Project Management and Works Management System	This will improve field tasks and resource management processes by synchronizing the work progress, network data, locations and statuses of field personnel. It helps determine best options in terms of finances and time, routes, and effective tasks allocation by considering various factors, such as: skills, certifications, technical expertise, etc., all of which contributes to reduction of maintenance costs.	160,000,000
Restructuring, Human Resource Alignment and Capacity Building	Deployment of the new systems of this magnitude would require restructuring the organization and possible recruitment of additional staff with specialized skills. Furthermore, capacity building exercise will have to be done to prepare employees for the use of the systems.	240,000,000
		13,453,250,000

Management Systems Certification Programmes

1. QUALITY MANAGEMENT SYSTEM ISO 9001

Kaduna Electric aims to be certified under ISO 9001 for specific business areas including Electricity Supply (Marketing, Sales and Customer Service), Power Distribution (including design, installation and maintenance of electricity supply services), Metering, Telecoms, Kaduna Electric Data Centres and Meter Asset Management).

Kaduna Electric also aims for separate certification for its Engineering Centre.

2. ENVIRONMENTAL MANAGEMENT SYSTEM ISO 14001

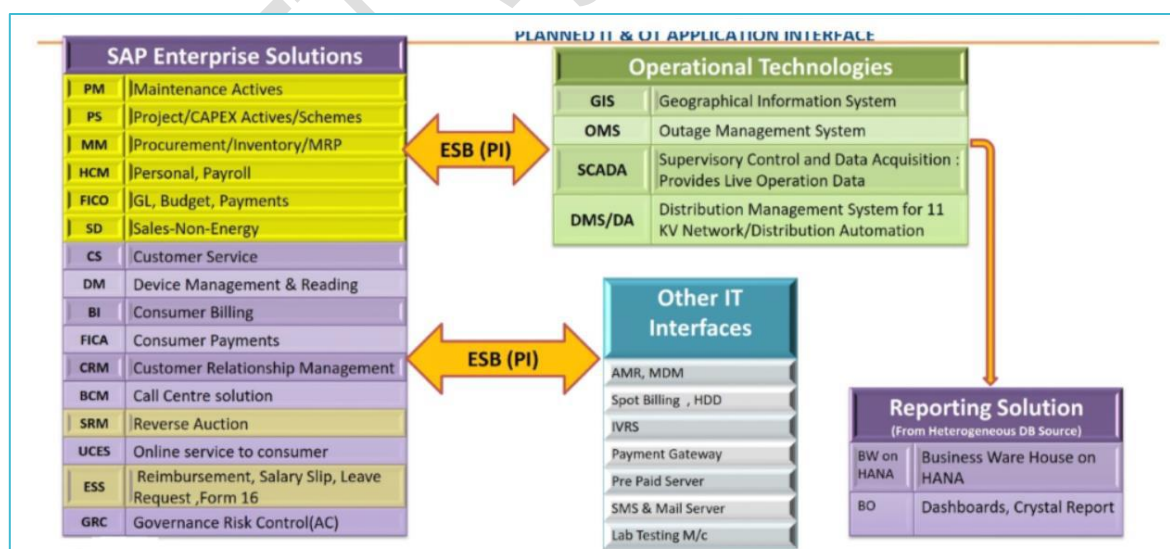
Kaduna Electric aims to be certified under ISO 14001 for specific business areas and sites including Operation and Maintenance of Electricity Distribution Systems.

3. OCCUPATIONAL HEALTH AND SAFETY OHSAS 18001

Kaduna Electric shall be certified under OHSAS 18001 for operation of the corporate occupational health and safety management system to support Kaduna Electric Group Risk Management activities.

4. INFORMATION SECURITY STANDARD ISO 27001

Kaduna Electric shall target having Data Centres to be certified to the Information Security Standard ISO 27001. These areas are subject to both internal and external audit of the relevant management systems.



Chapter 6 – Financing Plan

Costing of the Proposed Plans

The total cost implication of the investment plans over a 5-year period is estimated to N118Bn. Distribution Management Plan has the highest value, taking 60% of the total investment value, followed by ATC&C loss reduction with 25% and then Management Improvement Plan with 11% and finally Customer Service Improvement Plan with 4%.

Table 23: Summary of 5-Year Investment Plan (Million Naira)

Investment Plan	2020	2021	2022	2023	2024	Total
Distribution Management Plan	14,076	21,114	17,515	10,557	7,038	70,300
ATC&C Loss Reduction Plan	5,824	8,736	7,280	4,368	2,912	29,120
Customer Service Improvement Plan	994	1,492	1,243	746	497	4,972
Management Improvement Plan	2,692	4,036	3,363	2,018	1,345	13,454
Total	23,586	35,378	29,401	17,689	11,792	117,846

A total of N23,6Bn or 20% of the total CAPEX value will be deployed in 2020, while N35.4Bn, N29.4Bn, N17.7Bn and 11.8Bn representing 30%, 25%, 15% and 10% of the total investment value to be deployed in 2021, 2022, 2023 and 2024 respectively.

Description of Financing Strategy

As part of the financing plan, investors of Kaduna Electric have arranged to source for cheap long-term financing from development partners such as Development Bank of Nigeria (DBN) and Africa Development Bank (AfDB). In addition to the cheap funds from development partners, the company will also source funds for capital expenditure through various funding arrangements including bilateral sources, grants, loans (commercial & concessional), donor funding, vendor financing, franchising and funding through partnerships. These sources will be used to fund our CAPEX fueling an annual reduction in ATC&C losses, growth in revenue and improvement in quantity and quality of power supply to our customers. This section details the various funding sources to be used to finance CAPEX of the company as contained in the PIP document.

Franchising

As part of the measures to address some of the infrastructure deficit in the industry and improve liquidity position of the DisCos, NERC came up with franchising regulation which will enable DisCos franchise some areas within their coverage area to third party franchisees. The franchise arrangement could take three different forms. Under operations and maintenance franchise (Full

Franchise) the franchisee is expected to undertake some capital expenditure in the form of network upgrade and maintenance. We plan to franchise a number of feeders under full franchise arrangement model. The franchisee will invest in network upgrade and maintenance within the franchised feeders.

Konexa KE Partnership

In furtherance of the franchising arrangement, KE entered into a special form of partnership with Konexa (details explained in Chapter 1). Through ring-fencing and creating SPV in a sub-concession arrangement, Konexa attracts long-term patient capital internationally to invest and improve efficiency in the sub concession area. Konexa is currently working on two sub-concession area (an industrial and residential areas) with a total projected expenditure of about thirty-five million US dollars (USD35, 000,000). The investment is expected to be done in phases with 70% of the total amount to be invested in the first phase while the remaining 30% will be deployed in the second phase. Konexa plans to scale up by taking more concession areas following successful implementation of the first project.

West Africa Power Pool (WAPP) / German Corporation for International Cooperation (GIZ)

In order to improve financial viability of distribution companies to participate effectively in the ECOWAS regional electricity market, the WAPP in collaboration with GIZ is working with some DisCos in the region to source funding for distribution loss reduction projects. Kaduna Electric has submitted proposal for donor funding of two loss reduction projects. The donor funding through this source will be used to finance construction of two 2X15MVA injection substations at Badariya and Rigasa areas under Birnin-Kebbi and Rigasa area offices respectively. The proposed cost of each of the projects is N739,624,483.80 and N 797,979,985.30 for Badariya and Rigasa respectively.

Vendor Financing

One of the financing arrangements we are considering is vendor financing which could be used for vehicle financing, smart network devices and metering of our public distribution transformers (DTs) to ensure better energy accounting and reduction in non-technical losses.

International Finance Corporation (IFC)

Another major source of funding for our projects contained in the PIP document is the international finance corporation. Through this source, IFC will provide about two hundred and fifty to five hundred million dollars (\$250-500mn) available to all DisCos. KE plans to key-in the IFC scheme to finance part of the capital projects in the PIP.

World Bank (PSRP)

The Power Sector Recovery program (PSRP) was set to address some of the challenges in the power sector and to improve the efficiency and commercial viability of the sector. This involves policy actions, regulatory, operational, governance and financial interventions to be implemented by the Federal Government over a period of five years. Part of the financial interventions is to secure World Bank's financial support to finance the PSRP. Through the World Bank financial support, DisCos would receive funding for priority loss reduction projects. A total sum of \$1,000mn would be provided by the world bank to all the DisCos. The portion allocated to KE would be used to finance some of our capital projects.

Siemens (National Electrification Project – NEP)

The visit to Nigeria and subsequent meeting with the president by the German Chancellor Angela Merkel led to the signing of bilateral agreements between Nigeria and Germany to explore areas of cooperation with the German government. One of such areas where the bilateral agreements were focused is the power sector. The bilateral agreement on power sector is aimed at providing solutions to resolve transmission and distribution challenges. TCN and the DisCos submitted proposals on their priority projects which will be executed by German company Siemens. The total amount to be realized from this source is Two Hundred Million USD (\$200mn). The funds will be applied on capital projects and supply of equipment.

Other Sources

In addition to the sources mentioned above, we plan to explore other funding sources such as loans from financial institutions such as AfDB and CBN/Government, capital investment by current shareholders, issuing shares to attract additional investors and cashflow from operations. We intend to explore loan option especially from foreign financial institutions as most of our local financial institutions may not be disposed to lending long-term at low interest rate.

Tariff Impact

With the deployment of CAPEX targeted at the manageable areas, we propose to implement a zonal tariff structure where the manageable areas will be charged the full cost-reflective tariff rate, while the Difficult-to-Manage Areas will have a different tariff regime. The proposal will be submitted to NERC once work on the tariff model is concluded.

Approved Capex Cases and Resultant Tariffs and Profitability

This part presents cases in which the identified Capex requirements are considered and approved by the NERC, with tariff assumptions from the latest minor review (June 2019).

This also considers that the end of 2020 is year 3 of ATC&C loss reduction. The assumptions for these include:

- The tariffs used are from the MYTO Minor Review tariffs for 2020 to 2024;
- Capex requirements identified in the PIP are considered and approved by the NERC; and
- The energy levels received from 2020 till 2024 remains at same levels (as assumed in the MYTO Minor Review model)

Based on these assumptions, Table 24 presents the allowed tariffs for Kaduna Electric, where Case 1 is the summary of loss reduction trajectory with full cost recovery and with full investment of capex across the company including both MAs and DMAs. Case 2 (to be provided to the NERC at a later date) considers the investment in manageable areas only; while Case 3 considers investments in Difficult to Manageable Areas only.

Table 24: Summary of Tariff Impact

	Years	Tariff (N/kWh)	Capex (Nm)	ATC&C Loss Reduction (%)
Case 1 (Disco Wide)	2020	79.29	23,586	45%
	2021	115.51	35,378	34%
	2022	111.83	29,401	27%
	2023	99.86	17,689	21%
	2024	83.45	11,792	19%
Case 2 (Manageable Areas)	2020	65.50	15,793	43%
	2021	76.24	17,689	36%
	2022	72.69	14,700	27%
	2023	70.90	9,844	20%
	2024	54.24	6,896	17%
Case 3 (Difficult to Manageable Areas)	2020	128.58	16,510	66%
	2021	131.02	23,349	61%
	2022	123.66	19,110	53%
	2023	109.72	12,559	48%
	2024	106.90	7,664	45%

Chapter 7 – Risk Assessment and Mitigation

Key risks to the implementation of the PIP as well as mitigation plans are highlighted in the table below.

Table 25: Risk Analysis

Risk Area	Probability	Impact	Description	Mitigation Plan
Government Policy and Actions	High	High	1. Policy Reversals which could affect implementation of PSRP, including interfering policy dictates to the regulators, unclear statements negating positive investor environment etc	Continuous engagement with the Federal and State Governments on the long-term investor relations necessary for growth and sustainable business
	High	High	2. MDAs Payment MDA debts, which make up over 20% of billing for the company remain unpaid and piling with no serious action since 2014.	Difficult to manage situations on MDAs payment arise for Kaduna Electric due to challenge in disconnecting esp military formations.
	High	High	3. Performance Agreement expectations need to be reconsidered in the light of grossly changed variables including loss studies, new market realities etc.	Engagement with BPE is necessary to see the refection of achievable and realistic Performance Agreement targets.
Regulatory Risks	High	High	Regulatory Certainty which could affect implementation of PSRP, specifically setting a cost reflective tariffs, implementation of minor reviews, regulatory asset determinations etc.	NERC to carryout bi-annual tariff review as required by law and make provision for tariff shortfall where necessary to address gaps in Discos' balance sheet.
	High	High	Loss Reduction Trajectory - Rejection of the actual loss levels of the discos presented a unique challenge including MDA losses etc. Investments are required to covered "non-accepted" loss levels which have no return or profits. - Continued recognition of the 2013 loss levels are highly unrealistic due to time effect and compounding of losses due to underinvestments. Using actual losses ultimately favour the consumers.	Engagement with NERC to recognize the effect of the time variability of the loss reduction trajectory. The underinvestment automatically increases losses while the MYTO recognizes losses as fixed.

Financial/Investment Risks	Medium	High	Difficulty in securing required investment funds to execute plan due to poor financial health of the power sector	Diversify sources of funding to include commercial loans, Government Loans, shareholder funding, multilateral and donor funding
Market Participants Risks	Medium	High	1. Energy and Capacity Bills from Generators are much higher than MYTO prices and time to true-up is inconsistent and doesn't consider TVM 2. NBET activates PPAs without consultation with Discos, the offtakers.	Consultations with the NBET in collaboration of NERC and MO.
Exchange Rate Risks	Low	High	Possible shocks due to exchange rates volatility which could affect dollarized investment loans	Hedge against currency fluctuations to reduce impact, consider loan syndication from local sources
Determining Generation Capacity over a 5-year period	Medium	High	Uncertainty on generation capacity to be achieved over the 5-year period which is a key determinant of Disco energy inputs and sales output	Guarantees from Gencos & TCN on capacity, consider energy from alternative sources; embedded generation, renewables
TCN Expansion Project Delays	High	High	1. Birnin Kebbi-Sokoto; Extension of 330KV line or reconducting existing 132KV line to guarantee supply improvement to key customers (CCNN, other MDs) 2. Kaduna Millennium City; Construct new 132/330KV Transmission station by stepping down Mando-Jos line to serve rapidly expanding demand in Eastern Kaduna 3. New Industrial Park; Construct new 132KV line to proposed Kaduna Industrial Park to upcoming industrial clusters with high demand	Government and Multilateral support for TCN expansion projects to guarantee adequate supply to critical load centers
Customer Apathy/Resistance	Medium	Medium	Possible customer resistance due to likely tariff increase which could result to apathy towards improvement initiatives	1.Continuous stakeholder engagements and customer education to highlight benefits of improvement plan on socio-economic growth of society 2. Social investment programs targeted at SMEs and underprivileged
Inadequate Skillset to Support Implementation	Medium	Low	Technical capacity and Skillset gap in business development, financial modelling, project finance, risk management, GIS to achieve desired outcome	Capacity building and training programs to identified gaps in skillset. Retention of skilled staff, knowledge transfer, develop technology and R&D partnerships, ensure strict

			within the specified improvement plan timeframe.	compliance with SLA, ensure compliance with safety standards
Socio-Political Risks	Medium	Medium	Rising and Biting Poverty Rates in Disco franchise area could lead to social unrest. Change in Government could also lead to adverse effects on improvement programs	1. Social investment programs targeted at SMEs and underprivileged 2. Multilateral support for recovery program could reduce political risks
	High	High	Banditry, Insurgency and Civil Unrest are reoccurring incidents in Kaduna Electric's franchise area with over 13% of energy uncollectible	Continuous investment and engagement in security and logistics support Collaboration with security outfits to augment operations.
ICT infrastructure and data security compromise	Medium	Medium	Possible Loss of critical company data and ICT hardware affecting business continuity	Securing ICT infrastructure and company data through by deploying robust ICT infrastructure with full disaster recovery capabilities

Even though underlying demand for electricity is expected to grow steady over the next decades, the delivery and meeting of these demands is going to be a huge challenge due to socio-economic and investment challenges. The benefits that meeting these challenges enables – economic empowerment, convenience, and others – are ever more critical. To bridge this gap, we believe regulators, utilities, and consumer advocates will need to collaborate closely in several areas:

- capturing the value of benefits and contributing their fair share of the value of the electric network;
- assuring the affordability of tariff rates and total bills;
- considering alternative billing determinants (time of use billing, kVA_r etc) and structures, focusing keenly on the implications for cost allocation across customer categories;
- considering the value of the electricity network in the continuous provision of energy and accommodating new energy sources that provide customers with choices.

A handful of distribution companies are acting now on the new imperatives. We expect that this will build competitive advantages, including brand power that will help attract customers, talent, and investment. We expect our company will continue with business as usual even as the pace of changes and externalities accelerate.

Chapter 8 – Operational KPIs

Operational KPIs – Manageable Areas

KPI targets in the manageable areas relating to technical, metering, safety and loss levels over the 5-year period are reported in the table below.

Table 26: Operational KPIs for Manageable Areas

KPI	Description	2020	2021	2022	2023	2024
Metering Progress	Percentage of customers metered	60%	85%	100%	100%	100%
HV Fault Clearance Index	Percentage of HV Fault cleared within 8hrs	90%	95%	100%	100%	100%
LV Fault Clearance Index	Percentage of LV Fault cleared within 8hrs	85%	95%	100%	100%	100%
New Customers Acquired	Number of new customers acquired in the year	120,000	85,000	70,000	50,000	50,000
Health & Safety (Serious Injury)	Number of serious injuries resulting from Health and Safety incidence	9	6	3	0	0
Health & Safety (Death)	Number of deaths resulting from Health and Safety incidence	0	0	0	0	0
T&C Losses	Combined technical and commercial losses	24%	19%	17%	14%	13%
Collection Losses	Losses due to uncollectable billed revenue	25%	21%	12%	7%	5%
ATC&C Losses	Aggregate technical, commercial and collection losses	43%	36%	27%	20%	17%

Operational KPIs – Difficult to Manage Areas

The table below reports the same KPI targets for the difficult to manage areas.

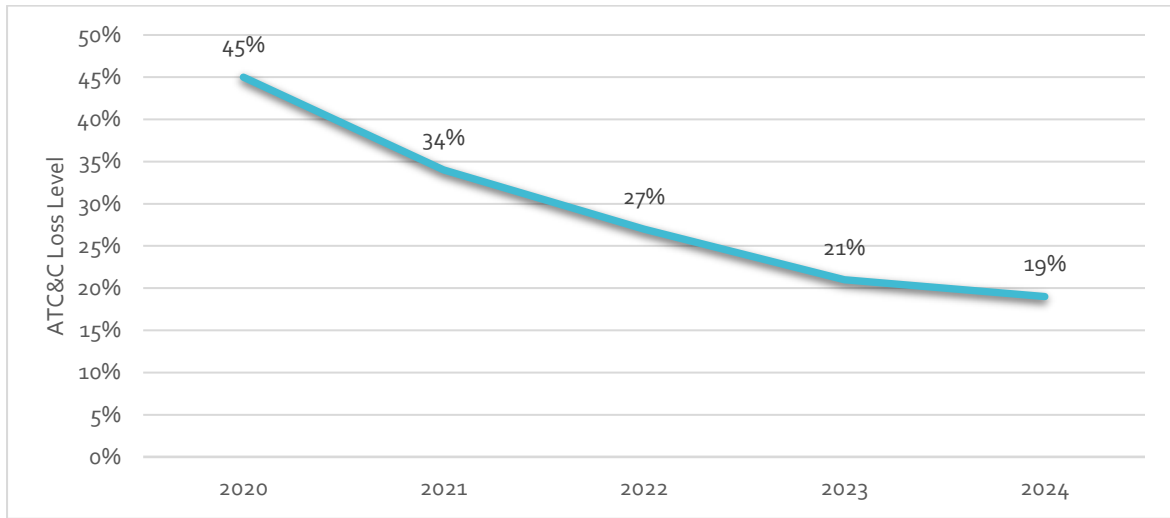
Table 27: Operational KPIs for Difficult to Manage Areas

KPI	Description	2020	2021	2022	2023	2024
Metering Progress	Percentage of customers metered	30%	45%	53%	55%	60%
HV Fault Clearance Index	Percentage of HV Fault cleared within 8hrs	80%	85%	85%	90%	90%
LV Fault Clearance Index	Percentage of LV Fault cleared within 8hrs	70%	75%	80%	80%	80%
New Customers Acquired	Number of new customers acquired in the year	50,000	35,000	30,000	20,000	20,000
Health & Safety (Serious Injury)	Number of serious injuries resulting from Health and Safety incidence	10	10	5	5	5
Health & Safety (Death)	Number of deaths resulting from Health and Safety incidence	0	0	0	0	0
T&C Losses	Combined technical and commercial losses	35%	31%	27%	23%	21%
Collection Losses	Losses due to uncollectable billed revenue	55%	43%	35%	33%	30%
ATC&C Losses	Aggregate technical, commercial and collection losses	66%	61%	53%	48%	45%

Companywide ATC&C Loss Reduction Target

Following the implementation of the PIP, the ATC&C target for the entire company is expected to reduce to 45% at the end of 2020 and further down to 19% at the end of 2024 as shown in the figure below. It is worth mentioning that the average ATC&C for the company at the moment (2019) is around 69%.

Figure 13: Companywide ATC&C Loss Reduction Target



Chapter 9 – Conclusion

In pursuit of Power Sector Recovery Plan of the Federal Government, NERC is implementing a more robust tariff review process aimed at improving the performance of the Nigeria Electricity Supply Industry (NESI). One key action point required from the DisCos is development of a performance improvement plan that will capture the actual CAPEX requirement to drive NESI to the desired level of operational efficiency.

The PIP is expected to outline 5-year (2020 – 2024) operational plan and loss reduction strategy that clearly states target output over planning horizon and stipulates programs that will lead to the realization of those outputs. It is also expected to clearly outline the projected costs and financing plans associated with the projects as well as an analysis of risk factors and proposed mitigation measures.

The Kaduna Electric PIP report was developed to meet the expected outcomes as outlined in the NERC PIP guidelines. Due to the nature of our network, customer spread and landmass coverage area, it is important to adequately segment the market as a means to prioritize areas of investment/focus in our capital deployment program for the next 5-years. The KE market area is segmented into 4 different classes – Premium Customer Group (PCG), Manageable Urban and Rural Areas (MU&RAs), Difficult to Manage Rural Areas (DMRAs) and Informal Settlement in Peri-Urban Areas (ISPAs). The 4 market segments are further broken down to two broad categories of Manageable Areas (PCG and MU&RAs) and Difficult to Manage Areas (DMRAs and ISPAs). Most of CAPEX deployment in the PIP, particularly those related to technical improvements and ATC&C investment plans, are focused in the manageable areas.

Accordingly, the CAPEX requirement for the various plans over the period 2020 – 2024 is estimated to be N117.8Bn with distribution management plan (technical upgrade and substations and feeders) taking 60% of the total CAPEX value followed by ATC&C loss reduction plan with 25%, then management improvement plan (deployment IT system and automation including SCADA) with 11% and finally customer service improvement plan with 4% of the total CAPEX value.

Following the upgrades, we expect ATC&C loss level to reduce from around 55% in the manageable areas now down to 17% in 2024 while in the difficult to manage areas, we expect the ATC&C loss level to reduce from around 78% now to 45% in 2024. Companywide, we target an ATC&C loss level of 19% by 2024.

While the PIP mainly focuses on capital deployment to achieve efficiency improvement, it is important to note that running the new network, particularly with the level of automation planned

will come with a substantial OPEX requirement. Our estimate reveals Kaduna Electric would require on average around N2Bn monthly to cater for the operational expenses.

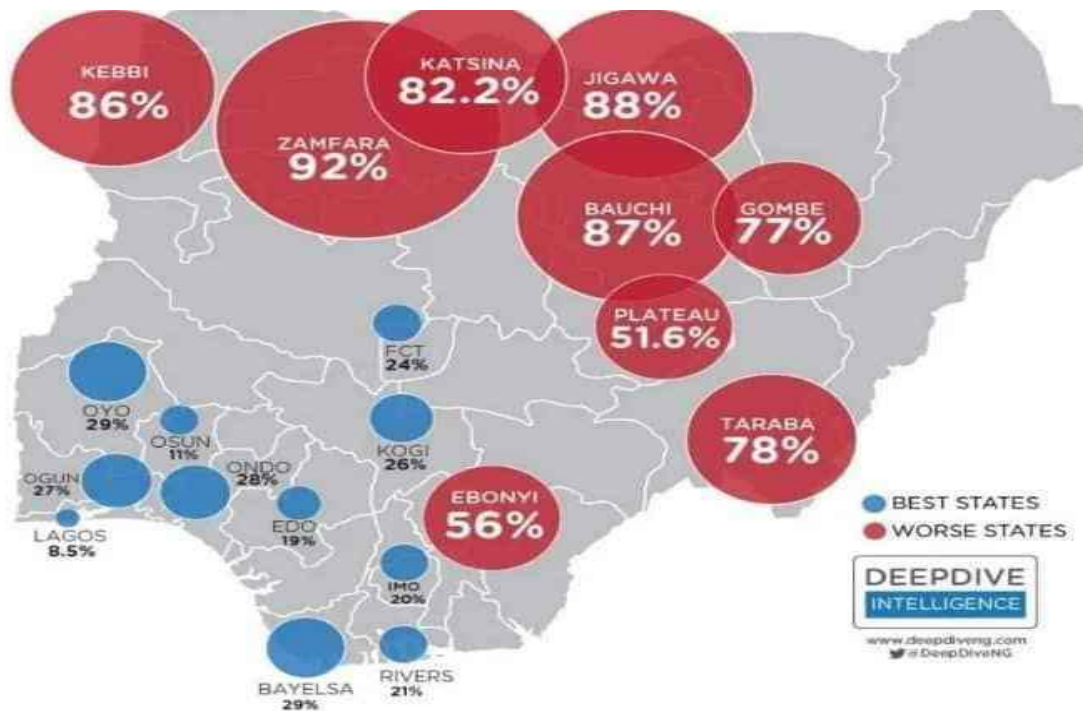
As explained earlier, focusing on the manageable areas is only a phased approach to normalizing our entire network. The fact of the matter is given the size of our network, it is impossible to fully normalize the entire franchise area in 5 years. Despite the limited CAPEX to the non-manageable areas, the company has put in plans in place to ensure that the area enjoys improved service delivery. Some of these measures include:

- Setting up a team to be responsible for identifying mini-grid sites and integrated mini-grid areas within the non-manageable zone and liaising with potential developers interested in participating in the area for a number of years as outlined in the mini-grid regulation.
- Setting up Franchising and Special Customer department responsible for managing franchising activities (mostly related to billing and collection activities and network maintenance) in the non-manageable areas. Among the biggest contributors of extremely high ATC&C losses in the rural areas are lack of adequate manpower and material to effectively cover the wide area of clustered villages as well as high poverty rate within the region. Through sub-franchising, including working directly with the communities where necessary, the first challenge can be addressed as it will bring about close monitoring of operations, resulting in improved performance in the area.

In Kaduna Electric's tariff structure, we are proposing a lower tariff for the non-manageable areas given the company is not planning any significant investment in the area for the period 2020 -2024. Details of the proposed tariff is being worked on and will be submitted to NERC in due course.

Given that the non-manageable areas are going to be charged a lower tariff and given that the area is not going to be fully normalized, we propose that NERC should allow Kaduna Electric bulk bill customers in the area at DT level until the area is fully normalized. This will be done with full consultation with the communities, with the understanding that they will be charged lower tariff rates and as the area is normalized, they will be transferred to a higher tariff threshold.

Figure 14: Poverty Intensity Map



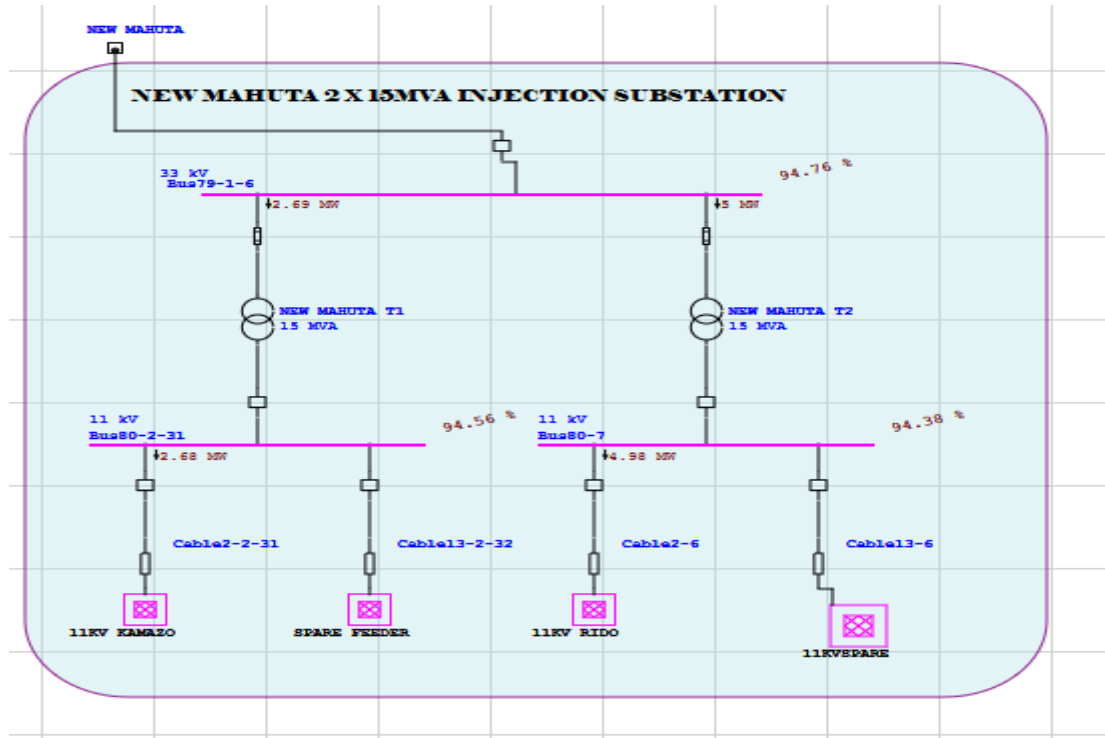
Data Source: Oxford Poverty and Human Development Initiative (2017). "Nigeria Country Briefing", Multidimensional Poverty Index Data Bank. OPHI, University of Oxford.

The poverty rate in Northern Nigeria is alarming and most of the extremely poor families live in the non-manageable areas. As shown in the figure above, three out of the four states we operate have a poverty rate of more than 80%. In addition to Kaduna Electric charging a lower tariff, the government may have to consider providing some form of subsidy to those living in the area to help stimulate electricity consumption to drive the families out of poverty.

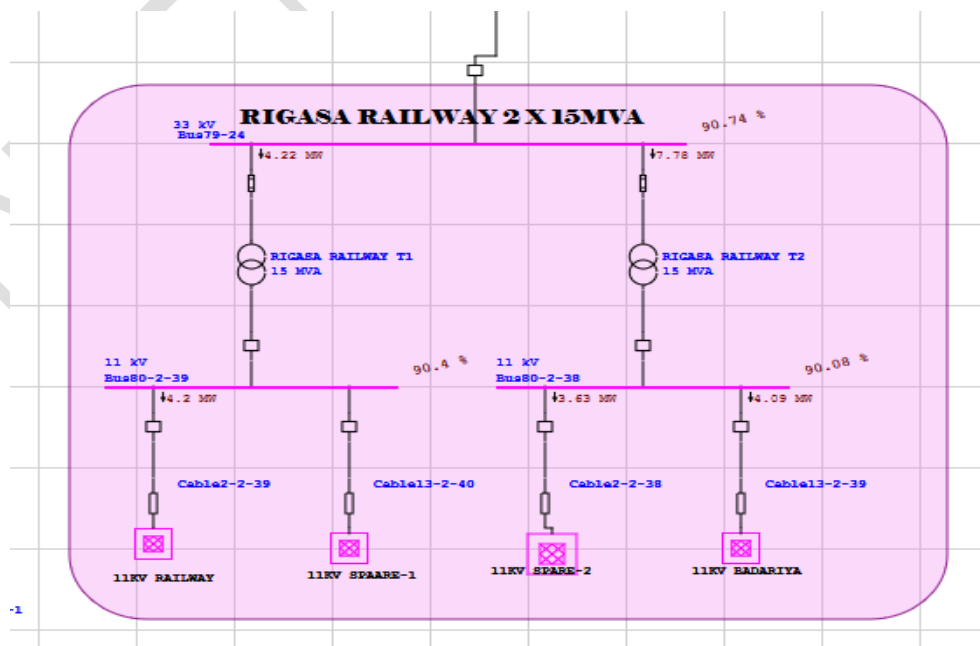
Kaduna Electric also plans to work with multilateral donor organization to attract grants towards normalizing the non-manageable areas, particularly the ISPAs. Because of the nature of customers in the area and their high tendencies for electricity theft, their normalization process is usually more expensive because of use specialized cabling as against open conductors that is prone to hooking. If grants can be attracted, then a good part of the non-manageable areas will also be normalized in the next 5 years. The FG either through Rural Electrification Agency (REA) or through establishing a special fund could also key into the initiative of normalizing the unmanageable areas.

Appendix I – Extract from ETAP Software on New Injections

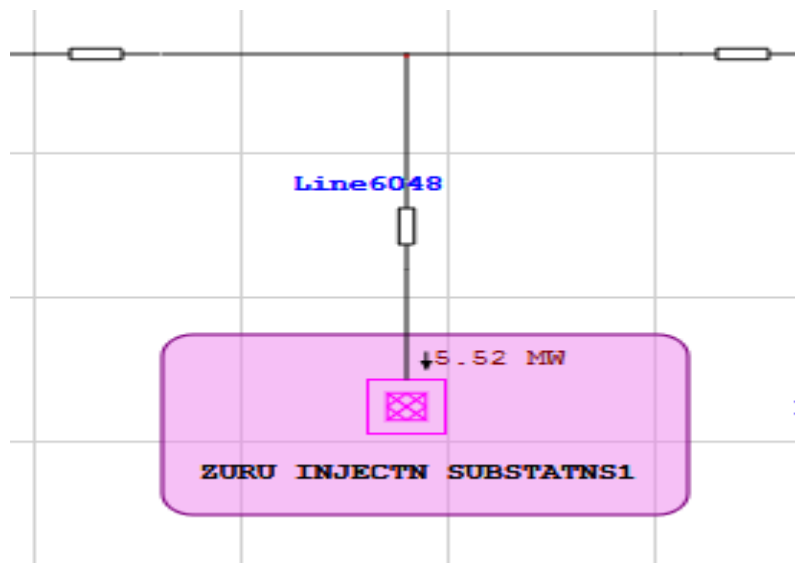
New Mahuta 2x15MVA Injection Station



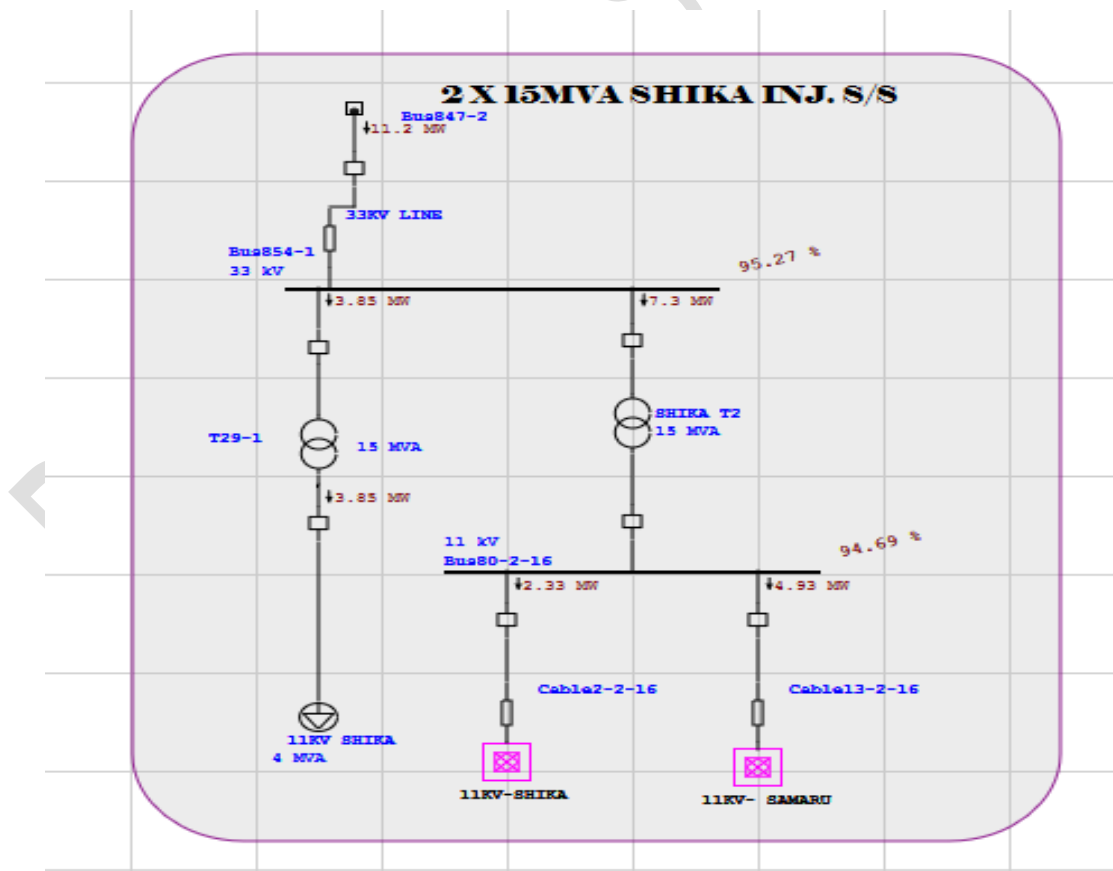
Rigasa Railway 2x15MVA Injection Station



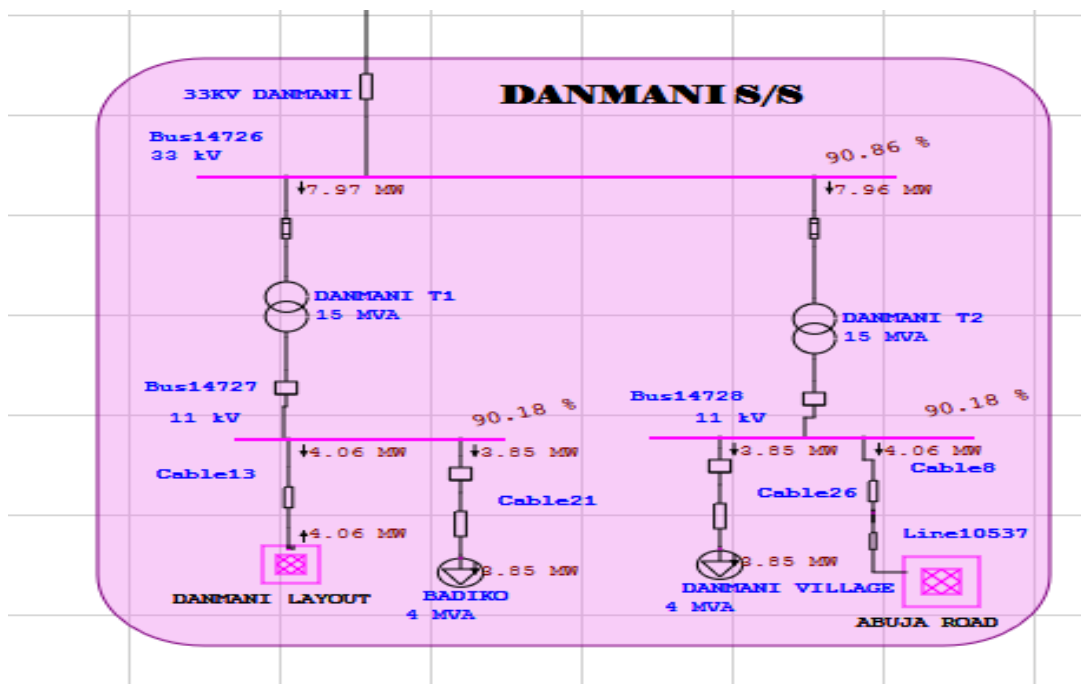
Zuru Injection Station



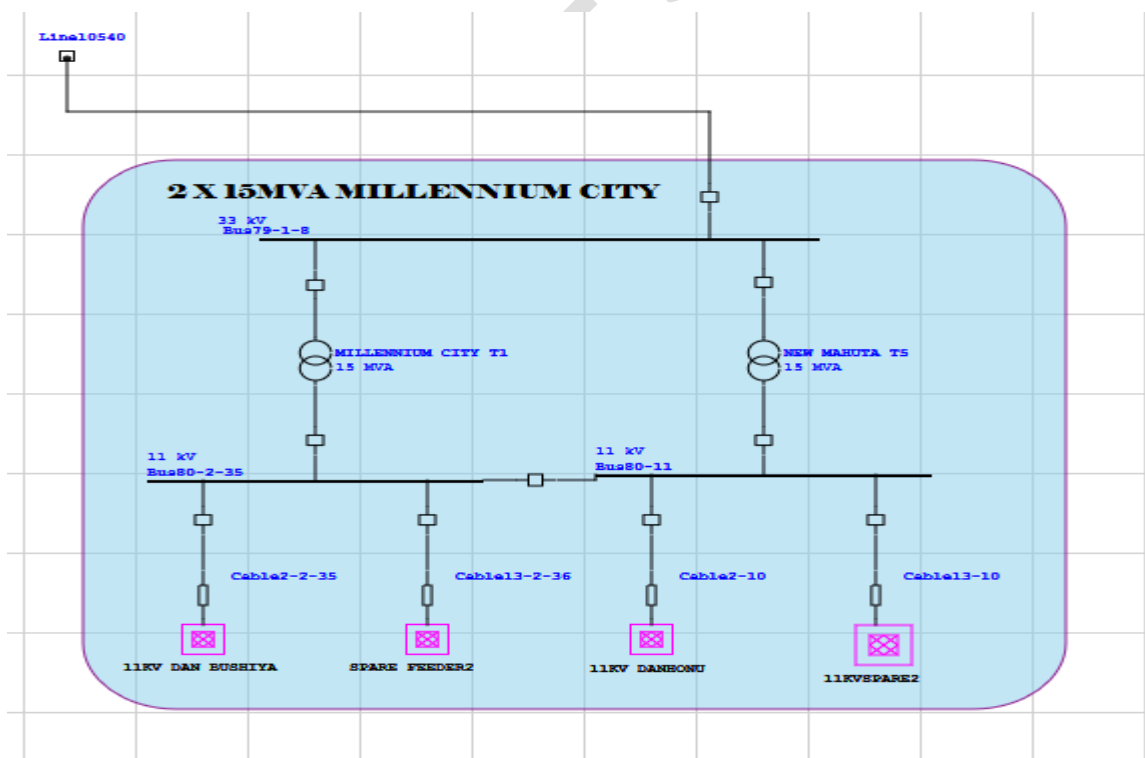
Shika 2x15MVA Inj. Station



Danmani Injection Station



2x15MVA Millennium City



Appendix II – Estimate of Improvements in Non-Manageable Areas

MV Line Upgrade in Difficult to Manage Areas

S/NO	FEEDER	MV Line Rehabilitation
1	11KV KACHIA	8,385,000.00
2	11KV KAGORO	-
3	11KV MANCHOK	121,303,000.00
4	11KV ZONKWA	15,093,000.00
5	11KV Dankande	71,272,500.00
6	11KV JAJI	76,862,500.00
7	11KV Katabu	90,558,000.00
8	33KV Turunku	406,672,500.00
9	11KV BARRACKS ZURU	64,844,000.00
10	11KV BUNZA	83,850,000.00
11	11KV GRA JEGA	83,850,000.00
12	11KV GWADANGWAJI	88,881,000.00
13	11KV GWANDU	-
14	11KV KAMBA	33,540,000.00
15	11KV KARA	35,217,000.00
16	11KV KEBBE	33,540,000.00
17	11KV RIKOTO/ZURU	5,869,500.00
18	11KV SABON GARIN JEGA	13,136,500.00
19	11KV WARRAH	8,385,000.00
20	11KV WASAGU	5,590,000.00
21	11KV YAURI	13,975,000.00
22	11KV ZAURO	13,975,000.00
23	33KV ALIERO	491,920,000.00
24	33KV GWANDU	559,000,000.00
25	33KV JEGA	810,550,000.00
26	33KV JEGA	1,322,035,000.00
27	33KV KAMBA	561,795,000.00
28	33KV KOKO	944,710,000.00
29	11KV ANKA	16,490,500.00
30	11KV BUNGUDU	90,837,500.00
31	11KV GUMMI	18,167,500.00
32	11KV KAURA NAMODA	84,409,000.00
33	11KV MARU	6,428,500.00
34	11KV SHINKAFI	18,167,500.00
35	11KV TALATA MAFARA	55,900,000.00
36	11KV TSAFE	36,614,500.00
37	11KV TUDUN WADA ZAM	15,931,500.00
38	33KV ANKA	150,930,000.00
39	33KV BAKURA	117,390,000.00
40	33KV KAURAN NAMODA	559,000,000.00

41	33KV MAFARA	61,490,000.00
42	33KV MAGAMI	444,405,000.00
43	33KV MARADUN	223,600,000.00
44	33KV TSAFE	662,415,000.00
45	33KV RIGASA	40,527,500.00
46	11KV Birnin Gwari	19,565,000.00
47	11KV HAYIN RIGASA	33,540,000.00
48	11KV MAKARFI ROAD	31,304,000.00
49	11KV MANDO ROAD	37,173,500.00
50	11KV SABON GARIN RIG	26,273,000.00
51	11KV TUDUN WADA RIG	20,683,000.00
52	33KV AIRPORT ROAD	197,047,500.00
53	33KV Birnin Gwari	986,635,000.00
54	11KV BAFARAWA	37,453,000.00
55	11KV BODINGA	27,391,000.00
56	11KV DANGE	111,800,000.00
57	11KV GORONYO	159,315,000.00
58	11KV GUMBI	65,962,000.00
59	11KV ILLELA	83,850,000.00
60	11KV ILLELA ROAD	25,155,000.00
61	11KV ISA	81,055,000.00
62	11KV SABON BIRNI	6,987,500.00
63	11KV SARKIN FADA	27,950,000.00
64	11KV SHUNI	-
65	11KV WAMA KO	75,465,000.00
66	11KV WURNO	85,247,500.00
67	11KV YABO	36,894,000.00
68	33KV YABO/SHAGARI	619,931,000.00
69	11KV IKARA	41,925,000.00
70	11KV MAKARFI	31,304,000.00
71	11KV SABON GARI ZAR	36,335,000.00
72	11KV SAMINAKA	-
73	11KV SHIKA	44,720,000.00
74	11KV WUSASA	48,353,500.00
75	11KV ZARIA CITY	45,838,000.00
76	33KV KARAYE (KWANAR DAN GORA TRX KANO)	17,049,500.00
77	33KV KUDAN	623,285,000.00
78	33KV MAKARFI	1,031,355,000.00
79	33KV NNPC SAMINAKA	-
80	33KV SOBA	1,411,475,000.00
		14,695,830,500
		25,211,630,500

LV Line Upgrade in Difficult to Manage Areas

	FEEDER	NO OF BAD DTS	COST OF INTERVENTION USING AL CONDUCTOR	COST FOR OVERHAUL (USING RETLINE CABLE)
1	11KV KACHIA	2	22,635,200	42,555,200
2	11KV KAGORO	7	79,223,200	148,943,200
3	11KV MANCHOK	0	-	-
4	11KV ZONKWA	0	-	-
5	11KV Dankande	3	33,952,800	63,832,800
6	11KV JAJI	15	169,764,000	319,164,000
7	11KV Katabu	12	135,811,200	255,331,200
8	33KV Turunku	42	475,339,200	893,659,200
9	11KV BARRACKS ZURU	18	203,716,800	382,996,800
10	11KV BUNZA	14	158,446,400	297,886,400
11	11KV GRA JEGA	38	430,068,800	808,548,800
12	11KV GWADANGWAJI	39	441,386,400	829,826,400
13	11KV GWANDU	10	113,176,000	212,776,000
14	11KV KAMBA	20	226,352,000	425,552,000
15	11KV KARA	23	260,304,800	489,384,800
16	11KV KEBBE	3	33,952,800	63,832,800
17	11KV RIKOTO/ZURU	14	158,446,400	297,886,400
18	11KV SABON GARIN JEGA	15	169,764,000	319,164,000
19	11KV WARRAH	5	56,588,000	106,388,000
20	11KV WASAGU	3	33,952,800	63,832,800
21	11KV YAURI	14	158,446,400	297,886,400
22	11KV ZAURO	3	33,952,800	63,832,800
23	33KV ALIERO	83	939,360,800	1,766,040,800
24	33KV GWANDU	59	667,738,400	1,255,378,400
25	33KV JEGA	131	1,482,605,600	2,787,365,600
26	33KV JEGA	5	56,588,000	106,388,000
27	33KV KAMBA	32	362,163,200	680,883,200
28	33KV KOKO	112	1,267,571,200	2,383,091,200
29	11KV ANKA	10	113,176,000	212,776,000
30	11KV BUNGUDU	16	181,081,600	340,441,600
31	11KV GUMMI	9	101,858,400	191,498,400
32	11KV KAURA NAMODA	22	248,987,200	468,107,200
33	11KV MARU	8	90,540,800	170,220,800
34	11KV SHINKAFI	10	113,176,000	212,776,000
35	11KV TALATA MAFARA	19	215,034,400	404,274,400
36	11KV TSAFE	17	192,399,200	361,719,200
37	11KV TUDUN WADA ZAM	14	158,446,400	297,886,400
38	33KV ANKA	54	611,150,400	1,148,990,400
39	33KV BAKURA	20	226,352,000	425,552,000
40	33KV KAURAN NAMODA	62	701,691,200	1,319,211,200

41	33KV MAFARA	10	113,176,000	212,776,000
42	33KV MAGAMI	16	181,081,600	340,441,600
43	33KV MARADUN	23	260,304,800	489,384,800
44	33KV TSAFE	50	565,880,000	1,063,880,000
45	33KV RIGASA	1	11,317,600	21,277,600
46	11KV Birnin Gwari	13	147,128,800	276,608,800
47	11KV HAYIN RIGASA	27	305,575,200	574,495,200
48	11KV MAKARFI ROAD	30	339,528,000	638,328,000
49	11KV MANDO ROAD	18	203,716,800	382,996,800
50	11KV SABON GARIN RIG	28	316,892,800	595,772,800
51	11KV TUDUN WADA RIG	26	294,257,600	553,217,600
52	33KV AIRPORT ROAD	21	237,669,600	446,829,600
53	33KV Birnin Gwari	75	848,820,000	1,595,820,000
54	11KV BAFARAWA	8	90,540,800	170,220,800
55	11KV BODINGA	8	90,540,800	170,220,800
56	11KV DANGE	20	226,352,000	425,552,000
57	11KV GORONYO	21	237,669,600	446,829,600
58	11KV GUMBI	11	124,493,600	234,053,600
59	11KV ILLELA	15	169,764,000	319,164,000
60	11KV ILLELA ROAD	12	135,811,200	255,331,200
61	11KV ISA	19	215,034,400	404,274,400
62	11KV SABON BIRNI	4	45,270,400	85,110,400
63	11KV SARKIN FADA	8	90,540,800	170,220,800
64	11KV SHUNI		-	-
65	11KV WAMAKO	18	203,716,800	382,996,800
66	11KV WURNO	11	124,493,600	234,053,600
67	11KV YABO	9	101,858,400	191,498,400
68	33KV YABO/SHAGARI	121	1,369,429,600	2,574,589,600
69	11KV IKARA	33	373,480,800	702,160,800
70	11KV MAKARFI	10	113,176,000	212,776,000
71	11KV SABON GARI ZAR	23	260,304,800	489,384,800
72	11KV SAMINAKA		-	-
73	11KV SHIKA	5	56,588,000	106,388,000
74	11KV WUSASA	25	282,940,000	531,940,000
75	11KV ZARIA CITY	27	305,575,200	574,495,200
76	33KV KARAYE (KWANAR DAN GORA TRX KANO)	4	45,270,400	85,110,400
77	33KV KUDAN	114	1,290,206,400	2,425,646,400
78	33KV MAKARFI	119	1,346,794,400	2,532,034,400
79	33KV NNPC SAMINAKA		-	-
80	33KV SOBA	145	1,641,052,000	3,085,252,000
GRAND TOTAL		2,111	23,891,453,600	44,917,013,600

Appendix III – Preliminary Costing of Konexa Pilot Project

Aurecon is currently consulting for Konexa on engineering designs and improvement plan within their concession area in Kaduna. Aurecon is globally renowned Engineering consultancy firm and they have done detailed work in the Konexa area over the past 6 months to come up with preliminary cost estimate for technical improvements to be done in the area. We have therefore adopted some of the costs in the build up to our intervention plans.

It is worth mentioning we have also compared Aurecon/Konexa cost to that of Siemens and we've found Konexa's cost to be much lower and far more realistic.

GENERAL	Count/km	Cost/Unit	Total	
MicroSada Implementation	1	\$ 650,000.00	\$ 650,000.00	Phase 1
Operationalization (Operational Systems, Strategic stock, specialised equipment)	1	\$ 500,000.00	\$ 500,000.00	Phase 1
TOTAL GENERAL:			\$ 1,150,000.00	
ARIA AREA				
ZARIA 11kV	Count/km	Cost/Unit	Total	
Consumer Connections Upgrade (R2, R3, C1, C2, D1, A1)	5974	\$ 700.00	\$ 4,181,800.00	Phase 1
LV Line Upgrades	72	\$ 10,000.00	\$ 720,000.00	Phase 1
LV Pillars	25	\$ 1,100.00	\$ 27,500.00	Phase 1
DT Protection Upgrade	56	\$ 3,000.00	\$ 168,000.00	Phase 1
DT Replacements (300kVA)	4	\$ 15,000.00	\$ 60,000.00	Phase 1
DT Additions (Reconfigure LV) (300kVA)	22	\$ 25,000.00	\$ 550,000.00	Phase 1
DT Replacements (500kVA)	3	\$ 20,000.00	\$ 60,000.00	Phase 1
DT Additions (Reconfigure LV) (500kVA)	0	\$ 30,000.00	\$ -	Phase 1
Sectionalisors	9	\$ 13,000.00	\$ 117,000.00	Phase 2
Fault Path Indicators	15	\$ 1,000.00	\$ 15,000.00	Phase 2
Auto Recloser	2	\$ 18,000.00	\$ 36,000.00	Phase 2
MV Line Rehabilitation	27.3	\$ 8,600.00	\$ 234,780.00	Phase 1
Comms (All MV Line to DTs)	27.3	\$ 3,600.00	\$ 98,280.00	Phase 1
TOTAL:			\$ 6,268,360.00	
NTI 11kV	Count/km	Cost/Unit	Total	
Consumer Connections Upgrade (R2, R3, C1, C2, D1, A1)	157	\$ 700.00	\$ 109,900.00	Phase 1
LV Line Upgrades	8	\$ 10,000.00	\$ 80,000.00	Phase 1
LV Pillars	3	\$ 1,100.00	\$ 3,300.00	Phase 1
DT Protection Upgrade	16	\$ 3,000.00	\$ 48,000.00	Phase 1
DT Replacements (300kVA)	0	\$ 15,000.00	\$ -	Phase 1
DT Additions (Reconfigure LV) (300kVA)	2	\$ 25,000.00	\$ 50,000.00	Phase 1
DT Replacements (500kVA)	0	\$ 20,000.00	\$ -	Phase 1
DT Additions (Reconfigure LV) (500kVA)	0	\$ 30,000.00	\$ -	Phase 1
Sectionalisors	3	\$ 13,000.00	\$ 39,000.00	Phase 1
Fault Path Indicators	5	\$ 1,000.00	\$ 5,000.00	Phase 1
Auto Recloser	1	\$ 18,000.00	\$ 18,000.00	Phase 1
MV Line Rehabilitation	6.2	\$ 8,600.00	\$ 53,320.00	Phase 1
Comms (All MV Line to DTs)	6.2	\$ 3,600.00	\$ 22,320.00	Phase 1
11kV Feeder Cable (New Konexa II Stage 1 to NTI RMU site)	1.6	\$ 70,000.00	\$ 112,000.00	Phase 1
33kV JAJI Feeder Rehabilitation	9.3	\$ 9,000.00	\$ 83,700.00	Phase 1
33kV Switchyard - JAJI/KATABU/KONEXA 3	1	\$ 770,000.00	\$ 770,000.00	Phase 2
TOTAL:			\$ 1,394,540.00	
MD Customer Interventions	Count/km	Cost/Unit	Total	
FALKE OIL	1	\$ 100,000.00	\$ 100,000.00	Phase 1
PRIME EQUITY	1	\$ 55,000.00	\$ 55,000.00	Phase 1
TOTAL:			\$ 155,000.00	
New Infrastructure				
NTI Substation Relocation & Konexa III Stage 1	1	\$ 1,225,000.00	\$ 1,225,000.00	Phase 1
NTI Substation Relocation & Konexa III Stage 2	1	\$ 1,505,000.00	\$ 1,505,000.00	Phase 2
PV Stage 1 (1MW)	1	\$ 800,000.00	\$ 800,000.00	Phase 1
PV Stage 2 (2.5MW)	1	\$ 4,700,000.00	\$ 4,700,000.00	Phase 2
TOTAL:			\$ 8,230,000.00	
*DANKANDA 11kV PORTION OF ZARIA (SHOULD NOT BE MOVED BACK TO ZARIA 11kV)				
TOTAL ZARIA:			\$ 16,047,900.00	

KUDENDA		Count/km	Cost/Unit	Total	
SUNGLASS 11KV					
Consumer Connections Upgrade (R2, R3, C1, C2, D1, A1)	1254	\$	700.00	\$	877,800.00 Phase 1
LV Line Upgrades	16	\$	10,000.00	\$	160,000.00 Phase 1
LV Pillars	2	\$	1,100.00	\$	2,200.00 Phase 1
DT Protection Upgrade	26	\$	3,000.00	\$	78,000.00 Phase 1
DT Replacements (300kVA)	0	\$	15,000.00	\$	- Phase 1
DT Additions (Reconfigure LV) (300kVA)	2	\$	25,000.00	\$	50,000.00 Phase 1
DT Replacements (500kVA)	0	\$	20,000.00	\$	- Phase 1
DT Additions (Reconfigure LV) (500kVA)	0	\$	30,000.00	\$	- Phase 1
Sectionalisors	8	\$	13,000.00	\$	104,000.00 Phase 1
Fault Path Indicators	9	\$	1,000.00	\$	9,000.00 Phase 1
Auto Recloser	1	\$	18,000.00	\$	18,000.00 Phase 1
MV Line Rehabilitation	9	\$	8,600.00	\$	77,400.00 Phase 1
Comms (All MV Line to DTs)	9	\$	3,600.00	\$	32,400.00 Phase 1
	TOTAL:			\$	1,408,800.00
MD Customer Interventions					
NBP	1	\$	2,700,000.00	\$	2,700,000.00 Phase 1
SUNGLASS	1	\$	565,000.00	\$	565,000.00 Phase 1
	TOTAL:			\$	3,265,000.00
New Infrastructure					
33kV FDR Rehabilitation and Upgrades (Incl Comms)	1	\$	1,389,375.00	\$	1,389,375.00 Phase 1
33kV RING FEEDER CONVERSION	1	\$	3,744,000.00	\$	3,744,000.00 Phase 2
KUDENDA INJECTION UPGRADE	1	\$	1,429,400.00	\$	1,429,400.00 Phase 1
PAN INJECTION UPGRADE	1	\$	1,866,000.00	\$	1,866,000.00 Phase 2
KONEXA SWITCHAYRD (SY) @ Town 1 TS	1	\$	768,800.00	\$	768,800.00 Phase 1
KONEXA 1 INJECTION	1	\$	3,151,000.00	\$	3,151,000.00 Phase 2
KONEXA 2 INJECTION	1	\$	3,126,800.00	\$	3,126,800.00 Phase 2
KONEXA/UNTL SWITCHAYRD (SY2) @ UNTL	1	\$	760,000.00	\$	760,000.00 Phase 3
	TOTAL:			\$	16,235,375.00
PV					
KONEXA PV1 (7.5MW)	1	\$	16,606,570.90	\$	16,606,570.90 Phase 3
	TOTAL:			\$	16,606,570.90
TOTAL KUDENDA:				\$	37,515,745.90