Transmission Company of Nigeria

Appraisal of Transmission Projects

March 2014

Technical support:

YACHIYO ENG. CO., LTD.

Program support:

Japan International Cooperation Agency

Appraisal of Transmission Projects

Table of Contents

Annexes

Appraisal of Transmission Projects

1 Purpose of this Investment Appraisal

The purpose of this investment appraisal package is to request expressions of interest from investors who want to participate in TCN's transmission expansion program by providing capital funding in the form or loans or equity investment. This appraisal package provides the following information about TCN's requirements:

- This **Executive Summary** provides the context for the request for funding, and summarizes the opportunities for investment.
- **Annex 1** provides descriptions and schedules for projects that are currently underway and in the planning stages, and shows the funding requirements both at the individual project level and by project groupings.
- **Annex 2** provides an economic assessment of new projects currently in the planning stages.
- **Annex 3** provides a financial assessment of the new projects.
- **Annex 4** provides a financial assessment of TCN covering the recent past performance for 2011-2013, and the projected performance for 2014-15.
- **Annex 5** shows the guidelines to be used for competitive procurement and contracting.

The target audience for this investment package includes FGN, state and local governments, sovereign funds, development banks, contractors, developers and others potential sources of capital funding. Investors can use this appraisal document to gain a better understanding of TCN's transmission expansion plans and the size and timing of the company's capital funding requirements, and to identify projects and sets of projects that provide the best fit for the investor's particular funding preferences and requirements.

TCN is now actively inviting expressions of interest from interested investors. If you want to participate in this opportunity, you are encouraged to contact Mr. Shahid Mohamad, TCN Executive Director, Transmission Services Provider, at email smohammad@mhi.mb.ca or phone (+234) 812 882 3233.

2 Need for Transmission Refurbishment and Expansion

Nigeria's transmission system, which consists of 330kV and 132kV high voltage lines, substations, and control facilities is owned and operated by a single government-owned company, Transmission Company of Nigeria (TCN). TCN consists of four business units: the Transmission Services Provider (constructing, owning, operating and maintaining transmission facilities), System Operator, Market Operator and TCN Headquarters.

TCN now faces a pressing need to improve the reliability of the power system and expand its capacity to deliver energy from generation to load. TCN's capital program has been developed to address the following key drivers for transmission improvements:

- The existing system will be able to deliver up to 7 GWs of generation to load with completion of NIPP projects. However, much of the existing system is old, unreliable and unstable, which results in too frequent customer outages at the transmission level.
- The system has limited redundancy in its design and experiences an unacceptable number of total system blackouts. These blackouts impact customer, particularly commercial and industrial users, and have the real potential of making Nigeria a less attractive country to start a new business or expand an existing business.
- Existing substations and lines are in desperate need of refurbishment, as past funding of TCN's capital requirements has not kept pace with the need for refurbishment.
- NBET's PPAs with Successor Company GenCos and new IPPs provide for a large amount of new and refurbished generation projects that will be developed in the coming years with the expectation that TSP will expand its network to wheel the power to the DisCos.
- The system as-is cannot support the anticipated growth in per capita usage and numbers of customers in all classes. If the existing system is not expanded it will negatively impact the country's potential to increase its GNP.

Figure 1 shows the expected phased expansion of the transmission system compared to the expected peak capability of the generation connected to the grid. The primary targets for expanding the transmission system are to increase the wheeling capacity of the grid from about 7 GW in 2014 to 10 GW by 2017, and to 20 GW by 2020. The figure below demonstrates that TCN's transmission expansion program, if implemented on a timely basis, will keep pace with the expected in-service dates for new generation, plus a prudent margin of around 30% in extra wheeling capacity.

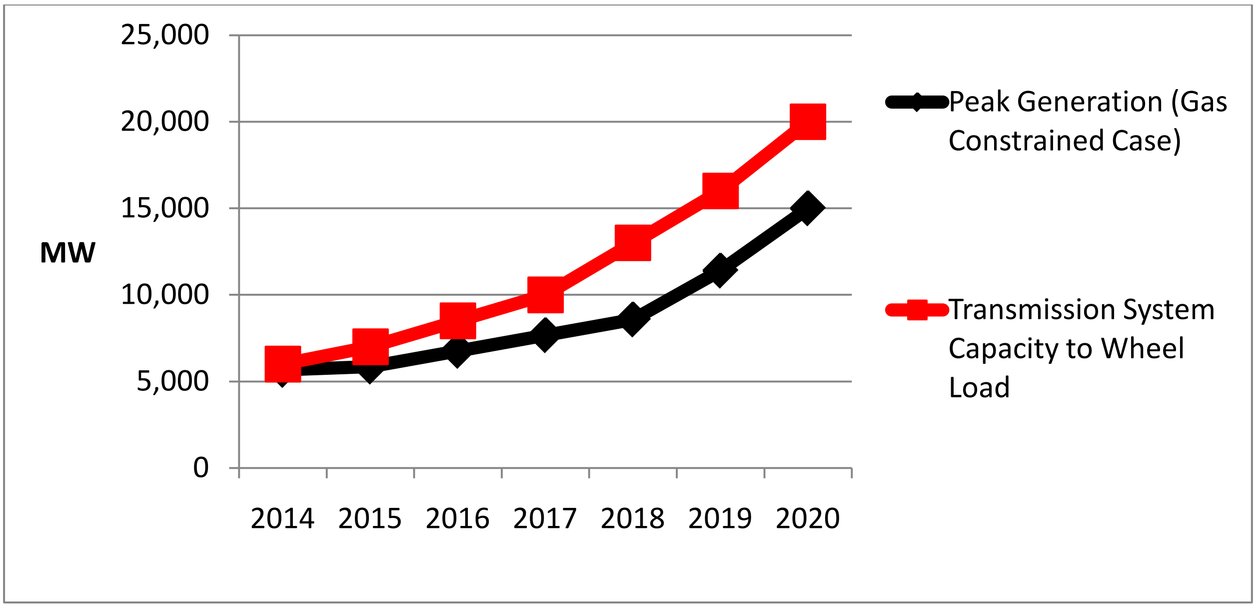

Figure 1: Available Generation Compared to Transmission Capability

3 Capital Funding Requirements for TCN Business Units

3.1 Transmission Services Provider

The Transmission Services Provider Business Unit is the owner of the transmission network and is responsible for maintaining and constructing lines and substations. TSP's mission is to provide electricity transmission services in a cost effective, efficient and reliable way.

TSP needs to implement an ambitious program of transmission improvements. For the period 2014-15, TCN will focus mainly on refurbishing existing facilities to restore the network to its original capacity, finishing projects that are in various stages of construction, and initiating the construction of over 100 new lines and substations, and many new voltage control facilities, to expand the network to a total load carrying capability of 10,000 MW by 2017.

TCN has conducted extensive planning and engineering studies to develop an optimal expansion plan to meet the targets for grid expansion from 7 GW at present to 10 GW by 2017, and to 20 GW by 2020. The detailed studies and results are shown in Annex 1 of this Investment Appraisal Package. As further explained in the annex, groups of projects will be completed in phases according to the schedule shown in Table 1 below.

Table 1: TSP Targets for Transmission Refurbishment and Expansion Program

	USD Millions	Naira Billions	GW Target	In Service
Capital Refurbishment	$947	152	-	2015
Projects under Construction	$989	158	7-8,000	2015
Expand to 10 GW; increase network reliability	$2,235	353	10,000	2017
Expand from 10 GW to 13 GW	$1,570	251	13,000	2018
Expand from 13 GW to 16 GW	$1,000	160	16,000	2019
Expand from 16 GW to 20 GW	$1,000	160	20,000	2020
Total	**$7,742**	**1,239**		

Besides lines and substations projects, TSP needs to set up new regional stores to support the expansion of the network and the maintenance and construction needs of the regions. Table 2 lists the numbers required. It is planned to complete the exercise within 15 months starting from the availability of funds.

Table 2: TSP Additions to Land and Buildings 2014-15

TSP Land & Buildings	Number
Regional Warehouses/Stores	8
Add - Transformer Reclamation Workshop	1
Add - Regional Manager Offices	8

Table 3 shows needed TSP vehicle additions. With expansion of the network and transfer of NIPP facilities to TSP, many new vehicles will be needed in 2014-15, including a new fleet of heavy duty maintenance vehicles that will have the capabilities to reach the off-road and remote locations in the grid to ensure proper maintenance is conducted in the most efficient manner, and specialized utility vehicles like bucket trucks and cranes. Heavy utility trucks are also needed for each of the eight TSP Regions across the country.

Table 3: TSP Vehicle Additions

Vehicle Fleet	2014	2015
TSP Maintenance Vehicles	200	120
TSP Utility Vehicles	8	
TSP Other Vehicles	103	52

3.2 System Operator

The System Operator ensures integrated operation of the power system in Nigeria. All generating plants, distribution companies and the Transmission Service Provider are stakeholders of SO. The main responsibilities of SO include:

- Monitor system parameters and security.
- Ensure integrated operation of the power system to deliver quality uninterrupted power.
- Facilitate merit order dispatch.
- Facilitate the operation of the power market through bilateral exchange.
- Undertake power system studies, comprehensive system planning and contingency analysis.
- Maintain and augment telemetry, computing and communication facilities.

The SO needs to undertake the following major new projects in 2014-15, in addition to expenditures for basic office and transport needs:

- SCADA Restoration and Expansion: $33 Million
- Telecoms improvement project: $26 Million
- New Control Center Building at NCC: $40 Million

The following sections provide the justification for the required capital expenditures.

SCADA and Telecom

The present SCADA system (World Bank 2009 project) is mostly dysfunctional and is being made to somehow serve the purpose with reactivation contracts. Further, since 2009 till date, new generating stations and substations have been added into the power system, which are not connected to the SCADA system through RTUs. So a new modern SCADA system is required and once it is implemented it has to be maintained and updated. The cost towards the new SCADA system has been captured in the capital budget while the cost towards maintaining and updating the system besides providing for spares is captured in the operating budget. The project to have a new SCADA system will take eighteen months from placing orders to successful commissioning.

The voice and data communication is done through optic fibre, micro wave and PLCC. This system is radial which makes it very vulnerable to outages. Hence it is planned to make a ring network configuration encompassing the new and old stations, so that in case of any outage there is always an alternate path available. Secondly the identified weak links need to be revamped for seamless communication for the SCADA system. Thirdly many new stations which have come up are not effectively covered through a communication link. Lastly we need to put in place a hotline voice communication from NCC to other control centers or stations of Discos and Gencos without which real time operation of the power system is highly vulnerable with dependency on GSM network.

All these need to be completed in phases so that we have an effective communication system in place. The costs for implementation and maintaining the communication system is captured in the Capital and Operating budgets respectively. If funded, the entire communication system upgrade project will take around eighteen months to commission.

New Control Centre Building at NCC

The control center building at Osogbo is in a dilapidated state and is very small from the perspective of housing up all the SCADA & Telecom servers and maintenance tools besides having the viewing gallery and control room for real-time operation and setting up scheduling desks for TEM. So it is planned to build a new control room within the stretch of available land in Osogbo. The project to have a fully functional new control centre building will require around fifteen months.

3.3 Market Operator

The Market Operator is the Nigerian electricity market administrator designated for the implementation of the Market Rules. The MO has been administering the Pre-Transitional Stage of the market since the formal inception of the organized electricity market in 2004. The Market Rules require the MO to operate in a manner that guarantees efficiency, transparency and non-discriminatory market administration service to all Participants.

The MO is responsible for the following duties:

- Review the efficiency and adequacy of Market Rules and Market Procedures and propose such amendments as may be required to ensure their efficacy and adequacy;
- Admit & Register Participants; organise and maintain a Participants' Register; centralise the Information required for market administration, and organise and maintain the related data bases;
- Verify that each Connection Point (Trading Point) where a Participant injects or extracts energy has proper commercial metering related to physical exchange (injection and consumption) of energy, provision of Ancillary Services and other necessary commercial transactions;
- Manage the market settlement process, including preparation and transmittal of market invoices to Market Participants, revenue collection from DisCos, payment to services provides (MO, SO, NBET, NERC), finance and banking, and dispute resolution related to settlements and contract quantities.

The MO capital expenditure budget for 2015 provides for a one-time major project to upgrade settlement systems and tools to achieve the following goals:

- Improve telecommunications and website interface to automate and streamline business processes for meter data collection and settlements;
- Improve ICT in line with corporate governing structure, ICT policy and standards document to cover ICT operations across the enterprise network;
- Establish internal controls and security for market sensitive data;
- Create special fit-for-purpose server room in a restricted part of the building with security arrangements, centralize server resources across the various sections and improve authentication for users;
- Fully implement AMR as the primary system for collecting grid meter data and feeding the data to the settlement system;
- Install redundant AMR (hub – ACTARIS System) to address risk of unplanned AMR hub outage;
- Create private built-for-purpose web portal for all energy data from the System Operator and all market data supplied to Market Participants;
- Create hosted e-discovery services should be procured as part of the hosted email service contract.

The full specification of this project is not yet available. The estimated capital expenditure requirement for the project is $10 Million USD (1.6 Billion Naira).

4 Funding Sources and Uses

4.1 Summary of TCN Capital Expenditure Budgets

This section summarizes TCN's capital expenditure budget by Business Unit. The budget projections are driven by the need to refurbish existing facilities, expand/reinforce the network, improve system operations and prepare for the Transitional Electricity Market (TEM). The Business Unit budgets fully reflect the amounts needed to grow the infrastructure in step with rapid expansion of generation and load. The budget amounts are significantly higher than past spending levels, reflecting the fact that in the past TCN has suffered from inadequate funding.

Table 4 and Table 5 show the capital expenditure budgets by Business Unit for 2014-18 in dollars and Naira, respectively. The figures shown here include allocation of common costs for shared services to the BUs. The assumed disbursement profile for major projects like lines and substations is front loaded to open letters of credit covering 70% of project costs.

Table 4: Capital Expenditure by Business Unit, 2014-18 in Million 2013 USD

$USD Millions (2013 $)	2014	2015	2016	2017	2018
TSP Capital Expenditure					
Substation Refurbishment	568.0	236.7	47.3	47.3	47.3
New Lines and Substations	495.4	2059.2	1434.3	1270.8	1085.6
Land & Buildings	104.0	104.0	20.0	20.0	20.0
Office Tools, Furniture & Equipment	11.5	12.4	3.6	3.3	3.2
Motor Vehicles	38	13.2	9.8	9.8	9.8
TOTAL TSP CAPEX	1,216.9	2,425.5	1,515.0	1,351.2	1,165.9
SO Capital Expenditure					
SCADA and Telecom	26.2	33.7	6.0	6.0	6.0
Land & Buildings	0	40.0	0	0	0
Office Tools, Furniture & Equipment	3.4	2.0	0.6	0.6	0.6
Motor Vehicles	1.1	1.5	1.9	2.3	2.7
TOTAL SO CAPEX	30.7	77.2	8.5	8.9	9.3
MO Capital Expenditure					
Land & Buildings	0.0	0.0	0.0	0.0	0.0
Office Tools, Furniture & Equipment	1.5	11.6	0.9	0.5	0.5
Motor Vehicles	0.7	0.7	0.7	0.7	0.7
TOTAL MO CAPEX	2.2	12.3	1.6	1.2	1.2
TOTAL CAPEX	1,249.8	2,514.9	1525.1	1361.3	1,176.4
Cumulative CAPEX	1,250	3,765	5,290	6,651	7,828

Table 5: Capital Expenditure by Business Unit, 2014-18 in Billion 2013 Naira

Billions Naira (2013 N)	2014	2015	2016	2017	2018
<u>TSP Capital Expenditure</u>					
Substation Refurbishment	88.1	36.7	7.3	7.3	7.3
New Lines and Substations	76.9	319.6	222.6	197.2	168.5
Land & Buildings	16.1	16.1	3.1	3.1	3.1
Office Tools, Furniture & Equipment	1.8	1.9	0.6	5.1	5.0
Motor Vehicles	5.9	2.0	1.5	1.5	1.5
TOTAL TSP CAPEX	188.9	376.3	235.1	214.2	185.4
<u>SO Capital Expenditure</u>					
SCADA and Telecom	4.1	5.2	0.9	0.9	0.9
Land & Buildings	0.0	6.2	0.0	0.0	0.0
Office Tools, Furniture & Equipment	0.5	0.3	0.1	0.1	0.1
Motor Vehicles	0.2	0.2	0.3	0.4	0.4
TOTAL SO CAPEX	4.8	11.9	1.3	1.4	1.4
<u>MO Capital Expenditure</u>					
Land & Buildings					
Office Tools, Furniture & Equipment	0.2	1.8	0.1	0.1	0.1
Motor Vehicles	0.1	0.1	0.1	0.1	0.1
TOTAL MO CAPEX	0.3	1.9	0.2	0.2	0.2
TOTAL CAPEX (NAIRA)	194.0	390.1	336.6	215.8	187.0
Cumulative CAPEX	194	584	921	1,137	1,324

Figure 2 provides a bar chart of the capital expenditure budget projection by Business Unit.

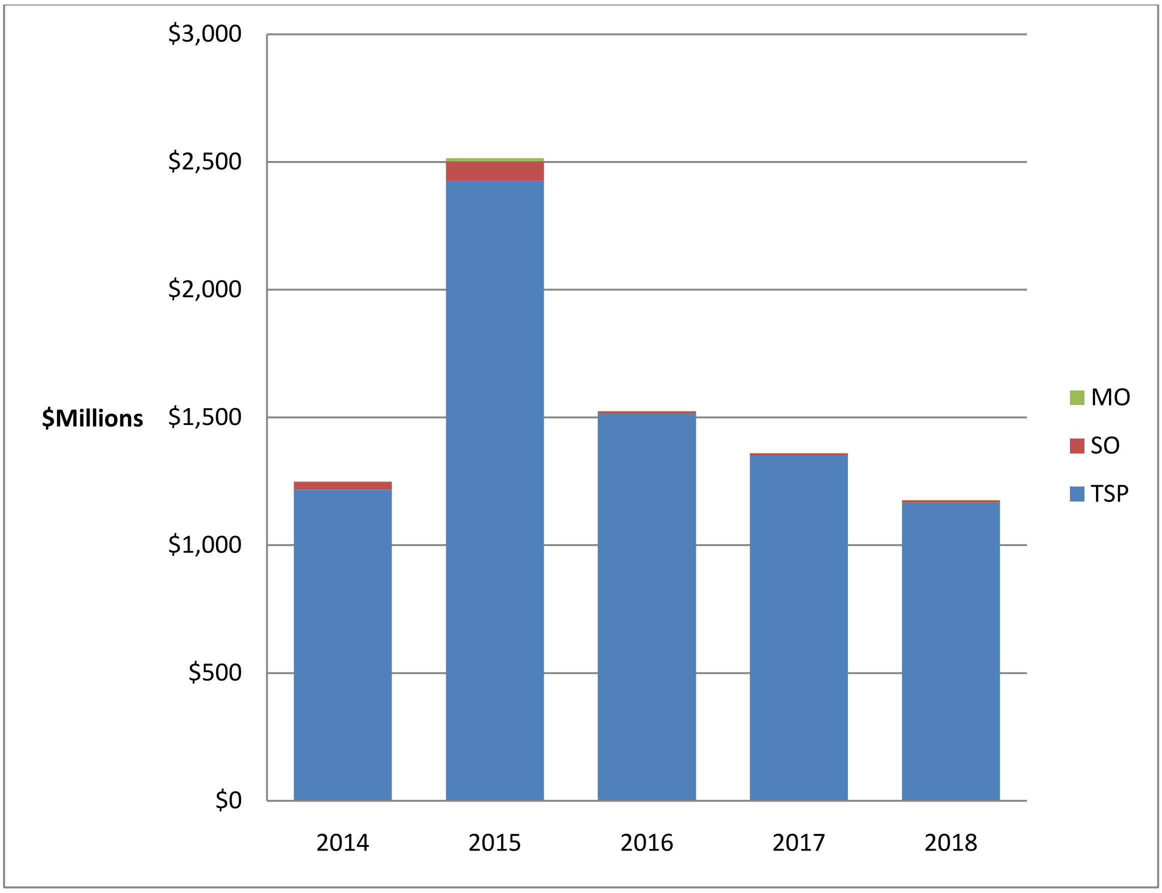

Figure 2: Capital Expenditure Budgets for BUs for 2014-18 in $Million 2013

Table 6 shows the total capital funding requirement for TCN for 2014-15, excluding items to be funded from internal resources (i.e. office tools and equipment, motor vehicles).

Table 6: TCN Total Capital Funding Requirement for 2014-15

Year	Capital Funding Requirement	
	USD Millions ($)	Billion Naira (N)
2014	1,212	189
2015	2,556	411

4.2 Existing and Potential Sources of Capital Funding

Table 7 shows existing and potential sources of funding to meet the capital funding requirement.

Table 7: Existing and Potential Sources of Capital Funding for TCN

Source	Capital Funding	
	USD Millions ($)	Billion Naira (N)
Secured debt funding	623	103
FGN budget appropriations	125 per yr.	21 per yr.
Proceeds from the sale of NIPP GenCos	1,600	264
Other Loans (TBD)	-	-

Table 8 provides a breakdown of existing sources of borrowing for capital expenditures.

Table 8: Existing Borrowing for TCN Capital Program

Source	US$ M
Secured Funding - Debt	
AfDB (EPSERP)	100
AfDB (EPSERP)	50
World Bank (NEGIP)	108
World Bank (NEGIP)	60
Eurobond	136
Agence Francaise de Development (AFD)	170
Total	623

Figure 3 provides a comparison of capital funding requirements with existing sources of funding. It is clear that there is a major funding gap that needs to be addressed.

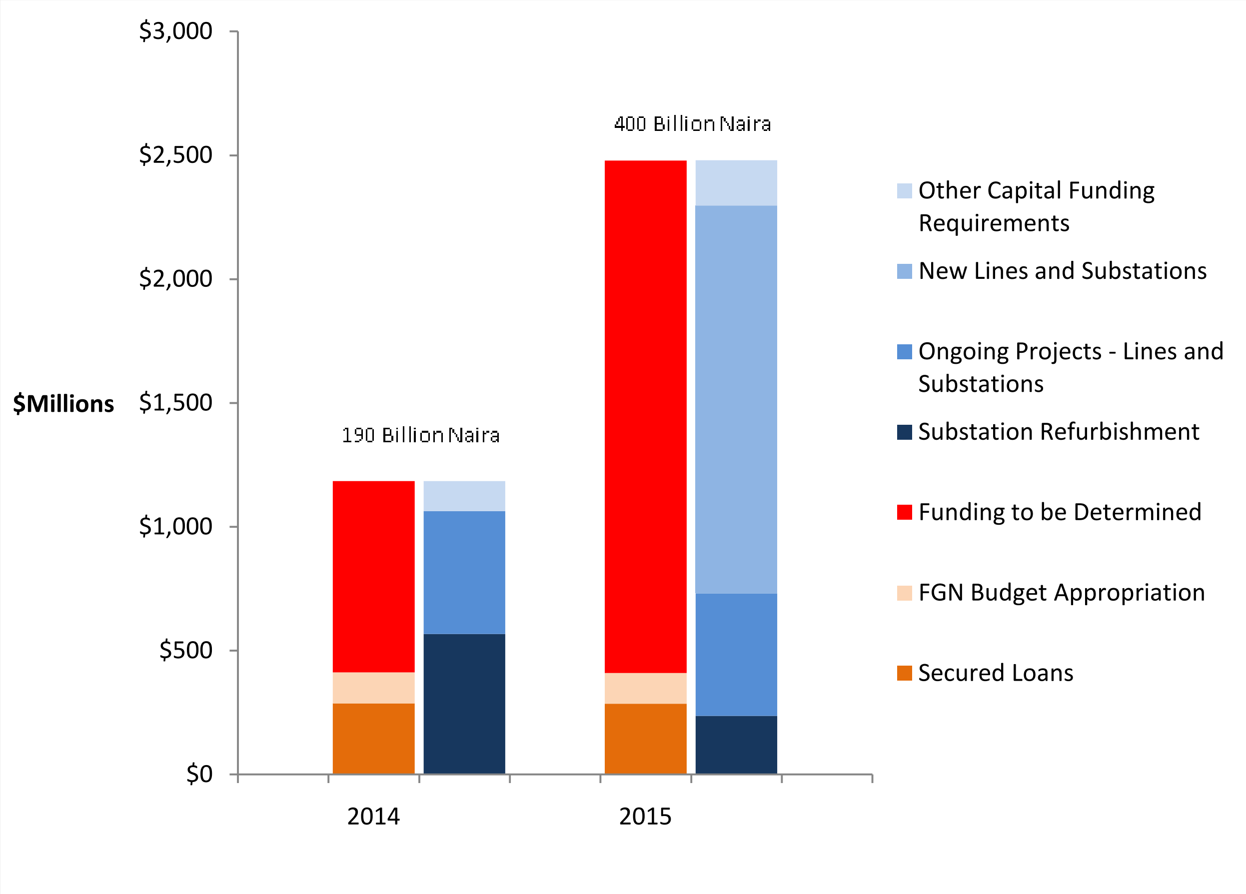

Figure 3: Capital Funding Requirements versus Existing Sources of Funding

5 Summary of Investment Opportunity

5.1 Financing Packages

Table 1 above shows the TCN transmission refurbishment and expansion program grouped into a set of investment funds ("Financing Packages"). The detailed list of projects within each grouping is shown in Annex 1.

TCN's most immediate goal is to subscribe investment funds for the following packages:

- Capital refurbishment;
- Package 1, which consists of new projects already under various stages of construction; and
- Package 2 Groups 1-5, which consist of new projects required to increase wheeling capacity from 7 to 10 GW.

Once the investment funds for the above groups are fully subscribed, TCN intends to apply any additional available funding to expansion projects in the following phases: Package 3 (10-13 GW), Package 4 (13-16 GW) and Package 5 (16-20 GW).

5.2 Project Prioritization

To the extent possible, TCN prefers to direct the available capital funding from investors to the projects that will address the most immediate needs. TSP has developed the following prioritization for the transmission refurbishment and expansion program:

- First priority: critical refurbishment & replacement
- Second priority: critical on-going projects to be completed
- Third priority: projects to increase wheeling capability (to be started in parallel with above)

First priority: critical refurbishment & replacement

Table 10 shows the funding requirements for critical refurbishment and replacement projects. The purpose of this set of projects is to restore the reliability and stability of the existing system.

Table 9: Funding Requirements for Critical Refurbishment & Replacement

Category	No.	USD ml	NGN bn
Replacement of breakdown equipment	116	32	5.1
Reinforcement Projects	26	111	17.7
New trans lines & substations	10	238	38.12

The refurbishment and replacement projects will provide the following benefits:

- Provide two country-wide 330kV double circuit loops to enhance reliability and stability
- Supplement the generation, transmission and distribution projects constructed under the National Integrated Power Project (NIPP)
- Restore over 600 MVA transformation capacity
- Enhance stability and reliability of the system
- Alleviate overloads that lead to equipment breakdowns
- Mitigate frequent failures and system collapses
- Increase WAPP wheeling revenues

The projects are considered low risk/high reward for the following reasons:

- No need for feasibility, wayleave, compensation, environmental studies
- Short implementation time, immediate benefits

- Relatively low cost and low risk of project completion

Second priority: critical on-going projects yet to be completed

Table 11 shows summary statistics for on-going projects that have no firm commitment for timely capital cash flow. There are 226 such projects. Table 12 shows a breakdown of percentage completion for these projects.

The ongoing projects are critically important to enhance system reliability, stability and efficiency. Issues such as cost escalation, wayleave, non-payment of contractor invoices, and quality control have delayed commissioning. Delayed completion of these projects limits TCN's ability to start new projects and stay ahead of the expansion targets

Table 10: Summary Statistics for Ongoing Projects

Voltage Level	Miles of Lines	Transformation Capacity
330 kV	600 kM	3,720 MVA
132 kV	4,182 kM	5,510 MVA

Table 11: Percentage Completion for Ongoing Projects Requiring Capital Funding

Percent Complete	Number	Billion Naira
Completed w/outstanding payments	18	1.90
Projects ≥75%, <100% completed	36	10.44
Projects ≥40%, <75% completed	16	29.41
Projects ≥10%, <40% completed	43	80.23
Projects with little/no activity	7	20.76
Projects with planning underway	29	5.49

Third priority: projects to increase wheeling capability

TCN's immediate priority for system expansion is to increase system capability to wheel load from 7 GW to 10 GW by 2017 ("Financing Package 2"). These projects must proceed on a timely basis to keep up with the anticipated expansion of generation and load.

The projects in Financing Package 2 are organized into 5 groupings based on geographical regions to optimize the overall benefits, as projects in Groups are interdependent and must be completed together. Grouping projects within the same geographical area may be advantageous for mobilizing construction work, since all components of the group are within the same proximity. It is the hope of TCN that funders will support a specific group of projects, or combine with others to fund a group. Once funding is in place for a specific group, contractors (or consortiums) will be invited to bid for a contract to develop that group of projects.

Table 12: Project Groups to Expand System from 7 GW to 10 GW by 2017

Fund Group	Description	Substation & Line Projects	Voltage Control Projects	Million USD	Bn Naira
1	Kainji-Birnin Kebbi-Gusau	11	13	438	70
2	Lagos	25	21	548	88
3	Jos – Gombe – Damaturu	4	8	246	39
4	Awka – Ugwuaji – Jos	16	13	617	99
5	Benin – Katampe	5	16	385	62
	Totals			**2,235**	**358**

6 Investment Framework

Investors are invited to participate in financing packages that best fit their particular funding preferences and requirements. TCN intends to work with interested investors to form a consortium for each financing package. Funds invested in a package will be pooled. It is envisioned that each investor consortium will have an executive oversight function. TCN intends to comply with any requirements imposed by investor consortia for project implementation such as program design, monitoring, controls and reporting. The following sections provide a general framework for oversight and management of the investment funds.

6.1 Investment Fund Structure

TCN has developed the following basic structure to be used for the investment funds:

- Sets of projects will be grouped into “financing packages.”
- Investors will form a consortium for each package.
- Funds invested in a package will be pooled.
- Each consortium will have an oversight function.
- TSP will set up Project Implementation Unit(s).
- Each package (or multiple packages) will be managed by a single Owner’s Engineer reporting to the PIU.
- Universally accepted procurement guidelines will be used.
- FGN will be involved for approvals, guarantees, oversight, waivers etc.

- TCN Board will approve investment plans.

The foregoing structure is provided as a basic guideline. The framework will be refined and revised as needed to meet the needs of investors.

6.2 Roles and Responsibilities

Figure 4 shows a graphical depiction of the roles and responsibilities for the executive management, oversight, administration and execution of the investment funds.

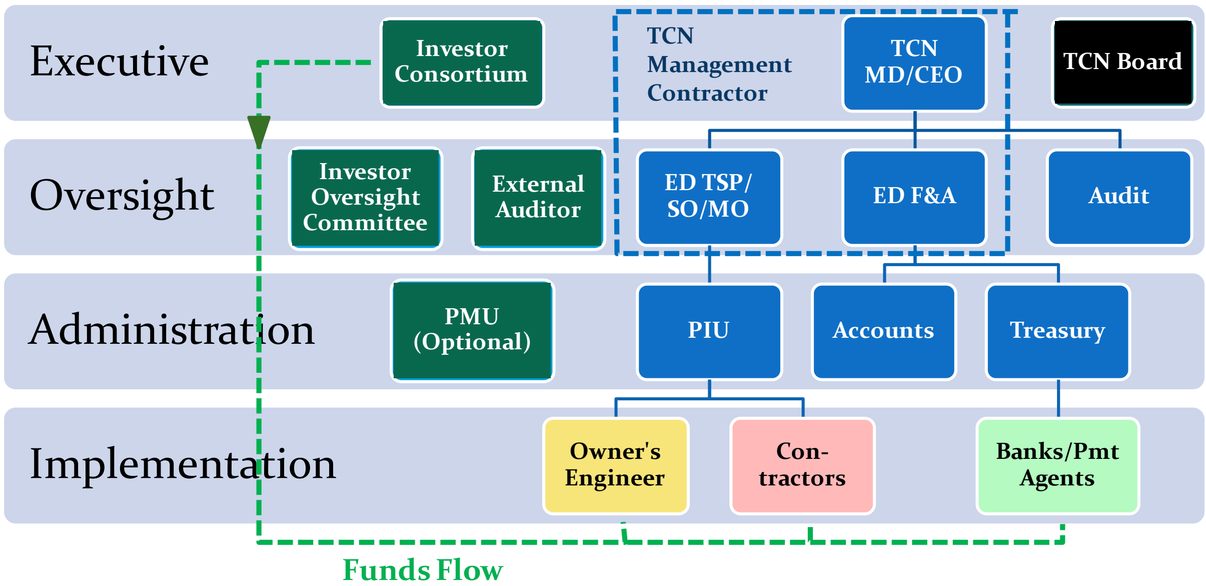

Figure 4: Roles and Responsibilities for Investment Funds

6.3 Duties of Owner's Engineer

TCN intends to engage an Owner's Engineer for each investment fund or multiple investment funds, similar to the approach used for the NIPP projects. The Owner's Engineer must bring international qualifications in large-scale infrastructure investment programs. The Owner's Engineer will have the following duties:

- Pre-tender feasibility studies and basic engineering
- Bidding strategy including bid packaging concept
- Assessment of contractor qualifications
- Technical specifications
- Cost estimates
- Commercial documents

- Bid evaluation and contract finalization
- Engineering reviews
- Interfaces, integration, project phasing
- Review of contractors' specifications and plans
- Statutory permits and clearances
- Construction management
- Commissioning and trouble-shooting
- Project completion activities

6.4 Contracting Alternatives

TCN is open to any of the following forms of contracting, depending on investors' needs and preferences:

- Traditional Engineer Procure Construct (EPC)
- Build Own Transfer (BOT)
- Build Own Operate (BOO)
- Build Own Operate Transfer (BOOT)
- Build Own Operate Maintain Transfer (BOOMT)

Annex 5 shows the guidelines to be used for competitive procurement and contracting.

6.5 Banking and Payments

TCN will work with investors to institute effective banking and payment arrangements. In general, investment funds will be kept separate from TCN general funds. The Investment Consortium will be involved in selection of banks and approvals for release of funds to contractors. Investors will have the option to make direct payment to contractors. Such terms and conditions will be set out in the funding agreements.

6.6 Criteria for Matching Investors to Investment Funds

The following criteria, among others, will be used to match investors to investment funds:

- Ability to meet required funding disbursement schedule
- Investor's internal corporate governance restrictions
- Investor's requirements for due diligence and approvals
- Amount of investment required versus investor's capacity

- Investor’s requirements for return on investment
- Extent of studies completed versus investor’s requirements
- Investor’s requests for non-standard terms and conditions
- Flexibility of funding model eg BOT
- Investor’s track record
- Level of counterpart funding required

7 Economic and Financial Assessments of Projects

Annex 3 provides an economic assessment of the new projects included in Financing Package 2. The economic analysis compares two cases, with and without the transmission projects. Project benefits are calculated as the savings to consumers for replacement of costly self-generation from diesel and petrol generators with grid-supplied power priced at prevailing tariff levels. Project costs are calculated as the sum of project completion costs plus economic values of lands occupied by transmission. All of the groups of projects in Financing Package 2 are estimated to be cost effective from the consumer’s standpoint.

Annex 4 provides an assessment of the financial viability of each group of projects in Package 2 assessed in terms of project benefits (revenues collected for the incremental wheeled energy) and costs (investment costs, operations & maintenance costs and corporate income tax on profits). Each group is considered financially viable if its Financial Internal Rate of Return (FIRR) is equal to or greater than the Weighted Average Cost of Capital (WACC), estimated at 7.5% (real after tax as per NERC estimates for MYTO tariff evaluation).

The benefits are evaluated for two alternative tariff scenarios, MYTO II tariff levels and fully cost reflective tariffs. The assessment indicates that fully cost reflective tariffs will provide the required positive financial results for all Groups in Financing Package 2. However, financial returns are inadequate if existing MYTO II tariff levels will persist into the future. To address this risk, TCN intends to make an application to NERC for higher tariffs to reflect changes since the tariffs were developed, which have been unfavourable to TCN from a revenue standpoint.

Annex 1

Transmission System Development Plan and Capital Funding Requirements

TCN Transmission System Development Plan and Capital Funding Requirements

March 2014

Manitoba
HYDRO INTERNATIONAL
Initiative of
Manitoba Hydro

CONTENTS

1.0 Report Objectives

The objectives of this report are to summarise TCN's Transmission System Development Plan and associated capital funding requirements, as approved by the Supervisory Board in February 2014. If properly funded, this plan will improve the overall security and quality of supply of electricity, and ensure that the system can efficiently evacuate unrestricted power from the generators to the distribution companies and large industrial and commercial users.

This report covers:

- a summary of the results of the TCN Transmission Development Plan as prepared by MHI;
- a prioritized list of transmission network capital projects currently underway and proposed to reach a total system capacity of 10 GW by 2017, and 20 GW by 2020; and
- a summary of the phased capital funding requirements for the TCN Transmission Development Plan.

2.0 Transmission Planning Study for 10 GW System

2.1. Introduction

Nigeria's transmission system, which consists of 330kV and 132kV high voltage lines, substations, and control facilities is owned and operated by the Transmission Company of Nigeria (TCN). Within TCN, the Transmission Services Provider Business Unit is responsible for constructing and maintaining the transmission system infrastructure.

The transmission system has problems with reliability and security, and is currently inadequate for the major generation expansion projects that are in the planning or construction phases. As the NIPP transmission construction program nears completion, the capacity of the transmission system is expected to reach around 7,000 MW. This represents the estimated total capacity of the network to wheel energy from generation to load over the 330/132 kV system. TCN aspires to increase the capacity of the grid from 7 GW up to 10 GW by 2017, and up to 20 GW by 2020. At the same time, TCN will need to refurbish older facilities to improve reliability and security.

In support of the initial goal to reach 10 GW by 2017, MHI and TCN system planning experts have prepared a Transmission Development Plan using the PSSE planning software. The first step in the planning process involved converting TCN's existing NEPLAN model to PSSE. MHI planning engineers and TCN planning engineers worked on the conversion of the initial NEPLAN based 4,500 MW model and subsequent development of the PSSE 10,000 MW model over a period of many months both in Abuja and at the engineering offices in Manitoba.

The 10 GW model was completed in July 2013. Since then, MHI and TCN engineers have continued to refine the Transmission Development Plan. This has resulted in some additions to the list of required substations, lines and voltage compensation facilities. The lists of projects shown in this report reflect all additions made subsequent to publication of the MHI report.

2.2. Executive Summary of MHI Transmission Development Plan Report

Below is an excerpt from the executive summary of the report presenting the results for the 10 GW model. Please see Appendix A for the full report.

> In early 2013 Manitoba Hydro International Ltd. (MHI) was contracted to assist Transmission Company of Nigeria (TCN) with model development and system studies related to the ongoing system expansion projects.
>
> The existing generation and network resources cannot sustain the entire load and hence load rotation schemes have been adopted. This results in daily power cuts to customers. The proposed system expansions are aimed at serving the existing loads as well as catering the potential load growth over the next five years.
>
> The model development and study results reported here focused on two specific stages of TCN system:

1. 4.5 GW network model: This is considered as the base system with a load of 4.5 GW and is a representative of the TCN network as of December 2012.
2. 10 GW network model: This is the projected TCN network with 10 GW of load and is expected to be in operation by December 2016.

When developing the transmission models, certain assumptions had to be made when the required data was not available. These assumptions were made with the consent of TCN engineers and details are discussed in the report.

The following tasks have been accomplished under this project:

1. Conversion of 4.5 GW model representing the network as of the 4^{th} Quarter of 2012 from NEPLAN to PSS/E. Converted PSS/E model was submitted to TCN.

2. Converted 4.5 GW model was expanded by incorporating generation, transmission and substation projects planned for 10 GW network expansions. Projects planned to complete by December 2016 were included in 10 GW model. In order to complete the model, MHI had to perform a preliminary reactive power requirement analysis considering only the peak load conditions. Based on this analysis, additional shunt devices (not listed in the TCN project list provided to MHI) were added to the model. While the equipment identified by MHI is adequate to operate the system with peak load according to TCN Grid Code criteria, the locations and sizes (to some extent) are not optimized. Reactive power compensation scheme design is a separate task undertaken by TCN. This 10 GW model was further validated by TCN.

3. Base cases were analyzed for steady state performances under system intact and N-1 contingency conditions. Steady state voltage violations and thermal overloads were identified. Most of violations existing in the 4.5 GW network will be mitigated by network expansions identified for 10 GW network. However, remaining violations and new violations introduced due to the increased load and network expansions are required to be addressed for the 10 GW system. These issues are identified in this study and potential mitigation measures are proposed.

4. A cursory transfer facility study was performed to identify network resources required to facilitate generation re-dispatch between hydro generation and thermal generation. This is important since hydro generation may vary from 1500 MW in wet season to 150 MW in dry season.

5. The following four critical interfaces were identified in the 330 kV, 10 GW network during system studies.

    - Transmission interface across areas Osogbo, Benin and Enugu
    - Transmission interface across Kaduna and Kano
    - Transmission interface across Katampe, Shiroro and Gwagwalada
    - Transmission interface across Kainji to Birnin Kebbi (BKebbi)

    These four interfaces have voltage related issues which has been analysed in detail. The first three issues can be mitigated by adding reactive power support which has been proposed in the report. *However, it should be noted that the root cause of most of these issues is insufficient capacity of the transmission network to carry the increased power transfer*. The fourth issue cannot be mitigated by reactive power support and requires building of new transmission lines. TCN should analyse these issues further and determine the most suitable upgrades (either adding shunts or building more lines) by considering technical and economic viability.

6. During the base case analysis and transfer facility studies, many steady state voltage violations and thermal overloads were identified. Worst overloading has been listed in this report for TCN to determine suitable mitigation measures. In order to mitigate voltage violations and achieve N-1 compliance for 10 GW system, the following mitigation measures have been proposed.

   A. **Tapping identified for 330 kV lines:** In selected locations, it is recommended to tap both circuits of a 330 kV double circuit transmission line instead of one circuit.

   B. **Adding shunt reactive power devices:** Mechanically switched shunt capacitors and several variable shunts (Potentially a SVC or a combination of mechanically switched shunts and SVC) were identified as mitigation measures for voltage violations. This is mainly due to low power factor assumed for the load. The proposed reactive power scheme could be used as the initial setting for reactive power study planned by TCN. Details are presented in the report.

   C. **Building new transmission lines and sub-stations:** Building new lines and adding new transformers were identified as the last resort to prevent voltage violations and voltage depressions causing non-converged post-contingency networks.

   The details of the proposed network additions are listed in the main body of the attached report.

7. A preliminary investigation was carried out to identify system expansion projects which should be prioritized to minimize the system issues and improve system reliability during the expansion from 4.5 GW network to 10.0 GW network. Nine projects with system level impacts and twenty six projects with area level importance have been identified as projects with high priority.

3.0 Transmission Development Plan

TCN's Transmission Development Plan includes all of the line, substation and voltage compensation projects needed for the 10 GW system model as described in Section 2.0 of this report. The projects are bundled into the following categories:

1. Rehabilitation of existing facilities
2. Financing Package 1 – New projects currently underway that need incremental funding
3. Financing Package 2 – New projects in the plan for 10 GW system

TCN has developed a preliminary list of additional projects that will be needed to increase system capacity from 10 GW to 20 GW. These projects are grouped into three additional financing packages consistent with the staged development of the system.

3.1. Rehabilitation of Existing Facilities

MHI and TCN surveyed the rehabilitation requirements for each of the eight transmission regions within TSP, as shown in Table 3-1. In addition to the costs developed through the survey, NIAF has identified the costs for other likely rehabilitation requirements using an age methodology applied to the entire network, as described further in Appendix G, and these funding amounts were added to bring the total to approximately $947 Million USD. None of these rehabilitation projects is funded at present.

Table 3-1: Rehabilitation and Repair Costs by Region

Region	Subtotal
Kaduna	10,325,722,661
Enugu	5,935,158,643
Bauchi	14,011,765,700
Shiroro	1,632,955,280
Benin	1,216,297,000
Osogbo	10,727,214,163
Port Harcourt	3,589,853,438
General Infrastructure Repair Requirements Due to Ageing of Components	105,555,033,115
Total (NAIRA):	**152,994,000,000**
Total (USD):	**$947,000,000**

3.2. Financing Package 1 – Ongoing Projects that Need Incremental Funding

Appendix B shows the list of projects and a map for Financing Package 1, which includes all ongoing TCN transmission line and substation projects that require additional capital funds to complete construction, make operational, and pay all project related costs. These projects underpin the subsequent expansion of the transmission system, and it is critically important to complete them as a high priority. The total cost to bring these projects to conclusion is approximately $989 Million USD.

The objective of completing the ongoing projects is to stabilize the system and address the following persistent reliability and security issues:

- Rotating Customer Outages – It is well recognized that there is insufficient generation/transmission/distribution to serve customer demand in Nigeria. As a result, rotating customer outages are used to balance supply and demand on a daily basis.

- Limited ability to withstand single equipment outage – The TCN network has been designed to a N-0 reliability standard for the most part, which focuses on delivering energy when all transmission elements are in service. Thus when a single transmission element is out of service there is a good chance that load will not be served. Many power systems are designed to an N-1 (or higher) criteria that provides for all load to be served even in one element is out of service. In addition, the TCN network currently has voltage problems that are in large part due to insufficient means of supplying the reactive requirements of loads. Coupling the N-0 design and the limited reactive sources, the TCN network is prone to experience a partial or total blackout when a single transmission element is forced out of service.

- Frequent System Collapses – The Nigerian power system suffers from frequent partial or total system collapses when compared to the average power systems in the world. Currently the system experiences about two per month on average. There are many contribution factors to these outages but it is clear that the undersized TCN network, the lack of ability to withstand singe contingencies and the lack of proper means of control voltage within reliability criteria are major contributors.

Package 1 Projects have the following characteristics:

- 122 projects; 330kV and 132kV transmission lines and substations
- All projects are ongoing;
    - 25% are substantially complete (>90%)
    - 25% are partially complete (50% - 90%)
    - 50% just started (0% – 50%)
- Completion by 2015, if funding can be expedited
- Transmission system benefits include:
    - increase the transmission grid capability to 7 GW with adequate reliability and security
    - reinforce poor performing grid system
    - establish a foundation for next phases of 20 GW transmission system expansion

3.3. Financing Package 2 – New Projects for 10 GW System

Financing Package 2 consists of new projects to be initiated on an expedited basis to reach a total system capacity of 10 GW. Appendix C shows the list of projects for Financing Package 2. The appendix also provides a map of the projects and a 1-page summary for each individual project.

The total cost to complete the Package 2 projects is approximately $2.2 Billion USD. The estimated costs for Projects listed in Financing Package 2 were developed by TCN and reviewed by JICA engineers. The project costs are estimated using the unit costs of TCN's ongoing projects, $/km for transmission lines and $/MVA for substations. Reference unit costs are selected depending on line voltage (330kV or 132kV), number of circuits and conductors (single/double/quad) and transformer configuration (330/132kV, 2x150MVA or 132/33kV, 2x60MVA or both).

The projects in Financing Package 2 have been organized into 5 orderly groupings based on geographical regions, as listed in Table 3-2 and shown on the TCN Transmission System Map in Appendix C. Projects are grouped to optimize the overall benefits, as projects in Groups are interdependent and must be completed together. Grouping projects within the same geographical area may be advantageous for mobilizing construction work, since all components of the group will be within the same proximity.

It is the hope of TCN that funders will support a specific group of projects, or combine with others to fund a group. Once funding is in place for a specific group, contractors (or consortiums) will be invited to bid for EPC contracts for that group.

Table 3-2: Geographic Project Groups for Financing Package 2

Group	Region	Total Funding Required	
		$Million USD	Billion NGN
1	Kainji-Birnin Kebbi-Gusau	$412	66
2	Lagos	$548	88
3	Jos – Gombe – Damaturu	$246	39
4	Awka – Ugwuaji – Jos	$617	99
5	Benin – Katampe	$385	62
Total		$2,208	353

3.4. Financing Packages 3-5 – Incremental Projects to Increase from10-20 GW

TCN has developed draft plans for phased expansion of the network to 20 GW by 2020. The engineering studies and models are currently being developed for Package 3 (10-13 GW), Package 4 (13-16 GW) and Package 5 (16-20 GW). Appendix D, Appendix E and Appendix F show maps and preliminary lists of projects for these financing packages.

3.5. Summary of Transmission Project Capital Funding Requirements

Table 3-3 shows the capital funding requirements for refurbishment of existing lines and substations, a TSP metering project, the completion of new projects already underway (Financing Package 1) and the initiation and completion of new projects to expand the system to 10 GW (Financing Package 2). The cost estimate for capital refurbishment was developed by NIAF (see Appendix G for assumptions). The cost estimate for Package 1 is based on signed contract amounts. The cost estimate for Package 2 was developed by TCN and JICA, as explained earlier.

Table 3-3: Capital Funding Requirements for Refurbishment and Expansion to 10 GW

Projects	$Millions	GW Target	In Service
Capital Refurbishment	$947	7,000	2015
TSP Feeder Verification Meters	$1		2015
Package 1 - Projects under Construction	$989	7-8,000	2015
Package 2 - 10 GW system	$2,235	10,000	2017
Sub-Total ($USD Millions)	$4,172		

Table 3-4 shows the funding requirement for three additional project packages needed to expand the system to 20 GW by the year 2020. The estimated cost to expand from 10 GW to 20 GW was developed by TCN using cost data provided by NIAF for generic components of line and substation projects. The NIAF figures are based on actual recent costs for NIPP transmission projects. See Appendix G for NIAF assumptions used for estimating costs.

Table 3-4: Funding Requirements to go from 10 GW to 20 GW

Projects	$Millions	GW Target	In Service
Package 3 (13 GW)	$1,570	13,000	2018
Package 4 (16 GW)	$1,000	16,000	2019
Package 5 (20 GW)	$1,000	20,000	2020
Sub-Total ($USD Millions)	$3,570		

In summary, the total capital funding requirements to refurbish the existing system, improve reliability and security, and expand to 20 GW is estimated at $7.7 Billion USD.

Table 3-5 shows the cash flow requirements to achieve the 20 GW build-out, based on a high level estimated construction schedule. The assumed disbursement profile of the investment plan is front loaded to open letters of credit covering 70% of project costs at the start of the construction contract.

Table 3-5: Capital Cash Flow Requirement (2014 – 2020) for the 20 GW Plan (M$ USD)

Capital Cash Flow Requirement	2014	2015	2016	2017	2018	2019	2020	Totals
Capital Refurbishment	$568	$237	$47	$47	$47			$947
TSP Feeder Verification Meters	$1							$1
Package 1 - Projects under Construction	$495	$495						$989
Package 2 - 10 GW system		$1,565	$335	$335				$2,235
Package 3 - 13 GW			$1,099	$236	$236			$1,570
Package 4 - 16 GW				$700	$150	$150		$1,000
Package 5 - 20 GW					$700	$150	$150	$1,000
Total for 20 GW by 2020	***$1,063***	***$2,296***	***$1,482***	***$1,318***	***$1,133***	***$300***	***$150***	***$7,742***

Appendix A MHI/TCN 10 GW PSSE Based System Study and Report

ENGINEERING CONSULTING SERVICES

Report for Milestone Seven: Model Development and System

Transmission Company of Nigeria
Attention:
Contact Name: Wazilri Ibrahim
Chairman of the Board

Manitoba HVDC Research Centre
a division of Manitoba Hydro International Ltd.
211 Commerce Drive
Winnipeg, MB R3P 1A3, Canada
www.hvdc.ca

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0.1	Second issue after TCN comments	Dec., 30, 2013

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The use of this proposal by third parties shall be at their own risk, and MHI accepts no duty of care to any such third party.

Executive Summary

In early 2013 Manitoba Hydro International Ltd. (MHI) was contracted to assist Transmission Company of Nigeria (TCN) with model development and system studies related to the ongoing system expansion projects.

The existing generation and network resources cannot sustain the entire load and hence load rotation schemes have been adopted. This results in daily power cuts to customers. The proposed system expansions are aimed at serving the existing loads as well as catering the potential load growth over the next five years.

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2. 10 GW network model: This is the projected TCN network with 10 GW of load and is expected to be in operation by December 2016.

When developing above models, certain assumptions had to be made when the required data was not available. These assumptions were made with the consent of TCN engineers and details are discussed in this report.

Following tasks have been accomplished under this project.

1. Conversion of 4.5 GW model representing the network as of the 4th Quarter of 2012 from NEPLAN to PSS/E. Converted PSS/E model was submitted to TCN.

2. Converted 4.5 GW model was expanded by incorporating generation, transmission and substation projects planned for 10 GW network expansions. Projects planned to complete by December 2016 were included in 10 GW model. In order to complete the model, MHI had to perform a preliminary reactive power requirement analysis considering only the peak load conditions. Based on this analysis, additional shunt devices (not listed in the TCN project list provided to MHI) were added to the model. While the equipment identified by MHI is adequate to operate the system with peak load according to TCN Grid Code criteria, the locations and sizes (to some extent) are not optimized. Reactive power compensation scheme design is a separate task undertaken by TCN. This 10 GW model was further validated by TCN.

3. Base cases were analyzed for steady state performances under system intact and N-1 contingency conditions. Steady state voltage violations and thermal overloads were identified. Most of violations existing in the 4.5 GW network will be mitigated by network expansions identified for 10 GW network. However, remaining violations and new violations introduced due to the increased load and network expansions are required to be addressed for the 10 GW system. These issues are identified in this study and potential mitigation measures are proposed.

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5. The following four critical interfaces were identified in the 330 kV, 10 GW network during system studies.

   - Transmission interface across areas Osogbo, Benin and Enugu
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   These four interfaces have voltage related issues which has been analysed in detail. The first three issues can be mitigated by adding reactive power support which has been proposed in the report. *However, it should be noted that the root cause of most of these issues is insufficient capacity of the transmission network to carry the increased power transfer*. The fourth issue cannot be mitigated by reactive power support and requires building of new transmission lines. TCN should analyse these issues further and determine the most suitable upgrades (either adding shunts or building more lines) by considering technical and economic viability.

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A. **Tapping identified for 330 kV lines:** In selected locations, it is recommended to tap both circuits of a 330 kV double circuit transmission line instead of one circuit.

B. **Adding shunt reactive power devices:** Mechanically switched shunt capacitors and several variable shunts (Potentially a SVC or a combination of mechanically switched shunts and SVC) were identified as mitigation measures for voltage violations. This is mainly due to low power factor assumed for the load. The proposed reactive power scheme could be used as the initial setting for reactive power study planned by TCN. Details are presented in the report.

C. **Building new transmission lines and sub-stations:** Building new lines and adding new transformers were identified as the last resort to prevent voltage violations and voltage depressions causing non-converged post-contingency networks.

The details of the proposed network additions are listed in the main body of this report and Appendices.

7. A preliminary investigation was carried out to identify system expansion projects which should be prioritized to minimize the system issues and improve system reliability during the expansion from 4.5 GW network to 10.0 GW network. Nine projects with system level impacts and twenty six projects with area level importance have been identified as projects with high priority.

The 10 GW model was finalised on 15 of July 2013. Any changes to the TCN development plan identified after this date are not reflected in the study model. Despite the assumptions[1] made in model development, the model sufficiently represents the expanded 10 GW system to identify limitations and potential issues. Thus the study results and major issues identified and reported will provide valuable and meaningful insight to planning and operational aspects of the expanded TCN network. The issues and potential mitigation measures identified in the report should be considered in the ongoing TCN network planning activities.

---

[1] Assumptions including the reactive power compensation scheme adopted by MHI and incorporated into the model are unlikely to have significant deviations from the final 10 GW model.

Contents

1. Introduction

In early 2013 Manitoba Hydro International Ltd. (MHI) was contracted to assist Transmission Company of Nigeria (TCN) with model development and studies related to the ongoing system expansion projects.

The current generation and network resources cannot facilitate the entire load and hence load rotation schemes have been adopted. This results in daily power cuts to customers. The proposed system expansions are aimed at serving the existing loads as well as catering the potential load growth for the next five years.

The model development and study results reported here focused on two specific stages of TCN system;

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2. 10 GW network model: This is the projected TCN network with 10 GW of load and is expected to be in operation by December 2016.

The upgraded system will be able to accommodate all loads including peak load conditions. The upgrades include additions of generation, reinforced and expanded transmission, and reactive power compensation designed to meet the system operation requirements considering expansions and additional loads.

The main tasks undertaken by MHI can be listed as follows:

- Review the 4.5 GW TCN network model provided to MHI in NEPLAN file format and convert the same to PSS/E format.
- Develop the 10 GW system model in PSS/E format based on identified system expansion projects as provided by TCN and additional requirements identified by MHI (based on preliminary studies).
- Identify additional network facilities (i.e. Transmission lines and reactive power supporting devices) required to satisfy single component outage (N-1) compliance for 10 GW system model under peak load conditions.
- Perform system studies to identify potential operational issues under different generation dispatch conditions.
- Preliminary assessment to identify the key projects and priorities when expanding the system from 4.5 GW to the 10 GW state.

The study includes an analysis of the current network (4.5 GW), and the upgraded network (10 GW) using Power System Simulator for Engineering (PSS/E). The model of the 4.5 GW network is a representation of the system as of the fourth quarter of 2012. The 10 GW network model represents projects scheduled to be completed by December 2016. When developing both system models, certain assumption had to be made when the required data was not available; these assumptions are discussed in detail in this report.

The studies are categorised and reported in three parts.

1. Powerflow study for the base case
   - identify steady state voltage violations and thermal overloads and to adjust the 10 GW model to meet operating criteria. Potential mitigation measures are identified.

2. A cursory transfer facility study
   - investigate network adequacy to re-dispatch generation between hydro generation and thermal generation depending on the season of the year. Potential mitigation measures are identified to eliminate steady state voltage violations and thermal overloads.

3. Preliminary assessment to identify the key projects and priorities when expanding the system from 4.5 GW to the 10 GW state.

This report presents the details and assumptions of the study model, study results and recommendations.

2. Model Conversion and Development

2.1. Conversion of 4.5 GW generation (existing) model

TCN has been using NEPLAN™ power system analysis software for system planning studies. The most complete model available with the planning department of TCN was a powerflow case presenting TCN system during December 2012. This powerflow case, available in NEPLAN format was converted to a powerflow case in PSS/E™ version 33 format. This was done manually by converting each individual network element from NEPLAN format to PSS/E format since automated software which can convert powerflow data between the two formats was commercially unavailable.

The converted case has 388 in-service buses, 26 in-service generators and 138 in-service loads delivering 4.5 GW of generation. The original NEPLAN case which was converted to PSS/E had many out-of-service elements such as generators, branches and loads. Initially, these out-of-service elements were also converted along with in-service elements. After consultation with TCN engineers, most of the out of service elements were removed from the 4.5 GW model, as they were either not commissioned or no longer a part of the TCN system as of December 2012.

The converted model was provided to TCN for further validation. Note that only network elements above 33 kV level was validated. TCN engineers confirmed that the initial power flow results obtained from the PSS/E model were similar to the results obtained from the NEPLAN model. This provides a preliminary validation. All the suggestions provided by TCN except two were incorporated into the 4.5 GW model. Two suggestions which were not implemented are the following.

1. Splitting aggregate generators in a plant into individual generators.

2. Splitting the aggregate load at 33 kV level so that actual low voltage feeder load can be represented in the model.

These changes should be made in the future and require additional information from TCN for correct implementation in the model. However, not splitting generators does not impact studies presented later in this report. Not splitting loads will only have a marginal impact on the study results.

2.2. Development of 10 GW load/15 GW generation model

The 4.5 GW model was extended to develop the planned 10 GW model by adding new generation, transmission and substation projects scheduled to be completed by December 2016 by TCN, NIPP and the IPPs. Details of these new project data were supplied by TCN. In situations where actual data is unavailable, device parameters were assumed with approval from TCN.

Generators

The 4.5 GW model was extended by adding a number (40) of new plants. Total aggregate capacity of new plants is over 7 GW. With the addition of these new generation plants, the total installed capacity of TCN system was increased to about 16 GW. Powerflow data such as MVA rating, power factor and rated voltage were available for NIPP generation projects. For IPP plants, only the projected real power outputs were available. Assumptions were made regarding new generator data when developing the 10 GW model. Complete list of assumptions are listed in section 3.

Transmission Lines

NIPP and TCN transmission line project details corresponding to the 10 GW developments were used to expand the 4.5 GW model with new transmission line data. These transmission line development projects enhance the transmission network at 132 kV and 330 kV levels. Almost all connection locations and lengths of new transmission lines were available. However, line electrical parameters required to represent the transmission lines were unavailable. Assumptions were made regarding line parameters of these new transmission lines. A complete list of assumptions is outlined in section 3.

Line parameters of existing lines were examined for abnormalities (reviewing the velocity of propagation based on entered data, etc.). Some of the lines had unrealistic X/R ratios. These were reported to TCN for validation and some of these parameters were validated and those were corrected in the model.

Transformers (generator and grid transformers)

The transformer list in the 4.5 GW model was extended by including step up transformers and grid transformers corresponding to 10 GW expansions. In most instances, data available were limited to connection details, voltage and power ratings of the transformers. Other essential information such as transformer leakage impedance, tap range and availability of an OLTC were not available. Therefore assumptions were made when defining percentage impedance, vector group and the rating of the transformers. A complete list of assumptions is outlined in section 3.

Loads

Existing load (load in the 4.5 GW model) was scaled up to make the 10 GW load case since the exact load distribution is unknown at this stage. Load scaling was done using the load projections provided by TCN. New load at each bus assumed the same power factor as the existing load connected to the same bus. Thus, the average power factor of the 10 GW load is maintained at 0.87, similar to the existing 4.5 GW load. Some loads are represented at the 132 kV level. While this practise is acceptable for transmission planning studies, it is suggested to move the load to the 33 kV level or lower voltage levels representing actual low voltage feeder loads.

Shunt reactive power requirement

The new 10 GW model includes all the shunt reactive power devices currently available in the TCN network as well as the shunt reactive power devices which have been proposed as a part of 10 GW system expansions. In addition to these existing and planned shunt reactive power devices, new shunt reactive power devices are proposed based on the studies presented in this report.

Note: Some of the proposed shunt reactive power devices are incorporated into the model at the model adjustment stage. The remaining shunt devices are proposed as a result of analysis performed on the study model and are not incorporated into the model.

2.3. Future updates of the model

There were assumptions made regarding powerflow model data when developing the 4.5 GW model and the10 GW model. These assumptions were pertaining to unavailable data. TCN has established a task force to validate the generator and transformer data. The validation process and updating of data would be a continuous exercise as 10 GW model projects are being completed and commissioned.

In addition, some loads are modeled as aggregate loads at 33 kV or 132 kV voltage levels. These loads should be split to reflect actual physical connections. Similarly, generators modeled with aggregate generator representation should be split to reflect actual physical connections.

3. Assumptions

MHI developed the TCN system powerflow study models in the industry standard PSS/E software version 33.4.0.

When updating the converted 4.5 GW network model and developing the 10 GW network, information on a large number of parameters related to network elements such as generators, transformers and transmission lines were required. While majority of this information was provided by TCN engineers, some of the data was unavailable. Therefore, certain assumptions had to be made in order to proceed with the model development. The notable assumptions are discussed in this section.

It should be noted that, although these assumptions are typical (for comparable systems), the model data entries should be updated for future studies when the specific data of those network elements become available.

3.1. Generators

- Plants where the individual unit specification was not available, the machines were modeled as a single lumped unit.
- The NIPP units were added with machine ID '5' and the IPP's with ID '6'.
- When the reactive power capability was unavailable, the following was assumed to calculate reactive power limits.
    - The maximum reactive power supply capability (Qmax) at rated power was calculated by assuming a power factor of 0.85.
    - The reactive power absorption capability for each machine was assumed to be 2/3 of the maximum reactive power supply capability.

3.2. Transmission Lines

- Line parameters for the new transmission lines are calculated based on line lengths and the existing line parameters at the same voltage level.
- When the lengths of new 330 kV transmission lines are not available, the length was assumed to be equal to the low voltage transmission line (if applicable) between the same buses.
- Emergency thermal rating of transmission lines is assumed to be 110% of the continuous rating.

3.3. Transformers

- All the newly added transformers were assumed to have the same percentage impedance and vector group as the existing transformers of comparable rating.

- The newly added transformers were assumed to have no on load tap changer (OLTC).
- All 330/132 kV transformers were assumed to be three winding transformers and a new tertiary bus at 33 kV voltage level was added to the model.
- When existing 132 kV substations were expanded to add 330 kV bus-bars, two parallel three-winding transformer with voltage ratio of 330/132/33 kV were added.
- When the continuous thermal rating of a transformer winding is not available, it is assumed to be equal to the winding MVA.
- Emergency thermal ratings of transformers are assumed to be 110% of the continuous rating.

3.4. Loads

- In the 10 GW case, loads were added to each area based on the projection provided by TCN. An average load power factor of 0.87 was maintained similar to the 4.5 GW network model.

4. Study Criteria

The criteria used for monitoring voltage and thermal overloads are described in this section.

Criteria for voltage violations tabulated Table 1 was obtained from TCN grid code.

Table 1 - Voltage criteria for the Study

	Over-voltage limit (pu)	Under-voltage limit (pu)
System intact (N-0) condition		
330 kV level	1.050	0.950
132 kV level	1.098	0.900
Single contingency (N-1) condition		
330 kV level	1.100	0.900
132 kV level	1.148	0.850

TCN grid code stipulates that system intact voltage should be within 5% of the rated voltage for the 330 kV network whereas voltage of 132 kV network should be within 10% of the rated voltage. According to TCN grid code, there is an additional 5% tolerance for the voltages in single contingency (N-1) situations compared to the system intact criteria.

Specific information on thermal overloads was not available in the TCN grid code. Therefore, thermal overload criteria were assumed according to standard practice used for system studies. The thermal overload criteria are as follows.

System intact (N-0) thermal overload:

- Transmission line and transformer loading over continuous rating (Rate A in PSS/E model).

Single contingency (N-1) thermal overload:

- Transmission line and transformer loading over emergency rating (Rate B in PSS/E model). Emergency rating was assumed to be 110% of the continuous rating of the corresponding transformer or transmission line.

In this study, only voltage violations and thermal overloads at transmission level (at or above 132 kV level) were monitored.

5. Powerflow Study for Base Cases

The main objective of this study is to adjust 4.5 GW and 10 GW study models for planning studies and identify additional reactive power supporting devices that are required to obtain a converged powerflow for 10 GW model.

Identification of additional reactive power devices (not planned by TCN) for the 10 GW network was an important step since TCN have not yet identified all the required reactive power supporting devices. This was done in two stages. These devices will be referred to as '*high impact shunts*' in the rest of the report.

1. Identification of additional shunt reactive power devices to obtain an acceptable system intact voltage profile. This step was important to obtain a converged network solution for the newly developed model and then to bring the voltage profile of high voltage network (132 kV and above) within TCN planning criteria.

2. In addition, several additional shunt reactive power devices were incorporated to avoid extensive amount of voltage violations and diverged[2] network solutions under post-contingency conditions. These selected additions were aimed to mitigate large number of reactive power issues affecting many contingency situations. This step was essential to bring the number of post-contingency violations to manageable level so that potential mitigation measures can be analysed.

System studies were carried out by incorporating high impact shunt devices. These shunt devices were essential to perform system studies presented in this report. However, it should be noted that these devices are optimized for the 10 GW network. In future, TCN should revalidate the locations and ratings of these shunt devices through a dedicated reactive power study. This should be done considering seasonal variations of load and generation for the next few years.

Powerflow studies were carried out to identify thermal and voltage violations as per TCN Grid Code outlined in Section 4. These violations are identified for system intact (N-0) and single outage (N-1) contingency conditions. Whenever a violation was found, suitable mitigation measures were identified from system adjustments such as transformer/shunt adjustments and generation re-dispatch. However, if mitigation measures beyond system adjustments are required, and then transmission system reinforcements such as addition of new

[2] Often, diverged post-contingency network condition is an indication of inadequate reactive power support for post-contingency network. However, study engineer should be careful to separate inadequate reactive power condition from numerical issues causing divergence.

shunt reactive power devices (in addition to high impact shunt devices), upgrading existing lines or building new lines are proposed.

The rest of this section presents the following:

- A summary of system adjustments and the 4.5 GW and 10 GW networks used in system studies. Both system models were adjusted suitable for planning studies.
- Summary of steady state voltage violations and thermal overloads in both 4.5 GW and 10 GW networks. System intact and post-contingency voltage violations were observed for 4.5 GW model whereas only post-contingency voltage violations were observed for 10 GW network after incorporating high impact shunts. Details of complete list of steady sate violations and potential mitigations measures are listed in appendix A.

5.1. Model adjustments

5.1.1. 4.5 GW Network adjustments

A power flow case representing the TCN network as of the fourth quarter of 2012 was converted from NEPLAN to PSS/E. Generator dispatch was set based on the daily broadcast reports provided by the TCN. Various system adjustments including adjustments of the status of shunt devices were performed in consultation with TCN engineers to adjust the network.

5.1.2. 10 GW Network adjustments and upgrades

To obtain a converged power flow solution and eliminate all the system intact voltage violations (at 330 kV and 132 kV levels), high impact shunts were identified and included in the model. In the model, these shunts are labeled with ID '78', '79'. Dispatch for 10 GW was set such that the local area loads are supplied by generation within the area; this minimizes inter area transfer and system losses.

5.2. Summary of the model after adjustments

The following is a summary and comparison of the 4.5 GW and 10 GW models. Note that the 10 GW network includes high impact shunt devices but does not include all the upgrades proposed as a result of this study.

5.2.1. Generation

The installed generation capacity of the 4.5 GW network is 8.7 GW and the total generation is 4.9 GW. In the 10 GW network, installed capacity is 16 GW and the total generation is 10.9 GW. Note that installed capacities mentioned above may not be accurate as most of the generation expansions are still in the early planning stages and actual ratings are not finalized at the time of model development. Table 2 tabulates installed generation capacity and generation dispatch for 4.5 and 10 GW systems. In addition to the expansion made to existing plants, new plants at Alaoji, Egbema, Ihovbor, Calabar, Omoku, etc. have contributed to increased generation in the 10 GW network.

Table 2 – Installed generation capacity and generation dispatch for base models

Plant Name	4.5 GW Network		10 GW Network	
	Installed Capacity (MW)	Generated Power (MW)	Installed Capacity (MW)	Generated Power (MW)
SHIRORO	450.0	400.0	600.0	600.0
JEBBA	465.0	402.0	540.0	540.0
KAINJI	540.0	254.0	760.0	460.0
GURARA	-	0.0	30.0	0
EGBIN	1200.0	787.7	1320.0	1142.4
AFAM IV & V	418.5*	165.0	411.0	220.0
SAPELE	1700.0*	393.4	930.0	630.0
DELTA	600.0	140.0	710.0	530.0
GEREGU	250.0	220.0	849.0	400.0
OMOTOSHO	450.0	278.0	786.0	744.0
OLORUNSHOGO	700.0	516.9	975.0	975.0
ALAOJI	-	-	1688.0	1500.0
IHOVBOR	-	-	450.0	450.0
CALABAR	-	-	562.5	337.5
GBARAIN	-	-	225.0	225.0
EGBEMA	-	-	337.5	337.5
OMOKU	-	-	337.5	225.0
IBOM POWER	69.9	69.9	170.0	170.0
TRANS-AMADI	-	-	124.0	100.0
AES (LAGOSENRON)	270.0	210.0	294.0	240.0
AGIP (OKPAI)	450.0	467.0	480.0	450.0
SHELL (AFAM VI)	828.0*	456.0	650.0	500.0
RIVERS IPP	300.0	140.0	300.0	0
IJORA	20.0	0.0	20.0	20.0
OBAJANA	-	-	150.0	150.0
OKE-ARO	-	-	540	0
AZURA	-	-	525	0
DANGOTE	-	-	500	0
KADUNA	-	-	215	0
NOTORE	-	-	525	0
TOTAL	**8711.4**	**4899.9**	**16004.5**	**10946.4**

*Note: Installed capacities of these plants are higher in the 4.5 GW system than the 10 GW system. This may be correct as some existing machines are retired when the system is expanded from 4.5 GW to 10 GW. However, this should be verified and reflected in corresponding models if required.

Table 3 tabulates the area-wise generation capacity and generation dispatch for 4.5 GW and 10 GW networks.

Table 3 – Area based Generation capacity and generation dispatch for base models

Area	4.5 GW Network		10 GW Network	
	Installed Capacity (MW)	Generated Power (MW)	Installed Capacity (MW)	Generated Power (MW)
AREA 1 – LAGOS	2190.0	1514.5	3597.5	2671.351
AREA 2 – OSOGBO	450.0	278.0	450.0	450.0
AREA 3 – SHIRORO	1455.0	1056.0	1900.0	1600.0
AREA 4 – BENIN	2550.0	753.4	4114.0	2160.0
AREA 5 – KADUNA	0.0	-	245.0	0.0
AREA 6 – BAUCHI	0.0	-	0.0	-
AREA 7 – ENUGU	450.0	467.0	480.0	450.0
AREA 8 – PT HARCO	1616.4	830.9	5218.0	3615.0
TOTAL	**8711.4**	**4899.9**	**16004.5**	**10946.4**

Area generation capacities in all eight areas except area 2 and area 6 have increased after system expansions. However, areas 1, 3, 4 and 8 have the bulk of generation capacity for both 4.5 GW and 10 GW systems. Generation dispatch for 4.5 GW model was based on the generation dispatch identified for the fourth quarter in 2012.

5.2.2. Load

Table 4 is a summary of the area load distribution for 4.5 GW and 10 GW networks. Both models have approximate load power factor of 0.87. Area 1 has the largest area load in both systems.

Table 4 - Comparison of load distribution by area

Area	4.5 GW Network		10 GW Network	
	Active Power (MW)	Reactive Power (MVAr)	Active Power (MW)	Reactive Power (MVAr)
AREA 1 - LAGOS	1300.0	767.3	3294.4	1932.9
AREA 2 - OSOGBO	582.5	296.5	1046.1	584.8
AREA 3 – SHIRORO	490.5	304.3	1203.1	731.2
AREA 4 – BENIN	421.	209.7	925.2	511.1
AREA 5 - KADUNA	344.0	203.0	1408.8	828.4
AREA 6 - BAUCHI	183.0	95.2	579.4	300.2
AREA 7 - ENUGU	381.0	218.8	769.4	430.3
AREA 8 – PT HARCO	732.1	337.2	1069.6	500.1
TOTAL	**4434**	**2432**	**10296**	**5819**

5.2.3. Inter-area Transfer

The inter-area transfers for the 4.5 GW model is tabulated in Table 5, which shows the real and reactive power transfer between areas. Significant power transfer can be observed between area 3 and area 5, and also between area 4 and area 7.

Table 5: Inter-area transfer for 4.5 GW network

FROM \ TO		LAGOS (1)	OSOGBO (2)	SHIRORO (3)	BENIN (4)	KADUNA (5)	BAUCHI (6)	ENUGU (7)	PT HARCO (8)
LAGOS (1)	MW MVAr	N/A	117 -167	-	-147 -55	-	-	-	-
OSOGBO (2)	MW MVAr	-117 167	N/A	3 -92	-115 -1	-	-	-	-
SHIRORO (3)	MW MVAr	0 0	-3 92	N/A	-	**486** **-75**	-	-	-
BENIN (4)	MW MVAr	147 55	115 1	-	N/A	-	-	**-302** **38**	-
KADUNA (5)	MW MVAr	-	-	**-486** **75**	-	N/A	145 -128	-	-
BAUCHI (6)	MW MVAr	-	-	-	-	-145 128	N/A	-	-
ENUGU (7)	MW MVAr	-	-	-	**302** **-38**	-	-	N/A	-96 27
PT HARCO (8)	MW MVAr	-	-	-	-	-	-	96 -27	N/A

Inter-area transfers for the 10 GW model are tabulated in
Table 6. It can be seen that there are new interconnections between areas 3-4, 4-8 and 6-7. Highest inter-area power transfer is observed between area 7 and area 8.

Table 6: Inter-area transfer for 10 GW network

FROM \ TO		LAGOS (1)	OSOGBO (2)	SHIRORO (3)	BENIN (4)	KADUNA (5)	BAUCHI (6)	ENUGU (7)	PT HARCO (8)
LAGOS (1)	MW MVAr	N/A	-478 214	-	-232 55	-	-	-	-
OSOGBO (2)	MW MVAr	478 -214	N/A	10 -179	-1140 201	-	-	-	-
SHIRORO (3)	MW MVAr	-	-10 179	N/A	-891 28	1195 51	-	-	-
BENIN (4)	MW MVAr	232 -55	1140 -201	891 -28	N/A	-	-	-691 266	-412 109
KADUNA (5)	MW MVAr	-	-	-1195 -51	-	N/A	-288 -59	-	-
BAUCHI (6)	MW MVAr	-	-	-	-	288 59	N/A	-943 136	-
ENUGU (7)	MW MVAr	-	-	-	691 -266	-	943 -136	N/A	-2040 261
PT HARCO (8)	MW MVAr	-	-	-	412 -109	-	-	2040 -261	N/A

Table 7 contains the summary of the inter-area transfer tables for both the 4.5 GW and 10 GW models. Net power coming out from each area is shown to identify whether an area is importing or exporting active power.

Table 7: Inter-area transfer summary

Area	Network	
	4.5 GW	10 GW
1	-30 MW	-710 MW*
2	-229 MW	-652 MW
3	**483 MW**	**294 MW**
4	**-40 MW**	**1160 MW**
5	-341 MW	-1483 MW
6	-145 MW	-655 MW
7	**206 MW**	**-406 MW**
8	**96 MW**	**2452 MW**

**(-) sign indicates power import*

When expanding the 4.5 GW model to the 10 GW model, power export has increased for areas 4 and 8 while area 3 has a slight reduction in power export. Area 7 has changed its status from an exporting area to an importing area. All other areas (areas 1, 2, 5 and 6) have increased the amount of power imports.

5.2.4. Distribution of reactive power supply and demand

This section presents the distribution of load reactive power consumption and distribution of reactive power supply by generators and shunts.

Load reactive power

Table 8 lists load active power, reactive power and power factor for area load. In both models, overall power factor is approximately at 0.87.

Table 8 - Load reactive power and power factor for each area

Area	4.5 GW NETWORK			10 GW NETWORK		
	ACTIVE POWER (MW)	REACTIVE POWER (MVAR)	POWER FACTOR	ACTIVE POWER (MW)	REACTIVE POWER (MVAR)	POWER FACTOR
AREA 1 - LAGOS	1300.0	767.3	0.861	3294.4	1932.9	0.863
AREA 2 - OSOGBO	545.8	274.5	0.893	1046.1	584.8	0.873
AREA 3 – SHIRORO	532.9	316.1	0.860	1179.0	720.9	0.853
AREA 4 – BENIN	398.5	200.3	0.893	925.2	511.1	0.875
AREA 5 - KADUNA	344.0	203.0	0.861	1408.8	828.4	0.862
AREA 6 - BAUCHI	183.0	95.2	0.887	583.4	302.7	0.888
AREA 7 - ENUGU	398.0	229.4	0.866	769.4	430.3	0.873
AREA 8 – PT HARCO	573.2	267.8	0.906	1115.5	519.2	0.907
TOTAL	**4275.4**	**2353.6**	**0.876**	**10321.8**	**5830.3**	**0.871**

The total load reactive power requirement has increased from 2354 MVAr for 4.5 GW network to 5830 MVAr for 10 GW network. This is an increment of

3476 MVAr in reactive power demand. A growth of 148% compared to the reactive power demand of 2354 MVAr in 4.5 GW network. This increased reactive power demand should be supplied by generators, fixed or switching shunt capacitors and transmission lines[3] to maintain an acceptable voltage profile across the network.

Generator reactive power support

Table 9 tabulates area based reactive power capability[4] and reactive power generation for in-service generators.

Table 9 - Reactive power capability and reactive power generation by area

Area	4.5 GW Network		10 GW Network	
	Reactive Power Capability (MVAr)	Generated Reactive Power (MVAr)	Reactive Power Capability (MVAr)	Generated Reactive Power (MVAr)
AREA 1 - LAGOS	1367.5	975.9	2040.9	1523.8
AREA 2 - OSOGBO	500.0	149.9	280	184.1
AREA 3 – SHIRORO	645.8	41.1	1054	294.1
AREA 4 – BENIN	960	755.7	1892.7	520.4
AREA 5 - KADUNA	0.0	0.0	0.0	0.0
AREA 6 - BAUCHI	0.0	0.0	0.0	0.0
AREA 7 - ENUGU	238.8	105.9	238.8	165.4
AREA 8 – PT HARCO	859.0	426.3	3053.7	824.2
TOTAL	**4571.1**	**2454.8**	**8560.1**	**3512.0**

Reactive power capability of generators has increased from 4571 MVAr in 4.5 GW network to 8560 MVAr in 10 GW network. Consequently, reactive power generation has increased from 2455 MVAr to 3512 MVAr. This is an increment of 1058 MVAr in reactive power generation. However, the increment in reactive power supplied by generators (1058 MVAr) does not meet the increment in load reactive power demand (3476 MVAr) even though the reactive power demand is within generator reactive power capability. This is because; reactive power cannot be transferred over a long distance from the location of generators to load centers while maintaining acceptable voltage profile (or voltage gradient) across the network.

Shunt reactive power support

[3] A transmission line loaded below its surge impedance loading supplies reactive power to the power system.
[4] Note that the reactive power capabilities for most generator units were unavailable and appropriate assumptions were made considering typical values.

Table 10 tabulates a summary of existing shunt reactors and capacitors.

Table 10 - Reactive power supplied by existing fixed shunts (by area)

Area	4.5 GW Network				10 GW Network			
	Capacitors (MVAr)		Reactors (MVAr)		Capacitors (MVAr)		Reactors (MVAr)	
	In Service	Out of Service	In Service	Out of Service	In Service	Out of Service	In Service	Out of Service
AREA 1 - LAGOS	0	144	0	125	144	0	0	125
AREA 2 - OSOGBO	0	20	0	85	0	20	0	85
AREA 3 – SHIRORO	50	40	0	315	40	50	0	325
AREA 4 – BENIN	0	0	0	75	0	0	0	75
AREA 5 - KADUNA	0	20	0	350	0	20	0	340
AREA 6 - BAUCHI	0	0	200	75	0	0	0	275
AREA 7 - ENUGU	0	0	0	100	0	0	0	100
AREA 8 – PT HARCO	0	0	0	85	0	0	0	85
TOTAL	**50**	**224**	**200**	**1210**	**184**	**90**	**0**	**1410**

The total amount of existing shunt capacitance and shunt reactance is 274 MVAr and 1410 MVAr, respectively. Both capacitors and reactors are used in 4.5 GW network. No reactors are used in 10 GW network and 184 MVAr worth capacitors are in service while 90 MVAr worth capacitors are out of service. These out of service capacitors were not required for the scenarios studied. These capacitors may be redundant at current locations under peak load conditions. Thus, it is suggested to further study the requirement of these capacitors at current locations and move them if necessary.

Fixed shunts planned by TCN as part of network expansion are summarized in Table 11. A total of 874 MVAr capacitors are planned. No reactors are planned for the 10 GW network. Total of 640 MVAr capacitive shunt devices are in service whereas 234 MVAr shunts are out of service in the 10 GW base case. These capacitors are not needed for the base case conditions with peak load. However, most of these out of service capacitive shunts are utilized in the transfer cases analysed in section 7 under the transfer study.

Table 11 – Reactive power supplied by the TCN planned fixed shunts (by area)

Area	10 GW NETWORK			
	CAPACITORS (MVAr)		REACTORS (MVAr)	
	IN SERVICE	OUT SERVICE	IN SERVICE	OUT SERVICE
AREA 1 – LAGOS	260	44	0	0
AREA 2 – OSOGBO	110	10	0	0
AREA 3 – SHIRORO	110	0	0	0
AREA 4 – BENIN	60	20	0	0
AREA 5 – KADUNA	100	80	0	0
AREA 6 – BAUCHI	0	0	0	0
AREA 7 – ENUGU	0	60	0	0
AREA 8 – PT HARCO	0	20	0	0
TOTAL	**640**	**234**	**0**	**0**

In addition to fixed shunts tabulated above, there is one switched shunt planned by TCN. This is to be installed at Gombe_3 (63000). It has capability of delivering maximum of 115 MVAr and absorbing of 168 MVAr of reactive power.

Table 12 summarizes the high impact fixed shunts incorporated into 10 GW model.

Table 12 – High impact shunts incorporated into the model

Area	10 GW NETWORK			
	CAPACITORS (MVAr)		REACTORS (MVAr)	
	IN SERVICE	OUT OF SERVICE	IN SERVICE	OUT OF SERVICE
AREA 1 - LAGOS	690	0	0	0
AREA 2 - OSOGBO	200	0	0	0
AREA 3 – SHIRORO	290	0	35	0
AREA 4 – BENIN	190	0	0	0
AREA 5 - KADUNA	474	0	0	0
AREA 6 - BAUCHI	98	0	10	0
AREA 7 - ENUGU	110	0	0	0
AREA 8 – PT HARCO	100	0	0	0
TOTAL	**2152**	**0**	**45**	**0**

All shunt devices which were proposed as high impacts shunts are mechanically switched devices or fixed shunts. Most of these fixed shunts were incorporated to eliminate system intact voltage violations in the 10 GW model, while only 135 MVAr worth capacitors were introduced to reduce the large number of violations under N-1 conditions. There were a few instances where reactors[5] were required to suppress the over-voltages in areas with lightly loaded 330 kV transmission lines[6].

Note that fixed shunts tabulated in Table 12 are also part of the proposed solution. A complete set of reactive power devices required to achieve N-1 compliance for 10 GW base case will be presented at the end of section 6.3.

Note: Overall power factor of the load (or distribution feeders) seen by the transmission network is 0.87. Typically, overall power factor at the transmission level is greater than 0.9. This is achieved by employing local reactive power compensation at low voltage levels. It is suggested to improve load power factor seen at transmission level by using local reactive power compensation which will reduce the amount of reactive power compensation required at the transmission level. Improving power factor at the transmission level will result in low system losses and reduced branch loading.

[5] This study does not identify the requirement of reactors to control over voltages except an isolated condition.

[6] These are new transmission lines corresponding to network expansions and existing reactors cannot be used to supress these overvoltages.

5.2.5. Network elements

A considerable amount of components are added to the system to expand the 4.5 GW model to the 10 GW model. Table 13 shows a comparison in the number of network elements used in the 4.5 GW model and the 10 GW model. Only existing and TCN-planned components are counted in this table, in addition high impact shunts are also incorporated into the 10 GW base case to mitigate voltage violations that have not been included in this table.

Table 13 – Other network elements

ELEMENT	4.5 GW NETWORK	10 GW NETWORK
BUSES	397	649
MACHINES	32	75
LINES	234	455
TRANSFORMERS	350	563
LOADS	132	238
FIXED SHUNTS	41	136
SWITCHED SHUNT	-	1

5.2.1. System Losses

Area-wise system losses are given in Table 14. It can be seen that the losses have been increased in all areas when moving from 4.5 GW network to 10 GW network. This is to be expected as the network has expanded.

Table 14 – Area-wise system losses	**Real Power Loss (MW)**	
	4.5 GW Network	**10 GW Network**
AREA 1 - LAGOS	41.3	86.7
AREA 2 - OSOGBO	17.4	55.9
AREA 3 – SHIRORO	50.3	102.4
AREA 4 – BENIN	57.1	74.4
AREA 5 - KADUNA	11.9	73.1
AREA 6 - BAUCHI	6.3	74.9
AREA 7 - ENUGU	5.6	85.9
AREA 8 – PT HARCO	25.5	93.1
TOTAL	**215.4**	**646.4**

5.3. AC Contingency Analysis

This section presents a comparison of steady state voltage violations, thermal overloads and diverged post-contingency networks between 4.5 GW and 10 GW models. Voltage violations and thermal overloads were observed according to TCN steady state criteria stated in section 4.

5.3.1. N-0 (system Intact) Violations

Voltage Violations

Table 15 provides the summary of system intact under-voltage violations appearing in the 4.5 GW network.

Table 15 – Summary of system intact under-voltage violations in 4.5 GW network

Level of Violation (pu)	No. of Voltage Violations	
	132 kV	330 kV
V<0.7	4	0
0.7<V<0.8	7	0
0.8<V<0.9	38	0
0.9<V<0.95	N/A	0

There are 49 under-voltage violations out of which 11 are severe violations below 0.8 pu. All of these voltage violations are in the 132 kV network. The worst under-voltage violation is 0.48 pu at Sokoto 1 (32016). A detailed list of system intact under-voltage violations is presented in Table 39 presented in Appendix A.

Table 16 provides the summary of system intact over-voltage violations in the 4.5 GW network.

Table 16 – Summary of system intact over-voltage violations in 4.5 GW network

Level of Violation (pu)	No. of Voltage Violations	
	132 kV	330 kV
1.098>V>1.05	N/A	14
V>1.098	0	0

Over-voltage violations appear only in the 330 kV network. The model can be adjusted to eliminate some of these overvoltage violations at the expense of severe under-voltage violations in 132 kV network at system intact and N-1 contingency conditions. A detailed list of system intact over-voltage violations is given in Table 39 presented in the Appendix A

No voltage violations were observed for 10 GW model under system intact condition. This is a result of an improved transmission network, increased distribution of generation, new shunts planned by TCN and also incorporation of high impact shunts into the 10 GW model.

Thermal Overloads

Table 17 shows the summary of transmission line overloads under the system intact conditions.

Table 17 – Summary of System intact transmission line thermal overloads in 4.5 GW and 10 GW networks

Level of Thermal Overload	No. of Thermal Overloads	
	4.5 GW Network	10 GW Network

	132 kV	330 kV	132 kV	330 kV
100% of Rate A<Loading <110% of Rate A	11	0	5	0
110% of Rate A<Loading <150% of Rate A	6	0	6	0
Loading >150% of Rate A	1	0	6	0

Thermal overloads are present only in 132 kV network for both models. Some of these line overloads in 4.5 GW network are not present in the 10 GW network due to the newly added lines which make parallel paths. However, some new overloads which are absent in the 4.5 GW model are present in the 10 GW model. This is due to increased system loading which requires line upgrades (i.e. Kano 1-52001 to Dan Agundi 1-52007, Kano 1-52001 to Walalambe 1-52019) to increase thermal ratings. A complete list of system intact line overloads are provided (in Appendix A) in Table 40.

Table 18 is a summary of system intact transformer overloads.

Table 18 – Summary of System intact transformer thermal overloads in 4.5 GW and 10 GW networks

Level of Thermal Overload	No. of Thermal Overloads			
	4.5 GW Network		10 GW Network	
	132 kV	330 kV	132 kV	330 kV
100% of Rate A<Loading <110% of Rate A	0	2	2	1
110% of Rate A<Loading <150% of Rate A	2	2	4	5
Loading >150% of Rate A	8	1	17	0

A complete list of system intact transformer overloads are provided in Table 41 (in Appendix A) In the appendix, some transformers are marked as having 'Suspicious Ratings'. Some of these transformers are three winding transformers and ratings of individual windings appear to be abnormal and are required to be validated. Thus, thermal overloads seen in these transformers may be due to the improper rating assumed rather than an actual overload. These items are relative easy for TCN to verify and the list of thermal overloads should be updated accordingly.

5.3.2. N-1 (post contingency) Violations

Non-converged contingencies

Complete lists of N-1 contingencies studied in AC contingency analysis are tabulated in Appendix B.

Table 19 lists all of the non-converged contingencies appearing **only** in the 4.5 GW network. These contingencies do not cause non-converged network solutions in the 10 GW network due to the TCN planned and high impact shunts incorporated into 10 GW model. These non-converging cases indicate inadequate voltage support in the system.

Some of the main upgrades that have helped in the above cases are

- The planned transformer/ line additions near Benin 1 (42004),
- Area 6-7 connection (Jos 3 – 63001 to Makurdi 3 - 73003) along with the planned switched shunt at Gombe 3 (63000)
- The new 330 kV network from BKebbi 3 (33002) until Kaduna 3 (53000).

*Table 19 – Non-converged contingencies appear **only** in 4.5 GW network*

From		To		Rating	4.5 GW Network
Name	Number	Name	Number		
Katampe	32002	Apo	32006	132 kV	NC
Jebba	33003	Shiroro	33020	330 kV	NC
Delta	42003	Benin	42004	132 kV	NC
Delta	42003	Amukpe	42015	132 kV	NC
Delta	42003	Delta	45001	132/33 kV	NC
Kaduna	53000	Jos	63001	330 kV	NC
Gombe	62000	T-Junction	62013	132 kV	NC
Savannah	62012	T-Junction	62013	132 kV	NC
Gombe	63000	Jos	63001	330 kV	NC
Afam	82000	Rivers IPP	82014	132 KV	NC
Katampe	33001	Katampe	32002	330/132/33 kV	NC
Benin	43002	Benin	42004	330/132/33kV	NC
Jos	63001	Jos	62001	330/132/33 kV	NC
Afam	83000	Afam	82000	330/132/33 kV	NC

The lists of non-converged contingencies of the 10 GW network are given in Table 43 and 43 (in Appendix A).

Voltage violations

Table 20 provides a summary of the under-voltage violations appearing only in the 4.5 GW network.

Table 20 – Summary of post contingency (N-1) under-voltage violations appear only in 4.5 GW network

Level of Violation	No. of Voltage Violations	
	132 kV	330 kV
V>0.7pu	18	1
0.7pu>V>0.85pu	39	0
0.85pu>V>0.9pu	N/A	0

All the under-voltage violations except one occurred in the 132 kV network. The worst under-voltage of 0.35 pu occurred at Abakaliki 1 (72016) following the loss of 330 kV line connecting Nhaven 3 (73000) and Onitsha 3 (73001).The complete list of N-1 under-voltage violations are provided in the Appendix-A in Table 44.

N-1 under-voltage violations that appear in both 4.5 GW and 10 GW networks are given in

Table 21. All of these violations are due to the loss of the 330kV/132 kV/33 kV transformer connecting Osogbo 3 (23001) to Osogbo 1 (22001).

Table 21 – Post contingency (N-1) under-voltage violations appear in both 4.5 GW and 10 GW network

Bus			Contingency					4.5 GW Network	10 GW Network
			From		To		Rating (kV)		
Number	Name	Voltage Level	Name	Number	Name	Number			
22004	ADO EKITI 1	132 kV	OSOGBO 3	23001	OSOGBO 1	22001	330/132/33	**0.66**	**0.47**
22005	AKURE 1	132 kV						**0.68**	**0.48**
22016	ONDO1 1	132 kV						**0.75**	**0.62**
22017	ONDO2 1	132 kV						**0.80**	**0.67**
22007	IFE 1	132 kV						**0.84**	**0.76**
22009	ILESHA 1	132 kV						**0.85**	**0.76**

N-1 under-voltage violations appearing **only** in the 10 GW network are given in Table 22.

Table 22 – Post contingency (N-1) under-voltage violations appear only in 10 GW network

Bus			Contingency					10 GW Network
			From		To		Rating (kV)	
Number	Name	Voltage Level	Name	Number	Name	Number		
222009	ILESHA TEE1	132 kV	OSOGBO 3	23001	OSOGBO 1	22001	330/132/33	**0.79**
22015	OMUARAN 1	132 kV						**0.83**
32004	KUBWA	132 kV	KATAMPE 1	32002	KUBWA	32004	132	**0.60**
32017	SULEJA 1	132 kV						**0.78**
32007	BIDA 1	132 kV						**0.79**
32015	MINNA 1	132 kV						**0.84**
72010	AYANGBA 1	132 kV	NHAVEN 1	72002	9TH MILE 1	72006	132	**0.53**
72013	NSUKKA 1	132 kV						**0.54**
72006	9TH MILE 1	132 kV						**0.54**
72010	AYANGBA 1	132 kV	9TH MILE 1	72006	NSUKKA 1	72013	132	**0.51**
72013	NSUKKA 1	132 kV						**0.52**

The list of N-1 over-voltages appearing in the 4.5 GW network is shown in Table 23. There are no N-1 over-voltage violations in 10 GW network.

Table 23 – Post contingency (N-1) over-voltage violations appear only in 4.5 GW network

Bus			Contingency					4.5 GW Network
			From		To		Rating (kV)	
Number	Name	Voltage Level	Name	Number	Name	Number		
32003	BKEBBI 1	132 kV	BKEBBI 1	32003	SOKOTO 1	32016	132	**1.16**
33002	BKEBBI 3	330 kV						**1.16**
62012	SAVANNAH 1	132 kV	APO 1	32006	KARU 1	32011	132	**1.15**
63001	JOS 3	330 kV						**1.13**
53001	KANO 3	330 kV						**1.11**
63000	GOMBE 3	330 kV						**1.11**

Voltage at BKebbi 132 kV and 330 kV buses elevate following the loss of 132 kV transmission line between BKEBBI 1 (32003) and SOKOTO 1 (32016). This is due to the excess reactive power which was previously consumed by the load (43 MVAr) at Sokoto. The loss of 132 kV transmission line between APO 1 (32006) and KARU 1 (32011) yield excess reactive power of about 50 MVAr, which was previously consumed by the radial network in Karu region. This is the reason for the over voltage seen at 132 kV bus at Savanna and 330 kV buses Jos, Kano and Gombe. At Savanna, the system intact voltage is marginally below the over voltage limit while voltages the other three buses exceed the system intact over voltage limit.

Thermal overloads

Table 24 presents a summary of the line overloads appearing in both the 4.5 GW and 10 GW networks.

Table 24 – Summary of post contingency (N-1) transmission line thermal overloads in 4.5 GW network and 10 GW network

Level of Thermal Overload	No. of Thermal Overloads			
	4.5 GW Network		10 GW Network	
	132 kV	330 kV	132 kV	330 kV
100% of Rate B<Loading <110% of Rate B	5	0	9	0
110% of Rate B<Loading <150% of Rate B	12	1	17	0
Loading >150% of Rate B	12	0	21	0

The 10 GW network does not contain any 330 kV N-1 line overloads while 4.5 GW network contains one such overload. Some of the line overloads in the 4.5 GW model are not present in the 10 GW model due to the planned line upgrades. However, some overloads have become worse due to increased load. These loads and line ratings must be verified before recommending/considering any line additions or upgrades.

A complete list of N-1 transmission line overloads can be found in Table 46 (in Appendix A). A summary of N-1 transformer overloads in both 4.5 GW and 10 GW networks is given in Table 25.

Table 25 – Summary of post contingency (N-1) transformer thermal overloads in 4.5 GW network and 10 GW network

Level of Thermal Overload	No. of Thermal Overloads			
	4.5 GW Network		10 GW Network	
	132 kV	330 kV	132 kV	330 kV
100% of Rate B<Loading <110% of Rate B	0	1	1	1
110% of Rate B<Loading <150% of Rate B	4	4	3	7
Loading >150% of Rate B	11	3	15	4

Similar to the system intact situation, most of the overloads may be due to the inaccuracies in transformer MVA ratings. A complete list of N-1 transformer overloads is provided in Appendix A, Table 47.

5.4. Shunt reactive power devices required to achieve N-1 compliance to 10 GW base case

Section 5.3 (AC contingency analysis) presented steady state voltage violations and thermal overloads observed for 4.5 GW and 10 GW base models under system intact and N-1 post contingency conditions. These violations were observed after improvements made by incorporating shunt reactive power devices listed in Table 12. Thus, more mitigation system upgrades in addition to shunts listed in Table 12 are required to achieve N-1 compliance for the TCN system. Additional upgrades required for the 10 GW base cases will be discussed in section 7 with upgrades identified in transfer studies.

6. Transfer Facility Study to Identify Upgrades Required to Re-dispatch Power between Hydro Units and Thermal Units

Performing transfer studies for a system that is undergoing wide expansion and developments, such as the TCN system, is essential to identify constrained interfaces (or flow gates) and hence transfer limits for those constrained interfaces. Typically, transfer scenarios are developed based on actual events where generation is required to be shifted from one area to another. Constrained interfaces and transfer limits for a given scenario depend on the network resources. For this reason, transfer limits for the TCN system may be estimated once the system model is finalized. However, a transfer facility study which identifies system upgrades is very useful for TCN system planners.

Expanded TCN system will have many possible transfer scenarios. Out of these, re-dispatching generation from hydro units to thermal units in dry seasons and re-dispatching thermal units to hydro units in wet seasons is a transfer scenario with paramount importance. This is important since hydro generation in Shiroro area may vary from 1.5 GW in wet season to 150 MW in dry season. The Objective of the studies presented in this section is to identify network facilities required to re-dispatch power between hydro units and thermal units.

The 10 GW base case has been developed assuming all the installed hydro generators are available in full capacity. Thus, the base model represents the wet season. Under this powerflow study, network limitations when hydro generation is re-dispatched to thermal generation are studied and when problems are encountered, mitigation measures are proposed. If mitigation measures required are beyond system adjustments, then suitable system reinforcements are suggested. In this study, it was assumed that the load is at its peak of 10 GW during both the dry and wet seasons as load information during dry and wet seasons were unavailable.

6.1. Development of transfer cases

TCN provided three generation scenarios to create transfer cases to reflect generation dispatch during the dry season. Thus, three transfer cases were derived from 10 GW base case by reducing the hydro generation and increasing thermal generation based on a priority list provided by TCN. Dispatch of hydro generation at each plant corresponding to the three transfer cases is tabulated in Table 25.

Table 26 Generation at Hydro plants for dispatch cases

	Shiroro (MW)	Jebba (MW)	Kanji (MW)	Total Hydro (MW)
Total installed capacity	600	590	760	1950
Base Case	600	460	460	1520
Dispatch 1 (DP1)	**300**	**186**	**220**	**706**
Dispatch 2 (DP2)	**150**	**186**	**70**	**406**
Dispatch 3 (DP3)	**0**	**93**	**70**	**163**

Table 27 tabulates the generation at thermal plants where the generation is increased to compensate for diminishing hydro generation.

Table 27 Addition thermal generation added to compensate the deficiency from Hydro plants

Plant	Base Case	Dispatch 1 (DP1)	Dispatch 2 (DP2)	Dispatch 3 (DP3)
Omotoso (MW)	294	294	294	336
Geregu (MW)	0	300	400	414
Azura (MW)	0	0	100	300
Geometrix_ab (MW)	540	540	728	728
Notore (MW)	0	525	525	525

Three dispatches (transfer cases) were created sequentially, that is, dispatch 1 (DP1) was created from the base case by gradually lowering hydro generation while increasing thermal generation. Similarly, dispatch 2 (DP2) and dispatch 3 (DP3) transfer cases were made.

In the process of transitioning from one dispatch to the next by gradually decreasing hydro generation and increasing thermal generation, it reached a point where voltage depression (around Makurdi, Katampe, Jos areas[7]) cannot be mitigated without additional reactive power support. Thus, reactive power support was added to facilitate re-dispatch at a transition point which is in between two dispatch scenarios. Additional reactive power support added to each dispatch case along with reactive power support already added in base case development is tabulated in Table 28.

[7] These under voltage violations were observed in the corridor between hydro and thermal generators where the power transfer was increased as a result of the changes in generation dispatch.

Table 28 Addition reactive power requirement

Bus Name	Base Case Capacitors (MVAr)	Additional Capacitors (MVAr)		
		DP1	DP2	DP3
73003 MAKURDI_3	-	100	100+50	100+50+50
73004 ALIADE_3	-	0	0+70	0+70+0
22007 IFE 1	20	10	10+10	10+10+0
33001 KATAMPE 3	100	60	60+50	60+50+40
63001 JOS 3	-	0	0+50	0+50+220
22001 OSOGBO 1	-	0	0+0	0+0+10
Total	**120**	**170**	**170+230**	**170+230+320=720**

As shown in Table 28, a total of 720 MVAr additional reactive power support is required to support transfer cases. Please refer appendix C for QV curves and more details about the selection of additional reactive power requirement tabulated in Table 28.

Table 29 tabulates the hydro generation at each transition point (case) where additional reactive power support tabulated in Table 28 were added.

Table 29 Generation at Hydro plants for transition cases

	Shiroro (MW)	Jebba (MW)	Kanji (MW)	Total Hydro (MW)
Transition case 1 (Int_DP1)	300	186	220	706
Transition case 2 (Int_DP2)	210	186	70	466
Transition case 3 (Int_DP3)	70	186	70	326

6.2. Transfer Study

Voltage violations and thermal overloads were observed according to TCN steady state criteria stated in section 4.

6.2.1. N-0 (System intact) violations

N-0 voltage violation

With the proposed reactive power compensation for the base case (section 6) and the reactive power compensation for the dispatch cases given in Table 28; there are no voltage violations for the system intact situation of the base case or any of the dispatch cases.

N-0 thermal overload

Tables containing thermal overloads observed in the system intact situation for the base case and all dispatch cases can be found in Appendix A. Table 48 tabulates all line overloads, and Table 49 tabulates all three winding transformer overloads. All lines and transformers loaded between 90% and 100% are also included in these tables due to the uncertainty of the parameters and the locations of reactive power devices.

Transmission line overloads (Table 48) show that area 1 has the most overloaded lines for the base case and all dispatch cases. As mentioned before many of three winding transformers have not yet been properly rated in terms of their MVA due to lack of required information. These values should be updated and the loading should be compared with the actual rating. These units have been marked with the 'Rating Suspicious' note.

6.2.1. N-1 (post contingency) Violations

This section outlines issues observed when performing N-1 contingencies and suggests solutions to mitigate the problems.

Non-convergent post contingency network condition

Table 29 tabulates the non-converged cases observed when running the N-1 contingencies. There are nearly 90 contingencies excluded from this table as they only cause problems for dispatch 3 and all can be solved by adding variable (dynamic) compensation at Katampe 3 (33001).

Table 30 Non-converged (NC) contingencies

Contingency				Voltage Rating	Status			
FROM		TO						
Name	Num.	Name	Num.		Base Case	DP1	DP2	DP3
Katampe	33001	Shiroro	33020	330 kV	NC	NC	NC	NC
Katampe	33001	Gwagwalada	35036	330 kV	NC	NC	NC	NC
BKebbi	33002	Kainji	33005	330 kV	NC	NC	NC	NC
Shiroro	33020	Kaduna	53000	330 kV	NC	NC	NC	NC
Gwagwalada	35036	Lokoja	43008	330 kV	NC	NC	NC	NC
Gwagwalada	35036	Obajana	43009	330 kV	NC	NC	NC	NC
Ajaokuta	42000	Okene	42009	132 kV	NC	NC	NC	NC
Delta	42003	Effurun	42014	132 kV	NC	NC	NC	NC
Benin	42004	Irrua	42008	132 kV	NC	NC	NC	NC
Benin	42004	Amukpe	42015	132 kV	NC	NC	NC	NC
Effurun	42014	Effurun	85002	132-33 kV	NC	NC	NC	NC
Kaduna	53000	Kano	53001	330 kV	NC	NC	NC	NC
Gombe	62000	Bauchi	62008	132 kV	NC	NC	NC	NC
Jos	62001	Bauchi	62008	132 KV	NC	NC	NC	NC
Gombe	63000	Yola	63002	330 kV	NC	NC	NC	NC
Gombe	63000	Damaturu	63007	330 kV	NC	NC	NC	NC
Jos	63001	Makurdi	73003	330 kV	NC	NC	NC	NC
Maiduguri	63005	Damaturu	63007	330 kV	NC	NC	NC	NC
Makurdi	72025	Aliade	82012	132 kV	NC	NC	NC	NC
Kano	53001	Kano	52001	330-132-33 kV	NC	NC	NC	NC
Makurdi	73003	Makurdi	72025	330-132-33 kV	NC	NC	NC	NC
Ganmo	23003	Jebba	33003	330 kV		NC	NC	NC
Ajaokuta	43000	Lokoja	43008	330 kV		NC	NC	NC
Ajaokuta	43000	Obajana	43009	330 kV		NC	NC	NC
Kaduna	53000	Gen Kaduna	153000	330-16 kV		NC	NC	NC
Ayede	22000	Ibadan	22006	132 kV			NC	NC
Ayede	22000	Ilesha Tee	222009	132 kV			NC	NC
Katampe	32002	Kubwa	32004	132 kV			NC	NC
Osogbo	23001	Osogbo	22001	330-132-33 kV			NC	NC
Arogbajo	13028	Osogbo	23001	330 kV			NC	NC
Ayede	23000	Osogbo	23001	330 kV			NC	NC
Osogbo	23001	Benin North	43006	330 kV			NC	NC
Shiroro	33020	Gwagwalada	35036	330 kV			NC	NC
Aliade	73004	Ugwuaji	73006	330 kV			NC	NC
Jebba	33004	Jebba Hydro	36006	330-16 kV			NC	NC
Arigbajo	13028	Ayede	23000	330 kV				NC
Osogbo	23001	Ganmo	23003	330 kV				NC

A full summary of all the necessary mitigations for non-convergent cases can be found in the Appendix-A, in Table 50.

N-1 voltage violation

Table 31 contains all voltage violations observed for all cases under N-1 contingencies. These limits are as per the TCN criteria.

Table 31 Voltage violation at N-1

Contingency				Rating (kV)	Bus	Voltage (pu)			
From		To				Base Case	DP1	DP2	DP3
Name	Num	Name	Num						
Osogbo	23001	Osogbo	22001 / 25022	330/132/33	22001 OSOGBO 1 132.00	0.85	0.83	NC	NC
Osogbo	23001	Osogbo	22001 / 25022	330/132/33	22004 ADO EKITI 1 132.00	0.47	0.44	NC	NC
Osogbo	23001	Osogbo	22001 / 25022	330/132/33	22005 AKURE 1 132.00	0.48	0.45	NC	NC
Osogbo	23001	Osogbo	22001 / 25022	330/132/33	22007 IFE 1 132.00	0.76	0.73	NC	NC
Osogbo	23001	Osogbo	22001 / 25022	330/132/33	22009 ILESHA 1 132.00	0.76	0.74	NC	NC
Osogbo	23001	Osogbo	22001 / 25022	330/132/33	22011 ISEYIN 1 132.00	0.85	0.85	NC	NC
Osogbo	23001	Osogbo	22001 / 25022	330/132/33	22013 OFFA 1 132.00	0.87	0.84	NC	NC
Osogbo	23001	Osogbo	22001 / 25022	330/132/33	22015 OMUARAN 1 132.00	0.83	0.80	NC	NC
Osogbo	23001	Osogbo	22001 / 25022	330/132/33	22016 ONDO1 1 132.00	0.62	0.59	NC	NC
Osogbo	23001	Osogbo	22001 / 25022	330/132/33	22017 ONDO2 1 132.00	0.67	0.64	NC	NC
Osogbo	23001	Osogbo	22001 / 25022	330/132/33	222009 ILESHA TEE1 132.00	0.79	0.77	NC	NC
Katampe	32002	Kubwa	32004	132	32004 KUBWA 132.00	0.60	0.59	NC	NC
Katampe	32002	Kubwa	32004	132	32007 BIDA 1 132.00	0.79	0.78	NC	NC
Katampe	32002	Kubwa	32004	123	32013 KONTAGORA 1 132.00	0.85	0.85	NC	NC
Katampe	32002	Kubwa	32004	132	32015 MINNA 1 132.00	0.84	0.83	NC	NC
Katampe	32002	Kubwa	32004	132	32017 SULEJA 1 132.00	0.78	0.78	NC	NC
Shiroro	33020	Gwagwalada	35036	330	32005 AKWANGA 1 132.00	-	0.84	NC	NC
Shiroro	33020	Gwagwalada	35036	330	32012 KEFFI 1 132.00	-	0.85	NC	NC
Delta	42003	Delta	45001	132/33	42003 DELTA 1 132.00	0.74	0.74	0.74	0.74
Delta	42003	Delta	45001	132/33	42014 EFFURUN 1 132.00	0.58	0.58	0.58	0.58
Okene	42009	Ukpilla	42010	132	42010 UKPILLA 1 132.00	-	0.85	0.85	0.85
Kano	52001	Dan Agundi	52007	132	63002 YOLA 3 330.00	-	-	-	1.10
Kano	52001	Dan Agundi	52007	132	63006 JALINGO 3 330	-	-	-	1.11
NHaven	72002	9th mile	72006	132	72006 9TH MILE 1 132.00	0.54	0.53	0.53	0.53
9th mile	72006	NSukka	72013	132	72010 AYANGBA 1 132.00	0.51	0.50	0.50	0.50
9th mile	72006	NSukka	72013	132	72013 NSUKKA 1 132.00	0.52	0.51	0.51	0.51

Most of the voltage violations shown in this table will be solved once the mitigations for the non-convergent cases have been implemented. It is found that with the addition of reactive power compensation at Osogbo, Katampe and Kano the majority of these violations will be resolved. A full list of proposed mitigation measures can be found in Appendix A, in Table 51.

N-1 thermal overload

Tables summarizing thermal overloads for N-1 contingencies are found in Table 52, Table 53 and Table 54, and presented in Appendix A. Similar to the system intact tables, only overloads of 90% or higher are included. These tables are separated into 3 sections, Table 52 tabulates transmission line overloads, Table 53 tabulates two winding transformer overloads and Table 54 tabulates three winding transformer overloads[8]. As the hydro generation is decreased in area 3, there are less overloaded transmission lines in area 3.

[8] Many three winding transformers have not yet been properly rated in terms of their MVA due to lack of required information. That value should be updated and the loading should be compared with the actual rating. These units have been marked with the 'Rating Suspicious' note.

6.2.2. Critical Interfaces

N-1 study for above dispatch cases reveals, there are four constrained interfaces in the 10 GW network.

1. Transmission interface across areas Osogbo, Benin and Enugu
2. Transmission interface across Kaduna and Kano
3. Kainji to Birnin Kebbi (BKebbi)
4. Katampe, Shiroro and Gwagwalada

Locations of these critical interfaces are shown in Figure 1.

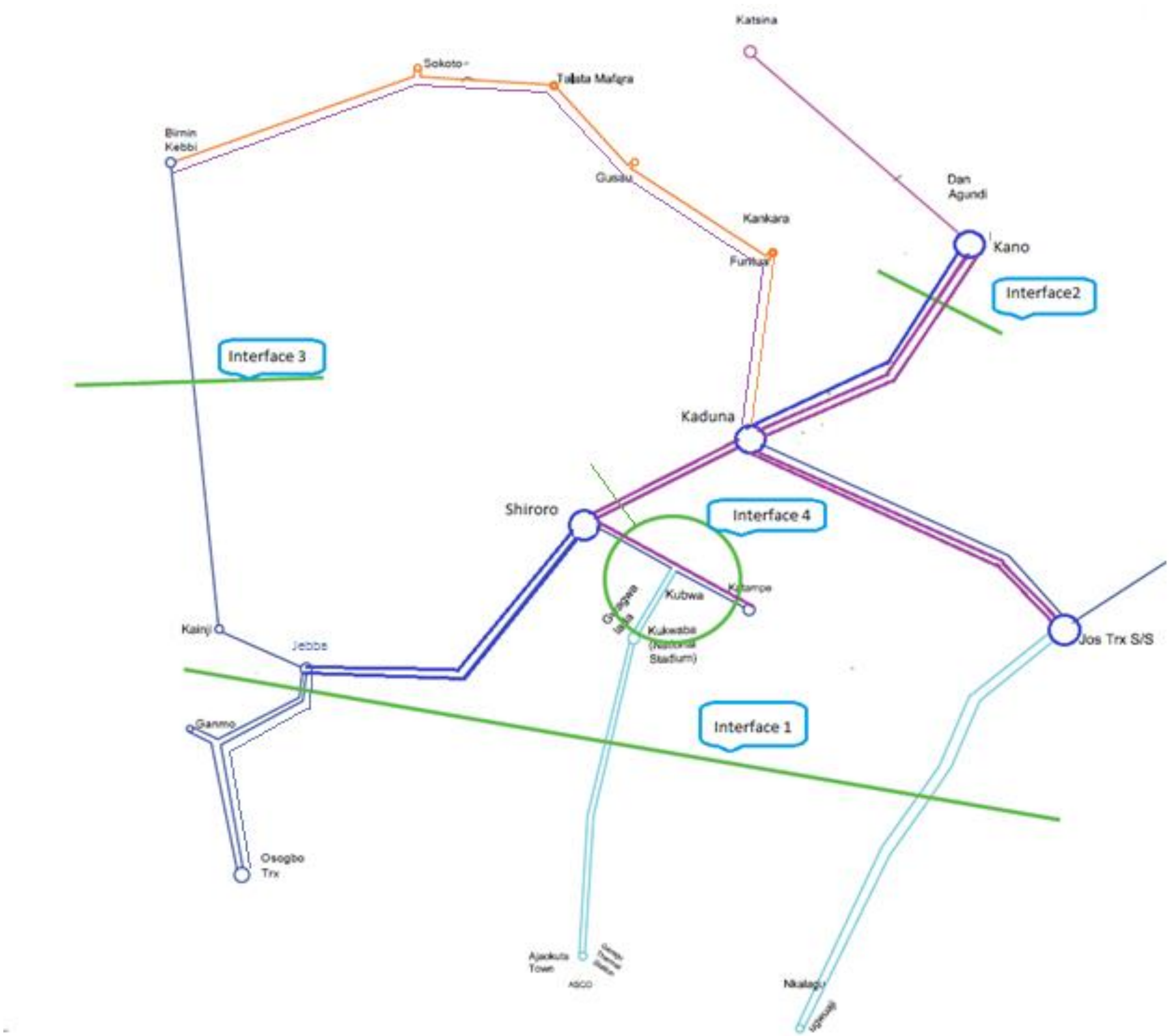


Figure 1 Critical interfaces in 10 GW network

Critical interface 1: Transmission interface across areas Osogbo, Benin and Enugu

There are four 330 kV single and double circuit lines making a power transfer interface across areas Osogbo, Benin and Enugu. This transmission interface connects areas Shiroro, Kaduna and Bauchi to the thermal generation heavy areas. In this multi-line interface, except Ganmo to Jebba 330 kV single line, all the other lines are double circuit 330 kV lines.

Table 32 lists the power transfer in each 330 kV line and the total power transfer across the interface for the 10 GW base case and the three dispatch cases.

Table 32 power transfer across constrained interface 1

Case	Power transfer (MW)				
	Ganmo to Jebba	Osogbo to Jebba	Ajaokuta to Gwagwalada	Makurdi to Jos	Total Interface Power Transfer
Base Case	-90	100	886	894	1790
Dispatch 1	45	337	1103	1047	2532
Dispatch 2	97	425	1216	1128	2866
Dispatch 3	140	490	1290	1180	3100
Increment from Base case to Dispatch 3	**230**	**390**	**404**	**286**	**1310**

The base case represents a generation dispatch with all hydro generators in Shiroro area at its maximum generation in the wet season. Dispatch 3 represents a dry season with hydro generation at its minimum. As a result of the change in hydro generation, power transfer across the interface increases from 1790 MW in the base case to 3100 MW in dispatch 3.

Double circuit transmission lines between Jos and Makurdi, and Ajaokuta to Gwagwalada are the most critical line in this interface. Loss of one circuit will cause the remaining circuit to be overloaded. This overloaded line exceeds[9] its surge impedance loading level and consequently severe voltage depression was observed at Jos and Makurdi for all dispatch scenarios.

In dispatch 2 and 3 as transfer increases the line loading exceed the surge impedance level even in system intact condition. As shown in Table 28, an additional 470 MVAr at Makurdi and Jos is required to maintain system intact

[9] A transmission line starts to absorb reactive power from the system when line loading exceeds its surge impedance loading. Amount of reactive power absorbed increases as the length of transmission line increases.

voltage within limits. Although additional reactive power support could help to mitigate adverse effects, the root cause of this problem is inadequate transmission across interface one. In particular, transmission network enhancements in the corridor between Ajaokuta to Gwagwalada and Makurdi to Jos 330 kV lines are recommended.

Critical interface 2: Transmission interface across Kaduna and Kano

In the 10 GW model, there are three 330 kV transmission lines connecting Kaduna and Kano, each carrying approximately 310 MW for all the dispatch cases. When expanding from the 4.5 GW model to the 10 GW model, load in area 5 (Kaduna) increases from 344 MW to 1056 MW, resulting in further system reinforcements to maintain system voltage levels. In base case, in order to maintain the system intact voltage at the Kano, an additional 202 MVAr of reactive power compensation was required. Out of this 202 MVAr, 93 MVAr is consumed by the load connected to the Kano (53001).

The 10 GW model has a double circuit connection between Gusau and Funtua. However, only a small fraction of the area 3 to area 5 transfers is supplied by this line. The area 3 to area 5 transfer is mainly facilitated by the double circuit lines between Shiroro and Kaduna.

The loss of one circuit between Kaduna and Kano increases the reactive power requirement at Kano due to over loading of other two lines beyond surge impedance level. Therefore a requirement of an additional reactive power at Kano is identified. The addition of a switch shunt will mitigate this issue and can be used to maintain voltage under other N-1 conditions. Otherwise reinforcement to this interface by additional transmission lines would also mitigate the problem with reactive power deficiencies.

Critical interface 3: Kainji to Birnin Kebbi (BKebbi)

In both the 4.5 GW and the 10 GW models, there is one 330 kV line connection between Kainji and Birnin Kebbi (BKebbi). In the 10 GW case, the loads at BKebbi, Sokoto, Talamafara and Gusau totals to about 350 MW. In the 10 GW base case the Kainji to BKebbi 330 kV line supplies 379 MW to BKebbi. Under the third dispatch case (DP3) situation, that transfer is reduced to 305 MW.

The existing connections between areas 3 and 5 (i.e. Gusau to Zaria) are not sufficient to supply the necessary power to serve the loads BKebbi, Sokoto, Tmafara and Gusau in the event that the connection between Kainji and BKebbi is lost. Without system reinforcement at Kainji and BKebbi, such as an additional transmission line between the two, loads at BKebbi, Sokoto, Tmafara and Gusau will have to be shed to maintain sufficient voltages at BKebbi and Sokoto regions.

Critical interface 4: Katampe Shiroro and Gwagwalada

In order to maintain the system intact voltage at 330 kV bus in Katampe when hydro generation is reduced, additional shunt reactive power compensation is required at Katampe.

In the 10 GW model, Shiroro and Katampe are connected by a double circuit line with one of the lines tapped at Gwagwalada, which has a double circuit connection to Ajaokuta. With only one of the lines between Shiroro and Katampe tapped, there is uneven loading in lines from Shiroro and Katampe. This results in one of the lines becoming overloaded and consuming excessive reactive power. This can be avoided by tapping both circuits at Gwagwalada.

Gwagwalada and Ajaokuta are connected by a double circuit line. Both of these lines will become increasingly loaded as the thermal generation in Geregu is increased. The loss of one of these lines will result in the other becoming heavily loaded to the point where it will exceed its surge impedance loading. This causes severe voltage depressions at Gwagwalada. To meet N-1 compliance, an additional line between Ajaoluta and Gwagwalada is required as explained under critical interface 1 above.

A similar situation can be observed for the double circuit line between Shiroro and Kaduna. It is possible to mitigate the problem with the addition of a 40% series compensation.

6.3. Proposed additional network additions and mitigation measure

Tables listed in this sub-section list all proposed shunt devices employed to solve voltage violation and non-convergence issues in the system model. This also includes high impact shunt devices that were initially incorporated into the 10 GW model.

A list of high impact shunt devices are tabulated in Table 33.

Table 33: Shunt reactive power devices incorporated in 10 GW base case

Bus		Amount (MVAr)
Name	Bus #	
Abeokuta Old	25002	10
Akoka	12016	50
Alausa	12018	75
Ikeja	12003	50
Ikorodu	15022	20
Ilupeju	16025	50

Itire	16032	20
Maryland	12031	60
Maryland	15017	40
Ogba	12032	50
Oke_Aro	12042	75
Old Abeokuta	12038	50
Otta	12033	50
Oworosoki	12034	50
Papalanto	12014	50
Akure	22005	70
Akure	25003	20
Ife	22007	20
Omuaran	25016	30
Ondo1	25017	10
Ondo2	22017	40
Akwanga	35000	20
Apo	32006	60
Bida	32007	40
Cemtral Area	32008	20
Gwagwalada	35036	50
Keffi	32012	25
Niamey	32021	25
Effurun	42014	55
Effurun	85002	50
Effurun	85002	50
Irrua	45002	30
Ukpilla	42010	10
Dakata	55000	70
Dan Agundi	55001	85
Dutse	52009	45
Dutse	55002	10
Hadejia	52022	34
Kankia	52005	30
Kankia	55008	15
Kano	52001	50
Kano	52001	50
Kano	53001	50
Kano (Switched shunt)	53001	35
Bauchi	62008	83
Bauchi	65003	15
Abakaliki	72016	50

Yandev	72019	60
Delta	42003	95
Katampe	33001	50
Total Capacitive Compensation		**2152**
Tmafara	33007	-35
Jalingo	63006	-10
Total Inductive Compensation		**-45**

Table 33 tabulates the total amount of reactive power added to remove voltage violations when re-dispatching the generation for the dispatch cases

Table 34 Proposed additional shunt compensation to facilitate re-dispatch between hydro and thermal units

Bus		Amount (MVAr)
Name	**Bus #**	
Makurdi	73003	200
Aliade	73004	70
Ife	22007	20
Katampe	33001	150
Jos	63001	270
Osogbo	22001	10
Total Capacitive Compensation		**720**

Table 35 through Table 38 tabulate all of the system reinforcements except high impact shunts proposed to mitigate either N-1 non-convergent cases or N-1 voltage violations for the base case and all dispatch cases. The full list of non-convergent cases, voltage violations and their mitigations can be found in Appendix A in Table 50 and Table 51.

Table 35 Additional shunts devices for N-1 compliance

Type	Bus		Amount (MVAr)
	Name	Bus #	
Switched	Osogbo	22001	60
Switched	Katampe	33001	100
Switched	Kano	53001	200
Total switching shunts			**360**
Fixed	Nsukka	75010	5
Fixed	Apo	32006	20
Fixed	Biu	62009	15
Fixed	Damboa	62019	20
Fixed	Awka	72009	30
Total fixed shunts			**90**

Table 36 Additional Lines and Transformers for N-1 compliance

Type	From		To		Rating
	Name	Bus #	Name	Bus #	
Line	BKebbi	33002	Kainji G.S.	33005	330 kV
Line	Katampe	33001	Kaduna	53000	330 kV
Line	Ajaokuta	42000	Ukpilla	42010	132 kV
Line	Delta	42003	Effurun	42014	132 kV
Line	Delta	42003	Effurun	42014	132 kV
Line	Gombe	63000	Yola	63002	330 kV
Line	Gombe	63000	Damaturu	63007	330 kV
Line	Maiduguri	63005	Damaturu	63007	330 kV
Transformer	Aliade	73004	Aliade	82012	330/132 kV
Transformer	Kano	53001	Kano	52001	330/132/33 kV

Table 37 Tapping of the lines for N-1 compliance

From		To		New connection	
Name	**Bus #**	**Name**	**Bus #**	**Name**	**Bus #**
Katampe	33001	Shiroro	33020	Gwagwalada	35036
Delta	42003	Benin	42004	Amukpe	42015
Gombe	63000	Jos	63001	Bauchi*	62008
Katampe	32002	Suleja	32017	Kubwa	32004

* Requires a step-down transformer to tap a 330 kV line at Bauchi

Table 38 line compensation for N-1 compliance

From		To		Amount
Name	**Bus #**	**Name**	**Bus #**	
Shiroro	33020	Kaduna	53000	%40 compensation

These proposed components do not represent the definitive solutions to the non-convergent cases and voltage violations; they simply represent one possible solution. These are not arbitrarily selected, but they represent a single possible solution found based on 10 GW system model. They may not necessarily be the optimal solution for the final 10 GW TCN system considering various load/generation conditions.

7. Preliminary Assessment to Identify the Key Projects and prioritize them in the System Expansion from 4.5 GW to 10 GW

In this study, an investigation was carried out to identify system expansion projects which should be prioritized to minimize the system issues and improve system reliability during the transition from the 4.5 GW capacity network to the 10.0 GW capacity network. This was accomplished by studying PSS/E models developed for 4.5 GW network and 10.0 GW network under system intact conditions and (N-1) contingency conditions. The significance of any project to be prioritized over the others was determined by considering the following aspects.

- Any expansion project which significantly contributes to reduce the existing thermal overloads and voltage violations in a particular area in 4.5 GW network.

- Any expansion project which relieves thermal overloads and voltage violations in the 10 GW network.

- Any expansion project which increases the system reliability in 10 GW network.

Projects satisfying the above criteria are considered as an important project to be prioritized in the network expansion process.

The investigation to identify key projects was carried out considering their impact on individual areas as well as the system-wide impact. Hence the prioritized projects can be separated to two categories.

1. The projects which contribute to improve the local network in a particular area
   - These projects are mainly 132 kV level system improvements including new 132 kV transmission lines and 330/132 kV transformers. The 330 kV level system projects also contribute towards the improvements in local areas.

2. The projects which contribute to system-wide improvements
   - These projects are 330 kV level system improvements and are mainly new 330 kV transmission lines

The following section provides a detailed investigation to identify the thermal and voltage issues in individual areas and the projects which should be given priority to mitigate them. Additionally, the critical projects which contribute to system-wide improvements are also discussed.

7.1. Area-wise high impact projects

Area 1

Certain 132 kV buses in area 1 such as Otta1 (12033), Papalanto1 (12014) and Old Abeokuta (12038) show a low voltage profile in the 4.5 GW case. The 132 kV network in this area is a radial network and therefore the buses which are far away from the 330 kV bus have low voltage issues. Any load increment in this area will escalate the under-voltage problem. The following two projects convert the radial network near Papalanto and Abeokuta regions to a ring network. This results in significantly improved voltage profile in the area.

a) 132 kV double circuit line connecting Old Abeokuta (12038), New Abeokuta (12039) and Oloronsogo1 (12043)
b) Two transformers (330 kV/132 kV) between Oloronsogo3 (13005) and Oloronsogo1 (12043)

Additionally, the following two projects are important to improve the voltage in Area 1; mainly the voltage depression seen in the 132 kV network in Alagbon region buses Alagobon1 (12017), Akoka1 (12016) and Akangba1 (12001).

c) 330 kV double circuit lines between Aja3 (13000) and Alagbon3 (13027)
d) Three transformers (330 kV/132 kV/33 kV) between Alagbon3 (13027) and Alagbon1 (12017)

Area 2

In area 2, no specific projects were identified to be prioritized over others in the system expansion. However, the following two projects are suggested as important projects in accommodating the increased load in Akure1 (22005), Ondo2 (22017) and Ilesha (22009) even though these two projects are not planned by TCN.

a) 132 kV single circuit line between Osogbo1 (22001) and Akure1 (22005)
b) 132 kV single circuit line between Osogbo1 (22001) and Ilesha Tee1 (222009)

Hence, the above two projects are recommended to be considered in the future system development planning process for this area.

Area 3

A low voltage profile was observed in number of buses in the 132 kV transmission network preventing further loading at those buses. Several projects are needed to be prioritized in the implementation process to avoid serious voltage and thermal violations in the area.

The following project significantly improves the existing 132 kV voltage profile in the Katampe region including the buses Katampe 1 (32002), Apo 1 (32006), Kubwa 1 (32004 and Karu 1 (32011).

a) Three transformers (330 kV/132 kV/ 33kV) between Katampe 3 (33001) and Katampe 1 (32002)

Additionally, the severe under-voltage issues observed at Sokoto 1 (32016) and Tmafara 1 (32018) buses can be mitigated by implementing the following project. Note that this is a part of a series of 330 kV transmission line expansion projects. This expansion also has a system-wide impact and will be discussed in detail in the section7.2.

a) 330 kV double circuit line through BKebbi 3 (33002), Sokoto 3 (35009) and Tmafara 3 (33007)

Note: The new transmission line in the above project does not deliver a considerable amount of power, but gives voltage support to the area.

The following projects are considered to be important from a system reliability point of view, since they provide an alternative path for the power flow to areas 3 and 5. These expansions also have a system-wide impact and will be discussed in detail in the section7.2.

a) 330 kV double circuit line through Ajaokuta 3 (43000), Lokoja 3 (43008) and Objana 3 (43009)
b) 330 kV double circuit line through Gwagwalada 3 (35036) Lokoja 3 (43008) and Objana 3 (43009)
c) 330 kV single circuit line between Gwagwalada 3 (35036) and Katampe 3 (33001)
d) 330 kV single circuit line between Gwagwalada 3 (35036) and Shiroro 3 (33020)

Area 4

A severe voltage depression was observed in the 132 kV buses Benin 1 (42004), Delta 1 (42003), Irrua 1 (42008), Ukpilla 1 (42010) and Effurun 1 (42014) in area 4. The low voltage profile at the Benin 1 (42004) bus is the main reason for the above voltage issue. The voltage of this bus can be reinforced by implementing the following projects. Subsequently, the voltage of the surrounding buses will also be improved.

a) Three transformers (330 kV/132 kV/ 33kV) between Benin 3 (43002) and Benin 1 (42004)

b) Additional three circuits of the 132 kV line between Benin 1 (42004) and Delta 1 (42003)

Area 5

Area 5 has a lightly loaded 330 kV and 132 kV transmission network in the 4.5 GW load case and hence the voltage profile in the area is healthy. However, the following project is identified as critical and should be prioritized to cater the load growth in this area.

a) 330 kV double circuit line between Kaduna 3 (53000) and Kano 3 (53001)

Additionally, the load growth in Katsina region should be supported by the following projects.

a) 330 kV double circuit line between Kano 3 (53001) and katsina 3 (53002)
b) Two transformers (330 kV/132 kV/ 33kV) between Katsina 3 (53002) and Katsina 1 (52012)

The low voltage profile in Funtua 1 (52016) and Zaria 1 (52015) can be supported by the following project in the event of load growth in this area. This project also has system-wide impacts.

a) 330 kV double circuit line through Kaduna (53000), Zaria 3 (53003) Funtua 3 (53004)

Area 6

Similar to area 5, this area also has lightly loaded 330 kV and 132 kV transmission network in the 4.5 GW load case and hence the voltage profile in the area is healthy. However, the load growth in this area requires several projects to be implemented with priority.

The following two projects are identified as critical projects to cater the load growth in the area as well as to improve the power supply reliability. These projects strengthen the existing single circuit line through Kaduna 3 (53000), Jos 3 (63001) and Gombe 3 (33008) by adding parallel circuits.

a) 330 kV double circuit line between Kaduna 3 (53000) and Jos 3 (63001)
b) 2^{nd} circuit of the 330 kV line between Jos 3 (63001) and Gombe 3 (33008)

An alternative for the Kaduna – Jos line is listed below.

This project provides an alternate path for the power transfer from area 7 to area 6 thereby improving the system reliability. This project is a part of a series of 330 kV line projects to transfer power from area 7 to area 6. The completion of all parts of the project is required to count this as an alternate solution.

a) 330 kV double circuit line through Jos 3 (63001), Makurdi 3 (73003) and Aliade 3 (73004)

Additionally, the following project is important to cater the load growth in Damboa 1 (62019) and Biu 1 (62009) while maintaining the voltage within acceptable limits at Maiduguri 1 (62021), Damboa 1 (62019) and the vicinity.

a) 330 kV single circuit line through Gombe 3 (33008), Damaturu 3 (63007) and Maiduguri 3 (63005)

Area 7

The following project is important to mitigate the under-voltage issues resulting from the load growth in the area. The project provides an alternate path for the power flow into the existing 132 kV radial network. Additionally, this project is a part of the transmission development project to transfer power from area 8 to area 6. Hence, the project also has system-wide impact.

a) 330 kV double circuit line connecting Ikot-Ekpene (83004), Ugwuaji 3 (73008), Aliade 3 (73004) and Makurdi 3 (73003)

Area 8

A low voltage profile was observed on a number of buses in the 132 kV transmission network including the buses Rivers IPP (82014) and PHCT region. The following projects are to be prioritized in the region to meet the load growth.

a) 330 kV double circuit line between Afam iv 3 (83000) and Onne 3 (83007)
b) Two transformers (330 kV/132 kV) between Onne 3 (83007) and Onne 1 (82013)
c) 132 kV double circuit line between Onne 1 (82013) and PHCT Main 1 (82007)

7.2. The System-wide high impact projects

Many of the projects listed in section 7.1are required to improve the voltage profile within a specific area to cater the load growth. However, there are few transmission projects which run through several areas in the network to strengthen the system. These are 330 kV transmission lines which help to transfer power between areas, improve the voltage profile and increase the system reliability.

In this section, such projects are identified as the projects to be prioritized from the overall system point of view.

System Upgrade 1

The combination of the following transmission projects creates a new power-flow path from area 4 to area 3. These are very important projects to cater the load growth in the area 3 by facilitating the import of power from area 4. Additionally, this alternate path improves the system reliability in case of a contingency situation. Furthermore, these projects provide an additional flow-way to the power requirements in the area 5.

a) 330 kV double circuit line through Ajaokuta 3 (43000), Lokoja 3 (43008) and Objana 3 (43009)
b) 330 kV double circuit line through Gwagwalada 3 (35036) Lokoja 3 (43008) and Objana 3 (43009)
c) 330 kV single circuit line between Gwagwalada 3 (35036) and Katampe 3 (33001)
d) 330 kV single circuit line between Gwagwalada 3 (35036) and Shiroro 3 (33020)

System Upgrade 2

Similar to the system upgrade 1 above, the combination of the following transmission projects creates a new power-flow path from area 8 to area 6. These projects facilitate the load growth in area 6 and area 7 by transferring the required power from area 8. In addition to the voltage support, these projects improve the system reliability in case of a contingency situation.

a) 330 kV double circuit line through Jos 3 (63001), Makurdi 3 (73003), Aliade 3 (73004) and Ugwuaji (73006)
b) 330 kV quadruple circuit line between Ugwuaji (73006) and Ikot-Ekpene (83004)

System Upgrade 3

The 132 kV network linking BKebbi 1 (32003), Sokoto 1 (32016) and Tmafara 1 (32018) buses in area 3 is very weak and has severe under-voltage issues. The only project available in this area to strengthen the system is the following 330 kV transmission line project. Under this project, several 330 kV double circuit line segments are combined together to provide a new power-flow path from area 3 to area 5. It should be noted that this new path doesn't deliver considerable amount of power, but gives voltage support to the area.

a) 330 kV double circuit line through BKebbi 3 (33002), Sokoto 3 (35009), Tmafara 3 (33007), Gusau 3 (33008), Funtua 3 (53004), Zaria 3 (53003) and Kaduna (53000)

System Upgrade 4

The following 330 kV transmission projects are considered as priority projects to transfer the power generated at Afam IV 3 (83000) to area 1 and area 2. This will facilitate the load growth in the area 1.

a) 330 kV double circuit line between Afam IV 3 (83000) and Onne 3 (83007)
b) 330 kV double circuit line between Onne 3 (83007) and Delta IV 3 (43003)

8. Conclusions

- Despite the number of assumptions made in the study model development, study models sufficiently represents the expanded 10 GW network so that potential issue and limitations of facilities planned for 10 GW network can be identified. TCN should make necessary model data corrections and adjustments to further validate the 10 GW model.

- A number of voltage and thermal overload violations were identified in the base case analysis and transfer facility analysis. The worst violation has been reported for TCN to identify the suitable mitigation measure. Three different mitigation measures have been identified to mitigate voltage violations as follows.

  A. **Tapping identified for 330 kV lines:** In selected locations, it has been suggested to tap both circuits of a 330 kV dual circuit transmission line instead of one circuit.

  B. **Adding shunt reactive power devices:** Mechanically switched shunt capacitors and switched shunts (Potentially a SVC) were identified as mitigation measures for voltage violations. A total of 3322 MVAr shunt devices have been identified. This reactive power scheme could be used as the initial setting for reactive power study planned by TCN.

  C. **Building new transmission lines and sub-stations:** Building new lines and adding new transformers were identified as the last resort to prevent voltage violations and depressions causing non-converged post-contingency networks.

  Upgrades identified in above categories should be carefully studied and adopted to the network expansion plan.

About 3322 MVAr additional capacitive reactive power compensation has been identified in addition to the existing capacitors (274 MVAr) and capacitors planned (755 MVAr[10]) by TCN. Additional capacitive reactive power of 3322 MVAr has the following components.

  A. Maintain healthy system intact voltage for the 10 GW base case, about 2152 MVAr of capacitive reactive power is required.

[10] This includes the reactive power supply from the planned SVC at Gombe area.

B. Facilitate re-dispatch power transfer from hydro to thermal in dry season and thermal to hydro in wet season about 720 MVAr capacitive reactive power support is required.

C. Maintain voltage within TCN Grid Code criteria in N-1 condition, about 450 MVAr capacitive reactive power support is required.

- Out of additional 3322 MVAr identified in this study, 2100 MVAr of reactive power is required to maintain system intact voltage. This is mainly due to the following two reasons.

  A. Low power factor (0.87) of system load. It is recommended to improve the power factor of the load at low voltage levels which will reduce system leases and better utilize network capacity.

  B. Transmission lines which consume (These are long lines loaded beyond their surge impendence loading) reactive power from the system. These shows insufficient transmission capacity for 10 GW system load. Although, supplying reactive power by the means of shunt capacitors solves voltage related issues, more realistic solution would be to improve the capability of high voltage transmission network.

- In order to minimize the system issues and improve system reliability during the transition from 4.5 GW network to 10.0 GW network, number of projects have been identified as priority projects. Nine of these high priority projects will have system level impacts and twenty six of high priority projects will have area level impact.

9. Future work

1) Further validation of system models to improve the accuracy of the assumed parameters in the model.
2) System should be updated to include network elements planned by TCN and any other changes made after July 15 (when the test model was frozen) to more accurately represent the planned system.
3) Lumped generators should be splatted reflect actual generator units in the system.
4) Model should be further expanded to represent the low voltage network of the actual system. Some of the lumped loads at high voltage network can be modeled with feeder level details. Some of the parallel transformers need to be split and with correct portion of the served load.
5) The proposed reactive power requirement may be reduced as a result of adding proposed lines and transformers to the system, therefore further reactive power studies should be carried out after any additional elements have been added to the system.
6) A detailed reactive power study should be performed to optimize proposed reactive power compensation; reactive power scheme adopted in this study can be used as the initial setting.
7) Development of system dynamic models and performs dynamic stability studies and screening studies for small signal stability.
8) Sub synchronous resonance concerns if series compensation is implemented on transmission lines.
9) Electromagnetic transient studies to verify equipment design adequacy especially on the 330 kV level.
    a. Switching and lightning overvoltage studies for insulation coordination and line flashover rate compliance.
    b. Network resonance studies
    c. Breaker TRV studies

10. References

[1] The grid code for the Nigeria Electricity Transmission System-Version 01.

[2] Power System Stability and Control, P.S. Kundur, McGraw-Hill Professional; 1 edition (Jan 1 1994).

11. Appendix A – Power Flow Study Results

Note: Voltage which violate TCN criteria are given in per unit with respect to rated voltage. Thermal overloads are given as a percentage with respect to continuous rating (rate A in PSS/E model) of the branch.

Table 39 - System intact under-voltage violations in 4.5 GW network

BUS		Voltage	4.5 GW	Comments
Number	**Name**	**Level**	**Network**	
12001	AKANGBA 1	132 kV	0.88	New lines from Aja 3 (13000) -Alagbon 3 (13027)/Akangba 1 (12001) - Apada Rd (12027)+ caps at Itire 1(12020, Ijora 33 (15015)
12024	IJORA 1	132 kV	0.86	
12027	ISOLO 1	132 kV	0.88	
12016	AKOKA 1	132 kV	0.85	
12022	APAPA RD 1	132 kV	0.87	
12021	AMUWO ODOFIN	132 kV	0.87	
12029	OJO 1	132 kV	0.86	
12017	ALAGBON 1	132 kV	0.85	
12020	ITIRE 1	132 kV	0.88	
12023	EJIGBO 1	132 kV	0.88	New lines from Ikeja W 3 (13003)-Oke aro 3 (13026)-Egbin (13002) /Ikeja W 3 (13003)-Ogijo 3 (13029)-Omotoso (23002) / Orolonsogo 1 (12043) - New abeokuta 1 (12039) - Old Abeokuta (12038) + new generation at Orolonsogo 3 (13005) +Ikeja W 3 new tfs+ proposed planned caps
12034	OWOROSOKI 1	132 kV	0.85	
12003	IKEJA W 1	132 kV	0.88	
12033	OTTA 1	132 kV	0.85	
12014	PAPALANTO 1	132 kV	0.76	
12015	AGBARA 1	132 kV	0.86	
12018	ALAUSA 1	132 kV	0.84	
12019	ALIMOSHO 1	132 kV	0.87	
12026	ILLUPEJU 1	132 kV	0.86	
12031	MARYLAND1	132 kV	0.85	
12032	OGBA 1	132 kV	0.84	
12038	OLD ABEOKUTA	132 kV	0.63	
22004	ADO EKITI 1	132 kV	0.79	Proposed Caps at Akure 1 (22005), Akure 33 (25003) and planned cap at Akure 33 (25003)
22005	AKURE 1	132 kV	0.80	
22016	ONDO1 1	132 kV	0.86	Proposed caps at Ondo1 1 (22016) and Ife 1(22007)
32003	BKEBBI 1	132 kV	0.85	New transformers at BKebbi 3 (33002), New 330 kV nw connecting BKebbi 3 (33002)/ Sokoto 3 (33006)/Tmafara 3 (33007)..
32019	DOSSO	132 kV	0.78	
32021	NIAMEY 1	132 kV	0.71	
32018	TMAFARA 1	132 kV	0.82	
32016	SOKOTO 1	132 kV	0.48	
32004	KUBWA	132 kV	0.89	New transformers at Katampe 3 (33001), Proposed caps at Apo 1 (32006), Keffi 1 (32012), Planned cap at Katampe 3 (33001) , Lines from Katampe 1 (32002) to Kubwa (32004) and Suleja 1 (32017)
32011	KARU 1	132 kV	0.84	
32012	KEFFI 1	132 kV	0.79	
32008	CENTRAL AREA	132 kV	0.89	
32009	GARKI NODE 1	132 kV	0.89	
32005	AKWANGA 1	132 kV	0.74	
32006	APO 1	132 kV	0.86	
42003	DELTA 1	132 kV	0.59	New lines from Delta 1 (42003) to Benin 1 (42004), New transformers from Benin 3 (43002) to Benin 1 (42004), Proposed caps at Delta 1 (42003), Irrua 33 (45002), Ukpilla 1 (42010), Planned caps at Okene 33 (45003), Irrua 33 (45002)
42004	BENIN 1	132 kV	0.89	
42008	IRRUA 1	132 kV	0.76	
42009	OKENE 1	132 kV	0.87	
42010	UKPILLA 1	132 kV	0.81	
42014	EFFURUN 1	132 kV	0.55	
42015	AMUKPE 1	132 kV	0.84	

52011	GUSAU 1	132 kV	0.82	New 330 kV nw connecting Tmafara 3 (33007) to Gusau 3(33008), Funtua 3 (53004), Zaria 3 (53003) and Kaduna 3 (53000)
52016	FUNTUA 1	132 kV	0.86	
82004	CALABAR 1	132 kV	0.85	New generation at CALABAR_PS_3 (83008)
82007	PHCT MAIN1	132 kV	0.83	New lines connecting Delta iv 3 (43003) - Onne 3 (83007) - AFAM IV 3 (83000), Onne 1 (82013) - PHCT Main 1 (83007)/ Onne 330 kV/132 kV transformers
82008	PHCT TOWN1 1	132 kV	0.82	
82009	PHCT TOWN2 1	132 kV	0.82	

Table 40 - System intact over-voltage violations in 4.5 GW network

BUS Number	BUS Name	Voltage Level	4.5 GW Network	Reason	Comments
23002	OMOTOSO3	330 kV	1.07	Needs to be kept high to avoid voltage violations at Ikeja W 3 (13003) and its 132 KV network	More tf/ caps in 10 GW model
33020	SHIRORO 3	330 kV	1.07	Needs to be kept high to avoid voltage violations at Katampe 3 (33001) and its 132 KV network	New tfs Katampe 3/ Katampe 1, Caps, Suleja 1 (32017)- Katampe 1 (32002) line
43000	AJAOKUTA 3	330 kV	1.08	Need to be kept high to avoid voltage violations at 132 KV network at Benin 1 (42004)/Irrua (42008)/Ukpilla (42010)/Delta 1 (42003)/Effurun 1 (42014)	New lines Benin 1(42004) - Delta 1 (42003), Caps, Benin 3 - Benin 1 tfs
43001	ALADJA 3	330 kV	1.08		
43002	BENIN 3	330 kV	1.06		
43003	DELTA IV 3	330 kV	1.08		
43004	SAPELE 3	330 kV	1.07		
43005	GEREGU	330 kV	1.08		
53000	KADUNA 3	330 kV	1.06	Need to be kept high to avoid voltage violations at (32018) TMAFARA 1/ (52016) FUNTUA 1 and at Area 6 (Bauchi)	new 330 kV nw Tmafara 3/ Funtua 3 and area 7 to 6 connection (makurdi 3 73003 - Jos 3 63001)
53001	KANO 3	330 kV	1.06		
63001	JOS 3	330 kV	1.09	Needs to be kept high to avoid voltage violations in the 132 kV nw conecting Gombe (62000)/Damboa (62019)/Maiduguri (62021)	area 7 to 6 connection (makurdi 3 73003 - Jos 3 63001) + the planned switched shun at Gombe
73001	ONITSHA 3	330 kV	1.07	Needs to be kept high to avoid voltage violations in the 132 kV nw conecting Owerri (82028)/Ahoada (82018)/Yenegoa (82017)/Afam 1 (82000)/PHCT Main 1 (82007)	New line from Benin 3 (43002)/Onne 3 (83007)/ Afam iv (83000) and Owerri 330 kV (83005) bus and New generation at Egbema (83006)
73002	OKPAI 3	330 kV	1.08		
83000	AFAM IV 3	330 kV	1.06		

Table 41 - System intact transmission line thermal overloads in 4.5 GW network and 10 GW network

Line						RATING	4.5 GW Network	10 GW Network
From Bus		To Bus		Voltage Level	ID			
Number	Name	Number	Name					
12001	AKANGBA 1	12022	APAPA RD 1	132 kV	1	125.7		124.8
12001	AKANGBA 1	12024	IJORA 1	132 kV	1	125.7	101.7	
12001	AKANGBA 1	12024	IJORA 1	132 kV	2	125.7	101.7	
12002	EGBIN 1	12025	IKORODU	132 kV	1	125.7		147
12002	EGBIN 1	12025	IKORODU	132 kV	2	125.7		147
12003	IKEJA W 1	12019	ALIMOSHO 1	132 kV	1	125.7	146.4	168.9
12003	IKEJA W 1	12019	ALIMOSHO 1	132 kV	2	125.7	146.4	168.9
12003	IKEJA W 1	12026	ILLUPEJU 1	132 kV	1	125.7		101.4
12003	IKEJA W 1	12026	ILLUPEJU 1	132 kV	2	125.7		101.4
12003	IKEJA W 1	12033	OTTA 1	132 kV	1	125.7	101.5	
12003	IKEJA W 1	12033	OTTA 1	132 kV	2	125.7	101.5	
12014	PAPALANTO 1	12033	OTTA 1	132 kV	1	125.7	123.3	
12016	AKOKA 1	12017	ALAGBON_1	132 kV	1	125.7		122.1
12017	ALAGBON_1	12024	IJORA 1	132 kV	1	125.7		252.7
12019	ALIMOSHO 1	12032	OGBA 1	132 kV	1	125.7	103.9	
12019	ALIMOSHO 1	12032	OGBA 1	132 kV	2	125.7	103.9	
22001	OSOGBO 1	22005	AKURE 1	132 kV	1	125.7		100.1
22001	OSOGBO 1	222009	ILESHA TEE1	132 kV	1	125.7		146.5
32002	KATAMPE 1	32004	KUBWA	132 kV	1	125.7		108.1
32002	KATAMPE 1	32006	APO 1	132 kV	1	125.7	103.5	
32002	KATAMPE 1	32006	APO 1	132 kV	2	125.7	103.5	
32003	BKEBBI 1	32016	SOKOTO 1	132 kV	1	125.7	102.6	
42000	AJAOKUTA 1	42009	OKENE 1	132 kV	1	125.7	130.3	
42003	DELTA 1	42004	BENIN 1	132 kV	1	125.7	106.3	
42003	DELTA 1	42014	EFFURUN 1	132 kV	1	90.3		116.8
42003	DELTA 1	42014	EFFURUN 1	132 kV	2	90.3		116.8
42003	DELTA 1	42015	AMUKPE 1	132 kV	1	125.7	108.9	
42004	BENIN 1	42015	AMUKPE 1	132 kV	1	125.7	129.5	
52001	KANO 1	52007	DAN AGUNDI 1	132 kV	2	69.7		279.2
52001	KANO 1	52019	WALALAMBE 1	132 kV	2	125.7		186.1
52006	DAKATA 1	52019	WALALAMBE 1	132 kV	1	125.7		168.3
82000	AFAM 1	82007	PHCT MAIN1	132 kV	1	125.7	108.3	
82001	ALAOJI 1	82026	ABA 1	132 kV	1	125.7		107.8
82001	ALAOJI 1	82026	ABA 1	132 kV	2	125.7		107.8
82007	PHCT MAIN1	82014	RIVERS_IPP	132 kV	2	125.7	163.3	

Table 42 - System intact transformer thermal overloads in 4.5 GW network and 10 GW network

Transformer						RATE A	4.5 GW Network	10 GW Network
From Bus		To Bus		Overloaded Winding	Voltage Rating			
Number	Name	Number	Name					
13002	EGBIN 3	12002	EGBIN 1	WND 2	330 kV/132 kV/33 kV	50		156.5
13003	IKEJA W 3	12003	IKEJA W 1	WND 2	330 kV/132 kV/33 kV	50	318.4	344.5
23000	AYEDE 3	22000	AYEDE 1	WND 2	330 kV/132 kV/33 kV	50	209.2	324.3
23001	OSOGBO 3	22001	OSOGBO 1	WND 2	330 kV/132 kV/33 kV	50	239.5	355.9
23003	GANMO 3	22003	GANMO 1	WND 2	330 kV/132 kV/33 kV	50		196.2
33020	SHIRORO 3	32001	SHIRORO 1	WND 2	330 kV/132 kV/33 kV	50		189.1
33001	KATAMPE 3	32002	KATAMPE 1	WND 2	330 kV/132 kV/33 kV	50	287.5	239.7
33001	KATAMPE 3	32002	KATAMPE 1	WND 2	330 kV/132 kV/33 kV	50		239.7
33002	BKEBBI 3	32003	BKEBBI 1	WND 2	330 kV/132 kV/33 kV	50		106.2
33001	KATAMPE 3	32002	KATAMPE 1	WND 2	330 kV/132 kV/33 kV	50	287.5	
43002	BENIN 3	42004	BENIN 1	WND 2	330 kV/132 kV/33 kV	50	522	325.6
53001	KANO 3	52001	KANO 1	WND 2	330 kV/132 kV/33 kV	50		369.2
53000	KADUNA 3	52002	KADUNA 1	WND 2	330 kV/132 kV/33 kV	50	123.8	
53002	KATSINA 3	52012	KATSINA 1	WND 2	330 kV/132 kV/33 kV	50		185.8
63000	GOMBE 3	62000	GOMBE 1	WND 2	330 kV/132 kV/33 kV	50		129.8
63001	JOS 3	62001	JOS 1	WND 2	330 kV/132 kV/33 kV	50		110.7
73000	NHAVEN 3	72002	NHAVEN 1	WND 2	330 kV/132 kV/33 kV	50	130	292.7
83002	ALAOJI 3	82001	ALAOJI 1	WND 2	330 kV/132 kV/33 kV	50	228.2	215.2
83007	ONNE 3	82013	ONNE 1	WND 2	330 kV/132 kV/33 kV	50		162.7
43007	OMOKU 3	82019	OMOKU 1	WND 2	330 kV/132 kV/33 kV	50		162.8
13027	ALAGBON 3	12017	ALAGBON_1	WND 2	330 kV/132 kV/33 kV	100		214.9
13026	OKE_ARO_3	12042	OKE_ARO_1	WND 2	330 kV/132 kV/33 kV	100		230.1
83000	AFAM IV 3	82000	AFAM 1	WND 2	330 kV/132 kV/33 kV	102	191.7	115.1
13003	IKEJA W 3	12003	IKEJA W 1	WND 2	330 kV/132 kV/33 kV	150		114.8
13001	AKANGBA 3	12001	AKANGBA 1	WND 1	330 kV/132 kV/33 kV	150	102	
13003	IKEJA W 3	12003	IKEJA W 1	WND 1	330 kV/132 kV/33 kV	150	117.9	123.1
23000	AYEDE 3	22000	AYEDE 1	WND 1	330 kV/132 kV/33 kV	150		113.5
23001	OSOGBO 3	22001	OSOGBO 1	WND 1	330 kV/132 kV/33 kV	150		123.3
33001	KATAMPE 3	32002	KATAMPE 1	WND 1	330 kV/132 kV/33 kV	150	104.6	

43002	BENIN 3	42004	BENIN 1	WND 1	330 kV/132 kV/33 kV	150	208.8	112.3
53001	KANO 3	52001	KANO 1	WND 1	330 kV/132 kV/33 kV	150		128.8
73000	NHAVEN 3	72002	NHAVEN 1	WND 1	330 kV/132 kV/33 kV	150		101
83000	AFAM IV 3	82000	AFAM 1	WND 1	330 kV/132 kV/33 kV	162	136.5	

Table 43 – Non-converged contingencies appear in both 4.5 GW network and 10 GW network

From		To		Rating	Network	
Name	Number	Name	Number		4.5 GW	10 GW
Katampe	33001	Shiroro	33020	330 kV	NC	NC
Shiroro	33020	Shiroro Hydro	36012	330/16 kV	NC	NC
Shiroro	33020	Kaduna	53000	330 kV	NC	NC
Ajaokuta	42000	Okene	42009	132 kV	NC	NC
Benin	42004	Irrua	42008	132 kV	NC	NC
Benin	42004	Amukpe	42015	132 kV	NC	NC
Gombe	63000	Yola	63002	330 kV	NC	NC

Table 44 – Non-converged contingencies appear only in 10 GW network

From		To		Rating	Network	
Name	Number	Name	Number		4.5 GW	10 GW
Katampe	33001	Gwagwalada	35036	330 kV	-	NC
BKebbi	33002	Kainji G.S.	33005	330 kV	-	NC
Gwagwalada	35036	Lokoja	43008	330 kV	-	NC
Gwagwalada	35036	Obajana	43009	330 kV	-	NC
Delta	42003	Effurun	42014	132 kV	-	NC
Effurun	42014	Effurun	85002	132/33 kV	-	NC
Dan Agundi	52007	Dan Agundi	55001	132/33 kV	-	NC
Kaduna	53000	Kano	53001	330 kV	-	NC
Gombe	62000	Bauchi	62008	132 kV	-	NC
Jos	62001	Bauchi	62008	132 kV	-	NC
Gombe	63000	Damaturu	63007	330 kV	-	NC
Jos	63001	Makurdi	73003	330 kV	-	NC
Maiduguri	63005	Damaturu	63007	330 kV	-	NC
Makurdi	72025	Aliade	82012	132 kV	-	NC
kano	53001	Kano	52001	330/132/33 kV	-	NC
Makurdi	73003	Makurdi	72025	330/132/33 kV	-	NC

Mitigation methods for these cases can be found after Table 50

Table 45 – Post contingency (N-1) under-voltage violations appear **only** in 4.5 GW network

Bus			CONTINGENCY*	4.5 GW Network	Comments
Num	Name	Voltage Level			
12031	MARYLAND1	132 kV	CON_12003_12026	0.83	Expanded 132 kV network and addition all reactive compensation, help support voltage levels in 10 GW case
12026	ILLUPEJU 1	132 kV	CON_12003_12026	0.83	
12038	OLD ABEOKUTA	132 kV	CON_12003_12033	0.59	Expanded 132 kV network and addition all reactive compensation, help support voltage levels in 10 GW case
12014	PAPALANTO 1	132 kV	CON_12003_12033	0.72	
12033	OTTA 1	132 kV	CON_12003_12033	0.81	
12017	ALAGBON 1	132 kV	CON_12017_12024	0.81	
22002	IJEBU ODE 1	132 kV	CON_12025_12037	0.69	Ijebu Ode is incorrectly represented in 4.5 GW nw (no load & caps), Ayede has new caps in 10 GW
12037	SHAGAMU 1	132 kV	CON_12025_12037	0.73	
12018	ALAUSA 1	132 kV	CON_13002_13003	0.81	Expanded 132 kV network and addition all reactive compensation, help support voltage levels in 10 GW case
12032	OGBA 1	132 kV	CON_13002_13003	0.81	
12034	OWOROSOKI 1	132 kV	CON_13002_13003	0.82	
12016	AKOKA 1	132 kV	CON_13002_13003	0.82	
12031	MARYLAND1	132 kV	CON_13002_13003	0.82	
12026	ILLUPEJU 1	132 kV	CON_13002_13003	0.83	
12015	AGBARA 1	132 kV	CON_13002_13003	0.83	
12024	IJORA 1	132 kV	CON_13002_13003	0.83	
12029	OJO 1	132 kV	CON_13002_13003	0.83	
12019	ALIMOSHO 1	132 kV	CON_13002_13003	0.84	
12021	AMUWO ODOFIN	132 kV	CON_13002_13003	0.84	
12022	APAPA RD 1	132 kV	CON_13002_13003	0.84	
12023	EJIGBO 1	132 kV	CON_13002_13003	0.84	
22004	ADO EKITI 1	132 kV	CON_22001_222009	0.83	
22005	AKURE 1	132 kV	CON_22001_222009	0.84	
32012	KEFFI 1	132 kV	CON_32006_35001	0.76	Additional var support in Area 3 in the 10 GW case assists in voltage regulation
32011	KARU 1	132 kV	CON_32006_35001	0.81	
32006	APO 1	132 kV	CON_32006_35001	0.83	
52011	GUSAU 1	132 kV	CON_32018_52011	0.79	
32016	SOKOTO 1	132 kV	CON_33002_32003 _66004	0.35	
32021	NIAMEY 1	132 kV	CON_33002_32003 _66004	0.51	3 additional transformers added in 10GW case mitigate this problem.
32019	DOSSO	132 kV	CON_33002_32003 _66004	0.60	
32003	BKEBBI 1	132 kV	CON_33002_32003 _66004	0.69	
42003	DELTA 1	132 kV	CON_42009_42010	0.53	3 new lines between Benin1 -Delta 1, Proposed caps at Irrua, Ukpilla in 10 GW
42015	AMUKPE 1	132 kV	CON_42009_42010	0.78	
42004	BENIN 1	132 kV	CON_42009_42010	0.82	
52010	GAZOUA 1	132 kV	CON_52001_52005	0.84	

32018	TMAFARA 1	132 kV	CON_53000_52002_55018	0.80	New 330 kV nw connecting BKebbi/Sokoto/Tmafara/Gusa/Funtua
52016	FUNTUA 1	132 kV	CON_53000_52002_55018	0.84	
62021	MAIDUGURI 1	132 kV	CON_62001_62008	0.84	
72016	ABAKALIKI 1	132 kV	CON_73000_73001	0.35	New 330 kV network connecting Jos/Makurdi/Aliade/Ugwuaji/Nhaven/Ikot-Ekpene
72018	OTURKPO 1	132 kV	CON_73000_73001	0.40	
72011	NKALAGU 1	132 kV	CON_73000_73001	0.41	
72002	NHAVEN 1	132 kV	CON_73000_73001	0.44	
73000	NHAVEN 3	132 kV	CON_73000_73001	0.44	
72015	OJI RIVER 1	132 kV	CON_73000_73001	0.63	
72009	AWKA 1	132 kV	CON_73000_73001	0.80	
82000	AFAM 1	132 kV	CON_82000_82001	0.83	
82014	RIVERS_IPP	132 kV	CON_82000_82007	0.73	
82004	CALABAR 1	132 kV	CON_82005_86020	0.41	New generation at Calabar(83008) support the buses at 82004,82005,82010 etc when Ibom genbus(86020) is out of service
82005	EKET 1	132 kV	CON_82005_86020	0.44	
82010	UYO 1	132 kV	CON_82005_86020	0.46	
82017	YENAGOA 1	132 kV	CON_82005_86020	0.83	
82008	PHCT TOWN1 1	132 kV	CON_82007_82014	0.51	PHCT Main 1 is connected to Onne 1 and Afam iv 1 via new 132 kV lines
82009	PHCT TOWN2 1	132 kV	CON_82007_82014	0.51	
82007	PHCT MAIN1	132 kV	CON_82007_82014	0.51	

**refer* Table 55 *for contingency description*

Table 46 – Summary of post contingency (N-1) transmission line percentage thermal overloads in 4.5 GW network and 10 GW network

Line Name						Rate B	CONTINGENCY*	(%) overload	
From Bus		To Bus		kV Level	ID			4.5 GW	10 GW
Num	Name	Num	Name						
12001	AKANGBA 1	12020	ITIRE 1	132 kV	2	138.3	CON_12001_12020		154.7
12001	AKANGBA 1	12022	APAPA RD 1	132 kV	1	138.3	CON_12001_12021	117.8	147.8
12001	AKANGBA 1	12021	AMUWO ODOFIN	132 kV	1	138.3	CON_12001_12022	108.9	108.5
12001	AKANGBA 1	12021	AMUWO ODOFIN	132 kV	10	138.3	CON_12001_12022		108.5
12001	AKANGBA 1	12024	IJORA 1	132 kV	2	138.3	CON_12001_12024	172.2	
12001	AKANGBA 1	12027	ISOLO 1	132 kV	2	138.3	CON_12001_12027		105
12002	EGBIN 1	12025	IKORODU	132 kV	2	138.3	CON_12002_12025	127.4	261.1
12017	ALAGBON_1	12024	IJORA 1	132 kV	1	138.3	CON_12003_12015		232.7
12003	IKEJA W 1	12019	ALIMOSHO 1	132 kV	2	138.3	CON_12003_12019	272.3	288.4
12003	IKEJA W 1	12026	ILLUPEJU 1	132 kV	2	138.3	CON_12003_12026		193.2
12016	AKOKA 1	12017	ALAGBON_1	132 kV	1	138.3	CON_12003_12026		112
12003	IKEJA W 1	12033	OTTA 1	132 kV	2	138.3	CON_12003_12033	191.4	137
12014	PAPALANTO 1	12033	OTTA 1	132 kV	1	138.3	CON_12003_12033	115.1	
12001	AKANGBA 1	12024	IJORA 1	132 kV	1	138.3	CON_12003_12034	102.2	
12016	AKOKA 1	12024	IJORA 1	132 kV	1	138.3	CON_12016_12017		127.9
12017	ALAGBON_1	12024	IJORA 1	132 kV	1	138.3	CON_12016_12017		310.2
12017	ALAGBON 1	12024	IJORA 1	132 kV	1	138.3	CON_12016_12024	114.2	
12016	AKOKA 1	12017	ALAGBON_1	132 kV	1	138.3	CON_12017_12024		225.8
12016	AKOKA 1	12024	IJORA 1	132 kV	1	138.3	CON_12017_12024	118.6	
12003	IKEJA W 1	12019	ALIMOSHO 1	132 kV	1	138.3	CON_12018_12042		174
12019	ALIMOSHO 1	12032	OGBA 1	132 kV	2	138.3	CON_12019_12032	197.5	126.7
12003	IKEJA W 1	12019	ALIMOSHO 1	132 kV	1	138.3	CON_12032_15018	148.8	160.8
12019	ALIMOSHO 1	12032	OGBA 1	132 kV	1	138.3	CON_12032_15018	110.3	
12002	EGBIN 1	12025	IKORODU	132 kV	1	138.3	CON_12037_22000		146.9
12039	NEW ABEOKUTA	12043	OLORUNSOGO_1	132 kV	11	138.3	CON_12039_12043		120.9
13002	EGBIN 3	13003	IKEJA W 3	330 kV	1	855.1	CON_13002_13003	136.6	
22001	OSOGBO 1	222009	ILESHA TEE1	132 kV	1	138.3	CON_22000_22006		140.6
22007	IFE 1	22009	ILESHA 1	132 kV	1	138.3	CON_22007_222009		109.1
22009	ILESHA 1	222009	ILESHA TEE1	132 kV	1	138.3	CON_22007_222009		157.3
22007	IFE 1	222009	ILESHA TEE1	132 kV	1	138.3	CON_22009_222009		137.7
12002	EGBIN 1	12025	IKORODU	132 kV	1	138.3	CON_23000_22000_25006		147.8
22000	AYEDE 1	22006	IBADAN NORTH	132 kV	1	138.3	CON_23001_22001_25022		121.1
22001	OSOGBO 1	22005	AKURE 1	132 kV	1	138.3	CON_23001_22001_25022		146.1
22001	OSOGBO 1	222009	ILESHA TEE1	132 kV	1	138.3	CON_23001_22001_25022		187.2
32002	KATAMPE 1	32004	KUBWA	132 kV	1	138.3	CON_32001_32015		107
32002	KATAMPE 1	32017	SULEJA 1	132 kV	2	138.3	CON_32002_32004		119.7
32004	KUBWA	32017	SULEJA 1	132 kV	1	138.3	CON_32002_32004		152
52001	KANO 1	52007	DAN AGUNDI 1	132 kV	2	76.7	CON_32002_32004		254.6
32002	KATAMPE 1	32006	APO 1	132 kV	2	138.3	CON_32002_32006		190.1
32002	KATAMPE 1	32004	KUBWA	132 kV	1	138.3	CON_32002_32017		110.8
32002	KATAMPE 1	32006	APO 1	132 kV	1	138.3	CON_32006_35001	100.2	
32002	KATAMPE 1	32006	APO 1	132 kV	2	138.3	CON_32006_35001	100.2	
42003	DELTA 1	42014	EFFURUN 1	132 kV	1	99.3	CON_42003_45001		181.7
42003	DELTA 1	42014	EFFURUN 1	132 kV	2	99.3	CON_42003_45001		181.7
42004	BENIN 1	42015	AMUKPE 1	132 kV	1	138.3	CON_42003_45001		108
42000	AJAOKUTA 1	42009	OKENE 1	132 kV	1	138.3	CON_42008_45002		105.6
42003	DELTA 1	42014	EFFURUN 1	132 kV	1	99.3	CON_42009_42010		109.4
42004	BENIN 1	42008	IRRUA 1	132 kV	1	138.3	CON_42009_42010	133.9	104.8
42000	AJAOKUTA 1	42009	OKENE 1	132 kV	1	138.3	CON_42009_45003	124	
42003	DELTA 1	42015	AMUKPE 1	132 kV	1	138.3	CON_42015_15011	100.3	
52001	KANO 1	52019	WALALAMBE 1	132 kV	2	138.3	CON_52001_52028		171
52006	DAKATA 1	52019	WALALAMBE 1	132 kV	1	138.3	CON_52001_52028		154.7

MANITOBA·HVDC RESEARCH CENTRE

52001	KANO 1	52007	DAN AGUNDI 1	132 kV	2	76.7	CON_52006_55000		263.5
52001	KANO 1	52019	WALALAMBE 1	132 kV	2	138.3	CON_52006_55000		196.5
52006	DAKATA 1	52019	WALALAMBE 1	132 kV	1	138.3	CON_52006_55000		178.9
72002	NHAVEN 1	72011	NKALAGU 1	132 kV	2	138.3	CON_72002_72011		100.1
72001	ONITSHA 1	72009	AWKA 1	132 kV	1	138.3	CON_73000_72002_75020		108
72001	ONITSHA 1	72009	AWKA 1	132 kV	1	138.3	CON_73000_73001	190.6	
72002	NHAVEN 1	72015	OJI RIVER 1	132 kV	1	138.3	CON_73000_73001	146.6	
72009	AWKA 1	72015	OJI RIVER 1	132 kV	1	138.3	CON_73000_73001	168.6	
82000	AFAM 1	82007	PHCT MAIN1	132 kV	1	138.3	CON_82000_82001	121.4	
82007	PHCT MAIN1	82014	RIVERS_IPP	132 kV	2	138.3	CON_82000_82001	173.7	
82000	AFAM 1	82014	RIVERS_IPP	132 kV	2	138.3	CON_82000_82007	223.8	
82007	PHCT MAIN1	82014	RIVERS_IPP	132 kV	2	138.3	CON_82000_82007	304.5	
82001	ALAOJI 1	82026	ABA 1	132 kV	2	138.3	CON_82001_82026	150.7	193.7
82001	ALAOJI 1	82026	ABA 1	132 kV	1	138.3	CON_82005_86020	134.1	126
82006	ITU 1	82026	ABA 1	132 kV	1	138.3	CON_82005_86020	169.5	
82007	PHCT MAIN1	82013	ONNE 1	132 kV	2	138.3	CON_82007_82013		147.4
82000	AFAM 1	82007	PHCT MAIN1	132 kV	1	138.3	CON_82007_82014	300.8	
82017	YENAGOA 1	82018	AHOADA 1	132 kV	2	138.3	CON_82017_82018		120.9
82017	YENAGOA 1	82022	GBARAIN UBIE	132 kV	2	138.3	CON_82017_82022		157.6
82007	PHCT MAIN1	82013	ONNE 1	132 kV	1	138.3	CON_83000_82000_85010		105.4

**refer* Table 55 *for contingency description*

Table 47 – Post contingency (N-1) transformer thermal overloads in 4.5 GW network and 10 GW network

Transformer						RATE B	CONTINGENCY*	4.5 GW Network	10 GW Network
From Bus		To Bus		Winding	kV Rating				
No.	Name	No.	Name						
13002	EGBIN 3	12002	EGBIN 1	WND 2	330/132/33	55	CON_12002_16006	144.1	321.4
13000	AJA 3	12000	AJA 132	WND 2	330/132/33	55	CON_13000_12000_15004	154.3	
13003	IKEJA W 3	12003	IKEJA W 1	WND 2	330/132/33	55	CON_13003_12003_15023	336	344.9
23000	AYEDE 3	22000	AYEDE 1	WND 2	330/132/33	55	CON_23000_22000_25005	320.1	480.1
23001	OSOGBO 3	22001	OSOGBO 1	WND 2	330/132/33	55	CON_23001_22001_25022	401.7	528.2
23003	GANMO 3	22003	GANMO 1	WND 2	330/132/33	55	CON_23003_22003_225021		290.6
33001	KATAMPE 3	32002	KATAMPE 1	WND 2	330/132/33	55	CON_32001_32015		225.6
33001	KATAMPE 3	32002	KATAMPE 1	WND 2	330/132/33	55	CON_32003_32016	263.1	
33001	KATAMPE 3	32002	KATAMPE 1	WND 2	330/132/33	55	CON_32006_35001	266.2	
33001	KATAMPE 3	32002	KATAMPE 1	WND 2	330/132/33	55	CON_33001_32002_35019		269.3
33002	BKEBBI 3	32003	BKEBBI 1	WND 2	330/132/33	55	CON_33002_32003_35024		122.8
33002	BKEBBI 3	32003	BKEBBI 1	WND 2	330/132/33	55	CON_33002_32003_66004		110.8
33020	SHIRORO 3	32001	SHIRORO 1	WND 2	330/132/33	55	CON_33020_32001_35017		301.4
43002	BENIN 3	42004	BENIN 1	WND 2	330/132/33	55	CON_42003_45001		345.4
43002	BENIN 3	42004	BENIN 1	WND 2	330/132/33	55	CON_42009_42010	536.3	320.3
53000	KADUNA 3	52002	KADUNA 1	WND 2	330/132/33	55	CON_52002_52003	113.7	
53001	KANO 3	52001	KANO 1	WND 2	330/132/33	55	CON_52014_52015		368.5
53000	KADUNA 3	52002	KADUNA 1	WND 2	330/132/33	55	CON_53000_52002_55017	150.3	
53001	KANO 3	52001	KANO 1	WND 2	330/132/33	55	CON_53001_52001_55013	135.3	
63000	GOMBE 3	62000	GOMBE 1	WND 2	330/132/33	55	CON_63000_62000_65013	132.2	208.9
63001	JOS 3	62001	JOS 1	WND 2	330/132/33	55	CON_63000_62000_65013		105.3
63001	JOS 3	62001	JOS 1	WND 2	330/132/33	55	CON_63001_62001		216.5
73000	NHAVEN 3	72002	NHAVEN 1	WND 2	330/132/33	55	CON_73000_72002_75020	212.2	446.3
83002	ALAOJI 3	82001	ALAOJI 1	WND 2	330/132/33	55	CON_83002_82001_85008	296.1	245
73001	ONITSHA 3	72001	ONITSHA 1	WND 2	330/132/33	99	CON_73000_73001	115.8	
83000	AFAM IV 3	82000	AFAM 1	WND 2	330/132/33	112.2	CON_83007_82013_85017		121
83000	AFAM IV 3	82000	AFAM 1	WND 2	330/132/33	112.2	CON_86022_82014	260.4	
13002	EGBIN 3	12002	EGBIN 1	WND 1	330/132/33	165	CON_12002_16006		114.5
13001	AKANGBA 3	12001	AKANGBA 1	WND 1	330/132/33	165	CON_13001_12001_15000	111.2	
13003	IKEJA W 3	12003	IKEJA W 1	WND 1	330/132/33	165	CON_13003_12003_15023	127.8	124.6
23000	AYEDE 3	22000	AYEDE 1	WND 1	330/132/33	165	CON_23000_22000_25005	117.2	207.5
23000	AYEDE 3	22000	AYEDE 1	WND 1	330/132/33	165	CON_23000_22000_25006	117.2	176.1
23001	OSOGBO 3	22001	OSOGBO 1	WND 1	330/132/33	165	CON_23001_22001_25022	155	218.1
23003	GANMO 3	22003	GANMO 1	WND 1	330/132/33	165	CON_23001_22001_25022		100.1
23003	GANMO 3	22003	GANMO 1	WND 1	330/132/33	165	CON_23003_22003_225021		102.9
53001	KANO 3	52001	KANO 1	WND 1	330/132/33	165	CON_32002_32004		118.1
33020	SHIRORO 3	32001	SHIRORO 1	WND 1	330/132/33	165	CON_33020_32001_35017		104.5
43002	BENIN 3	42004	BENIN 1	WND 1	330/132/33	165	CON_42003_45001		129.9
43002	BENIN 3	42004	BENIN 1	WND 1	330/132/33	165	CON_42009_42010	228.4	112.2
53001	KANO 3	52001	KANO 1	WND 1	330/132/33	165	CON_52014_52015		127
73000	NHAVEN 3	72002	NHAVEN 1	WND 1	330/132/33	165	CON_72001_72009		131.7
73000	NHAVEN 3	72002	NHAVEN 1	WND 1	330/132/33	165	CON_73000_72002_75020		161.7
83002	ALAOJI 3	82001	ALAOJI 3	WND 1	330/132/33	165	CON_83002_82001_85008	107	
83000	AFAM IV 3	82000	AFAM 1	WND 1	330/132/33	178.2	CON_82000_82001	200.3	

*refer Table 55 for contingency description

N-0 thermal overloads (lines, 2 winding transformers and 3 winding transformers)

Table 48: System Intact transmission line thermal overloads for 10 GW network and all dispatch cases

Line Name	Thermal overloads (%)			
	Base Case	DP1	DP2	DP3
AKANGBA - ITIRE, 1, 132 kV (12001-12020)	91.5	92.1	92.4	92.7
AKANGBA - APAPA RD, 1, 132 kV (12001-12022)	124.8	125.1	125.3	125.5
EGBIN - IKORODU, 1, 132 kV (12002-12025)	147	150	151.6	153
IKEJA W - ALIMOSHO, 1, 132 kV (12003-12019)	168.9	169.2	169.3	169.6
IKEJA W - ILLUPEJU, 1, 132 kV (12003-12026)	101.4	101.6	101.7	101.8
AKOKA - ALAGBON, 1, 132 kV (12016-12017)	122.1	124	124.7	125.6
ALAGBON - IJORA, 1, 132 kV (12017-12024)	252.7	257.4	259.2	261.6
IKORODU - SHAGAMU, 1, 132 kV (12025-12037)	-	-	91.2	93.9
AYEDE-IBADAN NORTH, 1,132kV (22000-22006)	-	93.3	100.2	106.9
OSOGBO - AKURE, 1, 132 kV (22001-22005)	100.1	99.9	100.7	102.9
OSOGBO - ILESHA TEE, 1, 132 kV (22001-222009)	146.5	144.7	146.2	145.7
IFE - ILESHA TEE, 1, 132 kV (22007-222009)	90.8	90.5	91.3	91.1
KATAMPE - UBWA, 1, 132 kV (32002-32004)	108.1	111.4	113.7	116.6
KATAMPE - APO, 1, 132 kV (32002-32006)	100	99.4	99.5	99.6
KATAMPE - APO, 2, 132 kV (32002-32006)	100	99.4	99.5	99.6
APO - KARU, 1, 132 kV (32006-32011)	90.9	90.2	90.3	90.3
KATAMPE - GWAGWALADA, 2, 330 kV (33001-35036)	-	-	-	94.1
DELTA - EFFURUN, 1, 132 kV (42003-42014)	116.8	117.1	117	116.8
BENIN - DELTA IV, 1, 330 kV (43002-43003)	-	103.5	106.2	105.2
KANO - DAN AGUNDI, 2, 132 kV (52001-52007)	279.2	279.5	279.1	279.1
KANO - WALALAMBE, 2, 132 kV (52001-52019)	186.1	186.4	186	186
DAKATA-WALALAMBE, 1, 132kV (52006-52019)	168.3	168.6	168.3	168.3
ONITSHA - ALAOJI, 1, 330 kV (73001-83002)	-	98.5	104.2	103
ALAOJI - ABA, 1, 132 kV (82001-82026)	107.8	108.8	109.2	109.3
PHCT MAIN - ONNE, 1, 132 kV (82007-82013)	-	91.3	90.8	91

Table 49: System Intact 3 winding transformer thermal overloads for 10 GW network and all dispatch cases

3 Winding Transformer	Thermal overloads (%)				Remarks
	Base Case	DP1	DP2	DP3	
EGBIN 1,WND 2, 1, 330/132/33 kV (13002-12002)	156.5	161.1	163.1	164.5	Rating Suspicious
IKEJA W 1, WND 2, 1, 330/132/33 kV (13003-12003)	344.5	343.8	343.5	343.3	Rating Suspicious
ALAGBON_1, WND 2, 1, 330/132/33 kV (13027-12017)	214.9	217.5	218.5	219.7	Rating Suspicious
OKE_ARO_1, WND 2, 1, 330/132/33 kV (13026-12042)	230.1	229	228.6	228.1	Rating Suspicious
AKANGBA 3, WND 1, 1, 330/132/33 kV (13001-12001)	93.3	92.8	92.6	92.4	
IKEJA W 3, WND 1, 1, 330/132/33 kV (13003-12003)	123.1	122.9	122.8	122.7	
IKEJA W 3, WND 1, 1, 330/132/33 kV (13003-12003)	123.1	122.9	122.8	122.7	
AYEDE 1, WND 2, 1, 330/132/33 kV (23000-22000)	340.6	336	341.6	345.7	Rating Suspicious
OSOGBO 1, WND 2, 1, 330/132/33 kV (23001-	355.9	353.9	353.9	353.3	Rating

22001)					Suspicious
GANMO 1, WND 2, 1, 330/132/33 kV (23003-22003)	196.2	177.4	173.6	163	Rating Suspicious
AYEDE 3, WND 1, 1, 330/132/33 kV (23000-22000)	153.6	117.5	119.7	121.1	
OSOGBO 3, WND 1, 1, 330/132/33 kV (23001-22001)	123.3	121.6	122	120.6	
AYEDE TR2, WND 3, 1, 330/132/33 kV (23000-22000)	102	102	102	102	Rating Suspicious
SHIRORO 1, WND 2, 1, 330/132/33 kV (33020-32001)	189.1	175	168.6	162.1	Rating Suspicious
KATAMPE 1, WND 2, 1, 330/132/33 kV (33001-32002)	239.8	244.4	247.1	250	Rating Suspicious
BKEBBI 1, WND 2, 1, 330/132/33 kV (33002-32003)	106.2	102.3	101.5	101.6	Rating Suspicious
BKEBBI 1, WND 2, 1, 330/132/33 kV (33002-32003)	106.2	102.3	101.5	101.6	Rating Suspicious
BENIN 1, WND 2, 1, 330/132/33 kV (43002-42004)	325.6	324.1	324.1	325.2	Rating Suspicious
BENIN 1, WND 2, 1, 330/132/33 kV (43002-42004)	325.6	324.1	324.1	325.2	Rating Suspicious
BENIN 3, WND 1, 1, 330/132/33 kV (43002-42004)	112.3	111.8	111.8	112.1	
KANO 1, WND 2, 1, 330/132/33 kV (53001-52001)	369.2	368	367.2	367.1	Rating Suspicious
KATSINA 1, WND 2, 1, 330/132/33 kV (53002-52012)	185.8	185.7	185.5	185.5	Rating Suspicious
KANO 3, WND 1, 1, 330/132/33 kV (53001-52001)	128.8	128.5	128.1	128.1	
KANO 3, WND 1, 1, 330/132/33 kV (53001-52001)	128.8	128.5	128.1	128.1	
KANO 3, WND 1, 1, 330/132/33 kV (53001-52001)	128.8	128.5	128.1	128.1	
GOMBE 1, WND 2, 1, 330/132/33 kV (63000-62000)	129.8	129.7	129.4	129.8	Rating Suspicious
JOS 1, WND 2, 1, 330/132/33 kV (63001-62001)	110.7	110.9	112.1	112.3	Rating Suspicious
NHAVEN 1, WND 2, 1, 330/132/33 kV (73000-72002)	292.7	300.3	302.2	301.7	Rating Suspicious
NHAVEN 3, WND 1, 1, 330/132/33 kV (73000-72002)	101	103.6	104.1	104	
AFAM 1, WND 2, 1, 330/132/33 kV (83000-82000)	115.1	112.1	112.4	112.2	Rating Suspicious
ALAOJI 1, WND 2, 1, 330/132/33 kV (83002-82001)	215.2	219.1	222.9	222.9	Rating Suspicious
ALAOJI 1, WND 2, 1, 330/132/33 kV (83002-82001)	215.2	219.1	222.9	222.9	Rating Suspicious
ONNE 1, WND 2, 1, 330/132/33 kV (83007-82013)	162.7	175.8	174.7	175	Rating Suspicious
ONNE 1, WND 2, 2, 330/132/33 kV (83007-82013)	162.7	175.8	174.7	175	Rating Suspicious
OMOKU 1, WND 2, 1, 330/132/33 kV (43007-82019)	162.8	162.3	161.9	161.9	Rating Suspicious
OMOKU 1, WND 2, 2, 330/132/33 kV (43007-820	162.8	162.3	161.9	161.9	Rating Suspicious

Table 50: List of all non-convergent cases following N-1 contingencies and their mitigation measures for 10 GW case and all dispatch cases

FROM		TO		Voltage Rating	Fixes				Ref #
Name	Num.	Name	Num.		Base Case	DP1	DP2	DP3	
Katampe	33001	Shiroro	33020	330 kV	NC	NC	NC	NC	1
Katampe	33001	Gwagwalada	35036	330 kV	NC	NC	NC	NC	2
BKebbi	33002	Kainji	33005	330 kV	NC	NC	NC	NC	3
Shiroro	33020	Kaduna	53000	330 kV	NC	NC	NC	NC	4
Gwagwalada	35036	Lokoja	43008	330 kV	NC	NC	NC	NC	5
Gwagwalada	35036	Obajana	43009	330 kV	NC	NC	NC	NC	6
Ajaokuta	42000	Okene	42009	132 kV	NC	NC	NC	NC	7
Delta	42003	Effurun	42014	132 kV	NC	NC	NC	NC	8
Benin	42004	Irrua	42008	132 kV	NC	NC	NC	NC	9
Benin	42004	Amukpe	42015	132 kV	NC	NC	NC	NC	10
Effurun	42014	Effurun	85002	132-33 kV	NC	NC	NC	NC	11
Kaduna	53000	Kano	53001	330 kV	NC	NC	NC	NC	12
Gombe	62000	Bauchi	62008	132 kV	NC	NC	NC	NC	13
Jos	62001	Bauchi	62008	132 KV	NC	NC	NC	NC	14
Gombe	63000	Yola	63002	330 kV	NC	NC	NC	NC	15
Gombe	63000	Damaturu	63007	330 kV	NC	NC	NC	NC	16
Jos	63001	Makurdi	73003	330 kV	NC	NC	NC	NC	17
Maiduguri	63005	Damaturu	63007	330 kV	NC	NC	NC	NC	18
Makurdi	72025	Aliade	82012	132 kV	NC	NC	NC	NC	19
Kano	53001	Kano	52001	330-132-33 kV	NC	NC	NC	NC	20
Makurdi	73003	Makurdi	72025	330-132-33 kV	NC	NC	NC	NC	21
Ganmo	23003	Jebba	33003	330 kV	-	NC	NC	NC	22
Ajaokuta	43000	Lokoja	43008	330 kV	-	NC	NC	NC	23
Ajaokuta	43000	Obajana	43009	330 kV	-	NC	NC	NC	24
Kaduna	53000	Gen Kaduna	153000	330-16 kV	-	NC	NC	NC	25
Ayede	22000	Ibadan	22006	132 kV	-	-	NC	NC	26
Ayede	22000	Ilesha Tee	222009	132 kV	-	-	NC	NC	27
Katampe	32002	Kubwa	32004	132 kV	-	-	NC	NC	28
Osogbo	23001	Osogbo	22001	330-132-33 kV	-	-	NC	NC	29
Arogbajo	13028	Osogbo	23001	330 kV	-	-	NC	NC	30
Ayede	23000	Osogbo	23001	330 kV	-	-	NC	NC	31
Osogbo	23001	Benin North	43006	330 kV	-	-	NC	NC	32
Shiroro	33020	Gwagwalada	35036	330 kV	-	-	NC	NC	33
Aliade	73004	Ugwuaji	73006	330 kV	-	-	NC	NC	34
Jebba	33004	Jebba Hydro	36006	330-16 kV	-	-	NC	NC	35
Arigbajo	13028	Ayede	23000	330 kV	-	-	-	NC	36
Osogbo	23001	Ganmo	23003	330 kV	-	-	-	NC	37

Describe reasons for additional (other than in base case) blow up

1) Switched Shunt compensation at Katampe 3 (33001). An alternative solution is to Tap the line between Shiroro3 and Katampe around 145km from Shiroro this will reduce the MVAr requirement at Katampe, even when tapped there is still a requirement for switched shunt compensation at Katampe 3 (33001) for dispatch case 3.
2) Tap line between Shiroro 3 (33020) and Katampe 3 (33001) at around 145 km from shiroro, for dispacth case 3, additinal reactive is required from a switched shunt at katampe 3 (33001).
3) The 10 GW model has only one line between BKebbi (33002) and Kainji GS (33005), that carries high power. A second circuit between BKebbi and Kainji is required, there may already be additional lines proposed for this area.
4) Add a line between Katampe 3 (33001) and Kaduna 3 (53000), or add 40% series compensation tp Shiroro (33020) - Kaduna (53000) line.For dispatch 3 additinal Reacitve power is required from a switched shunt at katampe 3 (33001).
5) Part of constrained Interface problem (Interface 4)
6) Part of constrained Interface problem (Interface 4)
7) Due to the increase in load in Area 4 tripping a line between Benin and Ajaokuta will results in a non-convergent case. A possible solution for this is the addition of a line between Upkilla (42010) and Ajaokuta (42000).
8) Due to the Increase in the load in Area 4, it is necessary to add two additional lines between Delta (42003) and Effurun (42014)
9) Due to the increase in load in Area 4 tripping a line between Benin and Ajaokuta will results in a non-convergent case. A possible solution for this is the addition of a line between Upkilla (42010) and Ajaokuta (42000).
10) Based on the 10 GW case diagram there are 4 lines between Benin (42004) and Delta (42003) and one additional line which is tapped connecting delta to Ampuke then Ampuke to Delta. Another of the 4 lines should be tapped connecting to Ampuke
11) Due to the Increase in the load in Area 4, it is necessary to add two additional lines between Delta (42003) and Effurun (42014)
12) In the base case we 85 MVAr added to Kano 3 (supplied by switched shunt). For the dispatch cases the generator at kaduna (153000) is activated and so the reactive power requirement of the switch shunt at Kano 53001 is less. For the second and third dispacth cases the switched shunt at kano is not sufficient and so a switched shunt at Katampe is added in addition to an additional fixed shunt (150 MVAr). An alternative solution is to add 40% line compensation to the Shiroro(33020)-Kaduna(53000) lines
13) The load in area 6 is three times larger in the 10 GW case, A solution for this contingency is to tap another line between Gombe (63000) and Jos (63001) at Bauchi (62008) and connect through a step down transformer to the 132 kV level.
14) The load in area 6 is three times larger in the 10 GW case, A solution for this contingency is to tap another line between Gombe (63000) and Jos (63001) at Bauchi (62008) and connect through a step down transformer to the 132 kV level.

15) Area 6 has planned lines that are not included in the model. The solution for this contingency in to add a parallel line between Gombe (63000) and Yola (63002) this line may already be proposed but absent from the model.
16) Area 6 has some planned connections that are not included in the 10GW diagram. The solution for this contingency is to have a second circuit in parallel from Gombe (63000) to Damaturu (63007).
17) Part of the constrained interface problem (interface 1)
18) Area 6 has some planned connections that are not included in the 10GW diagram. The solution for this contingency is to have a second circuit in parallel from Maiduguri (63005) to Damaturu (63007).
19) This section of Area 7 seems to be very sensitive, (this may be a numerical issue in PSS/e), for more stability and to resolve this blown up contingency a stepdown transformer between the 330 kV side of Aliade (73004) and the 132 kV system of Oturkpo (72018).
20) There are four transformers between the 132 kV (52001) and 330 kV (53001) side of Kano. It seems that the transformers are already overloaded so a solution to both transformer overloading and non-convergent system would be to add another transformer at kano.
21) This section of Area 7 seems to be very sensitive, (this may be a numerical issue in PSS/e), for more stability and to resolve this blown up contingency a stepdown transformer between the 330 kV side of Aliade (73004) and the 132 kV system of Oturkpo (72018).
22) With switching shunts at Katampe (33001) and Osogbo (22001) that are required for other contingencies listed above will also solve this contigencies
23) *Part of the northern-southern flow gate issue of the TCN system
24) *Part of the northern-southern flow gate issue of the TCN system
25) With switched shunts at Katampe (33001) and Osogbo (22001) that are required for other contingencies listed above will also solve this contigencies
26) With switched shunts at Katampe (33001) and Osogbo (22001) that are required for other contingencies listed above will also solve this contigencies
27) With switched shunts at Katampe (33001) and Osogbo (22001) that are required for other contingencies listed above will also solve these contingencies
28) Switched shunts at Osogbo (22001), Katampe (33001)
29) Switched shunts at Osogbo (22001)
30) Switched shunts at Osogbo (22001), Katampe (33001)
31) Switched shunts at Osogbo (22001), Katampe (33001)
32) Switched shunts at Osogbo (22001), Katampe (33001)
33) Switched shunts at Osogbo (22001), Katampe (33001)
34) Switched shunts at Osogbo (22001), Katampe (33001)
35) Switched shunts at Osogbo (22001), Katampe (33001)
36) Switched shunts at Osogbo (22001)
37) Switched shunts at Osogbo (22001)

Table 51: N-1 Voltage violations for 10 GW case and all dispatch cases

Contingency				Rating (kV)	Bus	PU Voltage				Remarks
From		To				Base Case	DP1	DP2	DP3	
Name	Num	Name	Num							
Osogbo	23001	Osogbo	22001 / 25022	330/132/33	22001 OSOGBO 1 132.00	0.85	0.83	NC	NC	1
Osogbo	23001	Osogbo	22001 / 25022	330/132/33	22004 ADO EKITI 1 132.00	0.47	0.44	NC	NC	2
Osogbo	23001	Osogbo	22001 / 25022	330/132/33	22005 AKURE 1 132.00	0.48	0.45	NC	NC	3
Osogbo	23001	Osogbo	22001 / 25022	330/132/33	22007 IFE 1 132.00	0.76	0.73	NC	NC	4
Osogbo	23001	Osogbo	22001 / 25022	330/132/33	22009 ILESHA 1 132.00	0.76	0.74	NC	NC	5
Osogbo	23001	Osogbo	22001 / 25022	330/132/33	22011 ISEYIN 1 132.00	0.85	0.85	NC	NC	6
Osogbo	23001	Osogbo	22001 / 25022	330/132/33	22013 OFFA 1 132.00	0.87	0.84	NC	NC	7
Osogbo	23001	Osogbo	22001 / 25022	330/132/33	22015 OMUARAN 1 132.00	0.83	0.80	NC	NC	8
Osogbo	23001	Osogbo	22001 / 25022	330/132/33	22016 ONDO1 1 132.00	0.62	0.59	NC	NC	9
Osogbo	23001	Osogbo	22001 / 25022	330/132/33	22017 ONDO2 1 132.00	0.67	0.64	NC	NC	10
Osogbo	23001	Osogbo	22001 / 25022	330/132/33	222009 ILESHA TEE1 132.00	0.79	0.77	NC	NC	11
Katampe	32002	Kubwa	32004	132	32004 KUBWA 132.00	0.60	0.59	NC	NC	12
Katampe	32002	Kubwa	32004	132	32007 BIDA 1 132.00	0.79	0.78	NC	NC	13
Katampe	32002	Kubwa	32004	123	32013 KONTAGORA 1 132.00	0.85	0.85	NC	NC	14
Katampe	32002	Kubwa	32004	132	32015 MINNA 1 132.00	0.84	0.83	NC	NC	15
Katampe	32002	Kubwa	32004	132	32017 SULEJA 1 132.00	0.78	0.78	NC	NC	16
Shiroro	33020	Gwagwalada	35036	330	32005 AKWANGA 1 132.00	-	0.84	NC	NC	17
Shiroro	33020	Gwagwalada	35036	330	32012 KEFFI 1 132.00	-	0.85	NC	NC	18
Delta	42003	Delta	45001	132/33	42003 DELTA 1 132.00	0.74	0.74	0.74	0.74	19
Delta	42003	Delta	45001	132/33	42014 EFFURUN 1 132.00	0.58	0.58	0.58	0.58	20
Okene	42009	Ukpilla	42010	132	42010 UKPILLA 1 132.00	-	0.85	0.85	0.85	21
Kano	52001	Dan Agundi	52007	132	63002 YOLA 3 330.00	-	-	-	1.10	22
Kano	52001	Dan Agundi	52007	132	63006 JALINGO 3 330	-	-	-	1.11	23
NHaven	72002	9th mile	72006	132	72006 9TH MILE 1 132.00	0.54	0.53	0.53	0.53	24
9th mile	72006	NSukka	72013	132	72010 AYANGBA 1 132.00	0.51	0.50	0.50	0.50	25
9th mile	72006	NSukka	72013	132	72013 NSUKKA 1 132.00	0.52	0.51	0.51	0.51	26

Table 52: N-1 transmission line thermal overloads for 10 GW case and dispatch cases

Contingency*	Line Name	Thermal overloads (%)			
		Base Case	DP1	DP2	DP3
CON_12001_12020	AKANGBA - ITIRE, 2, 132 kV (12001-12020)	154.7	155.7	156.1	156.8
CON_12001_12021	AKANGBA - APAPA RD, 1, 132 kV (12001-12022)	147.8	148.2	148.4	148.8
CON_12001_12022	AKANGBA - AMUWO ODOFIN, 1, 132 kV (12001-12021)	108.5	108.8	108.9	109.2
CON_12001_12022	AKANGBA - AMUWO ODOFIN, 10, 132 kV (12001-12021)	108.5	108.8	108.9	109.2
CON_12001_12027	AKANGBA - ISOLO, 2, 132 kV (12001-12027)	105	105.2	105.3	105.5
CON_12002_12025	EGBIN - IKORODU, 2, 132 kV (12002-12025)	261.1	266.2	269.1	272.9
CON_12003_12019	IKEJA W - ALIMOSHO, 2, 132 kV (12003-12019)	288.4	288.9	289.2	290
CON_12003_12026	IKEJA W - ILLUPEJU, 2, 132 kV (12003-12026)	193.2	193.6	193.8	195.2
CON_12003_12033	IKEJA W - OTTA, 2, 132 kV (12003-12033)	137	137.5	137.7	138.2
CON_12003_12042	IKEJA W - OKE_ARO, 11, 132 kV (12003-12042)	96.5	96.5	96.5	96.5
CON_12016_12017	AKOKA - IJORA, 1, 132 kV (12016-12024)	127.9	129.4	130	131.1
CON_12016_12017	ALAGBON - IJORA, 1, 132 kV (12017-12024)	310.2	315.7	317.8	321.4
CON_12017_12024	AKOKA - ALAGBON, 1, 132 kV (12016-12017)	225.8	229.6	232	235.5
CON_12018_12042	IKEJA W - ALIMOSHO, 1, 132 kV (12003-12019)	174	174.2	174.4	174.9
CON_12018_12042	ALIMOSHO - OGBA, 1, 132 kV (12019-12032)	96.2	96.4	96.5	96.8
CON_12019_12032	ALIMOSHO - OGBA, 2, 132 kV (12019-12032)	126.7	126.9	127	127.3
CON_12025_12037	SHAGAMU - AYEDE, 1, 132 kV (12037-22000)	94.9	95.5	97	100.8
CON_12026_12031	ILLUPEJU - MARYLAND, 2, 132 kV (12026-12031)	99	99.1	99.2	99.4
CON_12039_12043	IKEJA W - OTTA, 1, 132 kV (12003-12033)	93.6	93.9	94	94.6
CON_12039_12043	NEW ABEOKUTA - OLORUNSOGO, 11, 132 kV (12039-12043)	120.9	120.7	120.7	121.2
CON_13003_12003_15023	AKANGBA - ITIRE, 1, 132 kV (12001-12020)	94.9	95.5	95.7	96.5
CON_13003_12003_15023	IKEJA W - ILLUPEJU, 1, 132 kV (12003-12026)	93.6	93.7	93.9	94.4
CON_22000_22012	AYEDE - IBADAN NORTH, 1, 132 kV (22000-22006)	-	92.9	99	105
CON_22007_222009	IFE - ILESHA, 1, 132 kV (22007-22009)	109.1	101	NC	NC
CON_22007_222009	ILESHA - LESHA TEE, 1, 132 kV (22009-222009)	157.3	146	NC	NC
CON_22009_222009	IFE - ILESHA TEE, 1, 132 kV (22007-222009)	137.7	134.3	136.3	137.5

CON_22010_22013	OSOGBO - AKURE, 1, 132 kV (22001-22005)	92.7	92.3	94.4	96.6
CON_22010_22013	OSOGBO - ILESHA TEE, 1, 132 kV (22001-222009)	136.8	134.3	136.7	140.5
CON_23000_22000_25005	EGBIN - IKORODU, 1, 132 kV (12002-12025)	147.7	150.9	152.8	155.8
CON_23000_22000_25006	EGBIN - IKORODU, 1, 132 kV (12002-12025)	147.8	151	152.9	155.3
CON_23000_22000_25005	IKORODU - SHAGAMU, 1, 132 kV (12025-12037)	98.4	104.9	108	113
CON_23000_22000_25006	IKORODU - SHAGAMU, 1, 132 kV (12025-12037)	98.5	105.1	108.2	112.3
CON_23001_22001_25022	AYEDE - IBADAN NORTH, 1, 132 kV (22000-22006)	121.1	136.3	NC	NC
CON_23001_22001_25022	OSOGBO - AKURE, 1, 132 kV (22001-22005)	146.1	145.4	NC	-NC
CON_23001_22001_25022	OSOGBO - ILESHA TEE, 1, 132 kV (22001-222009)	187.2	190.4	NC	NC
CON_23002_43002	OMOTOSO - BENIN, 2, 330 kV (23002-43002)	-	102.1	112	114.5
CON_32002_32004	KATAMPE - APO, 1, 132 kV (32002-32006)	98.1	99.1	NC	NC
CON_32002_32004	KATAMPE - SULEJA, 2, 132 kV (32002-32017)	119.7	123.8	NC	NC
CON_32002_32004	KUBWA - SULEJA, 1, 132 kV (32004-32017)	152	152.1	NC	NC
CON_32002_32004	APO- KARU, 1, 132 kV (32006-32011)	90.9	92	NC	NC
CON_32002_32006	KATAMPE - APO, 2, 132 kV (32002-32006)	190.1	189	189.6	184.4
CON_32002_32017	KATAMPE - KUBWA, 1, 132 kV (32002-32004)	110.8	116.4	120	124.9
CON_33001_32002_35019	KATAMPE - APO, 1, 132 kV (32002-32006)	93.7	93	93.4	91.4
CON_33003_33020	KATAMPE-GWAGWALADA, 2,330kV (33001-35036)	-	-	-	90.7
CON_42003_45001	AJAOKUTA - OKENE, 1, 132 kV (42000-42009)	92.6	94.7	94.6	93.1
CON_42003_45001	DELTA - EFFURUN, 1, 132 kV (42003-42014)	181.7	181.9	181.8	181.8
CON_42003_45001	DELTA - EFFURUN, 2, 132 kV (42003-42014)	181.7	181.9	181.8	181.8
CON_42003_45001	BENIN - MUKPE, 1, 132 kV (42004-42015)	108	108.2	108.2	108
CON_42009_42010	BENIN - RRUA, 1, 132 kV (42004-42008)	104.8	105.9	105.8	105.1
CON_43000_43005	AJAOKUTA - GEREGU, 2, 330 kV (43000-43005)	-	-	-	91.4
CON_43001_43003	BENIN - DELTA IV, 1, 330 kV (43002-43003)	98.7	116.8	120.1	118.9
CON_43002_43003	ALADJA - DELTA IV, 1, 330 kV (43001-43003)	-	95.9	98.8	97.9
CON_43002_43003	ALADJA - SAPELE, 1, 330 kV (43001-43004)	-	95.9	98.8	97.8
CON_43003_83007	ONITSHA - ALAOJI, 1, 330 kV (73001-83002)	96.3	121.3	128.8	127.8
CON_52006_55000	KANO - DAN AGUNDI, 2, 132 kV	263.5	265.4	263.6	264.3

	(52001-52007)				
CON_52006_55000	KANO - WALALAMBE, 2, 132 kV (52001-52019)	196.5	201	196.8	198.3
CON_52006_55000	DAKATA - WALALAMBE, 1, 132 kV (52006-52019)	178.9	183.3	179.3	180.7
CON_53000_53001	TAMBURAWA - KWANAR DANGO, 1, 132 kV (52013-52014)	-	-	94.5	94.6
CON_53000_53001	KWANAR DANGO - ZARIA, 78, 132 kV (52014-52015)	-	-	99.9	100
CON_63000_63001	JOS - BAUCHI, 1, 132 kV (62001-62008)	96.6	96.5	94.9	94.4
CON_72001_72009	NHAVEN - OJI RIVER, 1, 132 kV (72002-72015)	99.7	101	99.4	100.9
CON_72002_72011	NHAVEN - NKALAGU, 2, 132 kV (72002-72011)	100.1	101	100	100.7
CON_73000_72002_75020	ONITSHA - AWKA, 1, 132 kV (72001-72009)	108	106.5	106	109
CON_73001_83002	OKIGWE - MBALANO, 1, 132 kV (72017-72020)	-	101.9	109	108.6
CON_73001_83002	MBALANO - UMUAHIA, 1, 132 kV (72020-82027)	-	102.1	109.2	108.9
CON_82001_82026	ALAOJI - ABA, 2, 132 kV (82001-82026)	193.7	195.4	196.4	196.7
CON_82005_86020	ALAOJI - ABA, 1, 132 kV (82001-82026)	121.5	122.6	123.3	123.5
CON_82007_82013	PHCT MAIN- ONNE, 2, 132 kV (82007-82013)	147.4	155.9	155.2	155.4
CON_82017_82018	YENAGOA - AHOADA, 2, 132 kV (82017-82018)	120.9	120.9	120.9	120.9
CON_82017_82022	YENAGOA - GBARAIN UBIE, 2, 132 kV (82017-82022)	157.6	157.6	157.6	157.6
CON_82018_82028	AHOADA - OWERRI, 2, 132 kV (82018-82028)	92.6	92.8	93	93
CON_83000_82000_85010	PHCT MAIN - ONNE, 1, 132 kV (82007-82013)	105.4	108.8	108.6	108.7

**refer* Table 55 *for contingency description*

Table 53: N-1 2 winding transformer thermal overloads for 10 GW case and dispatch cases

Contingency*	2 Winding Transformer	Thermal overloads (%)			
		Base Case	DP1	DP2	DP3
CON_13005_12043	OLORUNSOGO, 2, 330/132 kV (12043-13005)	116	115.8	115.8	115.8

Table 54: N-1 3 winding transformer thermal overloads for 10 GW case and dispatch cases

Contingency*	3 Winding Transformer	Thermal overloads (%)				Remarks
		Base Case	DP1	DP2	DP3	
CON_12002_16006	EGBIN 1, WND 2, 1, 330/132/33 kV (13002-12002)	321.4	327.8	331.6	336.5	Rating Suspicious
CON_12002_16006	EGBIN 3, WND 1, 1, 330/132/33 kV (13002-12002)	114.5	116.8	118.4	120.6	
CON_12017_12024	AKANGBA 1, WND 2, 1, 330/132/33 kV (13001-12001)	94.2	94	94	94	
CON_12017_12024	AKANGBA 3, WND 1, 1, 330/132/33 kV (13001-12001)	99.6	99.4	99.5	99.6	
CON_13003_12003_15023	IKEJA W 1, WND 2, 1, 330/132/33 kV (13003-12003)	344.9	344.3	344	344	Rating Suspicious
CON_13003_12003_15023	IKEJA W 3, WND 1, 1, 330/132/33 kV (13003-12003)	124.6	124.4	124.4	124.5	
CON_13003_12003_15024	IKEJA W 1, WND 2, 1, 330/132/33 kV (13003-12003)	344.9	344.3	344	344	Rating Suspicious
CON_13003_12003_15024	IKEJA W 3, WND 1, 1, 330/132/33 kV (13003-12003)	124.6	124.4	124.4	124.5	
CON_22006_22008	OSOGBO 1, WND 2, 1, 330/132/33 kV (23001-22001)	345.5	360.6	365.2	375.1	Rating Suspicious
CON_22006_22008	OSOGBO 3, WND 1, 1, 330/132/33 kV (23001-22001)	117.2	121.1	122.8	124.7	
CON_23000_22000_25005	AYEDE 1, WND 2, 1, 330/132/33 kV (23000-22000)	480.1	495.5	503.1	510.1	Rating Suspicious
CON_23000_22000_25005	AYEDE 3, WND 1, 1, 330/132/33 kV (23000-22000)	207.5	213.2	216.7	220.3	
CON_23001_22001_25022	OSOGBO 1, WND 2, 1, 330/132/33 kV (23001-22001)	528.2	517.9	NC	NC	Rating Suspicious
CON_23001_22001_25022	OSOGBO 3, WND 1, 1,	218.1	215.5	NC	NC	

	330/132/33 kV (23001-22001)					
CON_23001_22001_25022	GANMO 3, WND 1, 1, 330/132/33 kV (23003-22003)	100.1	96.6	NC	NC	
CON_23001_23003	OSOGBO 1, WND 2, 1, 330/132/33 kV (23001-22001)	345.9	360.8	366.4	NC	Rating Suspicious
CON_23001_23003	OSOGBO 3, WND 1, 1, 330/132/33 kV (23001-22001)	120.2	124.6	127.3	NC	
CON_23003_22003_225021	GANMO 1, WND 2, 1, 330/132/33 kV (23003-22003)	290.6	264.5	260.6	247.7	Rating Suspicious
CON_23003_22003_225021	GANMO 3, WND 1, 1, 330/132/33 kV (23003-22003)	102.9	93.6	92.7	-	
CON_33001_32002_35019	KATAMPE 1, WND 2, 2, 330/132/33 kV (33001-32002)	269.3	274.1	277.1	279.6	Rating Suspicious
CON_33001_32002_35019	KATAMPE 3, WND 1, 1, 330/132/33 kV (33001-32002)	94.4	95.9	97.1	97.8	
CON_33001_32002_35019	KATAMPE 3, WND 1, 1, 330/132/33 kV (33001-32002)	94.4	95.9	97.1	97.8	
CON_33001_32002_35020	KATAMPE 1, WND 2, 1, 330/132/33 kV (33001-32002)	269.3	274.1	277.1	279.6	Rating Suspicious
CON_33001_32002_35020	KATAMPE 3, WND 1, 1, 330/132/33 kV (33001-32002)	94.4	95.9	97.1	97.8	
CON_33002_32003_35024	BKEBBI 1, WND 2, 1, 330/132/33 kV (33002-32003)	122.8	118.8	117.9	117.9	Rating Suspicious
CON_33002_32003_35025	BKEBBI 1, WND 2, 1, 330/132/33 kV (33002-320003)	122.8	118.8	117.9	117.9	Rating Suspicious
CON_33020_32001_35017	SHIRORO 1, WND 2, 1, 330/132/33 kV (33020-32001)	301.4	280.4	271.4	256.5	Rating Suspicious
CON_33020_32001_35017	SHIRORO 3, WND 1, 1, 330/132/33 kV (33020-32001)	104.5	97.1	94.1	-	
CON_42003_45001	BENIN 1, WND 2, 1, 330/132/33 kV (43002-42004)	345.4	344.4	344.5	345	Rating Suspicious
CON_42003_45001	BENIN 3, WND 1, 1, 330/132/33 kV (43002-42004)	129.9	129.7	129.6	129.8	
CON_52014_52015	KANO 1, WND 2, 1, 330/132/33 kV (53001-52001)	368.5	368.6	368.4	368.4	Rating Suspicious
CON_52014_52015	KANO 3, WND 1, 1, 330/132/33 kV (53001-52001)	127	127.4	127.3	127.3	
CON_63000_62000_65013	GOMBE 1, WND 2, 1, 330/132/33 kV	208.9	208.8	210	209.3	Rating Suspicious

	(63000-62000)					
CON_63001_62001	JOS 1, WND 2, 1, 330/132/33 kV (63001-62001)	216.5	215.9	218.4	218.5	Rating Suspicious
CON_73000_72002_75020	NHAVEN 1, WND 2, 1, 330/132/33 kV (73000-72002)	446.3	456.5	459	458.6	Rating Suspicious
CON_73000_72002_75020	NHAVEN 3, WND 1, 1, 330/132/33 kV (73000-72002)	161.7	165.6	165.8	166	Rating Suspicious
CON_83002_82001_85008	ALAOJI 1, WND 2, 1, 330/132/33 kV (83002-82001)	245	249.3	253.7	253.7	Rating Suspicious
CON_83002_82001_85008	ALAOJI 3, WND 1, 1, 330/132/33 kV (83002-82001)	-	-	90.7	90.7	
CON_83007_82013_85017	AFAM 1, WND 2, 1, 330/132/33 kV (83000-82000)	121	120	120.1	120	Rating Suspicious

refer Table 55 *for contingency description*

12. Appendix B – Contingency Legend

Table 55 - Contingency Legend

Transmission Line Contingencies	
Contingency Name	**Trip Element**
CON_12002_12025	Line - Egbin 1 to Ikorodu
CON_12003_12026	Line - Ikeja W 1 to Illupeju 1
CON_12003_12033	Line - Ikeja W 1 to Otta 1
CON_12016_12017	Line - Akoka 1 to Alagbon 1
CON_12017_12024	Line - Alagbon 1 to Ijora 1
CON_12017_12024	Line - Alagbon 1 to Ijora 1
CON_12025_12037	Line - Ikorodu to Shagamu 1
CON_12025_12037	Line - Ikododu 1 to Shagamu 1
CON_13002_13003	Line - Egbin 3 to Ikeja W 3
CON_13028_23000	Line - Arigbajo 3 to Ayede 3
CON_13028_23001	Line - Arigbajo 3 to Osogbo 3
CON_22000_22006	Line - Ayede 1 to Ibadan North
CON_22000_22012	Line - Ayede 1 to Jericho 1
CON_22001_222009	Line - Osogbo 1 to Ilesha Tee1
CON_22003_22010	Line - Ganmo 1 to Ilorin 1
CON_22006_22008	Line - Ibadan North to Iwo 1
CON_22007_222009	Line - Ife 1 to Ilesha Tee 1
CON_22010_22013	Line - Ilorin 1 to Offa 1
CON_23000_23001	Line - Ayede 3 to Osogbo 3
CON_23001_23003	Line - Osogbo 3 to Ganmo 3
CON_23001_43006	Line - Osogbo 3 to Benin North
CON_23002_43002	Line - Omotoso 3 to Benin 3
CON_23003_33003	Line - Ganmo 3 to Jebba T.S.3
CON_32002_32004	Line - Katampe 1 to Kubwa 1
CON_32002_32006	Line - Katampe 1 to Apo 1
CON_32002_32017	Line - Katampe 1 to Suleja 1
CON_32018_52011	Line - Tmafara 1 to Gusau 1
CON_33001_33020	Line - Katampe 3 to Shiroro 3
CON_33001_35036	Line - Katampe 3 to Gwagwalada 3
CON_33002_33005	Line - BKebbi 3 to Kainji G.S.3
CON_33002_33006	Line - BKebbi 3 to Sokoto 3
CON_33003_33020	Line - Jebba T.S.3 to Shiroro
CON_33020_35036	Line - Shiroro 3 to Gwagwalada 3
CON_33020_53000	Line - Shiroro 3 to Kaduna 3
CON_35036_43008	Line - Gwagwalada 3 to Lokoja 3

CON_35036_43009	Line - Gwagwalada 3 to Obajana 3
CON_42000_42009	Line - Ajaokuta 1 to Okene 1
CON_42003_42014	Line - Delta 1 to Effurun 1
CON_42004_42008	Line - Benin 1 to Irrua 1
CON_42004_42015	Line - Benin 1 to Amukpe 1
CON_42009_42010	Line - Okene 1 to Ukpilla 1
CON_42009_42010	Line - Okene 1 to Ukpilla 1
CON_43000_43005	Line - Ajaokuta 3 to Geregu
CON_43000_43008	Line - Ajaokuta 3 to Lokoja 3
CON_43000_43009	Line - Ajaokuta 3 to Obajana 3
CON_43001_43003	Line - Aladja 3 to Delta IV 3
CON_43002_43003	Line - Benin 3 to Delta IV 3
CON_43003_83007	Line - Delta IV 3 to Onnie 3
CON_52001_52005	Line - Kano 1 to Kankia 1
CON_52001_52007	Line - Kano 1 to Dan Agundi 1
CON_53000_53001	Line - Kaduna 3 to Kano 3
CON_62000_62008	Line - Gombe 1 to Bauchi 1
CON_62001_62008	Line - Jos 1 to Bauchi 1
CON_62001_62008	Line - Jos 1 to Bauchi 1
CON_63000_63002	Line - Gombe 3 to Yola 3
CON_63000_63007	Line - Gombe 3 to Damaturu 3
CON_63001_73003	Line - Jos 3 to Makurdi 3
CON_63005_63007	Line - Maiduguri 3 to Damaturu 3
CON_72002_72006	Line - Nhaven 1 to 9th Mile 1
CON_72006_72013	Line - 9th Mile 1 to Nsukka 1
CON_72025_82012	Line - Makurdi 1 to Aliade 1
CON_73000_73001	Line - Nhaven 3 to Onitsha 3
CON_73001_83002	Line - Onitsha 3 to Alaoji 3
CON_73004_73006	Line - Aliade 3 to Ugwuaji 3
CON_82000_82001	Line - Afam 1 to Alaoji 1
CON_82000_82007	Line - Afam 1 to PHCT main 1
CON_82001_82026	Line - Alaoji 1 to Aba 1
CON_82007_82013	Line - PHCT Main 1 to Onne 1
CON_82007_82014	Line - PHCT main 1 to Rivers IPP
3 winding transformer Contingencies	
Contingency Name	**Trip Element**
CON_13003_12003_15023	Three winding transformer - Ikeja West 3 to Ikeja West 1
CON_13003_12003_15024	Three winding transformer - Ikeja West 3 to Ikeja West 1
CON_23000_22000_25005	Three winding transformer - Ayede 3 to Ayede 1

CON_23000_22000_25006	Three winding transformer - Ayede 3 to Ayede 1
CON_23001_22001_25022	Three winding transformer - Osogbo 3 to Osogbo 1
CON_23003_22003_225021	Three winding transformer - Ganmo 3 to Ganmo 1
CON_33001_32002_35019	Three winding transformer - Katamper 3 to Katampe 1
CON_33001_32002_35020	Three winding transformer - Katamper 3 to Katampe 1
CON_33002_32003_35024	Three winding transformer - BKebbi 3 to BKebbi 1
CON_33002_32003_35025	Three winding transformer - BKebbi 3 to BKebbi 1
CON_33002_32003_66004	Three winding transformer - BKebbi 3 to BKebbi 1
CON_33020_32001_35017	Three winding transformer - Shiroro 3 to Shiroro 1
CON_53000_52002_55018	Three winding transformer - Kaduna 3 to Kaduna 1
CON_53001_52001_55013	Three winding transformer - Kano 3 to Kano 1
CON_73000_72002_75020	Three winding tranformer - Nhaven 3 to Nhaven 1
CON_73003_72025_75025	Three winding transformer - Makurdi 3 to Makurdi 1
CON_83000_82000_85010	Three winding transformer - Afam IV 3 to Afam 1
CON_83002_82001_85008	Three winding transformer - Alaoji 3 to Alaoji 1
2 winding transformer Contingencies	
Contingency Name	**Trip Element**
CON_12002_16006	Two winding transformer - Egbin 1 to Lagosenron G
CON_22005_25003	Two winding transformer - Akure 1 to Akure 33
CON_32002_35007	Two winding transformer - Katampe 1 to Katampe 33
CON_32003_65005	Two winding transformer - BKebbi 1 to BKebbi 33
CON_32004_35010	Two winding transformer - Kubwa to Kubwa 33
CON_32006_35001	Two winding transformer - Apo 1 to Apo 3
CON_33004_36006	Two winding transformer - Jebba G.S.3 to Jebba HYD 1
CON_33020_36012	Two Winding Transformer - Shiroro 3 to Shiroro Hyd
CON_42003_45001	Two winding transformer - Delta 1 to Delta 33
CON_42008_45002	Two winding transformer - Irrua 1 to Irrua 3
CON_42014_85002	Two Winding Transformer - Effurun 1 to Effurun 33
CON_52006_55000	Two winding transformer - Dakata 1 to Dakata 33

CON_52007_55001	Two Winding Transformer - Dan Agundi 1 to Dan Agundi 3
CON_53000_153000	Two winding transformer - Kaduna 3 to Gen_Kaduna
CON_63001_62001	Two winding transformer - Jos 3 to Jos 1
CON_82005_86020	Two winding transformer - Eket 1 to Ibom Genbus
CON_82007_85009	Two winding transformer - PHCT Main 1 to PHCT Main 33

13. Appendix C – QV Curves for transition cases

QV analysis can be used to observe the relationship between voltage and additional reactive power injection at a given location. QV analysis was performed for selected buses in all transition cases where severe voltage violations were observed. Figure 2 shows QV curves obtained at Katampe 330 kV bus for three transition cases identified in Table 29.

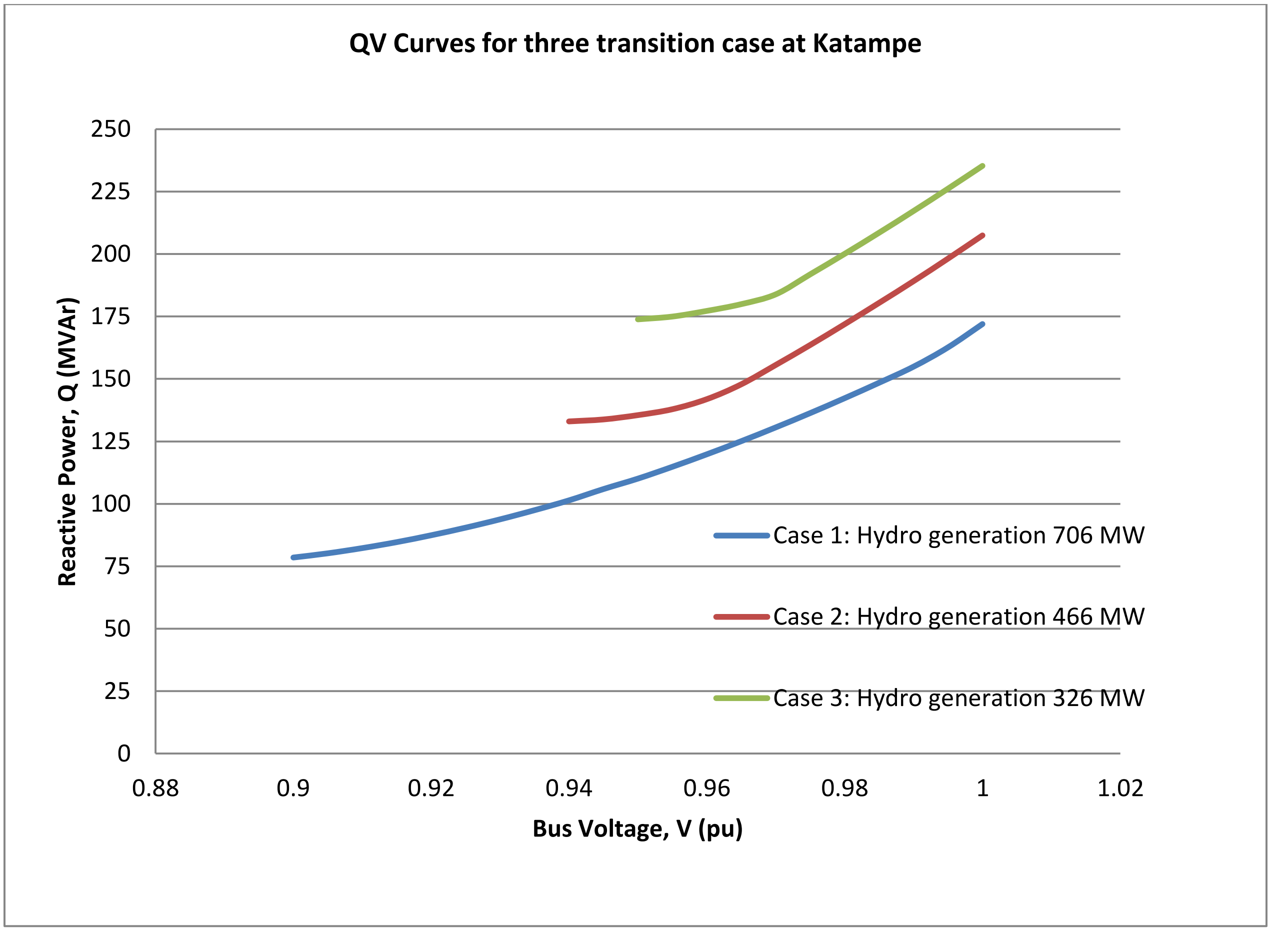


Figure 2: QV curves for three transition cases

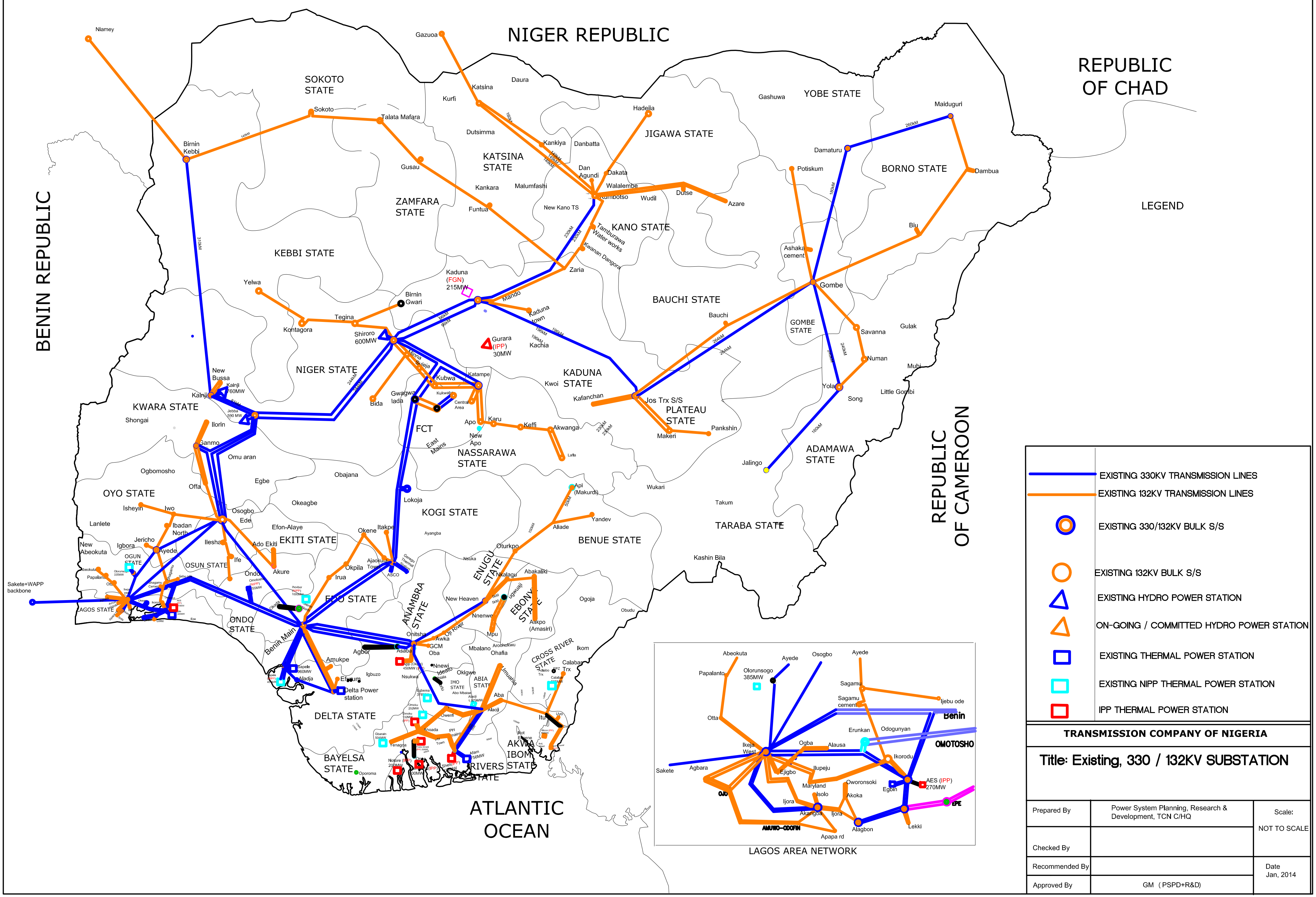
In Figure 2, curve 1, 2 and 3 are corresponding to transition case 1, 2 and 3 in Table 29. The left most point in each QV curve represents the minimum reactive power injection that provides a converged powerflow solution. For example, transition case 1 ('blue' curve) requires at about 75 MVAr to get a converged solution. Similarly, transition case 2 and 3 require about 130 MVAr and 175 MVAr to converge.

Transition case 1 requires about 175 MVAr reactive power support to maintain Katampe voltage at 1 pu. Similarly, transition case 2 and 3 requires about 210 MVAr and about 240 MAVr to maintain Katampe voltage at 1 pu. These observations made for transition cases were used to decide reactive power additions for transfer cases.

Since a 100 MVAr capacitor is already incorporated for the base case at Katampe 330 kV bus, only 60 MVAr was added to facilitate transfer case 1. Similarly, additional 50 MVAr was added when developing transfer Case 2 (Thus transfer case 2 has 100+60+50=210 MVAr) from transfer case 1. When developing transfer case 3 from transfer case 2, an additional 40 MVAr was added (transfer case 3 has 100+60+50+40= 250 MVAr).

Appendix B Financing Package 1 – Ongoing Projects Needing Incremental Funding

NIGERIAN POWER TRANSMISSION 330 / 132KV GRID MAP AS AT JAN 2014



TCN Current Capital Project Funding and Progress

S/N	Project Title	Name of Contractor	Client Group	Funding Source	Total Cost (Naira)	Payment to Date (₦)	Project Status	% Completed	Balance To Complete (Naira)
1	2nd Benin-Onitsha 330kv SC line.	ABB; Dextron Engineering Ltd	TCN/TSP	FGN, AFDB	4,205,289,346.35	3,259,440,031.79	7	70	945,849,314.56
2	Construction of 150MVA 330/132/33kV T/F and 330kV bays at Onitsha and Benin.	Siemens Ltd. MBH Power Ltd	TCN/TSP	FGN	639,623,673.85	484,766,799.13	8	100	154,856,874.72
3	Calabar 2x150MVA, 330/132/33kV Substation and line bay at Alaoji Substation.	Areva T & D SPR MBH Power Ltd.	TCN/TSP	FGN	598,094,641.88	561,402,566.38	8	95	36,692,075.50
4	Construction of 2 x 150MVA, 330/132kV substation at Yola and 330kV Bay Extension at Gombe.	Siemens Ltd. MBH Power Ltd.	TCN/TSP	FGN	5,991,019,162.16	5,525,165,558.39	8	100	465,853,603.77
5	Construction of Alaoji-Umuahia 132kV DC line	Pivot Engineering Co. Ltd	TCN/TSP	FGN	1,347,505,044.12	1,154,609,432.90	8	100	192,895,611.22
6	Umuahia 2x30/40MVA, 132/33kV Substation	Valenz Holdings (Nig) Ltd.	TCN/TSP	FGN	1,602,261,641.87	1,583,182,866.67	8	100	19,078,775.20
7	Arochukwu 2x30/40MVA, 132/33kV substation	Omen International Ltd.	TCN/TSP	FGN	921,727,696.35	856,788,022.35	9	80	64,939,674.00
8	Mbalano-Okigwe 132kv SC line	Antlatic Engineering & Construction	TCN/TSP	FGN, Eurobond	329,754,483.86	219,090,934.39	8	100	110,663,549.47
9	Okigwe 2x30/40MVA 132/33kV Substation	Union Allied Engineering Ltd.	TCN/TSP	FGN, Eurobond	1,839,789,715.03	894,631,560.77	7	65	945,158,154.26
10	Umuahia-Ohafia 132kv SC line	Harlesden Engineering Ltd	TCN/TSP	FGN	1,257,267,830.78	622,532,816.49	7	25 before termination	634,735,014.29
11	Ohafia 2x30/40MVA 132/33kV substation.	Union Allied Engineering Ltd.	TCN/TSP	FGN	1,972,613,202.90	916,274,491.86	7	65	1,056,338,711.04
12	Mbalano 2x30/40MVA 132/33kV substation.	Union Allied Engineering Ltd.	TCN/TSP	FGN, Eurobond	1,409,011,316.42	965,213,163.65	7	65	443,798,152.77

Client Group: TCN TSP, TCN SO, TCN PMU, NIPP

Project Status: 1 Location surveyed, 2 Land acquired, 3 EIA and SIA completed, 4 TOR and RFP completed, 5 Contract awarded, 6 Bid Bond posted,

7 Advance Payment issued, 8 Project completed, 9 Project stalled, 10 Project cancelled

TCN Current Capital Project Funding and Progress

S/N	Project Title	Name of Contractor	Client Group	Funding Source	Total Cost (Naira)	Payment to Date (₦)	Project Status	% Completed	Balance To Complete (Naira)
13	Akure-Ado Ekiti 132kv SC line	Siemens Ag + Dextron Engineering Ltd	TCN/TSP	FGN	849,000,374.22	808,865,623.14	8	100	40,134,751.08
14	Talata Mafara 2x30/40MVA 132/33kV substation	Continental Engr'g Nig. Ltd.	TCN/TSP	FGN	559,871,093.20	441,259,289.67	8	98	118,611,803.53
15	Katampe-National Stadium 132kv DC line	ABB Powerlines; Energo Nigeria Ltd	TCN/TSP	FGN, Eurobond	2,656,115,130.98	1,695,457,006.41	7	15	960,658,124.57
16	Damaturu 330/132kV Substation	Parsian High VoltageDiv./ Cartlark Int'l Ltd	TCN/TSP	FGN, Eurobond	2,502,960,280.52	2,165,010,592.92	7	85	337,949,687.60
17	Maiduguri 1x150MVA, 330/132kV Substation	Charnel Engr. Co. Ltd. & AY - KAY	TCN/TSP	FGN, Eurobond	2,811,394,650.71	1,578,045,838.79	7	4	1,233,348,811.92
18	Onitsha-Ifitedunu 132kv DC Transmission line	Bid evaluation completed and awaiting Management approval	TCN/TSP	FGN	2,265,940,601.10	0.00	4	0	2,265,940,601.10
19	Construction of 2 x 60MVA 132/33kV Sunstation at Ifitedunu and 2 x 132kv line bays extension at Onitsha	Bid evaluation completed and awaiting Management approval	TCN/TSP	FGN	2,582,869,065.18	0.00	4	0	2,582,869,065.18
20	Nnewi 2x60 MVA 132kV substation	Valenz Holdings (Nig) Ltd.	TCN/TSP	FGN	1,233,491,817.28	905,050,126.35	7	50	328,441,690.93
21	132/33KV Substation at Ayangba	Omen Int ltd	TCN/TSP	FGN	1,281,971,870.25	443,645,303.23	7	60	838,326,567.02
22	Jos - Kafanchan 132KV D/C Line .	Energo Nig Limited	TCN/TSP	FGN	1,407,774,047.57	1,380,307,527.82	8	100	27,466,519.75
23	Kafanchan 132kv 2 x 60mva Substation	Valenz Holding Ltd	TCN/TSP	FGN, Eurobond	1,225,704,689.74	1,022,437,878.75	7	65	203,266,810.99
24	Makere - Pankshin 132KV DC Line	Mogabs Nig. Ltd	TCN/TSP	FGN	564,386,464.12	445,203,306.75	7	75	119,183,157.37
25	2 x 30MVA 132/33KV S/S at Pankshin and Makeri	North China/EESE	TCN/TSP	FGN	2,058,143,958.24	1,377,000,784.40	8	100	681,143,173.84
26	Kano- Walalanbe 132KV Line (Turn in and out of Dan agundi-Dakata 132KV single Cct Line) and 2 x 30/40MVA S/S at Walalambe	GIT	TCN/TSP	FGN, Eurobond	1,783,781,485.32	993,443,856.67	7	55	790,337,628.65
27	Yelwa - Yauri 2 x 30/40MVA S/S and 100KM of 33KV Line	Valenz/ Electromontaz	TCN/TSP	FGN, Eurobond	1,067,910,710.00	960,287,664.25	7	52	107,623,045.75

TCN Current Capital Project Funding and Progress

S/N	Project Title	Name of Contractor	Client Group	Funding Source	Total Cost (Naira)	Payment to Date (₦)	Project Status	% Completed	Balance To Complete (Naira)
28	3rd Benin - Onitsha 330KV DC Line	KEC International	TCN/TSP	FGN, AFDB	6,539,926,332.00	6,355,495,241.05	8	98	184,431,090.95
29	Daura 2 x 30/40MVA S/S and 2x 132kv line bay ext. at Katsina	NCEP/Power Control & Appliances	TCN/TSP	FGN	1,686,967,544.11	1,375,752,974.36	7	5	311,214,569.75
30	Obudu - Ogoja 132KV DC Line	Jilon Elect Engr; Sinotec/KEC	TCN/TSP	FGN	1,148,659,353.21	570,147,357.06	7	12 before termination	578,511,996.15
31	2x30/40MVA 132/33kV S/S at Ogoja	Income Electrix Ltd	TCN/TSP	FGN	1,336,710,579.79	1,086,599,387.09	7	75	250,111,192.70
32	Rehabilitation of Sokoto - Talatmafara 132KV DC line	Dextron	TCN/TSP	FGN	356,639,704.67	342,009,117.90	8	100	14,630,586.77
33	1x60MVA Substation at Ughelli Power Plant and 1x30/40MVA substation reinforcement at	Continental Engr'g Nig. Ltd.	TCN/TSP	FGN, Eurobond	791,334,541.30	752,597,157.67	7	90	38,737,383.63
34	Umuahia - Mbalano 132KV Line	Santon Energy L:td	TCN/TSP	FGN, Eurobond	856,128,363.00	508,916,938.26	7	67 before termination	347,211,424.74
35	Ohafia - Arochukwu 132KV Line	Mogabs Nig. Ltd	TCN/TSP	FGN	978,642,547.37	632,432,579.95	7	44 before termination	346,209,967.42
36	Lokoja - Obajana 330KV Line and Substation	Elem & Elgo / Steers/Optic 1	TCN/TSP	FGN	695,939,096.83	176,823,563.70	7	45 before termination	519,115,533.13
37	330/132kV substation at Obajana	Payma Bargh/ Cartlark	TCN/TSP	FGN	2,568,846,118.51	2,125,164,458.08	7	35	443,681,660.43
38	Kukwaba 2x60MVA, 132/33kV substation	North China Power Egnineering/News Engineering	TCN/TSP	FGN, Eurobond	1,395,055,232.60	1,113,321,437.40	7	20	281,733,795.20
39	2 x60MVA 132/33kV S/S at Ogbomosho 1no. 132kV Bay Extension at Ganmo	Payma Bargh/ Cartlark	TCN/TSP	FGN, Eurobond	1,381,986,399.86	1,274,440,061.56	7	77	107,546,338.30
40	Nsukka - Ayangba 132KV DC Line	West Com Ltd/PPCL	TCN/TSP	FGN	1,480,777,014.45	1,123,416,372.02	7	45	357,360,642.43
41	2x60MVA, 132/33kV substation at Aboh Mbaise and 2x132kV line bays extension at Owerri	Ashtavinayaka/Bran Engineering	TCN/TSP	FGN	1,480,777,014.45	1,046,048,266.16	7	65	434,728,748.29
42	Transmission & Supply of Substation at Tamburawa Water Facility	PEL/ NESPAK	TCN/TSP	FGN	1,739,004,380.94	1,461,568,304.39	7	95	277,436,076.55
43	2 x 330KV Line bay extension at Kaduna, Jos and Onitsha	Valenz Holding Ltd	TCN/TSP	FGN	1,240,589,916.19	1,080,561,299.16	7	25	160,028,617.03

TCN Current Capital Project Funding and Progress

S/N	Project Title	Name of Contractor	Client Group	Funding Source	Total Cost (Naira)	Payment to Date (₦)	Project Status	% Completed	Balance To Complete (Naira)
44	2x60 MVA, 132/33 kV substation at Ideato and 2 x132KV Line Bays at Okigwe	Ashtavinayaka/Bran Engineering	TCN/TSP	FGN	1,852,143,857.48	1,588,087,757.17	7	65	264,056,100.31
45	2x60 MVA, 132/33 kV substation at Oba and 2 x132KV Line Bays at Nnewi	Xian/GIT Engineering	TCN/TSP	FGN	1,863,432,339.26	1,502,085,965.44	7	45	361,346,373.82
46	1X30 MVA 132/33 KV SS at Kwanar Dangora	MATALEC	TCN/TSP	FGN	1,395,402,462.00	1,382,743,021.82	7	100	12,659,440.18
47	Afam-Port Harcourt 132kV D/C turning in and out at Port harcourt main Ts	Rivers State Govt.	TCN/TSP	FGN	270,000,000.00	230,000,000.00	7	100	40,000,000.00
48	Compensation for Transmission Projects	Various	TCN/TSP	FGN	3,305,000,000.00	2,134,621,924.72	7	64	1,170,378,075.28
49	Port Clearing Charges for Transmission Projects	Various	TCN/TSP	FGN	1,462,826,305.00	358,337,410.86	7	24	1,104,488,894.14
50	Grid Rehabilitation And Reinforcement, Katsina, Hadejia, Kontagora.	Junot Construction	TCN/TSP	FGN	1,261,482,166.72	909,218,404.25	7	35	352,263,762.47
51	1X30MVA, 132/33 kV Substation at Wudil	CON Engineering	TCN/TSP	FGN	1,554,231,496.95	1,081,024,923.34	7	40	473,206,573.61
52	Kaduna - Jos 330KV DC Line	Dextron Engr. Ltd	TCN/TSP	FGN	8,714,447,318.27	5,107,847,214.53	7	60	3,606,600,103.74
53	2x30/40 MVA, 132/33 kV substation at Lanlate and 2 x132KV Line Bays at New Abeokuta 132/33 kV substation	Skipper Electricals Ltd	TCN/TSP	FGN	1,577,304,387.87	1,179,555,266.92	7	37	397,749,120.95
54	Transmission - 2x60MVA 132/33KV Substation at Igangan & 132kV Switching Station at Igboora	Rhuoga Energy	TCN/TSP	FGN	2,420,443,752.74	1,193,860,763.34	7	15	1,226,582,989.40
55	Ganmo -Ogbomosho 132kV DC line	Trennco Power/Eco Energo Group	TCN/TSP	FGN, Eurobond	1,223,259,627.73	733,902,162.39	7	15	489,357,465.34
56	Kaduna Plant to Mando Road and Substation Extension	Hundai Energy & Construction Ltd/ IPDC Ltd	TCN/TSP	FGN, Eurobond	1,235,598,207.04	493,924,327.19	7	20	741,673,879.85
57	Owerri - Abo Mbaise 132KV DC Line	Bateman	TCN/TSP	FGN	781,193,181.81	240,306,821.29	7	2	540,886,360.52

TCN Current Capital Project Funding and Progress

S/N	Project Title	Name of Contractor	Client Group	Funding Source	Total Cost (Naira)	Payment to Date (₦)	Project Status	% Completed	Balance To Complete (Naira)
58	Construction of 132kV Double Circuit Transmission Line from Akwanga to Lafia.	Bateman	TCN/TSP	FGN	1,147,170,485.67	433,408,824.15	7	10	713,761,661.52
59	2x30/40MVA, 132/33kV S/S at Lafia	Monotech Input/Bangladesh	TCN/TSP	FGN	1,490,085,721.56	740,626,322.85	7	5	749,459,398.71
60	Benin North-Oshogbo 330KV DC line with one SC turning in and out to New Akure substation	Gammon India Ltd	TCN/TSP	FGN, Eurobond	7,460,190,274.90	1,514,181,172.86	7	25	5,946,009,102.04
61	2x60MVA, 132/33KV S/S at Shonga.	New World/Ruoga Energy	TCN/TSP	FGN	1,600,790,830.21	296,779,005.54	7	3	1,304,011,824.67
62	Omotosho-Epe-Aja 330KV DC Line.	KEC International Limited	TCN/TSP	FGN	6,620,497,079.07	1,174,134,801.74	7	27	5,446,362,277.33
63	2x60MVA,132/33kV substation at Amasiri, Afikpo and 2x132kV line bay extension at Abakaliki	Techno Electric & Engineering Co. Ltd	TCN/TSP	FGN	1,453,991,357.66	440,041,842.36	9	5	1,013,949,515.30
64	2x60MVA,132/33kV substation at Mpu, with 2x132kV line bay extension at Nnenwe	Ashtavinayaka/Bran Engineering	TCN/TSP	FGN	1,478,201,187.82	396,761,411.32	7	6	1,081,439,776.50
65	2nd Kaduna-Kano 33kV DC line.	National Power Construction	TCN/TSP	FGN	8,514,855,688.26	656,253,791.77	7	0	7,858,601,896.49
66	New Akure 2X150MVA,330/132KV Substation	Matelec	TCN/TSP	FGN, Eurobond	4,541,953,527.00	641,529,925.78	7	15	3,900,423,601.22
67	Jalingo 2x30/40MVA, 132kV Substation	News Engineering Nig. Ltd.	TCN/TSP	FGN	693,836,117.08	627,600,582.27	8	100	66,235,534.81
68	Gombe - Yola - Jalingo 330kV SC line	Chrome Consortium/Dextron	TCN/TSP	FGN	12,249,781,621.08	11,967,059,384.02	8	100	282,722,237.06
69	Amukpe (Sapele) 1x30/40MVA Substation	News Engineering Nig. Ltd.	TCN/TSP	FGN	407,450,840.10	337,542,290.61	8	100	69,908,549.49
70	Oshogbo- Ede 132KV DC Line	Aster Infrast/Aster Teleservices	TCN/TSP	FGN	530,226,664.19	270,045,380.38	7	40	260,181,283.81
71	2X60MVA Substation at Ede	Cobra-Sibga JV	TCN/TSP	FGN	1,747,600,713.91	421,847,506.00	7	20	1,325,753,207.91
72	Erukan - Omotosho 330KV DC Trx. Line	Energo Nig Limited	TCN/TSP	FGN	6,222,079,519.42	1,159,161,122.44	7	10	5,062,918,396.98
73	2x 150MVA 330/132KV SS at Omotosho	AK-AY Elektrik	TCN/TSP	FGN	3,614,033,428.98	901,937,521.88	7	10	2,712,095,907.10
74	Kano-Katsina 330KV DC Transmission Line	Gammon India	TCN/TSP	FGN	6,123,452,721.78	1,647,714,774.41	7	30	4,475,737,947.37

TCN Current Capital Project Funding and Progress

S/N	Project Title	Name of Contractor	Client Group	Funding Source	Total Cost (Naira)	Payment to Date (₦)	Project Status	% Completed	Balance To Complete (Naira)
75	2x150MVA Substation at Katsina.	Barme/ESL	TCN/TSP	FGN	3,998,689,080.02	910,756,983.33	7	10	3,087,932,096.69
76	Abakaliki - Amasiri 132kV DC line	Fluor Eng/Eurafric	TCN/TSP	FGN	1,448,780,446.73	347,307,235.54	7	10	1,101,473,211.19
77	Katsina-Kurfi-Dutsinma-Kankara-Malumfashi 132KV Line	Skipper Electricals Ltd	TCN/TSP	FGN	2,990,230,818.96	752,376,872.65	7	10	2,237,853,946.31
78	2x60MVA, 132/33kV substation at Kurfi	Gracehill Energy Nig. Ltd	TCN/TSP	FGN	1,492,490,054.98	311,590,034.25	7	10	1,180,900,020.73
79	2x60MVA, 132/33kV substation at Dutsinma	Hoquado Limited	TCN/TSP	FGN	1,278,158,301.28	332,842,095.17	7	10	945,316,206.11
80	2x60MVA, 132/33kV substation at Kankara	PEL-NESPAK JV	TCN/TSP	FGN	1,411,387,601.67	295,357,363.84	7	10	1,116,030,237.83
81	2x60MVA, 132/33kV substation at Malumfashi	Monotech Input/Bangladesh	TCN/TSP	FGN	1,250,988,584.47	244,688,926.74	7	15	1,006,299,657.73
82	Kumbotso (Daura)-Dambatta 132KV Line	Icom Tele Ltd	TCN/TSP	FGN	1,533,623,568.20	857,049,649.96	7	20	676,573,918.24
83	2x60MVA, 132/33kV substation at Dambatta, Kano State.	PEL-NESPAK JV	TCN/TSP	FGN	1,533,623,568.20	891,399,251.06	7	20	642,224,317.14
84	Ganmo-Shonga 132KV DC Line .	Aster Infrast/Aster Teleservices	TCN/TSP	FGN	2,622,191,252.87	510,591,278.03	7	10	2,111,599,974.84
85	Katsina- Daura 132kv DC line Katsina State	Income Electrix Ltd. Reawarded to Optic 1 Nig. Ltd	TCN/TSP	FGN	2,465,300,298.12	1,068,597,635.73	7	48	1,396,702,662.39
86	Damaturu-Gashua 132kV DC transmission line (245km)	Dextron Eng., Ltd	TCN/TSP	FGN	5,440,638,606.31	0.00	5	0	5,440,638,606.31
87	Gashua-Hadejia 132kV DC transmission line (150km)	Jyot Structures Ltd	TCN/TSP	FGN	3,392,394,044.93	0.00	5	0	3,392,394,044.93
88	2x60MVA, 132/33kV substation at Gashua and 2x132kV line bays extensions at Damaturu and Hadejia substations.	Concept Eng/Chanref	TCN/TSP	FGN	2,146,875,489.00	0.00	5	0	2,146,875,489.00
89	2x330kV line bay extensions at each of Kaduna and Kano substations	Exenergia Power/Bigen Africa	TCN/TSP	FGN	1,157,997,292.40	224,590,903.76	7	5	933,406,388.64
90	Delta-Port Harcourt 330kV DC line	Icom Tele Ltd	TCN/TSP	FGN	6,173,850,833.93	1,176,077,625.48	7	1	4,997,773,208.45

TCN Current Capital Project Funding and Progress

S/N	Project Title	Name of Contractor	Client Group	Funding Source	Total Cost (Naira)	Payment to Date (₦)	Project Status	% Completed	Balance To Complete (Naira)
91	4x330kV line bays extensions at Delta and Port Harcourt substations	MBH Power Ltd	TCN/TSP	FGN	1,237,745,143.35	336,006,584.38	7	20	901,738,558.97
92	Yola-Song-Mubi-Gulak 132kV DC line	Skipper Electricals Ltd	TCN/TSP	FGN	7,457,033,255.05	1,286,756,684.96	7	1	6,170,276,570.09
93	2x60MVA, 132/33kV substations at Song	Qingado Wuxio/Ahmin Tech & Power System	TCN/TSP	FGN	1,691,183,805.43	224,620,542.51	7	5	1,466,563,262.92
94	2x60MVA, 132/33kV substation at Little Gombi	Shandong Taikai	TCN/TSP	FGN	1,468,436,221.81	301,474,797.36	7	8	1,166,961,424.45
95	2x60MVA, 132/33kV substations at Mubi	Hyundai/Richfied Energy	TCN/TSP	FGN	1,438,428,976.80	282,455,938.06	7	5	1,155,973,038.74
96	2x60MVA, 132/33kV substations at Gulak	Concept Eng/Chanref	TCN/TSP	FGN	1,876,263,194.07	215,339,107.55	7	5	1,660,924,086.52
97	2x60MVA 132/33kV substation at Okeagbe, Ondo State and line bays extension at Obajana	Power Control & Appliances	TCN/TSP	FGN	1,541,961,682.82	428,903,819.42	7	25	1,113,057,863.40
98	Obajana-Okeagbe 132kV DC line	Everest Infra energy Ltd	TCN/TSP	FGN	1,969,973,210.18	278,468,364.00	7	1	1,691,504,846.18
99	Ugwuaji-Nnenwe 132kV DC line	Ashtavinayaka/Bran Eng Ltd	TCN/TSP	FGN	860,431,361.12	198,722,276.00	7	10	661,709,085.12
100	2x60MVA, 132/33kV substation at Nnenwe	Metro Elektrik	TCN/TSP	FGN	1,754,876,530.28	145,014,161.00	7	2	1,609,862,369.28
101	Nnenwe-Mpu 132kV DC line	Power Projects Ltd/Dorman Long	TCN/TSP	FGN	860,403,171.63	129,681,834.98	7	1	730,721,336.65
102	Keffi-Kwoi-Kachia 132kV DC line	Aster Infrast/Aster Teleservices	TCN/TSP	FGN	3,017,531,968.16	538,523,491.39	7	3	2,479,008,476.77
103	2x60MVA substation at Kwoi	Liaoning Efacec Elect Equipment Co.	TCN/TSP	FGN	1,679,728,453.64	84,719,404.00	7	1	1,595,009,049.64
104	2x60MVA substation at Kachia	Esterbag Eng. Ltd	TCN/TSP	FGN	1,355,044,933.35	139,547,825.80	7	2	1,215,497,107.55
105	Omu Aran-Egbe 132kV DC line	Aravali Infra Power Ltd	TCN/TSP	FGN	1,086,539,157.35	168,792,105.00	7	3	917,747,052.35
106	2x60MVA 132/33kV substation at Egbe	TBEA Hengyang Transformer Co. Ltd	TCN/TSP	FGN	1,633,321,632.56	95,373,851.00	7	10	1,537,947,781.56

TCN Current Capital Project Funding and Progress

S/N	Project Title	Name of Contractor	Client Group	Funding Source	Total Cost (Naira)	Payment to Date (₦)	Project Status	% Completed	Balance To Complete (Naira)
107	DC 132kV line from Alscon to Ibom Power and Switching Station to link the GIS at Alscon with associated bay extensions at Ibom Power - Akwa Ibom State	KEC International Ltd	TCN/TSP	FGN, Eurobond	747,246,322.01	502,037,879.13	7	45	245,208,442.88
108	2x60MVA, 132/33kV Substation at Ose LGA Headquarters, Ondo State	Junot Eng. Services Ltd	TCN/TSP	FGN	1,607,059,828.55	333,774,712.81	7	1	1,273,285,115.74
109	Yenagoa-Oproma 132kV DC transmission line (50km)	Fluor Eng/Eurafric	TCN/TSP	FGN	5,965,951,491.16	0.00	5	0	5,965,951,491.16
110	2x60MVA, 132/33kV substation at Oproma and 2x132kV line bats extension at Yenagoa substation.	Alfa/Cobra/fedders JV	TCN/TSP	FGN	2,598,473,746.01	0.00	5	0	2,598,473,746.01
111	Gagarawa 2x60 MVA, 132/33 kV substation, Jigawa State	Power Control & Appliances	TCN/TSP	FGN	1,108,202,022.55	247,837,977.54	7	5	860,364,045.01
112	1x60MVA, 132/33kV substation reinforcement at Ukpilla substation, Edo State	Power Control & Appliances	TCN/TSP	FGN, Eurobond	542,587,478.01	160,102,471.70	7	5	382,485,006.31
113	Provision of additional 2x150MVA 330/132KV Transformer capacity at Olorunsogo T/S.	Matelec	TCN/TSP	FGN	3,628,192,987.56	433,341,705.04	7	0	3,194,851,282.52
114	Olorunsogo - Shagamu 132kV DC Transmission Line	Pivot Engineering Ltd	TCN/TSP	FGN	1,769,242,719.40	0.00	7	0	1,769,242,719.40
115	Ikorodu - Odogunyan - Shagamu 132kV DC Transmission Line	PPCL/ Westcom JV	TCN/TSP	FGN, Eurobond	3,192,097,185.53	2,383,660,127.00	7	45	808,437,058.53
116	2 x 60MVA, 132/33kV substations at Odogunyan and Ayobo with 132kV DC Tline Ikeja West - Ayobo.	LAGA CE	TCN/TSP	FGN, Eurobond	3,657,155,630.00	0.00	7	95	3,657,155,630.00
117	Rehabilitation of Afam TS with 1x150MVA 330/132/33kV transformer and construction of Afam IV to Afam II 132kV Transmission Line	Telavars Group	TCN/TSP	FGN, Eurobond	1,472,806,633.00	1,138,812,149.00	7	60	333,994,484.00

TCN Current Capital Project Funding and Progress

S/N	Project Title	Name of Contractor	Client Group	Funding Source	Total Cost (Naira)	Payment to Date (₦)	Project Status	% Completed	Balance To Complete (Naira)
118	1 x 150MVA 330/132kV transformer at Birnin Kebbi and Reinforcement at 330/132/33 kV substation, Kumbotso	MBH Power	TCN/TSP	FGN, Eurobond	3,559,832,143.76	3,009,152,389.00	7	85	550,679,754.76
119	Kainji - New Bussa 132kV DC Transmission Line & 330KV SC River Crossing	Dextron Engineering Ltd	TCN/TSP	FGN, Eurobond	308,108,608.21	157,431,893.07	7	98	150,676,715.14
120	Kainji 1 x 150MVA 330/132kV & 2 x 30/40MVA Substation at New Bussa	MBH Power	TCN/TSP	FGN, Eurobond	4,599,287,900.03	0.00	7	89	4,599,287,900.03
121	New Abeokuta - Igboora - Lanlate 132KV DC line and 132KV Tee - off at Igboara - Igangan.	Laga CePower Ltd	TCN/TSP	AFDB	2,352,416,105.00	2,352,416,105.00	5	0	0.00
122	Onitsha - Oba - Nnewi - Ideato - Okigwe 132KV DC Line	Ashtavinayaka/Bran Eng Ltd	TCN/TSP	AFDB	1,711,842,772.00	1,711,842,772.00	5	0	0.00
	TOTAL				**277,542,847,127.29**	**119,254,586,007.61**			**158,288,261,119.68**
					989,301,632.00	**158,288,261,119.68**	+G131/160		+J130/160

<u>Project Status:</u> 1 Location surveyed, 2 Land acquired, 3 EIA and SIA completed, 4 TOR and RFP completed, 5 Contract awarded, 6 Bid Bond posted, 7 Advance Payment issued, 8 Project completed, 9 Project stalled, 10 Project cancelled

TRANSMISSION PROJECT LOGICAL FRAMEWORK		TCN
Project Title : **2nd Benin-Onitsha 330kv SC line Edo-Delta- Anambra States**		**Date :** **April 2013**
Project Narrative	**Indicators**	**Critical considerations**
(1)Programme Objective: To improve power delivery of the Transmission grid.	Improve economic activity of the entire nation.	There is evacuation constraint on the existing SC line to wheel the bulk of generation from the south and eastern block to the rest of the grid.
(2) Project Objective: Power evacuation from the south and eastern block to the rest of the grid.	Additional 1,200MW transmission line capacity to be utilised.	About 1,000 MW of bulk generated power from the south to be evacuated to the rest of the grid.
(3) Scope/Outputs: Scope: a) Construction 2nd Benin-Onitsha 330kv SC line. (Edo-Delta &Anambra State) b) Line bay extension at Benin & Onitsha 330/132KV Substations. Outputs : Increase in transmission capacity by 1200 MW.	Extra 1200 MW transmission capacity is available.	Competent contractor is employed to deliver the project.
(4) Inputs/costs: …..km of 2nd Benin-Onitsha 330kv SC line (Bison) and related accessoires.	**Funding**: **Balance to complete**:	Fully funded LC/ Timely release of fund.
(5) Others: Power is necessary for - power evacuation - interconnectivity - Security & reliability of the grid.		

TRANSMISSION PROJECT LOGICAL FRAMEWORK		**TCN**
Project Title : Ahoada - Degema 132kV DC Transmission line + 2 x 132kV Line Bay Extensions		**Project Time line** **Start:** **Finish:**
Project Narrative	**Indicators**	**Critical considerations**
(1)Programme Objective: To improve power delivery from Ahoada & southern power hub to Delta area of Degema in Rivers State.	Improve economic activity of Rivers State.	There is evacuation constraint to wheel the generation from from Ahoada Power Station to supply bulk supply to Degema and environs in Rivers State.
(2) Project Objective: Power evacuation from Ahoada & southern power hub to Delta area of Degema in Rivers State.	Additional 240 MW transmission line capacity to be utilised.	About 200 MW of generated power from Ahoada Power Station to Degema and environs in Rivers State
(3) Scope/Outputs: Scope: a) Construction of Ahoada - Degema 132kV DC Transmission line b) Line bay extension at Ahoada 132KV Sub station. Outputs : Increase in transmission capacity by 240 MW.	Extra 240 MW transmission capacity is available.	Competent contractor is employed to deliver the project.
(4) Inputs/costs: Inputs a) Construction of Ahoada - Degema 132kV DC Transmission line b) Line bay extension at Ahoada 132KV Substation. Costs :	**Funding**: **Balance to complete**:	Fully funded LC/ Timely release of fund.
(5) **Others:** The project is necessary for - power evacuation - Bulk supply to Rivers State.		

TRANSMISSION PROJECT LOGICAL FRAMEWORK		TCN
Project Title : 2nd Ayede - Ishara - Shagamu 132kV Transmission Line + 2 Line Bay Extension + 2 x 60MVA 132/33kV at Ishara-Remo		**Project Time line** **Start:** **Finish:**
Project Narrative	**Indicators**	**Critical considerations**
(1)Programme Objective: To improve bulk power delivery from Ayede 330/132KV Substation to Ishara and Shagamu areas of Ogun State.	Improve economic activity of Ogun State.	There is bulk supply constraint from Ayede substation to Ishara and Shagamu areas of Ogun State.
(2) Project Objective: Bulk power delivery from Ayede 330/132KV Substation to Ishara and Shagamu areas of Ogun State.	Additional 240 MW transmission line capacity to be utilised.	About 200 MW of power from Ayede to Ishara and Shagamu areas of Ogun State.
(3) Scope/Outputs: Scope: a) Construction of 2nd Ayede - Ishara - Shagamu 132kV Transmission Line b)2 x 60MVA 132/33kV at Ishara-Remo c) Line bay extension at Ayede & Shagamu 132KV Sub stations. Outputs : Increase in transmission capacity by 240 MW.	Extra 240 MW transmission capacity is available. 120MVA Transformation.	Competent contractor is employed to deliver the project.
(4) Inputs/costs: Inputs a) Construction of 2nd Ayede - Ishara - Shagamu 132kV Transmission Line b)2 x 60MVA 132/33kV at Ishara-Remo c) Line bay extension at Ayede & Shagamu 132KV Sub stations. Costs :	**Funding**: **Balance to complete**:	Fully funded LC/ Timely release of fund.
(5) Others: The project is necessary for - Bulk supply - Reliability and - Voltage improvement.		

TRANSMISSION PROJECT LOGICAL FRAMEWORK		TCN
Project Title : **Delta – Port Harcourt 330kV DC Line.**		**Date :** **April 2013**
Project Narrative	**Indicators**	**Critical considerations**
(1)Programme Objective: To improve power delivery of the transmission grid.	Improve economic activity of the nation.	There is evacuation constraint to wheel the bulk of generation from the south to the rest of the grid.
(2) Project Objective: Power evacuation from the pool of power plants in the south to the rest of the grid.	Additional 1200 MW transmission line capacity to be utilised.	About 1000 MW of power is transported.
(3) Scope/Outputs: Scope: a) Construction of Delta – Port Harcourt 330kV DC Line. b) Line bay extension at Delta 330/132 KV Sub stations. Outputs : Increase in transmission capacity by 1200 MW.	Extra 1200 MW transmission capacity is available.	Competent contractor is employed to deliver the project.
(4) Inputs/costs: Inputs :…..km of Delta – Port Harcourt 330kV DC Line. Costs :	**Funding**: **Balance to complete**:	Fully funded LC/ Timely release of fund.
(5) Others: The project is necessary for - power evacuation - Reliability.		

TRANSMISSION PROJECT LOGICAL FRAMEWORK		TCN
Project Title : 4x330kV line bays extensions at Delta and Port Harcourt substations		**Date :** **April 2013**
Project Narrative	**Indicators**	**Critical considerations**
(1)Programme Objective: To improve power delivery of the transmission grid.	Improve economic activity of the nation.	There is evacuation constraint to wheel the bulk of generation from the south to the rest of the grid.
(2) Project Objective: Power evacuation from the pool of power plants in the south to the rest of the grid.	Supported Additional 1200 MW transmission line capacity to be utilised.	About 1000 MW of power is transported.
(3) Scope/Outputs: Scope: 4x330KV line bays extensions at Delta and PortHarcourt substations. Outputs : Line bays extensions.	Extra 1200 MW transmission capacity is available.	Competent contractor is employed to deliver the project.
(4) Inputs/costs: Inputs : 4x330KV line bays extensions at Delta and PortHarcourt substations Costs :	**Funding**: **Balance to complete**:	Fully funded LC/ Timely release of fund.
(5) **Others:** The project is necessary for - power evacuation - Reliability.		

TRANSMISSION PROJECT LOGICAL FRAMEWORK		TCN
Project Title : 2nd Akangba - Amuwo 132kV Transmission Line + 2 line Bay Extension		**Project Time line** **Start:** **Finish:**
Project Narrative	**Indicators**	**Critical considerations**
(1)Programme Objective: To improve bulk power delivery to Amuwo axis of Lagos State.	Improve economic activity of Lagos State .	There is bulk supply constraint on the existing SC line to Amuwo axis of Lagos State.
(2) Project Objective: Bulk power delivery to Amuwo axis of Lagos State.	Additional 240 MW transmission line capacities to be utilised.	About 200 MW of power Amuwo axis of Lagos State.
(3) Scope/Outputs: Scope: a) Construction of 2nd Akangba - Amuwo 132kV Transmission Line b) 2 line Bay Extension each at Akangba 8 Amuwo 132KV Sub stations. Outputs : Increase in transmission capacity by 240 MW.	Extra 240 MW transmission capacity is available. 120MVA Transformation.	Competent contractor is employed to deliver the project.
(4) Inputs/costs: Inputs a) Construction of 2nd Akangba - Amuwo 132kV Transmission Line b) 2 line Bay Extension each at Akangba 8 Amuwo 132KV Sub stations. Costs :	**Funding**: **Balance to complete**:	Fully funded LC/ Timely release of fund.
(5) **Others:** The project is necessary for - Bulk supply - Reliability and - Voltage improvement.		

TRANSMISSION PROJECT LOGICAL FRAMEWORK		TCN
Project Title : **DC 132KV line from Alscon to Ibom Power and Switching Station to link the GIS at Alscon with associated bay extension at Ibom (Akwa Ibom State)**		**Date :** **April 2013**
Project Narrative	**Indicators**	**Critical considerations**
(1)Programme Objective: To improve power delivery from Alscon Power Plant to the rest of the grid.	Improve economic activity of the nation.	There is evacuation constraint from the Alscon Power Plant to the rest of the grid.
(2) Project Objective: Power evacuation from Alscon Power Plant to the rest of the grid.	Additional 240 MW transmission line capacity to be utilised.	About 200 MW of generated power from Alscon Power Plant to the rest of the grid. Improve economic activity of the nation. .
(3) Scope/Outputs: Scope: a) Construction Alscon - Ibom 132kv DC Transmission line. b) Line bay extension at Ibom 132KV switchyard Outputs : Increase in transmission capacity by 240 MW.	Extra 240 MW transmission capacity is available.	Competent contractor is employed to deliver the project.
(4) Inputs/costs: a) Inputs : …..km of Alscon - Ibom 132kv DC Transmission line. b) Line bay extension at Ibom 132KV switchyard Costs :	**Funding**: **Balance to complete**:	Fully funded LC/ Timely release of fund.
(5) **Others:** The project is necessary for - power evacuation - Security of supply.		

TRANSMISSION PROJECT LOGICAL FRAMEWORK		TCN
Project Title : 2nd Oshogbo - Ilesha - Ife 132kV Transmission Line + 6 Line Bay Extension		**Project Time line** **Start:** **Finish:**
Project Narrative	**Indicators**	**Critical considerations**
(1)Programme Objective: To improve bulk power delivery to Ilesha & environs of Osun State.	Improve economic activity of Osun State .	There is bulk supply constraint on the existing SC line to Ilesha & environs of Osun State.
(2) Project Objective: Bulk power delivery to Amuwo axis of Ilesha & environs of Osun State.	Additional 240 MW transmission line capacity to be utilised.	About 200 MW of power to Ilesha & environs of Osun State.
(3) Scope/Outputs: Scope: a) Construction of 2nd Oshogbo - Ilesha - Ife 132kV Transmission Line b) 6 Line Bay Extension **Outputs**: Increase in transmission capacity by 240 MW.	Extra 240 MW transmission capacity is available.	Competent contractor is employed to deliver the project.
(4) Inputs/costs: Inputs a) Construction of 2nd Oshogbo - Ilesha - Ife 132kV Transmission Line b) 6 Line Bay Extension Costs :	**Funding**: **Balance to complete**:	Fully funded LC/ Timely release of fund.
(5) **Others:** The project is necessary for - Bulk supply - Reliability and - Voltage improvement.		

TRANSMISSION PROJECT LOGICAL FRAMEWORK		TCN
Project Title : **Reconductoring of Alaoji-Onitsha 330kV (138km) line**		**Date :** **April 2013**
Project Narrative	**Indicators**	**Critical considerations**
(1)Programme Objective: To improve power delivery of the Transmission grid.	Improve economic activity of the entire nation.	There is power evacuation constraint along Alaoji – Onitsha 330KV SC transmission line to the rest of the grid.
(2) Project Objective: Power evacuation from Afam and Alaoji Power stations to the rest of the grid.	Additional 1,200MW transmission line capacity to be utilised.	About 1,000 MW of bulk generated power from the south to be evacuated to the rest of the grid.
(3) Scope/Outputs: Scope: a) Removal and re-drumming of 138km bison conductor and reconductoring of same line with high temp cond.etc Outputs : Increase in transmission capacity by 1200 MW.	Extra 1200 MW transmission capacity is available.	Competent contractor is employed to deliver the project.
(4) Inputs/costs: **Inputs:** 138km of high temp cond (specs) and related accessories. **Costs**:	**Funding**: **Balance to complete**:	Fully funded LC/ Timely release of fund.
(5) **Others:** The project is necessary for; - power evacuation - reliability.		

TRANSMISSION PROJECT LOGICAL FRAMEWORK		TCN
Project Title : Kwale - Achalla - Ibusa 132kV Transmission Line + 2 x 60MVA 132/33kV Substation at Achalla & Ibusa + 6 Line Bay Extensions		**Project Time line** **Start:** **Finish:**
Project Narrative	**Indicators**	**Critical considerations**
(1)Programme Objective: To improve power delivery to Kwale in eastern district of Delta State.	Improve economic activity of Delta State.	There is evacuation constraint to wheel the generation from Kwale Power Station to its major neighbouring towns in eastern district of Delta State.
(2) Project Objective: Power evacuation from Kwale to its major neighbouring towns in Delta State	Additional 240 MW transmission line capacity to be utilised.	About 200 MW of generated power from Kwale Power Station to its major neighbouring towns in eastern district of Delta State.
(3) Scope/Outputs: Scope: a) Construction of Kwale - Achalla - Ibusa 132kV Transmission Line b) 2 x 60MVA 132/33kV Substation each at Achalla & Ibusa Outputs : Increase in transmission capacity by 240 MW.	Extra 240 MW transmission capacity is available. 240MVA transformation .	Competent contractor is employed to deliver the project.
(4) Inputs/costs: Inputs a) Construction of Kwale - Achalla - Ibusa 132kV Transmission Line b) 2 x 60MVA 132/33kV Substation each at Achalla & Ibusa . Costs :	**Funding**: **Balance to complete**:	Fully funded LC/ Timely release of fund.
(5) Others: The project is necessary for - power evacuation - Bulk supply		

TRANSMISSION PROJECT LOGICAL FRAMEWORK		TCN
Project Title : **Re conductoring of Onitsha – New Haven 330kV (96km) line**		**Date :** **April 2013**
Project Narrative	**Indicators**	**Critical considerations**
(1)Programme Objective: To improve power delivery of the Transmission grid.	Improve economic activity of the entire nation.	There is power evacuation constraint along Onitsha – New Haven 330KV SC transmission line to the rest of the grid.
(2) Project Objective: Power evacuation from the delta region to the rest of the grid.	Additional 1,200MW transmission line capacity to be utilised.	About 1,000 MW of bulk generated power from the south to be evacuated to the rest of the grid.
(3) Scope/Outputs: Scope: a) Removal and re-drumming of 96km bison conductor and reconductoring of same line with high temp cond.etc Outputs : Increase in transmission capacity by 1200 MW.	Extra 1200 MW transmission capacity is available.	Competent contractor is employed to deliver the project.
(4) Inputs/costs: **Inputs:** 96km of high temp cond (specs) and related accessories. **Costs**:	**Funding**: **Balance to complete**:	Fully funded LC/ Timely release of fund.
(5) **Others:** The project is necessary for; - power evacuation - reliability.		

TRANSMISSION PROJECT LOGICAL FRAMEWORK		TCN
Project Title : Kwale - Ivorogbo 132kV Transmission Line + 2 x 60MVA 132/33kV Substation at Ivorogbo + 2 Line Bay Extensions		**Project Time line** **Start:** **Finish:**
Project Narrative	**Indicators**	**Critical considerations**
(1)Programme Objective: To improve power delivery to Kwale in eastern district of Delta State.	Improve economic activity of Delta State.	There is evacuation constraint to wheel the generation from Kwale Power Station to its major neighbouring towns in eastern district of Delta State.
(2) Project Objective: Power evacuation from Kwale to its major neighbouring towns in Delta State	Additional 240 MW transmission line capacity to be utilised.	About 200 MW of generated power from Kwale Power Station to its major neighbouring towns in eastern district of Delta State.
(3) Scope/Outputs: Scope: a) Construction of Kwale - Ivorogbo 132kV Transmission Line b) 2 x 60MVA 132/33kV Substation at Ivorogbo Outputs : Increase in transmission capacity by 240 MW.	Extra 240 MW transmission capacity is available. 120MVA transformation .	Competent contractor is employed to deliver the project.
(4) Inputs/costs: Inputs a) Construction of Kwale - Ivorogbo 132kV Transmission Line b) 2 x 60MVA 132/33kV Substation at Ivorogbo . Costs :	**Funding**: **Balance to complete**:	Fully funded LC/ Timely release of fund.
(5) Others: The project is necessary for - power evacuation - Bulk supply		

TRANSMISSION PROJECT LOGICAL FRAMEWORK		TCN
Project Title : **Re conductoring of Alaoji - Aba- Itu 132kV SC Transmission line**		**Date :** **April 2013**
Project Narrative	**Indicators**	**Critical considerations**
(1)Programme Objective: To improve power delivery of the Transmission grid.	Improve economic activity of the entire nation.	There is power evacuation constraint along Alaoji - Aba – Itu-SC 132KV line to the rest of the grid.
(2) Project Objective: Power evacuation from the delta region to the rest of the grid.	Additional 240MW transmission line capacity to be utilised.	About 200 MW of bulk generated power from the south to be evacuated to the rest of the grid.
(3) Scope/Outputs: Scope: a) Removal and re-drumming of the conductor and reconductoring of same line with high temp cond.etc Outputs : Increase in transmission capacity by 240 MW.	Extra 200 MW transmission capacity is available.	Competent contractor is employed to deliver the project.
(4) Inputs/costs: **Inputs:** high temp conductor (specs) and related accessories. **Costs**:	**Funding**: **Balance to complete**:	Fully funded LC/ Timely release of fund.
(5) Others: The project is necessary for; - power evacuation - reliability.		

<table>
<tr><td colspan="2">TRANSMISSION PROJECT LOGICAL FRAMEWORK</td><td>TCN</td></tr>
<tr><td colspan="2">Project Title :
Gwagwalada - Abaji 132KV DC Transmission Line + 2 x 60MVA 132/33kV Substation at Abaji + 2 Line Bay Extension</td><td>Project Time line

Start:

Finish:</td></tr>
<tr><th>Project Narrative</th><th>Indicators</th><th>Critical considerations</th></tr>
<tr><td><u>(1)Programme Objective:</u>

To improve power delivery to Abaji area council and its environs.</td><td>Improve economic activity of FCT.</td><td>There is bulk power supply constraint to Abaji area council and its environs.</td></tr>
<tr><td><u>(2) Project Objective:</u>

Bulk Power supply to Abaji area council and its environs of FCT.</td><td>Additional
240 MW transmission line capacities to be utilised.
120MVA transformation.</td><td>About 200 MW Bulk Power supply to Abaji area council and its environs of FCT.</td></tr>
<tr><td><u>(3) Scope/Outputs</u>:

<u>Scope</u>:
a) Construction of Gwagwalada - Abaji 132KV DC Transmission Line
b) 2 x 60MVA 132/33kV Substation at Abaji
c) Line bay extension at Gwagwalada 132KV Sub station.
<u>Outputs</u> :
Increase in transmission capacity by 240 MW, 120MVA transformation capacities at Abaji 132/33KV substation.</td><td>Extra 240 MW transmission capacity is available.

120MVA transformation capacities at Abaji 132/33KV substation.</td><td>Competent contractor is employed to deliver the project.</td></tr>
<tr><td><u>(4) Inputs/costs:</u>
<u>Inputs</u>
a) Construction of Gwagwalada - Abaji 132KV DC Transmission Line
b) 2 x 60MVA 132/33kV Substation at Abaji
c) Line bay extension at Gwagwalada 132KV Sub station.

<u>Costs</u> :</td><td>Funding:

Balance to complete:</td><td>Fully funded LC/ Timely release of fund.</td></tr>
<tr><td>(5) <u>Others:</u>
The project is necessary for
- Bulk supply.
- Reliability and
- Improve Voltage</td><td></td><td></td></tr>
</table>

TRANSMISSION PROJECT LOGICAL FRAMEWORK		TCN
Project Title : **Re conductoring of Calabar - Itu 132kV SC Transmission line**		**Date :** **April 2013**
Project Narrative	**Indicators**	**Critical considerations**
(1)Programme Objective: To improve power delivery of the Transmission grid.	Improve economic activity of the entire nation.	There is power evacuation constraint along Calabar – Itu- SC 132KV line to the rest of the grid.
(2) Project Objective: Power evacuation from Calabar Power Plant to Itu and the rest of the grid.	Additional 240MW transmission line capacity to be utilised.	About 200 MW of bulk generated power from the south to be evacuated to the rest of the grid.
(3) Scope/Outputs: Scope: a) Removal and re-drumming of 120km 100mm2 wolf conductor and re conductoring of same line with high temp conductor. Outputs : Increase in transmission capacity by 240 MW.	Extra 200 MW transmission capacity is available.	Competent contractor is employed to deliver the project.
(4) Inputs/costs: **Inputs:** high temp conductor (specs) and related accessories. **Costs**:	**Funding**: **Balance to complete**:	Fully funded LC/ Timely release of fund.
(5) Others: The project is necessary for; - power evacuation - reliability.		

TRANSMISSION PROJECT LOGICAL FRAMEWORK		**TCN**
Project Title : Kainji - Kaima - Kishi 132kV DC Transmision Line + 2 x 60MVA 132/33kV Substations at Kaima & Kishi + 4 Bay Extensions		**Project Time line** **Start:** **Finish:**
Project Narrative	**Indicators**	**Critical considerations**
(1)Programme Objective: To improve power delivery to Kaima and Oke Ogun areas of Kwara and Oyo state.	Improve economic activity of Kwara and Oyo state	There is evacuation constraint of Kainji Power plant to to Kaima and Oke Ogun areas of Kwara and Oyo state
(2) Project Objective: Bulk Power supply to Kaima and Oke Ogun areas of Kwara and Oyo state	Additional 240 MW transmission line capacities to be utilised. 240MVA transformation.	About 200 MW Bulk Power supply to Kaima and Oke Ogun areas of Kwara and Oyo state.
(3) Scope/Outputs: Scope: a) Construction of Kainji - Kaima - Kishi 132kV DC Transmision Line b) 2 x 60MVA 132/33kV Substations each at Kaima & Kishi c) Line bay extension at Kainji 132KV Sub station. Outputs : Increase in transmission capacity by 240 MW, 240MVA transformation capacities at Kaima & Kishi 132/33KV substation.	Extra 240 MW transmission capacity is available. 40MVA transformation capacities at Kaima & Kishi 132/33KV substation.	Competent contractor is employed to deliver the project.
(4) Inputs/costs: Inputs a) Construction of Kainji - Kaima - Kishi 132kV DC Transmision Line b) 2 x 60MVA 132/33kV Substations each at Kaima & Kishi c) Line bay extension at Kainji 132KV Sub station. Costs :	**Funding**: **Balance to complete**:	Fully funded LC/ Timely release of fund.
(5) Others: The project is necessary for - Evacuation - Bulk supply.		

TRANSMISSION PROJECT LOGICAL FRAMEWORK		TCN
Project Title : **Re conductoring of Afam - PortHarcourt 132kV SC Transmission line**		**Date :** **April 2013**
Project Narrative	**Indicators**	**Critical considerations**
(1)Programme Objective: To improve power delivery of the Transmission grid.	Improve economic activity of the entire nation.	There is power evacuation constraint along Afam-Portharcourt Main 132KV SC line to Rivers State.
(2) Project Objective: Power evacuation from Afam Power Plant to Rivers State and the rest of the grid.	Additional 240MW transmission line capacity to be utilised.	About 200 MW of bulk generated power from the south to be evacuated to the rest of the grid.
(3) Scope/Outputs: Scope: a) Removal and re-drumming of …..km 100mm2 wolf conductor and re conductoring of same line with high temp conductor. Outputs : Increase in transmission capacity by 240 MW.	Extra 200 MW transmission capacity is available.	Competent contractor is employed to deliver the project.
(4) Inputs/costs: **Inputs:** high temp conductor (specs) and related accessories. **Costs**:	**Funding**: **Balance to complete**:	Fully funded LC/ Timely release of fund.
(5) **Others:** The project is necessary for; - power evacuation - reliability.		

TRANSMISSION PROJECT LOGICAL FRAMEWORK		**TCN**
Project Title : Birnin Kebbi - Shafaci 132/33kV DC Transmission Line + 2 x 60MVA 132/33kV Substation at Shafaci + 2 Line Bay Extension		**Project Time line** **Start:** **Finish:**
Project Narrative	**Indicators**	**Critical considerations**
(1)Programme Objective: To improve power delivery to southern part of BeninKebbi State.	Improve economic activity of Benin Kebbi State	There is bulk power constraint to Shafaci and environs in the southern part of BeninKebbi State.
(2) Project Objective: Bulk Power supply to Shafaci and environs in the southern part of BeninKebbi State.	Additional 240 MW transmission line capacities to be utilised. 120MVA transformation.	About 200 MW Bulk Power supply to Shafaci and environs in the southern part of Benin Kebbi State.
(3) Scope/Outputs: Scope: a) Construction of Birnin Kebbi - Shafaci 132/33kV DC Transmission Line b) 2 x 60MVA 132/33kV Substation at Shafaci c) Line bay extension at Benin Kebbi 132KV Sub station. Outputs : Increase in transmission capacity by 240 MW, 120MVA transformation capacity at Shafaci 132/33KV substation.	Extra 240 MW transmission capacity is available. 120MVA transformation capacities	Competent contractor is employed to deliver the project.
(4) Inputs/costs: Inputs a) Construction of Birnin Kebbi - Shafaci 132/33kV DC Transmission Line b) 2 x 60MVA 132/33kV Substation at Shafaci c) Line bay extension at Benin Kebbi 132KV Sub station. Costs :	**Funding**: **Balance to complete**:	Fully funded LC/ Timely release of fund.
(5) Others: The project is necessary for - Evacuation - Bulk supply.		

TRANSMISSION PROJECT LOGICAL FRAMEWORK		TCN
Project Title : Calabar - Oron 132/33kV DC Transmission Line + 2 x 60MVA 132/33kV Substation at Oron + Bay Extension		**Project Time line** **Start:** **Finish:**
Project Narrative	**Indicators**	**Critical considerations**
(1)Programme Objective: To improve power delivery to Oron and environs in Cross River State.	Improve economic activity of Oron and environs in Cross River State.	There is evacuation constraint to wheel the generation from Calabar Power Station to its major neighbouring towns of Oron and environs in Cross River State.
(2) Project Objective: Power evacuation from Kwale to its major neighbouring towns of Oron and environs in Cross River State	Additional 240 MW transmission line capacity to be utilised.	About 200 MW of generated power from Calabar Power Station to its major neighbouring towns of Oron and environs in Cross River State.
(3) Scope/Outputs: Scope: a) Construction of Calabar - Oron 132/33kV DC Transmission Line b) 2 x 60MVA 132/33kV Substation at Oron c) 2line bay extension at Calabar. Outputs : Increase in transmission capacity by 240 MW.	Extra 240 MW transmission capacity is available. 120MVA transformation .	Competent contractor is employed to deliver the project.
(4) Inputs/costs: a) Construction of Calabar - Oron 132/33kV DC Transmission Line b) 2 x 60MVA 132/33kV Substation at Oron c) 2line bay extension at Calabar. . Costs :	**Funding**: **Balance to complete**:	Fully funded LC/ Timely release of fund.
(5) **Others:** The project is necessary for - power evacuation - Bulk supply		

TRANSMISSION PROJECT LOGICAL FRAMEWORK		**TCN**
Project Title : **Afam - PH 132kv DC turning in and out at PH main TS**		**Date :** **April 2013**
Project Narrative	**Indicators**	**Critical considerations**
(1)Programme Objective: To improve power delivery from Afam Power Plant to Rivers State.	Improve economic activity of Rivers State.	There is evacuation constraint on the existing SC line to wheel the generation from Afam Power Station to Portharcourt, the capital of Rivers State.
(2) Project Objective: Power evacuation from Afam Power Station to Portharcourt.	Additional 240 MW transmission line capacity to be utilised.	About 200 MW of generated power from Afam Power Station to Portharcourt.
(3) Scope/Outputs: Scope: a) Construction Afam - PH 132kv DC turning in and out at PH main TS. b) Line bay extension at Afam & PH Mains 132KV Sub stations. Outputs : Increase in transmission capacity by 240 MW.	Extra 240 MW transmission capacity is available.	Competent contractor is employed to deliver the project.
(4) Inputs/costs: Inputs :…..km of Afam - PH 132kv DC turning in and out at PH main TS (Bear) and related accessoires. Costs :	**Funding**: **Balance to complete**:	Fully funded LC/ Timely release of fund.
(5) Others: The project is necessary for - power evacuation - Bulk supply to Rivers State.		

TRANSMISSION PROJECT LOGICAL FRAMEWORK		TCN
Project Title : Aiyede - Jericho 132kV DC Transmission Line + 2 x 132kV Line Bay Extension		**Project Time line** **Start:** **Finish:**
Project Narrative	**Indicators**	**Critical considerations**
(1)Programme Objective: To improve bulk power delivery from Ayede 330/132KV Substation to Jericho area of Ibadan in Oyo State.	Improve economic activity of Oyo State.	There is bulk supply constraint from Ayede substation to Jericho area of Ibadan.
(2) Project Objective: Bulk power delivery from Ayede 330/132KV Substation to Jericho area of Ibadan in Oyo State.	Additional 240 MW transmission line capacity to be utilised.	About 200 MW of power from Ayede to Jericho area of Rivers State
(3) Scope/Outputs: Scope: a) Construction of Aiyede - Jericho 132kV DC Transmission Line b) Line bay extension at Ayede &Jericho 132KV Sub stations. Outputs : Increase in transmission capacity by 240 MW.	Extra 240 MW transmission capacity is available.	Competent contractor is employed to deliver the project.
(4) Inputs/costs: Inputs a) Construction of Aiyede - Jericho 132kV DC Transmission Line b) Line bay extension at Ayede &Jericho 132KV Sub stations. Costs :	**Funding**: **Balance to complete**:	Fully funded LC/ Timely release of fund.
(5) Others: The project is necessary for - Bulk supply - Reliability and - Voltage improvement.		

TRANSMISSION PROJECT LOGICAL FRAMEWORK		**TCN**
Project Title : **Ikorodu – Odogunyan 132KV DC Transmission Line.**		**Date :** **April 2013**
Project Narrative	**Indicators**	**Critical considerations**
(1)Programme Objective: To improve power delivery from Egbin Power Plant to Ikorodu axis of Lagos and Ogun State.	Improve economic activity of Lagos and Ogun State .	There is constraint of power delivery to the Industrial town of Ikorodu.
(2) Project Objective: Adequate and reliable Power delivery to Ikorodu.	Additional 240 MW transmission line capacity to be utilised.	About 200 MW of power to be delivered to Ikorodu.
(3) Scope/Outputs: Scope: a) Removal and re-drumming of …..km 100mm2 wolf conductor and re conductoring of same line with bear conductor. b) Construction of Ikorodu – Odogunyan 132KV DC Transmission Line. c) Line bay extension at Ikorodu 132/33KV Substation. Outputs : Increase in transmission capacity by 240 MW.	Extra 240 MW transmission capacity is available.	Competent contractor is employed to deliver the project.
(4) Inputs/costs: **Inputs:** a) Removal and re-drumming of …..km 100mm2 wolf conductor and re conductoring of same line with bear conductor. b) Construction of Ikorodu – Odogunyan 132KV DC Transmission Line. c) Line bay extension at Ikorodu 132/33KV Substation. **Costs**:	**Funding**: **Balance to complete**:	Fully funded LC/ Timely release of fund.
(5) Others: The project is necessary for; - power evacuation - Bulk Supply to Ikorodu		

TRANSMISSION PROJECT LOGICAL FRAMEWORK		TCN
Project Title : **2x 150MVA, 330/132KV Substation at Lafia.**		**Start Date :** Finish Date :
Project Narrative	**Indicators**	**Critical considerations**
(1)Programme Objective: To improve power delivery to Nassarawa& Southern Kaduna states.	Improve economic activity of Nassarawa& Southern Kaduna states. .	Limitation of bulk supply to Nassarawa& Southern Kaduna states which includes the following 132KV substations @ Lafia, Akwanga,Keffi,Kwoi and Kachia.
(2) Project Objective: Bulk Power supply to Nassarawa& Southern Kaduna states.	Additional 300MVA Transformation capacity to be utilised.	About 200MW of power is delivered.
(3) Scope/Outputs: Scope: Construction of2x 150MVA, 330/132KV SubstationatLafia withturn in out fromMarkurdi-Jos DC Transmission Line. Outputs : Increase in transformationcapacity by 300 MVA.	Extra 300MVA transmission capacityisavailable.	Competent contractor is employed to deliver the project.
(4) Inputs/costs: Inputs : Construction of2x 150MVA, 330/132KV SubstationatLafia.. Costs :	**Funding**: **Balance to complete**:	Fully funded LC/ Timely release of fund.
(5) Others: The project is necessary for - power evacuation - Bulk supply - Reliability - Voltage Improvement.		

TRANSMISSION PROJECT LOGICAL FRAMEWORK		**TCN**
Project Title : **Obajana-Ado Ekiti 330KV DC line (80km)**		**Start Date :** **Finish Date :**
Project Narrative	**Indicators**	**Critical considerations**
(1)Programme Objective: To improve power delivery to Ado Ekiti and its environs in Ekiti State.	Improve economic activity of AdoEkiti and its environs in Ekiti State.	There is bulk power supply constraint on the existing 132KV infrastructure in the region.
(2) Project Objective: Bulk power supply to Ado Ekiti and its environs in Ekiti State.	Additional 1,200MW transmission line capacity to be utilised.	About 1,000 MW of bulk power to be transported and utilised.
(3) Scope/Outputs: Scope: Obajana - AdoEkiti 330KV DC line (80km). Outputs : Increase in transmission capacity by 1200 MW to be utilised.	Extra 1200 MW transmission capacityisavailable in addition to	Competent contractor is employed to deliver the project.
(4) Inputs/costs: Obajana - AdoEkiti 330KV DC line (80km). . Costs :	**Funding**: **Balance to complete**:	Fully funded LC/ Timely release of fund.
(5) **Others:** The project is necessary for; - Bulk power supply - reliability of the grid.		

TRANSMISSION PROJECT LOGICAL FRAMEWORK		TCN
Project Title : **2x 150MVA, 330/132KV+2X60MVA Substation at Ado Ekiti.**		**Start Date :** **Finish Date** :
Project Narrative	**Indicators**	**Critical considerations**
(1)Programme Objective: To improve power delivery to Estakiti and its environ.	Improve economic activity Ekiti and its environ.	Limitation of bulk supply to Ekiti and its environ.
(2) Project Objective: Bulk Power supply to Ekitistate and its environ.	Additional 300MVA Transformation capacity at Ado Ekiti to be utilised.	About 200MW of power is delivered to Ekitistate and its environ.
(3) Scope/Outputs: Scope: Construction of2x 150MVA, 330/132KV SubstationatAdo Ekiti +2x60MVA at Ado Ekiti Outputs : Increase in transformationcapacity by 300 MVA.	Extra 300MVA transmission capacityisavailable.	Competent contractor is employed to deliver the project.
(4) Inputs/costs: Inputs : Construction of2x 150MVA, 330/132KV SubstationatAdo Ekiti +2x60MVA at Ado Ekiti Costs :	**Funding**: **Balance to complete**:	Fully funded LC/ Timely release of fund.
(5) Others: The project is necessary for - power evacuation - Bulk supply to Ekiti State &environs.		

TRANSMISSION PROJECT LOGICAL FRAMEWORK		TCN
Project Title : **Damaturu – Gashua - Hadejia 132KV DC line (90km) and 2x60MVA 132KV Substation at Gashua.**		**Start Date :** **Finish Date :**
Project Narrative	**Indicators**	**Critical considerations**
(1)Programme Objective: To improve power delivery to in Yobe and Jigawa States.	Improve economic activity of Yobe and Jigawa States. .	There is inadequate bulk power supply to Gashua and also Power constraint on the existing 132KV infrastructure in the region. Damaturu needs to be linked to Hadejia to close the loop in the region for bulk supply reliability.
(2) Project Objective: Bulk power supply to Gashua and its environs and to close the loop (Damaturu – Hadejia 132kv Transmission line)in the region for bulk supply reliability.	Additional 1,200MW transmission line capacity to be utilised.	About 1,000MW of bulk power to be transported and utilised.
(3) Scope/Outputs: Scope: Damaturu – Gashua - Hadejia 132KV DC line (90km) and 2x60MVA 132KV Substation at Gashua. Outputs : Increase in transmission capacity by 240 MW to be utilised.	Extra 240 MW transmission capacity is available in addition to 120MVA Transformation capacity to be utilised at Gashua.	Competent contractor is employed to deliver the project.
(4) Inputs/costs: Damaturu – Gashua - Hadejia 132KV DC line (90km) and 2x60MVA 132KV Substation at Gashua. . Costs :	**Funding**: **Balance to complete**:	Fully funded LC/ Timely release of fund.
(5) **Others:** The project is necessary for; - Bulk power supply - reliability of the grid.		

TRANSMISSION PROJECT LOGICAL FRAMEWORK		TCN
Project Title : **Kaduna Power Plant to Mando Road 330kV and 330kV Substation Extension at Mando Road**		**Date :** **April 2013**
Project Narrative	**Indicators**	**Critical considerations**
(1)Programme Objective: To improve power delivery to Kaduna and neighbouring states.	Improve economic activity to Kaduna and northern states.	There is evacuation constraint from Kaduna Power plant to the grid.
(2) Project Objective: Power evacuation from Kaduna Power plant to Kaduna and northern states.	Additional 1,200MW transmission line capacity to be utilised.	250 MW of power from Kaduna Plant to be evacuated to the grid.
(3) Scope/Outputs: Scope: a) Construction of .... Kaduna Power Plant - Mando Road 330kV and b) 330kV Substation Extension at Mando Road Outputs : Increase in transmission capacity by 1200 MW.	Extra 1200 MW transmission capacity is available.	Competent contractor is employed to deliver the project.
(4) Inputs/costs: **Inputs:** a)….. Kaduna Power Plant - Mando Road 330kV and b) 330kV Substation Extension at Mando Road **Costs**:	**Funding**: **Balance to complete**:	Fully funded LC/ Timely release of fund.
(5) **Others:** The project is necessary for; - power evacuation -Security & reliability of the grid.		

TRANSMISSION PROJECT LOGICAL FRAMEWORK		**TCN**
Project Title : Obajana-Kabba - Isenlu 132kV DC line and 2x60MVA 132/33kV substation at Kabba & Isenlu		**Project Time line** **Start:** **Finish:**
Project Narrative	**Indicators**	**Critical considerations**
(1)Programme Objective: To improve power delivery from Obajana & to Okun land (Obajana-Kabba – Isenlu) of Kogi State.	Improve economic activity of Kogi State.	There is evacuation constraint to wheel the generation from Obajana Power Station and also bulk supply to Okun land of Kogi State.
(2) Project Objective: Power evacuation from Obajana power plant to Okun land of Kogi State .	Additional 240 MW transmission line capacities to be utilised. 240MVA transformation capacities at Kabba & Isanlu 132/33KV substations	About 200 MW of generated power from Obajana Power Station to Okun land of Kogi State. 240MVA transformation capacities at Kabba & Isanlu 132/33KV substations
(3) Scope/Outputs: Scope: Construction of a) Obajana-Kabba - Isenlu 132kV DC line and b) 2x60MVA 132/33kV substation each at Kabba & Isenlu c) Line bay extension at Obajana 132KV Sub station. Outputs : Increase in transmission capacity by 240 MW, 240MVA transformation capacities at Kabba & Isanlu 132/33KV substations.	Extra 240 MW transmission capacity is available. 240MVA transformation capacities at Kabba & Isanlu 132/33KV substations	Competent contractor is employed to deliver the project.
(4) Inputs/costs: Inputs a) Obajana-Kabba - Isenlu 132kV DC line and b) 2x60MVA 132/33kV substation each at Kabba & Isenlu c) Line bay extension at Obajana 132KV Sub station. Costs :	**Funding**: **Balance to complete**:	Fully funded LC/ Timely release of fund.

(5) <u>Others:</u> The project is necessary for - power evacuation - Bulk supply.		

TRANSMISSION PROJECT LOGICAL FRAMEWORK		TCN
Project Title : **Benin North-Oshogbo 330KV DC line with one SC turning in and out to New Akure substation**		**Date :** **April 2013**
Project Narrative	**Indicators**	**Critical considerations**
(1)Programme Objective: To improve power delivery of the Transmission grid.	Improve economic activity of Ondo and Ekiti States.	There is evacuation constraint on the existing Existing Benin – Osogbo SC line to wheel the bulk of generation from the south and eastern block to Akure and the rest of the grid.
(2) Project Objective: Power evacuation from the south and eastern block to the rest of the grid.	Additional 1,200MW transmission line capacity to be utilised.	About 1,000 MW of bulk generated power from the south to be evacuated to the rest of the grid in addition to 300MVA Transformation capacity to be utilised at Akure substation.
(3) Scope/Outputs: Scope: a) Benin North-Oshogbo 330KV DC line with one SC turning in and out to New Akure substation b) 2x150MVA 330/132 Substation at Akure. Outputs : Increase in transmission capacity by 1200 MW in addition to 300MVA Transformation capacity to be utilised at Akure.	Extra 1200 MW transmission capacity is available in addition to 300MVA Transformation capacity to be utilised at Akure.	Competent contractor is employed to deliver the project.
(4) Inputs/costs: a) ….. km Benin North-Oshogbo 330KV DC line with one SC turning in and out to New Akure substation b) 2x150MVA 330/132 Substation at Akure. . Costs :	**Funding**: **Balance to complete**:	Fully funded LC/ Timely release of fund.
(5) Others: The project is necessary for; - power evacuation - reliability of the grid. - Bulk supply to Ondo and Ekiti States.		

TRANSMISSION PROJECT LOGICAL FRAMEWORK		**TCN**
Project Title : Yandev - Katsina Ala 132kV DC Transmission Line + 2 x 60MVA 132/33kV Substation at Katsina Ala		**Project Time line** **Start:** **Finish:**
Project Narrative	**Indicators**	**Critical considerations**
(1)Programme Objective: To improve power delivery from Yandev to Katsina- Ala of Benue State.	Improve economic activity of Benue State.	There is bulk power supply constraint to Katsina - Ala of Benue State.
(2) Project Objective: Power evacuation from Yandev to Katsina Ala of Benue State.	Additional 240 MW transmission line capacities to be utilised.	About 200 MW of generated power from Yandev to Katsina Ala of Benue State.
(3) Scope/Outputs: Scope: Construction of a) Yandev - Katsina Ala 132kV DC Transmission Line and b) 2 x 60MVA 132/33kV Substation at Katsina Ala c) Line bay extension at Yandev 132KV Sub station. Outputs : Increase in transmission capacity by 240 MW, 240MVA transformation capacities at Katsina Ala 132/33KV substation.	Extra 240 MW transmission capacity is available. 240MVA transformation capacities at Katsina Ala 132/33KV substation.	Competent contractor is employed to deliver the project.
(4) Inputs/costs: Inputs a) Yandev - Katsina Ala 132kV DC Transmission Line and b) 2 x 60MVA 132/33kV Substation at Katsina Ala c) Line bay extension at Yandev 132KV Sub station. Costs :	**Funding**: **Balance to complete**:	Fully funded LC/ Timely release of fund.
(5) Others: The project is necessary for - Bulk supply to Benue State. - Reliability and - Improve Voltage		

TRANSMISSION PROJECT LOGICAL FRAMEWORK		TCN
Project Title : **Omotosho-Epe-Aja 330KV DC Line.**		**Date :** **April 2013**
Project Narrative	**Indicators**	**Critical considerations**
(1)Programme Objective: To improve power delivery from Omotoso and southern part of the Country to Lagos State.	Improve economic activity of Lagos State.	There is evacuation constraint of power from Omotoso and southern part of the Country to Lagos State.
(2) Project Objective: Power evacuation from Omotoso and the south and eastern block to the rest of the grid.	Additional 1,200MW transmission line capacity to be utilised.	About 1,000 MW of bulk generated power from the south to be evacuated to Lagos State.
(3) Scope/Outputs: Scope: a) Omotosho-Epe-Aja 330KV DC Line b) Line bay extension at Aja 330/132KV Substations. Outputs : Increase in transmission capacity by 1200 MW.	Extra 1200 MW transmission capacity is available.	Competent contractor is employed to deliver the project.
(4) Inputs/costs: **Inputs:** a) …..km of Omotosho-Epe-Aja 330KV DC Line b) Line bay extension at Aja 330/132KV Substations. **Costs**:	**Funding**: **Balance to complete**:	Fully funded LC/ Timely release of fund.
(5) **Others:** The project is necessary for; - power evacuation - Bulk Supply to Lagos - Security & reliability of the grid.		

TRANSMISSION PROJECT LOGICAL FRAMEWORK		TCN
Project Title : Ogbomosho - Oyo - Iseyin 132kV Transmission line with 2 x 60MVA Substation at Oyo		**Project Time line** **Start:** **Finish:**
Project Narrative	**Indicators**	**Critical considerations**
(1)Programme Objective: To improve power delivery to Oke Ogun (Iseyin) of Oyo State.	Improve economic activity of Oyo State.	There is bulk power supply constraint to Oke Ogun (Iseyin) of Oyo State.
(2) Project Objective: Effective Bulk Power supply to Oke Ogun (Iseyin) of Oyo State.	Additional 240 MW transmission line capacities to be utilised. 240MVA transformation capacities at 132/33KV substation	About 200 MW transmission line capacities to be utilised. 240MVAtransformation capacities at 132/33KV substation
(3) Scope/Outputs: Scope: Construction of : a) Ogbomosho - Oyo - Iseyin 132kV Transmission line and b) 2 x 60MVA Substation at Oyo c) Line bay extension at Ogbomoso 132KV Sub station. Outputs : Increase in transmission capacity by 240 MW, 240MVA transformation capacities at Ogbomoso 132/33KV substation.	Extra 240 MW transmission capacity is available. 240MVA transformation capacities at Ogbomoso 132/33KV substation.	Competent contractor is employed to deliver the project.
(4) Inputs/costs: Inputs a) Ogbomosho - Oyo - Iseyin 132kV Transmission line and b) 2 x 60MVA Substation at Oyo c) Line bay extension at Ogbomoso 132KV Sub station. Costs :	**Funding**: **Balance to complete**:	Fully funded LC/ Timely release of fund.
(5) **Others:** The project is necessary for - Bulk supply. - Reliability and - Improve Voltage		

TRANSMISSION PROJECT LOGICAL FRAMEWORK		TCN
Project Title : **New Akure 2x 150MVA, 330/132KV Substation.**		**Date :** **April 2013**
Project Narrative	**Indicators**	**Critical considerations**
(1)Programme Objective: To improve power delivery to Ondo and Ekiti States.	Improve economic activity of Ondo and Ekiti States.	Limitation of bulk supply to Ondo and Ekiti States
(2) Project Objective: Bulk Power supply to Ondo and Ekiti States	Additional 300MVA Transformation capacity at Akure to be utilised.	About 200 MW of power is delivered to Ondo and Ekiti States.
(3) Scope/Outputs: Scope: a) Construction of New Akure 2x 150MVA, 330/132KV Substation with turn- in- out of Benin North – Oshogbo SC Transmission line. Outputs : Increase in transformation capacity by 300 MVA.	Extra 300MVA transmission capacity is available.	Competent contractor is employed to deliver the project.
(4) Inputs/costs: Inputs : …..km of New Akure 2x 150MVA, 330/132KV Substation with turn- in- out of Benin North – Oshogbo SC Transmission line. Costs :	**Funding**: **Balance to complete**:	Fully funded LC/ Timely release of fund.
(5) Others: The project is necessary for - power evacuation - Bulk supply to Ondo & Ekiti states.		

<table>
<tr><th colspan="2">TRANSMISSION PROJECT LOGICAL FRAMEWORK</th><th>TCN</th></tr>
<tr><td colspan="2">Project Title :
Yenogoa - Okubu 132kV DC Transmission Line + 2 x 60MVA 132/33kV Substation at Okubu</td><td>Project Time line

Start:

Finish:</td></tr>
<tr><th>Project Narrative</th><th>Indicators</th><th>Critical considerations</th></tr>
<tr><td><u>(1)Programme Objective:</u>

To improve power delivery from Yenegoa & southern power hub to Delta area of Okubu in Rivers State.</td><td>Improve economic activity of Rivers State.</td><td>There is evacuation constraint to wheel the generation from from Yenegoa to supply bulk supply to Okubu and environs in Rivers State.</td></tr>
<tr><td><u>(2) Project Objective:</u>

Power evacuation from Yenegoa & southern power hub to Delta area of Okubu in Rivers State.</td><td>Additional 240 MW transmission line capacities to be utilised.

120MVA transformation capacity</td><td>About 200 MW of generated power from Yenegoa to Okubu and environs in Rivers State</td></tr>
<tr><td><u>(3) Scope/Outputs</u>:

<u>Scope</u>:
a) Construction of Yenogoa - Okubu 132kV DC Transmission Line
b) 2 x 60MVA 132/33kV Substation at Okubu
c) Line bay extension at Yenegoa 132KV Sub station.

Outputs :
Increase in transmission capacity by 240 MW.</td><td>Extra 240 MW transmission capacity is available.

120MVA transformation capacity.</td><td>Competent contractor is employed to deliver the project.</td></tr>
<tr><td><u>(4) Inputs/costs:</u>

<u>Inputs</u>
a) Construction of Yenogoa - Okubu 132kV DC Transmission Line
b) 2 x 60MVA 132/33kV Substation at Okubu
c) Line bay extension at Yenegoa 132KV Sub station.

<u>Costs</u> :</td><td>Funding:

Balance to complete:</td><td>Fully funded LC/ Timely release of fund.</td></tr>
<tr><td>(5) <u>Others:</u>

The project is necessary for
- power evacuation
- Bulk supply to Rivers State.</td><td></td><td></td></tr>
</table>

TRANSMISSION PROJECT LOGICAL FRAMEWORK		TCN
Project Title : **2^{nd} Kaduna - Kano 330KV DC Transmission Line.**		**Date :** **April 2013**
Project Narrative	**Indicators**	**Critical considerations**
(1)Programme Objective: To improve power delivery to Kano and other northern states of the Country.	Improve economic activity of Kano and other northern states of the Country	There is evacuation constraint of power from the grid to Kano and other northern states of the Country.
(2) Project Objective: Power evacuation from the grid to Kano and other northern states of the Country.	Additional 1,200MW transmission line capacity to be utilised.	About 1,000 MW of bulk generated power from the south to be evacuated to Lagos State.
(3) Scope/Outputs: Scope: a) 2^{nd} Kaduna - Kano 330KV DC Transmission Line. b) Line bay extension at Kaduna 330/132KV Substations. c) 2x150MVA 330/132KV Substation at Kano. Outputs : Increase in transmission capacity by 1200 MW and 300MVA transformation capacity.	Extra 1200 MW transmission capacity and 300MVA transformation capacity are available.	Competent contractor is employed to deliver the project.
(4) Inputs/costs: **Inputs:** a) 2^{nd} Kaduna - Kano 330KV DC Transmission Line. b) Line bay extension at Kaduna 330/132KV Substations. c) 2x150MVA 330/132KV Substation at Kano **Costs**:	**Funding**: **Balance to complete**:	Fully funded LC/ Timely release of fund.
(5) Others: The project is necessary for; - power evacuation - Bulk Power Supply - Security & reliability of the grid.		

TRANSMISSION PROJECT LOGICAL FRAMEWORK		TCN
Project Title : 2nd Mando - Kaduna Town 132kV Transmission Line = 4 x 132kV line Bay Extension at Mando Substation		**Project Time line** **Start:** **Finish:**
Project Narrative	**Indicators**	**Critical considerations**
(1)Programme Objective: To improve bulk power delivery to Kaduna and environs.	Improve economic activity of Kaduna State.	There is bulk supply constraint from Mando substation to Kaduna.
(2) Project Objective: Bulk power delivery from Mando substation to Kaduna	Additional 240 MW transmission line capacity to be utilised.	About 200 MW of power from Mando substation to Kaduna
(3) Scope/Outputs: Scope: a) Construction of 2nd Mando - Kaduna Town 132kV Transmission Line b) 4 x 132kV line Bay Extension at Mando Substation Outputs : Increase in transmission capacity by 240 MW.	Extra 240 MW transmission capacity is available.	Competent contractor is employed to deliver the project.
(4) Inputs/costs: Inputs a) Construction of 2nd Mando - Kaduna Town 132kV Transmission Line b) 4 x 132kV line Bay Extension at Mando Substation Costs :	**Funding**: **Balance to complete**:	Fully funded LC/ Timely release of fund.
(5) Others: The project is necessary for - Bulk supply - Reliability and - Voltage improvement.		

TRANSMISSION PROJECT LOGICAL FRAMEWORK		TCN
Project Title : **Omotosho-Ogijo 330KV DC Line.**		**Date :** **April 2013**
Project Narrative	**Indicators**	**Critical considerations**
(1)Programme Objective: To improve power delivery from Omotoso and southern part of the Country to Lagos State.	Improve economic activity of Lagos State.	There is evacuation constraint of power from Omotoso and southern part of the Country to Lagos State.
(2) Project Objective: Power evacuation from Omotoso and the south and eastern block to the rest of the grid.	Additional 1,200MW transmission line capacity to be utilised.	About 1,000 MW of bulk generated power from the south to be evacuated to Lagos State.
(3) Scope/Outputs: Scope: a) Omotosho - Ogijo 330KV DC Line b) Line bay extension at Omotosho 330/132KV Substations. Outputs : Increase in transmission capacity by 1200 MW.	Extra 1200 MW transmission capacity is available.	Competent contractor is employed to deliver the project.
(4) Inputs/costs: **Inputs:** a) 125 km of Omotosho - Ogijo 330KV DC Line b) Line bay extension at Omotoso 330/132KV Substations. **Costs**:	**Funding**: **Balance to complete**:	Fully funded LC/ Timely release of fund.
(5) **Others:** The project is necessary for; - power evacuation - Bulk Supply to Lagos - Security & reliability of the grid.		

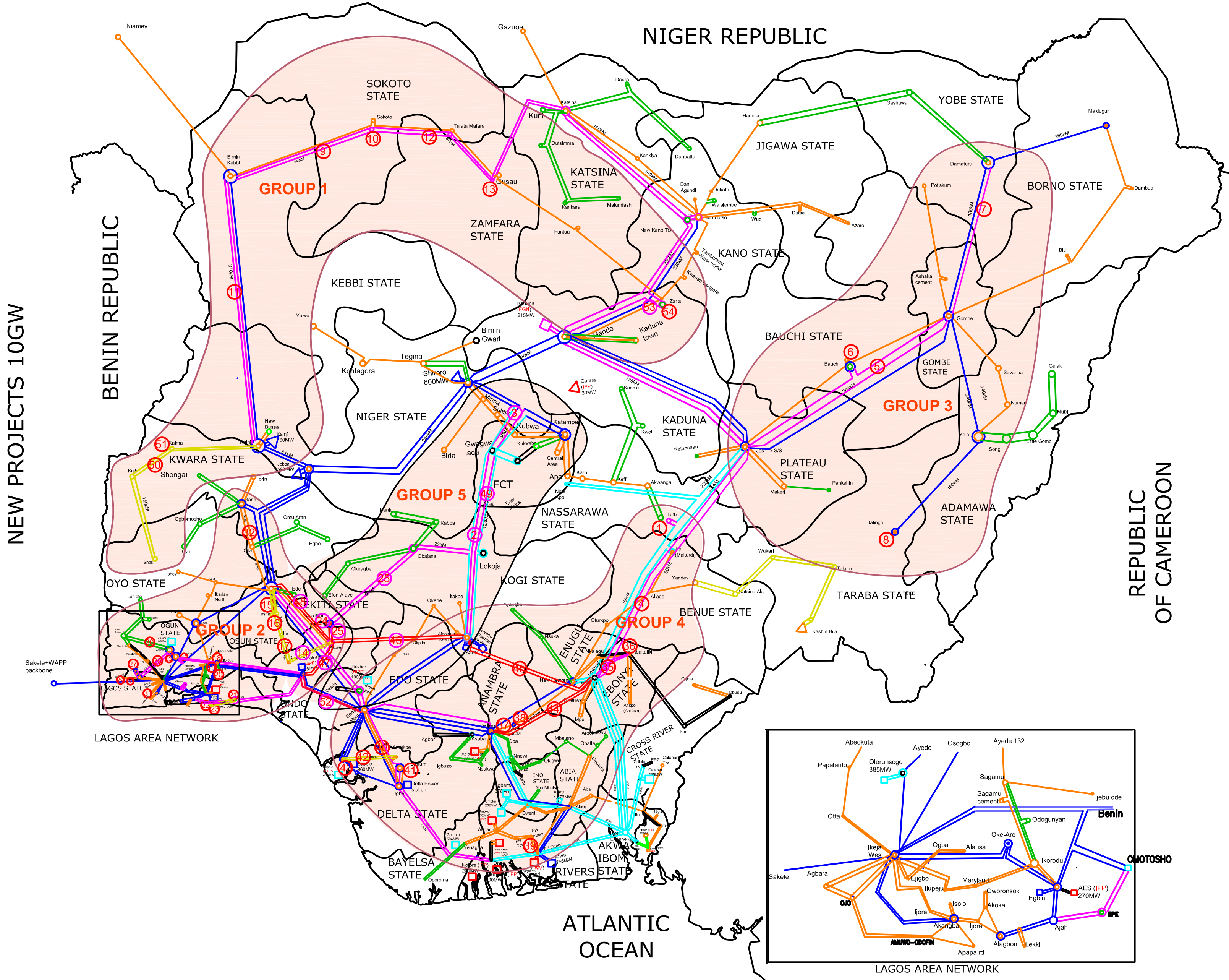
TRANSMISSION PROJECT LOGICAL FRAMEWORK		**TCN**
Project Title : Aiyede - Ibadan North 132kV DC Transmission Line + 4 x 132kV Line Bay Extension		**Project Time line** **Start:** **Finish:**
Project Narrative	**Indicators**	**Critical considerations**
(1)Programme Objective: To improve bulk power delivery from Ayede 330/132KV Substation to Ibadan area of Ibadan in Oyo State.	Improve economic activity of Oyo State.	There is bulk supply constraint from Ayede substation to Ibadan North area of Ibadan.
(2) Project Objective: Bulk power delivery from Ayede 330/132KV Substation to Ibadan North area of Ibadan .	Additional 240 MW transmission line capacity to be utilised.	About 200 MW of power from Ayede to Ibadan North area of Ibadan
(3) Scope/Outputs: Scope: a) Construction of Aiyede - Ibadan North 132kV DC Transmission Line b) Line bay extension at Ayede & Ibadan North 132KV Sub stations. Outputs : Increase in transmission capacity by 240 MW.	Extra 240 MW transmission capacity is available.	Competent contractor is employed to deliver the project.
(4) Inputs/costs: Inputs a) Construction of Aiyede - Ibadan North 132kV DC Transmission Line b) Line bay extension at Ayede & Ibadan North 132KV Sub stations. Costs :	**Funding**: **Balance to complete**:	Fully funded LC/ Timely release of fund.
(5) Others: The project is necessary for - Bulk supply - Reliability and - Voltage improvement.		

TRANSMISSION PROJECT LOGICAL FRAMEWORK		TCN
Project Title : 2nd Shiroro - Tegina 132kV Transmission Line + 2 Line bay Extension		**Project Time line** **Start:** **Finish:**
Project Narrative	**Indicators**	**Critical considerations**
(1)Programme Objective: To improve bulk power delivery to Kaduna and environs.	Improve economic activity of Kaduna State.	There is bulk supply constraint from Mando substation to Kaduna.
(2) Project Objective: Bulk power delivery from Mando substation to Kaduna	Additional 240 MW transmission line capacity to be utilised.	About 200 MW of power from Mando substation to Kaduna
(3) Scope/Outputs: Scope: a) Construction of 2nd Mando - Kaduna Town 132kV Transmission Line b) 4 x 132kV line Bay Extension at Mando Substation Outputs : Increase in transmission capacity by 240 MW.	Extra 240 MW transmission capacity is available.	Competent contractor is employed to deliver the project.
(4) Inputs/costs: Inputs a) Construction of 2nd Mando - Kaduna Town 132kV Transmission Line b) 4 x 132kV line Bay Extension at Mando Substation Costs :	**Funding**: **Balance to complete**:	Fully funded LC/ Timely release of fund.
(5) Others: The project is necessary for - Bulk supply - Reliability and - Voltage improvement.		

Appendix C Financing Package 2 – New Projects for 10 GW System

10GW MODEL

GRID MAP CONTAINING EXISTING / ON-GOING / COMMITTED 330 / 132KV TRANSMISSION PROJECTS AND NECESSARY NEW PROJECTS FOR 10 GW TRANSMISSION CAPABILITY



LEGEND

	PROPOSED 330KV TRANSMISSION LINES
	EXISTING 330KV TRANSMISSION LINES
	ON-GOING 330KV TRANSMISSION LINES BY TCN
	ON-GOING 330KV TRANSMISSION LINES BY NIPP
	ON-GOING 330KV TRANSMISSION LINES BY FMP
	PROPOSED 132KV TRANSMISSION LINES
	EXISTING 132KV TRANSMISSION LINES
	ON-GOING 132KV TRANSMISSION LINES BY TCN
	ON-GOING 132KV TRANSMISSION LINES BY NIPP
	PROPOSED 330/132KV BULK S/S
	EXISTING 330/132KV BULK S/S
	ON-GOING 330/132KV BULK S/S
	ON-GOING 330/132KV BULK S/S BY NIPP
	PROPOSED 132KV BULK S/S
	EXISTING 132KV BULK S/S
	ON-GOING 132KV BULK S/S
	EXISTING HYDRO POWER STATION
	ON-GOING/COMMITTED HYDRO POWER STATION
	EXISTING THERMAL POWER STATION
	EXISTING NIPP THERMAL POWER STATION
	IPP THERMAL POWER STATION

POWER HOLDING COMPANY OF NIGERIA (PHCN) PLC

Title: Existing, On-Gong and Proposed TCN/NIPP/IPP Projects

Prepared By	Power System Planning, Research & Development, TCN C/HQ	Scale: NOT TO SCALE
Checked By		
Recommended By		Date March, 2014
Approved By	GM (PSPD+R&D)	

Package-2 (New Projects for 10GW Network)

Group-1: Kainji-Birnin Kebbi-Gusau

TYPES	S/N	PROJECT DESCRIPTION	COST(US$)
TRANSMISSION LINES AND SUBSTATIONS	9	Birnin Kebbi - Sokoto D.C 330kV line (140km)	50,750,000
	10	2x150MVA, 330/132kV at Sokoto andAssociated 132kV	23,837,709
	11	2nd Kainji - Birnin Kebbi 330/132kV DC Transmission Line (310Km) + 2 Line bay Extension	112,375,000
	12	Sokoto – Tmafara - Gusau - Katsina 330 kV double circuit line (340KM)	123,250,000
	13	2x150MVA, 330/132kV at Gusau and Associated 132kV	23,837,709
	45	Kainji - Kaima - Kishi - Shaki 132kV DC Transmision Line(180km) + 2 x 60MVA 132/33kV Substations at Kaima & Kishi + 4 Bay Extensions	
	45-1	Kainji - Kaima - Kishi - Shaki 132kV DC Transmision Line(180km)	43,312,500
	45-2	2x60MVA 132/33kV Substations at Kaima & Kishi + 4 Bay Extensions	9,700,000
	47	25km 330kV DC Tee off to Zaria from the on-going Kaduna - Kano 330kV DC Line with 2 x 150MVA 330/132kV S/S at Zaria, 2no. 330kv line bays and 4 no. outgoing 132kV feeders.	
	47-1	25km 330kV DC Tee off to Zaria from the on-going Kaduna - Kano 330kV DC Line	1,812,500
	47-2	2 x 150MVA 330/132kV S/S at Zaria, 2no. 330kv line bays and 4 no. outgoing 132kV feeders	23,000,000
	Subtotal		**411,875,418**
CAPACITOR AND REACTORS	4	Kano SVC; 330kV, +35MVAr, -50MVAr	3,527,500
	27	Bida; 40MVAr, 132kV Fixed Shunt Capacitor	1,660,000
	30	Niamey; 25MVAr, 132kV Fixed Shunt Capacitor	1,037,500
	34	Tmafara; 35MVAr, 330kV Shunt Reactor project	1,452,500
	40	Kano; 50MVAr, 132kV Fixed Shunt Capacitor	2,075,000
	41	Kankia; 30MVAr, 132kV Fixed Shunt Capacitor	1,245,000
	42	Dutse; 45MVAr, 132kV Fixed Shunt Capacitor	1,867,500
	43	Hadejia; 34MVAr, 132kV Fixed Shunt Capacitor	1,411,000
	44	Dakata; 70MVAr, 33kV Fixed Shunt Capacitor project	2,905,000
	45	Dan Agundi; 85MVAr, 33kV Fixed Shunt Capacitor project	3,527,500
	46	Dutse; 10MVAr, 33kV Fixed Shunt Capacitor project	415,000
	47	Kankia; 15MVAr, 33kV Fixed Shunt Capacitor project	622,500
	Subtotal		**21,746,000**
POWER TRANSFORMERS			
Shunt Reactors		Birnin Kebbi: 50MVar, Ganmo: 50MVar	**4,150,000**
Total			**437,771,418**

Package-2 (New Projects for 10GW Network)

Group-2: Lagos

TYPES	S/N	PROJECT DESCRIPTION	COST(US$)
TRANSMISSION LINES AND SUBSTATIONS	14	Akure-Ondo 132kV DC line + line bay extensions. (92 km)	12,031,250
	15	Osogbo-Ilesha 132kV QUAD line(40km).	15,400,000
	16	Ilesha Tee - Ife 132kV dc line (20km)	4,812,500
	17	Ife - Ondo 132kV dc line (60km)	14,437,500
	18	2x150MVA 330/132KV + 2 x 60MVA 132/33kV Transformer capacity at Ogijo, Lagos and turn-in-out of Benin-Egbin-Ikeja West 330kv DC at Ogijo	37,745,000
	19	132kV D.C Line (50kM) from Ojigo - MFM and 132/33KV, 2X60MVA S/S @ MFM	
	19-1	132kV D.C Line (50kM) from Ojigo - MFM	4,812,500
	19-2	132/33KV, 2X60MVA S/S @ MFM	9,700,000
	20	2x150MVA, 330/132kV + 2x60MVA, 132/33kV substation at Epe and Associated 6no 33kV feeders.	32,700,000
	21	50km 132kV D.C line to Ibeju + 2x60MVA, 132/33kV substation at Ibeju Lekki and 2x132kV line bays extension at Epe.	
	21-1	50km 132kV D.C line to Ibeju	12,031,250
	21-2	2x60MVA, 132/33kV substation at Ibeju Lekki and 2x132kV line bays extension at Epe	9,700,000
	22	2 x 150MVA, 330/132kV substation at Ado Ekiti + 2 x 60MVA 132/33kV Transformers.	32,700,000
	23	Akure - Ado Ekiti 330kV D.C transmission line (80km)	29,000,000
	24	Arigbajo - Agbara 330kV D.C transmission line (40km)	14,500,000
	25	2x150MVA, 330/132kV substation at New Agbara, with 2x330kV and 4x132kV line bays.	28,475,000
	26	New Agbara - Agbara -Badagry 132kV D/C transmission line (70km).	16,843,750
	27	2X60MVA, 132/33kV substation at Badagry and 2x132kV line bays extension at Agbara.	9,700,000
	28	Arigbajo - New Abeokuta 132kV DC Transmission Line	11,057,767
	29	Convert Akangba -Amuwo -Ojo 132kV DC transmission line DC ACCC conductor(15km).	3,606,250
	30	Convert existing Oshogbo - Offa (50km) SC (Hyena)- Offa-Ganmo(50km) DC using existing ROW with ACCC conductor	12,031,250
	31	Olorunsogo - Arigbajo 330 KV QUAD Transmission line (15km)	8,700,000
	32	IkjW/Osogbo 330KV DC turn in-out 15km @ Arigbajo + Ogijo - Arigbajo DC Transmission line (40km).	19,937,500
	42	Omotosho -Akure 330kV DC Transmission line QUAD Conductor(80km)+ line Bays Extension	46,400,000
	43	Akure – Oshogbo 330 kV double circuit line QUAD Conductor (96km)+ line bay extensions.	55,680,000
	Subtotal		**442,001,517**
CAPACITOR AND REACTORS	2	Osogbo SVC; 330kV, +60MVAr, -75MVAr	5,602,500
	5	Ikeja 50MVAr, 132kV Fixed Shunt Capacitor	2,075,000
	6	Papalanto 50MVAr, 132kV Fixed Shunt Capacitor	2,075,000
	7	Akoka 50MVAr; 132kV Fixed Shunt Capacitor	2,075,000
	8	Alausa 75MVAr; 132kV Fixed Shunt Capacitor	3,112,500
	9	Meryland 60MVAr; 132kV Fixed Shunt Capacitor	2,490,000
	10	Ogba 50MVAr; 132kV Fixed Shunt Capacitor	2,075,000
	11	Otta 50MVAr; 132kV Fixed Shunt Capacitor	2,075,000
	12	Oworosoki 50MVAr; 132kV Fixed Shunt Capacitor	2,075,000
	13	Old Abeokuta 50MVAr; 132kV Fixed Shunt Capacitor	2,075,000
	14	Oke_Aro 75MVAr; 132kV Fixed Shunt Capacitor	3,112,500
	15	Maryland 40MVAr; 33kV Fixed Shunt Capacitor	1,660,000
	16	Ikorodu 20MVAr; 33kV Fixed Shunt Capacitor	830,000
	17	Ilupeju 50MVAr, 11kV Fixed Shunt Capacitor	2,075,000
	18	Itire 20MVAr; 11kV Fixed Shunt Capacitor	830,000
	23	Abeokuta Old;10MVAr, 33kV Fixed Shunt Capacitor	415,000
	25	Omuaran; 30MVAr, 33kV Fixed Shunt Capacitor	1,245,000
	55	IFE 1; 20MVAr, 132kV Fixed Shunt Capacitor	830,000
	58	OSOGBO 1; 10MVAr, 132kV Fixed Shunt Capacitor	415,000
	Subtotal		**37,142,500**
POWER TRANSFORMERS		150 MVA - 3nos, 300 MVA - 4nos , 60MVA(132/33kV) - 10nos	**62,974,200**
Shunt Reactors		Osogbo: 75MVar, Omotosho: 75MVar	**6,225,000**
Total			**548,343,217**

Package-2 (New Projects for 10GW Network)

Group-3: Jos - Gombe - Damaturu

TYPES	S/N	PROJECT DESCRIPTION	COST(US$)
TRANSMISSION LINES AND SUBSTATION	5	2nd Jos – Bauchi - Gombe 330 kV DC line(264KM) between + line bay extension &330/132KV S/S @ Bauchi.	95,700,000
	6	2 x 150MVA, 330/132kV + 2 x 60MVA 132/33kV substations at Bauchi with 2 x 330kV and 4 x 132kV line bays	32,700,000
	7	2nd 330 kV single circuit line through Gombe & Damaturu	48,937,500
	8	2x150MVA, 330/132kV at Jalingo andAssociated 132Kv .	23,837,709
	Subtotal		**201,175,209**
CAPACITOR AND REACTORS	1	Gombe SVC; 330kV, +115MVAr, -168MVAr (OR SVC with total size of +250MVAr,-100MVAr)	11,744,500
	48	Bauchi;83MVAr, 132kV Fixed Shunt Capacitor	3,444,500
	49	Bauchi; 15MVAr, 33kV Fixed Shunt Capacitor	622,500
	50	Jalingo; 10MVAr, 330kV Shunt Reactor project	415,000
	57	JOS 3; 270MVAr, 330kV Fixed Shunt Capacitor	11,205,000
	61	Biu; 20MVAr, 132kV Fixed Shunt Capacitor	830,000
	62	Damboa; 20MVAr, 132kV Fixed Shunt Capacitor	830,000
	Subtotal		**29,091,500**
POWER TRANSFORMERS		150 MVA - 6nos, 300 MVA - nill	**15,948,000**
Total			**246,214,709**

Package-2 (New Projects for 10GW Network)
Group-4: Awka - Ugwuaji - Jos

TYPES	S/N	PROJECT DESCRIPTION	COST(US$)
TRANSMISSION LINES AND SUBSTATION	1	2x150MVA, 330/132kV Lafia andAssociated 132Kv + line bay turn in and out of Makurdi - Jos 330kV line .	23,837,709
	4	2nd Ugwuaji - Aliade – Makurdi - Jos 330 kV double circuit line (490km) - Quad Conductor + line bay extensions.	177,625,000
	33	Ugwuaji - Abakaliki 330KV DC Transmission line (85km)	30,812,500
	34	2 x 150MVA 330/132KV + 2 x 60MVA, 132/33kv Substation @Abakaliki.	32,700,000
	35	Ugwaji - Onitsha turn - out @ Awka (2km) + 2 x 150MVA, 330/132kV substation at Awka + 2 x 60MVA 132/33kV Transformers.	
	35-1	Ugwaji - Onitsha turn - out @ Awka (2km)	725,000
	35-2	2 x 150MVA, 330/132kV substation at Awka + 2 x 60MVA 132/33kV Transformers	32,700,000
	36	Reconductoring of Afam-Port Harcourt 132kV line	7,937,500
	37	Ughelli - Efurrun – Benin 330 kV DC circuits (96km) + line bay extensions + 2 x 150MVA 330/132kV Substation + 2 x 60MVA 132/33kV Substation at Effunrun	
	37-1	Ughelli - Efurrun – Benin 330 kV DC circuits (96km) + line bay extensions	34,800,000
	37-2	2x150MVA 330/132kV Substation + 2x60MVA 132/33kV Substation at Effunrun	32,700,000
	38	2x150MVA at Sapele + Sapele - Amukpe 132KV DC Transmission line (40km)	
	38-1	Sapele - Amukpe 132KV DC Transmission line (40km)	9,625,000
	38-2	2x150MVA at Sapele	23,000,000
	39	Onitsha - Ugwuaji 330 kV double circuit line Bison Conductor (95km)+ line bay extensions at Onitsha and Ugwuaji.	34,437,500
	40	Ugwuaji - Ajaokuta – 330 kV double circuit line QUAD Conductor (180km)+ line bay extensions.	104,400,000
	Subtotal		**545,300,209**
CAPACITOR AND REACTORS	35	Delta; 95MVAr, 132kV Fixed Shunt Capacitor	3,942,500
	36	Ukpilla; 10MVAr, 132kV Fixed Shunt Capacitor project	415,000
	37	Effurun; 55MVAr, 132kV Fixed Shunt Capacitor project	2,282,500
	38	Irrua; 30MVAr, 33kV Fixed Shunt Capacitor project	1,245,000
	39	Effurun, 50MVAr, 33kV Fixed Shunt Capacitor project	2,075,000
	51	Abakaliki; 50MVAr, 132kV Fixed Shunt Capacitor	2,075,000
	52	Yandev; 60MVAr, 132kV Fixed Shunt Capacitor	2,490,000
	53	MAKURDI_3; 200MVAr, 330kV Fixed Shunt Capacitor	8,300,000
	54	ALIADE_3; 70MVAr, 330kV Fixed Shunt Capacitor	2,905,000
	59	Nsukka; 5MVAr, 33kV Fixed Shunt Capacitor	207,500
	63	Awka; 30MVAr, 132kV Fixed Shunt Capacitor	1,245,000
	Subtotal		**27,182,500**
POWER TRANSFORMERS		150 MVA -6nos, 300 MVA - 3nos , 60MVA(132/33kV) - 8nos	**41,873,760**
Shunt Reactors		Sapele: 75MVar	**3,112,500**
Total			**617,468,969**

Package-2 (New Projects for 10GW Network)

Group-5: Benin - Katampe

TYPES	S/N	PROJECT DESCRIPTION	COST(US$)
TRANSMISSION LINES AND SUBSTATION	2	2nd Ajaokuta - Lokoja – Gwagwalada 330 kV double circuit line 330 kV double circuit line (260km) - QUAD conductor+ line bay extensions.	80,837,500
	3	2nd Gwagwalada – Shiroro/ Katampe 330 kV double circuit 330KV Circuit line (40km) + line bay extensions..	14,500,000
	41	Ajaokuta - Akure – 330 kV double circuit line QUAD Conductor (200km)+ line bay extensions.	116,000,000
	44	Gwagwalada - Abaji 132KV DC Transmission Line + 2 x 60MVA 132/33kV Substation at Abaji + 2 Line Bay Extension	36,125,000
	46	2nd Benin - Omotosho 330KV DC Trx Line (125km)	72,500,000
	Subtotal		**319,962,500**
CAPACITOR AND REACTORS	3	Katempe SVC; 330kV +100MVAr, -75MVAr	7,262,500
	19	Akure 70MVAr, 132kV Fixed Shunt Capacitor	2,905,000
	20	Ife 20MVAr, 132kV Fixed Shunt Capacitor	830,000
	21	Ondo1; 10MVAr, 132kV Fixed Shunt Capacitor	415,000
	22	Ondo2 40MVAr, 33kV Fixed Shunt Capacitor	1,660,000
	24	Akure; 20MVAr, 33kV Fixed Shunt Capacitor	830,000
	26	Apo; 60MVAr, 132kV Fixed Shunt Capacitor	2,490,000
	28	Central Area; 20MVAr, 132kV Fixed Shunt Capacitor	830,000
	29	Keffi;25MVAr, 132kV Fixed Shunt Capacitor	1,037,500
	31	Katampe; 50MVAr, 330kV Fixed Shunt Capacitor	2,075,000
	32	Akwanga; 20MVAr, 33kV Fixed Shunt Capacitor project	830,000
	33	Gwagwalada; 50MVAr,33kV Fixed Shunt Capacitor project	2,075,000
	56	KATAMPE 3; 150MVAr, 330kV Fixed Shunt Capacitor	6,225,000
	60	Apo; 20MVAr, 132kV Fixed Shunt Capacitor	830,000
	Subtotal		**30,295,000**
POWER TRANSFORMERS		150 MVA -5nos, 300 MVA - 2nos, 60MVA(132/33kV) - 4nos	**28,910,880**
Shunt Reactors		Benin: 75MVar, Gwagwalada: 75MVar	**6,225,000**
Total			**385,393,380**

PACKAGE 2: NEW PROJECTS FOR 10GW NETWORK - FUND UTILIZATION IN US$						
No.	**Project Titles**	**Estimated Total Project Costs in US$**	**2015**	**2016**	**2017**	**2018**
1	2x150MVA, 330/132kV Lafia and Associated 132kV + line bay turn in and out of Makurdi - Jos 330kV line	23,837,709	16,686,396	4,767,542	2,383,771	
2	2nd Ajaokuta - Lokoja – Gwagwalada 330 kV double circuit line (260km) - QUAD conductor+ line bay extensions.	80,837,500	56,586,250	16,167,500	8,083,750	
3	2nd Gwagwalada – Shiroro/ Katampe 330 kV double circuit line (40km) + line bay extensions..	14,500,000	10,150,000	2,900,000	1,450,000	
4	2nd Ugwuaji - Aliade – Makurdi - Jos 330 kV double circuit line (490km) - Quad Conductor + line bay extensions.	177,625,000	124,337,500	35,525,000	17,762,500	
5	2nd Jos – Bauchi - Gombe 330 kV DC line(264KM) between + line bay extension &330/132KV S/S @ Bauchi.	95,700,000	66,990,000	19,140,000	9,570,000	
6	2 x 150MVA, 330/132kV + 2 x 60MVA 132/33kV substations at Bauchi with 2 x 330kV and 4 x 132kV line bays	32,700,000	22,890,000	6,540,000	3,270,000	
7	2nd 330 kV single circuit line through Gombe & Damaturu - 135km	48,937,500	34,256,250	9,787,500	4,893,750	
8	2x150MVA, 330/132kV at Jalingo and Associated 132kV line bays.	23,837,709	16,686,396	4,767,542	2,383,771	
9	Birnin Kebbi - Sokoto D.C 330kV line (140km)	50,750,000	35,525,000	10,150,000	5,075,000	
10	2x150MVA, 330/132kV at Sokoto andAssociated 132Kv .	23,837,709	16,686,396	4,767,542	2,383,771	
11	2nd Kainji - Birnin Kebbi 330/132kV DC Transmission Line (310Km) + 2 Line bay Extension	112,375,000	78,662,500	22,475,000	11,237,500	
12	Sokoto – Tmafara - Gusau - Katsina 330 kV double circuit line (340KM)	123,250,000	86,275,000	24,650,000	12,325,000	
13	2x150MVA, 330/132kV at Gusau and Associated 132kV	23,837,709	16,686,396	4,767,542	2,383,771	
14	Akure-Ondo 132kV DC line + line bay extensions. (50 km)	12,031,250	8,421,875	2,406,250	1,203,125	
15	Osogbo-Ilesha 132kV QUAD line(40km).	15,400,000	10,780,000	3,080,000	1,540,000	
16	Ilesha Tee - Ife 132kV dc line (20km)	4,812,500	3,368,750	962,500	481,250	
17	Ife - Ondo 132kV dc line (60km)	14,437,500	10,106,250	2,887,500	1,443,750	
18	2x150MVA 330/132KV + 2 x 60MVA 132/33kV Transformer capacity at Ogijo, Lagos and turn-in-out of Benin-Egbin-Ikeja West 330kv DC at Ogijo	37,745,000	26,421,500	7,549,000	3,774,500	

PACKAGE 2: NEW PROJECTS FOR 10GW NETWORK - FUND UTILIZATION IN US$						
No.	**Project Titles**	**Estimated Total Project Costs in US$**	**2015**	**2016**	**2017**	**2018**
19	132kV D.C Line (20kM) from Ojigo - MFM	4,812,500	3,368,750	962,500	481,250	
20	2X60MVA S/S @ MFM	9,700,000	6,790,000	1,940,000	970,000	
21	2x150MVA, 330/132kV + 2x60MVA, 132/33kV substation at Epe and Associated 6no 33kV feeders.	32,700,000	22,890,000	6,540,000	3,270,000	
22	50km 132kV D.C line to Ibeju	12,031,250	8,421,875	2,406,250	1,203,125	
23	2x60MVA, 132/33kV substation at Ibeju Lekki and 2x132kV line bays extension at Epe	9,700,000	6,790,000	1,940,000	970,000	
24	2 x 150MVA, 330/132kV substation at Ado Ekiti + 2 x 60MVA 132/33kV Transformers.	32,700,000	22,890,000	6,540,000	3,270,000	
25	Akure - Ado Ekiti 330kV D.C transmission line (80km)	29,000,000	20,300,000	5,800,000	2,900,000	
26	Arigbajo - Agbara 330kV D.C transmission line (40km)	14,500,000	10,150,000	2,900,000	1,450,000	
27	2x150MVA, 330/132kV substation at New Agbara, with 2x330kV and 4x132kV line bays.	28,475,000	19,932,500	5,695,000	2,847,500	
28	New Agbara - Agbara -Badagry 132kV D/C transmission line (70km).	16,843,750	11,790,625	3,368,750	1,684,375	
29	2X60MVA, 132/33kV substation at Badagry and 2x132kV line bays extension at Agbara.	9,700,000	6,790,000	1,940,000	970,000	
30	Arigbajo - New Abeokuta 132kV DC Transmission Line (45km)	11,057,767	7,740,437	2,211,553	1,105,777	
31	Convert Akangba -Amuwo -Ojo 132kV DC transmission line DC ACCC conductor(15km).	3,606,250	2,524,375	721,250	360,625	
32	Convert existing Oshogbo - Offa (50km) SC (Hyena)- Offa-Ganmo(50km) DC using existing ROW with ACCC conductor	12,031,250	8,421,875	2,406,250	1,203,125	
33	Olorunsogo - Arigbajo 330 KV QUAD Transmission line (15km)	8,700,000	6,090,000	1,740,000	870,000	
34	IkjW/Osogbo 330KV DC turn in-out 15km @ Arigbajo + Ogijo - Arigbajo DC Transmission line (40km).	19,937,500	13,956,250	3,987,500	1,993,750	
35	Ugwuaji - Abakaliki 330KV DC Transmission line (85km)	30,812,500	21,568,750	6,162,500	3,081,250	
36	2 x 150MVA 330/132KV + 2 x 60MVA, 132/33kv Substation @Abakaliki.	32,700,000	22,890,000	6,540,000	3,270,000	
37	Ugwaji - Onitsha turn - out @ Awka (2km)	725,000	507,500	145,000	72,500	
38	2 x 150MVA, 330/132kV substation at Awka + 2 x 60MVA 132/33kV Transformers	32,700,000	22,890,000	6,540,000	3,270,000	

PACKAGE 2:	NEW PROJECTS FOR 10GW NETWORK - FUND UTILIZATION IN US$					
No.	**Project Titles**	**Estimated Total Project Costs in US$**	**2015**	**2016**	**2017**	**2018**
39	Reconductoring of Afam-Port Harcourt 132kV line	7,937,500	5,556,250	1,587,500	793,750	
40	Ughelli - Efurrun – Benin 330 kV DC circuits (96km)	34,800,000	24,360,000	6,960,000	3,480,000	
41	2x150MVA 330/132KV, 2x60MVA 132/33KV S/S at Efurrun + line bay extensions	32,700,000	22,890,000	6,540,000	3,270,000	
42	Sapele - Amukpe 132KV DC Transmission line (40km)	9,625,000	6,737,500	1,925,000	962,500	
43	2x150MVA at Sapele	23,000,000	16,100,000	4,600,000	2,300,000	
44	Onitsha - Ugwuaji 330 kV double circuit line Bison Conductor (95km)+ line bay extensions at Onitsha and Ugwuaji.	34,437,500	24,106,250	6,887,500	3,443,750	
45	Ugwuaji - Ajaokuta – 330 kV double circuit line QUAD Conductor (180km)+ line bay extensions.	104,400,000	73,080,000	20,880,000	10,440,000	
46	Ajaokuta - Akure – 330 kV double circuit line QUAD Conductor (200km)+ line bay extensions.	116,000,000	81,200,000	23,200,000	11,600,000	
47	Omotosho -Akure 330kV DC Transmission line QUAD Conductor(80km)+ line Bays Extension	46,400,000	32,480,000	9,280,000	4,640,000	
48	Akure – Oshogbo 330 kV double circuit line QUAD Conductor (96km)+ line bay extensions.	55,680,000	38,976,000	11,136,000	5,568,000	
49	Gwagwalada - Abaji 132KV DC Transmission Line + 2 x 60MVA 132/33kV Substation at Abaji + 2 Line Bay Extension	36,125,000	25,287,500	7,225,000	3,612,500	
50	Kainji-Kaima-Kishi-Shaki 132kV DC Transmision Line(180km)	43,312,500	30,318,750	8,662,500	4,331,250	
51	2 x 60MVA 132/33kV Substations at Kaima & Kishi + 4 Bay Extensions	9,700,000	6,790,000	1,940,000	970,000	
52	2nd Benin - Omotosho 330KV QUAD Trx Line (125km).	72,500,000	50,750,000	14,500,000	7,250,000	
53	5km 330kV DC Tee-off to Zaria from the on-going Kaduna - Kano 330kV DC line	1,812,500	1,268,750	362,500	181,250	
54	2x150MVA 330/132kV Substation at Zaria, 2 no. 330kV line bays and 4 no. outgoing 132kV feeders	23,000,000	16,100,000	4,600,000	2,300,000	
55	Power transformers for Grid reinforcement, 132/33kV 60MVA - 21nos, 330/132kV 150MVA 14nos and 300MVA 16nos	149,706,840	149,706,840			

PACKAGE 2:	NEW PROJECTS FOR 10GW NETWORK - FUND UTILIZATION IN US$					
No.	**Project Titles**	**Estimated Total Project Costs in US$**	**2015**	**2016**	**2017**	**2018**
	Total (Transmission + Substation)	**$2,070,021,693**	**$1,493,927,237**	**$384,062,971**	**$192,031,485**	
	Reactive compensation projects	$165,170,000	$115,619,000	$33,034,000	$16,517,000	
	Grand Total project cost for 10GW	**$2,235,191,693**	**$1,609,546,237**	**$417,096,971**	**$208,548,485**	

TRANSMISSION PROJECT LOGICAL FRAMEWORK		TCN
Project Title Ikorodu 20MVAr; 33kV Fixed Shunt Capacitor		**Start Date : 2014** **Finish Date : 2016**
Project Narrative	**Indicators**	**Critical considerations**
(1)Programme Objective: To improve power quality in Ikorodu and Environs	Improve economic and commercial activities in Ikorodu and Environs	Poor voltage Profile in Ikorodu and Environs
(2) Project Objective: Bulk Power quality supply to Oke_Aro and Environs	Power quality is guaranteed	Good voltage Profile in Oke_Aro and Environs
(3) Scope/Outputs: Scope: Construction of Ikorodu 20MVAr; 33kV Fixed Shunt Capacitor Outputs : Power quality is guaranteed	Power quality is available .	Competent contractor is employed to deliver the project.
(4) Inputs/costs: Inputs : Construction of Ikorodu 20MVAr; 33kV Fixed Shunt Capacitor Costs :	**Funding**: **Balance to complete**:	Fully funded LC/ Timely release of fund.
(5) Others: The project is necessary for - power evacuation - Bulk supply - Reliability - Voltage Improvement.		

TRANSMISSION PROJECT LOGICAL FRAMEWORK		TCN
Project Title : **2x 150MVA, 330/132KV Substation at Lafia + associated 132kV line bay + turn in and out of Makurdi – Jos 330kV line.**		**Start Date : 2014** **Finish Date : 2016**
Project Narrative	**Indicators**	**Critical considerations**
(1)Programme Objective: To improve power delivery to Nassarawa & Southern Kaduna states.	Improve economic activity of Nassarawa & Southern Kaduna states. .	Limitation of bulk supply to Nassarawa & Southern Kaduna states which includes the following 132KV substations @ Lafia, Akwanga, Keffi, Kwoi and Kachia.
(2) Project Objective: Bulk Power supply to Nassarawa & Southern Kaduna states.	Additional 300MVA Transformation capacity to be utilised.	About 200MW of power is delivered to Lafia, Akwanga, Keffi, Kwoi and Kachia.
(3) Scope/Outputs: Scope: Construction of2x 150MVA, 330/132KV Substation at Lafia with turn in out from Markurdi-Jos DC Transmission Line. Outputs : Increase in transformation capacity by 300 MVA.	Extra 300MVA transmission capacity is available.	Competent contractor is employed to deliver the project.
(4) Inputs/costs: Inputs : Construction of2x 150MVA, 330/132KV Substation at Lafia. Costs : ₦3,814,033,428.98	**Funding**: **Balance to complete**:	Fully funded LC/ Timely release of fund.
(5) Others: The project is necessary for - power evacuation - Bulk supply - Reliability - Voltage Improvement.		

TRANSMISSION PROJECT LOGICAL FRAMEWORK		**TCN**
Project Title : **2x 150MVA, 330/132KV Substation at Sokoto.**		
Project Narrative	**Indicators**	**Critical considerations**
(1)Programme Objective: To improve power delivery to Sokoto state.	Improved economic activity of Sokoto state. .	Limitation of bulk supply to Sokoto on the existing 132/33KV Substation. 330/132kV transformation capacity will be required to utilize the 330kV transmission capacity to be provided by the Birnin Kebbi - Sokoto 330kv D.C line.
(2) Project Objective: Bulk Power supply to Sokoto State	Additional 300MVA Transformation capacity to be utilised.	About 200MW of power is delivered.
(3) Scope/Outputs: Scope: installation of2x 150MVA, 330/132KV and 2 x 60MVA 132/33kv Substation at Sokoto. Outputs : Increase in transformation capacity by 300 MVA.	Extra 300MVA transmission capacity is available.	Competent contractor is employed to deliver the project.
(4) Inputs/costs: Inputs : 2x 150MVA, 330/132KV Transformer and associated substation equipment. Costs : ₦3,814,033,428.98	**Funding**: **Balance to complete**:	Fully funded LC/ Timely release of fund.
(5) Others: The project is necessary for - Bulk supply - Reliability - Voltage Improvement .		

TRANSMISSION PROJECT LOGICAL FRAMEWORK		TCN
Project Title : Kainji - Birnin Kebbi D.C 330kV line (310km)		**Date :**
Project Narrative	**Indicators**	**Critical Consideration**
(1)Programme Objective: To secure supply to the entire North West the same time enhancing power exchanges within the North core West African Power Pool (WAPP).	- Increased economic activities in Kebbi, Sokoto, Zamfara. Improved relationship with the international community.	- Reliability of supply to the north western state; Sokoto, Kebbi, Zamfara and the international community in Niger has been a major challenge because of radial single 330kV supply to the area. No alternative supply to the area; an outage on the existing 330kV single circuit often lead to days of total blackout of supply to the area. Voltage constraint is another consideration.
(2) Project Objective: Power reliability and voltage improvement to north western state; Sokoto, Kebbi, Zamfara and the international community.	- Additional transmission Capacity utilised	- Extra 1320MW wheeling capacity of power will be available - More power to be evacuated from Kainji power plant
(3) Scope/Outputs: a) Construction of 310km Kainji - Birnin Kebbi 330 kV DC line + line bay extension &330/132KV S/S at Kainji and Birnin Kebbi.	Extra transmission capacity Utilised.	Competent contractor to be engaged for the project
(4) Inputs/Costs: a) About 930 km of Bison conducators + 330kV Towers and related lines/substation accessories. Costs: ₦17,980,000,000.00	Fully funded LC	Timely released of fund
5) Others Project is necessary for Power evacuation + Reliability Voltage Improvement Interconnectivity Redundancy		

TRANSMISSION PROJECT LOGICAL FRAMEWORK		TCN
Project Title : **Sokoto – Tmafara – Gusau - Katsina 330KV DC Transmission 340kM Line.**		
Project Narrative	**Indicators**	**Critical considerations**
(1)Programme Objective: To improve power delivery to Sokoto – Tmafara - Gusau and other northern states of the Country	Improve economic activity of Sokoto – Tmafara - Gusau and other northern states of the Country	Voltage related limitation in the North West occasioned by insufficient transmission capacity of the transmission network to carry the increased power transfer. According to the report of the 10GW analysis this limitation cannot be mitigated by reactive support and requires building of new transmission lines. and there is also the need to create 330kV loops for supply reliability and voltage improvement.
(2) Project Objective: Power evacuation from the grid to Sokoto – Tmafara - Gusau and other northern states of the Country .	Additional 1,200MW transmission line capacity to be utilised.	
(3) Scope/Outputs: Scope: a) Construction of 340km 330kV D.C line from Katsina to Sokoto – Tmafara - Gusau . Outputs : Increase in transmission capacity by 1200 MW	Extra 1200 MW transmission capacity	Competent contractor is employed to deliver the project.
(4) Inputs/costs: **Inputs:** a)Transmission line materials (list) **Costs**: ₦19,720,000,000.00	**Funding**: **Balance to complete**:	Fully funded LC/ Timely release of fund.
(5) Others: The project is necessary for; - power evacuation - Bulk Power Supply - Security & reliability of the grid.		

TRANSMISSION PROJECT LOGICAL FRAMEWORK		TCN
Project Title : **2x 150MVA, 330/132KV Substation at Gusau.**		**Start Date :** Finish Date :
Project Narrative	**Indicators**	**Critical considerations**
(1)Programme Objective: To improve power delivery to Zamfara state.	Improve economic activity of Zamfara state. .	Limitation of bulk supply to Gusau through the existing 132/33KV Substation. 330/132kV transformation capacity will be required to utilize the 330kV transmission capacity that will be provided.
(2) Project Objective: Bulk Power supply to Sokoto State	Additional 300MVA Transformation capacity to be utilised.	About 200MW of power is delivered.
(3) Scope/Outputs: Scope: installation of2x 150MVA, 330/132KV and 2 x 60MVA 132/33kv Substation at Guasu. Outputs : Increase in transformation capacity by 300 MVA.	Extra 300MVA transmission capacity is available.	Competent contractor is employed to deliver the project.
(4) Inputs/costs: Inputs : 2x 150MVA, 330/132KV Transformer and associated substation equipment. Costs : ₦3,814,033,428.98	**Funding**: **Balance to complete**:	Fully funded LC/ Timely release of fund.
(5) Others: The project is necessary for - Bulk supply - Reliability - Voltage Improvement .		

TRANSMISSION PROJECT LOGICAL FRAMEWORK		TCN
Project Title : **Akure – Ondo 132KV DC Transmission Line (62kM).**		
Project Narrative	**Indicators**	**Critical considerations**
(1)Programme Objective: To improve power delivery from the grid to Ondo and Ekiti State.	Improve economic activity of Ondo State.	There is constraint of power delivery to Ondo and Ekiti States; the existing 132kV line is old and not adequate to me the present load of the two States.
(2) Project Objective: Bulk Power delivery to Ondo and Ekiti State.	Additional 240 MW transmission line capacity to be utilised.	About 200 MW of power to be delivered to Akure and its environ in Ondo state
(3) Scope/Outputs: Scope: a) Akure - Ondo 132KV DC Transmission Line. Outputs : Increase in transmission capacity by 240 MW.	Extra 240 MW transmission capacity is available.	Competent contractor is employed to deliver the project.
(4) Inputs/costs: **Inputs:** a) Akure - Ondo132KV DC Transmission Line. b) Line bay extension at Osogbo 132/33KV Substations. **Costs**: ₦3,542,000,000.00	**Funding**: **Balance to complete**:	Fully funded LC/ Timely release of fund.
(5) Others: The project is necessary for; - power evacuation - Bulk Supply to Ondo state		

TRANSMISSION PROJECT LOGICAL FRAMEWORK		TCN
Project Title : 2nd **Osogbo – Ilesha Tee Junction - Ife - Ondo - Akure 132KV SC Transmission Line (108kM).**		
Project Narrative	**Indicators**	**Critical considerations**
(1)Programme Objective: To improve power delivery from the grid to Ilesha, Ife and Ondo town.	Improve economic activity of Ilesha, Ife and Ondo .	There is constraint of power delivery to Ilesha, Ife and Ondo town; the existing 132kV line is old and not adequate to meet the present load of the three towns.
(2) Project Objective: Bulk Power delivery to Ilesha, Ife and Ondo town .	Additional 120 MW transmission line capacity to be utilised.	About 100 MW of power to be delivered to Ilesha, Ife and Ondo town.
(3) Scope/Outputs: Scope: a) Construction of 108km S.C Osogbo - Ilesha Tee Junction - Ife - Ondo -Akure 132KV S.C Transmission Line. Outputs : Increase in transmission capacity by 120 MW.	Extra 120 MW transmission capacity is available.	Competent contractor is employed to deliver the project.
(4) Inputs/costs: **Inputs:** a) 324km of Bear conductors and 132kV line accessories including 132kV towers. **Costs**: ₦4,158,000,000.00	**Funding**: **Balance to complete**:	Fully funded LC/ Timely release of fund.
(5) Others: The project is necessary for; - power evacuation - Bulk Supply to Ilesha, Ife and Ondo town		

TRANSMISSION PROJECT LOGICAL FRAMEWORK		TCN
Project Title : Ogijo 2x 150MVA, 330/132KV +2x60MVA 132/33KV Substation and turn-in-out of Benin –Egbin-IkejaWest 330KV DC line.		**Date :** **April 2013**
Project Narrative	**Indicators**	**Critical considerations**
(1)Programme Objective: To improve power delivery to Ogun & Lagos States.	Improved economic activities in Ikorodu, Shagamu and Ijebu-Ode areas of Ogun & Lagos State. .	Limitation of bulk supply to Ikorodu, Shagamu and Ijebu-Ode.
(2) Project Objective: Bulk Power supply to Lagos & Ogun States	Additional a) 300MVA 330/132KV + 120MVA 132/33Transformation capacity at Ogijo b)120MVA 132/33Transformation capacity at MFM and 240 MW on Ogijo – MFM 132KV line to be utilised.	About 300 MVA of power is delivered to Lagos & Ogun States.
(3) Scope/Outputs: Scope: 2x 150MVA, 330/132KV +2x60MVA 132/33KV Substation at Ogijo, Lagos and turn-in-out of Benin –Egbin-IkejaWest 330KV DC line. Ikorodu-Shagamu 132KV DC line also be turned in-out in this station Outputs : Increase in transformation capacity by 300 MVA.	Extra 300MVA transmission capacity is available.	Competent contractor is employed to deliver the project.
(4) Inputs/costs: Inputs : Construction of 2x 150MVA, 330/132KV +2x60MVA 132/33KV Substation at Ogijo, Lagos and turn-in-out of Benin –Egbin-IkejaWest 330KV DC line. Ikorodu-Shagamu 132KV DC line also be turned in-out in this station + 132/33KV, 2x60MVA S/S @MFM and Ogijo – MFM 132KV DC line(12km) Costs :₦6,039,200,000.00	**Funding**: **Balance to complete**:	Fully funded LC/ Timely release of fund.
(5) Others: The project is necessary for - power evacuation - Bulk supply to Lagos & Ogun states.		

TRANSMISSION PROJECT LOGICAL FRAMEWORK		**TCN**
Project Title : 132/33KV, 2X60MVA S/S @ MFM and Ogijo – MFM 132kV DC line (20km).The ongoing Ikorodu – Shagamu 132kV DC line will also be turned in-out at this substation		**Date :**
Project Narrative	**Indicators**	**Critical Assumptions**
(1)Programme Objective: To improve power delivery to Ibadan Express / Ibafo axis of Ogun State.	Improved economic activities along Ibadan Express / Ibafo axis of Ogun State.	Bulk power supply to Ibadan Express / Ibafo axis of Ogun State has been grossly in adequate. The existing supply is through over stretched 33kV feeder from Ibadan (>100km) with many tee-offs. The area is fast developing with major institutions / commercial activities adorning the area there is urgent need to provide bulk 132/33kV supply to the area.
(2) Project Objective: Bulk power delivery to Ibadan Express / Ibafo axis of Ogun State.	132/33kV transformation capacity increased by 120MVA	About 100MW of power is delivered to Ibadan Express / Ibafo axis of Ogun State
(3) Scope /Outputs: Scope: Construction of 2 x 60MVA 132/33kV substation and associated 33kV feeder panels. Output: increased transformation capacity by 120MVA	Availability of 120MVA 132/33kV transformation capacity.	Competent contractor is employed to deliver the project.
(4) Inputs / Costs: Input: 2 x 60MVA 132/33kV transformers and associated substation equipment. 60km of Bear conductor and associated 132kV line accessories Costs: ₦3,200,000,000.00	Funding: Balance to complete	Timely release of Fund / Fully Funded LC
Others: The project is necessary for - Power Evacuation - Bulk supply to Lagos & Ogun State.		

TRANSMISSION PROJECT LOGICAL FRAMEWORK		TCN
Project Title : 2x150MVA, 330/132kV + 2x60MVA, 132/33kV substation at Epe and Associated 6no 33kV feeders		**Date :**
Project Narrative	**Indicators**	**Critical Considerations**
(1)<u>Programme Objective:</u> To improve power evacuation from Omotosho Power Plan and power supply improvement in Epe, Ibeju Lekki and environs.	More power would be evacuated from Omotosho power plant and improved economic activities in Epe, Ibeju Lekki and environs.	There is the need to evacuation generation from Omotosho Power plant and this will be done the proposed Epe 330/132/33kV substation. Another consideration is the constraint in existing 33kV power supply to Epe, one of the fast growing cities in Lagos State. The existing supply is through over stretched 33kV feeder from Ijebu-Ode (>60km) with many tee-offs. The area is fast developing with major institutions / commercial activities adorning the area hence the urgent need to provide bulk 330/132/33kV supply to the area.
(2) <u>Project Objective:</u> Power evacuation from Omotosho and AES. power supply improvement in Epe, Ibeju Lekki and environs.	Transformation available capacity increased	500MW of power is available from Omotosho power plant and 300MW from AES to be evacuated into the grid.
(3) <u>Scope / Outputs</u>: **Scope**: Construction of substation of 2x150MVA, 330/132kV+1x60MVA, 132/33kV and associated radiating feeders (6)etc: **Output:** Increased transformation capacity of 420MVA	Availability of 420MVA transformation capacity	Competent contractor is employed to deliver project.
(4) <u>Inputs / Costs:</u> **Input:** 2x 150MVA, 330/132KV Transformer and associated substation equipment. <u>Costs</u> : ₦5,839,200,000.00	**Funding** **Balance to complete**:	Timely release of fund / Fully Funded LC
(5) <u>Others:</u> Project is necessary for power evacuation + increased transformation capacity in Epe axis		

TRANSMISSION PROJECT LOGICAL FRAMEWORK		TCN
Project Title : 50kM Epe - Ibeju - Lekki 132kV DC line and 132/33KV, 2X60MVA S/S @ Ibeji-Lekki and 2 x 132kV line bays extension at Epe.		**Date :**
Project Narrative	**Indicators**	**Critical Assumptions**
(1)Programme Objective: To provide bulk power supply to Ibeju - Lekki area of Lagos State.	Stimulation of economic activities Ibeju - Lekki area of Lagos State.	No bulk power supply is available to the Free Export Processing Zone (EPZ) in Lekki Area of Lagos State. The area has been earned for industrial and EPZ. An International Air Port is also proposed in the area. There is urgent need to provide bulk 132/33kV supply to the area.
(2) Project Objective: Bulk power delivery to to Ibeju - Lekki area of Lagos State.	132/33kV transformation capacity increased by 120MVA	About 100MW of power is delivered to Ibeju - Lekki area of Lagos State.
(3) Scope /Outputs: Scope: Construction of 2 x 60MVA 132/33kV substation and associated 33kV feeder panels. Output: increased transformation capacity by 120MVA	Availability of 120MVA 132/33kV transformation capacity.	Competent contractor is employed to deliver the project.
(4) Inputs / Costs: Input: 2 x 60MVA 132/33kV transformers and associated substation equipment. 150km of Bear conductor and associated 132kV line accessories Costs: ₦4,300,000,000.00	Funding: Balance to complete	Timely release of Fund / Fully Funded LC
Others: The project is necessary for - Power Evacuation - Bulk supply to Ibeju - Lekki area of Lagos State. .		

TRANSMISSION PROJECT LOGICAL FRAMEWORK		TCN
Project Title : **2nd Ajaokuta - Lokoja – Gwagwalada 330 kV double circuit line 330 kV double circuit line (260km) + line bay extensions.**		
Project Narrative	**Indicators**	**Critical considerations**
(1)Programme Objective: To improve power delivery to Federal Capital Territory (FCT) and environs.	Improved economic activity of Federal Capital Territory (FCT) and stable / reliable supply to FCT and environs.	Based on the report of the analysis of 10GW network carried out by MHI/TCN there would power evacuation constraint on the new Ajaokuta - Lokoja – Gwagwalada 330 kV D.C especially for generation re-dispatch between hydro generation and thermal generation during dry season. Power supply to FCT, Kaduna Kano and other northern states will be affected. Other consideration is reliability of power supply in FCT.
(2) Project Objective: Power evacuation from Ajaokuta and the south and eastern block to the rest of the grid.	Additional 1,200MW transmission line capacity to be utilised.	About 1,000 MW of bulk generated power from Ajaokuta to be evacuated to FCT and environs.
(3) Scope/Outputs: a) Construction of 260km Ajaokuta - Lokoja – Gwagwalada 330 kV double circuit line (260km) extensions. b) Line bay extension at Ajaokuta, Lokoja and Gwagwalada 330/132KV Substations. Outputs : Increase in transmission capacity by 1200 MW.	Extra 1200 MW transmission capacity is available.	Competent contractor is employed to deliver the project.
(4) Inputs/costs: **Inputs:** a) About 780 km of Bison conducators + 330kV Towers and related lines/substation e **Costs**: ₦12,934,000,000.00	**Funding**: **Balance to complete**:	Fully funded LC/ Timely release of fund.
(5) Others: The project is necessary for; - power evacuation - Bulk Supply to Lagos - Security & reliability of the grid.		

TRANSMISSION PROJECT LOGICAL FRAMEWORK		TCN
Project Title : **2nd Egbin - Ikorodu 132kV DC Transmission Line (18kM) + 2 Line Bay Extension.**		
Project Narrative	**Indicators**	**Critical considerations**
(1)Programme Objective: To improve power delivery from the grid to Ikorodu and Maryland areas of Lagos State.	Improved economic in Ikorodu and Maryland areas of Lagos State.	There is constraint of power delivery to Ikorodu and Maryland areas of Lagos State. There is also the need to utilize the additional 300MVA 330/132kv Transformation capacity made available at Egbin Power Station.
(2) Project Objective: Bulk Power delivery to Ikorodu and Maryland areas of Lagos State.	Additional 240 MW transmission line capacity to be utilised.	About 200 MW of power to be delivered to Ikorodu and Maryland areas of Lagos State.
(3) Scope/Outputs: Scope: a) Construction of 18kM D.C Transmission line from Egbin - Ikorodu . Outputs : Increase in transmission capacity by 240 MW.	Extra 240 MW transmission capacity is available.	Competent contractor is employed to deliver the project.
(4) Inputs/costs: **Inputs:** a) About 60km of Bear conductor and associated 132kV transmission towers / accessories. b) Line bay extension at Egbin. **Costs**: ₦1,556,000,000.00	**Funding**: **Balance to complete**:	Fully funded LC/ Timely release of fund.
(5) Others: The project is necessary for; - power evacuation - Bulk Supply to Ikorodu and Maryland areas of Lagos State.		

TRANSMISSION PROJECT LOGICAL FRAMEWORK		TCN
Project Title : 2x150MVA, 330/132kV + 2x60MVA, 132/33kV Transformer Substations at Ado-Ekiti.		**Date :**
Project Narrative	**Indicators**	**Critical Considerations**
(1)Programme Objective: Power supply improvement in Ado-Ekiti and environs.	Improved economic activities in Ekiti State and environs.	The existing supply to Ekiti State is through old 132kV feeder from Osogbo - Akure - Ado-Ekiti with many tee-offs making this line unreliable.
(2) Project Objective: Power evacuation from Omotosho to Ekiti State	Additional 240 MW transmission line capacity to be utilised.	About 240 MW of power to be delivered to Ekiti State
(3) Scope / Outputs: **Scope**: Construction of substation of 2x150MVA, 330/132kV+1x60MVA, 132/33kV and **Output:** Increased transformation capacity of 420MVA	Transformation available capacity increased	Competent contractor is employed to deliver project.
(4) Inputs / Costs: **Input:** 2x 150MVA, 330/132KV Transformer and associated substation equipment. Costs : ₦5,839,200,000.00	**Funding** **Balance to complete**:	Timely release of fund / Fully Funded LC
(5) Others: Project is necessary for power evacuation + increased transformation capacity in Epe axis		

TRANSMISSION PROJECT LOGICAL FRAMEWORK		TCN
Project Title : Obajana-Ado Ekiti 330kV D/C transmission line (80km).		**Date :**
Project Narrative	**Indicators**	**Critical Consideration**
(1)Programme Objective: To Improve Power delivery to Ekiti state and neighbouring states.	Increased in Industrial and economic activities in Ekiti state and the neighbouring states	Evacuation of more power from Geregu power plant to the grid.
(2) Project Objective: Power evacuation from Geregu power plant to grid	Additional 1200MW transmission Capacity utilised	1320MW wheeling capacity available for evacuation of power from Geregu power plant to the grid.
(3) Scope/Outputs: Construction of 240kM Obajana-Ado Ekiti 330kV D/C transmission line **Outputs**: Increased in Transmission capacity by 1320MW	Extra transmission capacity of 1200mw made available	Competent contractor to be engaged for the project
(4) Inputs/Costs: ₦4,640,000,000.00	Fully funded LC	Timely released of fund
(5) Others: Project is necessary for Power evacuation + Reliability		

TRANSMISSION PROJECT LOGICAL FRAMEWORK		TCN
Project Title : Olorunsogo – Agbara, 330kV DC transmission line (40km)		**Date :**
Project Narrative	**Indicators**	**Critical Considerations**
(1)<u>Programme Objective:</u> To improve power supply in Agbara and to complete Agbara - Olorunsogo – Ikeja West loop	Improved economic activities in Agbara, Ikeja West and Olorunsogo	Evacuation of Olorunsogo Power Plant
(2) <u>Project Objective:</u> Power evacuation from Olorunsogo Power Plant/Loop Closing	Transmission capacity of 1000MW available	Over 500MW of power is available from Olorunsogo Power Plant to be evacuated into the grid.
(3) <u>Scope / Outputs</u>: **Scope**: Construction of double circuit bison conductor line of 330kV from Olorunsogo – Agbara (40km) **Output:** Increased transmission capacity of 1000MW	Availability of 1000MW transmission capacity	Competent contractor is employed to deliver project.
(4) <u>Inputs / Costs:</u> **Input:** **Costs:** ₦3,033,000,000.00	**Funding** **Balance to complete**:	Timely release of fund / Fully Funded LC
(5) <u>Others:</u> Project is necessary for power evacuation + Reliability		

TRANSMISSION PROJECT LOGICAL FRAMEWORK		TCN
Project Title : 2x150MVA, 330/132kV substation at New Agbara, with 2x330kV and 4x132kV line bays		**Date :**
Project Narrative	**Indicators**	**Critical Considerations**
(1) **Programme Objective:** To improve bulk power supply to the new Agbara axis	Improved economic activities in New Agbara/Connection to the Sakete Backbone	Evacuation of Olorunsogo Power Plant and Power Export to WAPP network.
(2) **Project Objective:** Power evacuation from Olorunsogo Power Plant/increase bulk supply to the New Agbara area	300MVA transformation capacity	500MW of power is available from Olorunsogo Power Plant to be evacuated into the grid.
(3) **Scope / Outputs**: **Scope**: Construction of 2x150MVA, 330/132kV substation at New Agbara, with 2x330kV and 4x132kV line bays **Output:** Increased transformation capacity of 300MVA	Availability of 300MVA transformation capacity	Competent contractor is employed to deliver project.
(4) **Inputs / Costs:** **Input:** **Costs:₦4,556,000,000.00**	**Funding** 100% (amount) L.C cost provided : **Balance to complete**:	Timely release of fund / Fully Funded LC
(5) **Others:** Project is necessary for power evacuation + Bulk supply +International Connection		

TRANSMISSION PROJECT LOGICAL FRAMEWORK		**TCN**
Project Title : New Agbara – Agbara – Badagry 132kV D/C transmission line (70km)		**Date :**
Project Narrative	**Indicators**	**Critical Considerations**
(1) <u>**Programme Objective:**</u> To improve power delivery to New Agbara – Agbara – Badagry and other neighbouring towns	Improved economic activities	- There is power evacuation constraints from Olorunsogo – Ikeja West.
(2) <u>**Project Objective:**</u> Power evacuation from Agabara – New Agbara - Badagry	240MW transmission capacity	- International Connection to Sakete/ - Power evacuation from Olrunsogo to Agbara and related axis
(3) <u>**Scope / Outputs**</u>: **Scope**: Construction of New Agbara – Agbara – Badagry 132kV D/C transmission line (70km) **Output:** Increased transformation capacity of 240MW	- Availability of 240MW transmission capacity	- Competent contractor is employed to deliver project.
(4) <u>**Inputs / Costs:**</u> **Input:** **Costs:**₦800,000,000.00	**Funding** 100% (amount) L.C cost provided : **Balance to complete**:	Timely release of fund / Fully Funded LC
(5) <u>**Others:**</u> Power Evacuation/ International Transmission connection + Bulk supply		

TRANSMISSION PROJECT LOGICAL FRAMEWORK		TCN
Project Title : 132/33KV, 2X60MVA S/S @ Badagry and 2 x 132kV line bays extension at Agbara.		**Date :**
Project Narrative	**Indicators**	**Critical Assumptions**
(1)Programme Objective: To provide bulk power supply to Badagry and Cotonou international border areas of Lagos State.	Increased economic activities in Badagry and Cotonou international border areas of Lagos State.	There is serious constraint in power supply to Badagry and Cotonou international border areas of Lagos State; the only supply to the area is through a over loaded and un reliable 33kV line from Agbara 132/33kV substation. Hence the urgent need to provide bulk 132/33kV supply to the areas.
(2) Project Objective: Bulk power delivery to Badagry and Cotonou international border areas of Lagos State.	132/33kV transformation capacity increased by 120MVA	About 100MW of power is delivered to Badagry and Cotonou international border areas of Lagos State.
(3) Scope /Outputs: Scope: Construction of 2 x 60MVA 132/33kV substation and associated 33kV feeder panels. Output: increased transformation capacity by 120MVA	Availability of 120MVA 132/33kV transformation capacity.	Competent contractor is employed to deliver the project.
(4) Inputs / Costs: Input: 2 x 60MVA 132/33kV transformers and associated substation equipment. Costs: ₦2,556,000,000.00	Funding: Balance to complete	Timely release of Fund / Fully Funded LC
Others: The project is necessary for - Power Evacuation - Bulk supply to Badagry and Cotonou international border areas of Lagos State. .		

TRANSMISSION PROJECT LOGICAL FRAMEWORK		TCN
Project Title : Olorunsogo --New Abeokuta 132kV D/C line(45km)		**Date :**
Project Narrative	**Indicators**	**Critical Consideration**
(1)Programme Objective: To Improve Power delivery to Abeokuta area of Ogun state and neighbouring states.	Increased in economic and commercial activities in Abeokuta area of Ogun State.	Evacuation of more power from Olorunsogo power plant to the grid.
(2) Project Objective: Power evacuation from Olorunsogo power plant to grid	Additional transmission Capacity utilised	250MW wheeling capacity available. Power from Olorunsogo power plant to be evacuated to the grid
(3) Scope/Outputs: Ogijo-New Abeokuta 132kV D/C line(45km) Construction of **Outputs**: Increased in Transmission capacity by 250mw	Extra transmission capacity of 250mw Utilised	Competent contractor to be engaged for the project
(5) Inputs/Costs: a) About 135km of Bear conductor and associated 132kV transmission towers / accessories. Cost: ₦1,732,242,719.00	Fully funded LC	Timely released of fund
(5) Others: Project is necessary for Power evacuation + Reliability Voltage Improvement.		

TRANSMISSION PROJECT LOGICAL FRAMEWORK		TCN
Project Title : **Re-conductoring of Akangba – Amuwo – Ojo 132kV DC (15km) Transmission line**		**Date :** **Nov. 2013**
Project Narrative	**Indicators**	**Critical considerations**
(1)Programme Objective: To improve power delivery on the 132kV Transmission grid in Lagos area.	Improved bulk power transfer to Amuwo and Ojo areas of Lagos State.	Based on the MHI / TCN 10GW network study there is power flow limitation on the existing Akangba - Amuwo - Ojo 132kV wolf conductor line and will require re-conductoring with High Temp and Low Sag Conductor .
(2) Project Objective: Additional Power delivery on 132kv Transmission grid in Lagos Area.	Additional 100MW transmission line capacity to be utilised.	About 100 MW of bulk generated power to made available on 132kV transmission grid in Lagos area.
(3) Scope/Outputs: Scope: a) Removal and re-drumming of 45km 100mm2 wolf conductor and re conductoring of same line with high temp conductor. Outputs : Increase in transmission capacity by 100 MW.	Extra 100 MW transmission capacity is available.	Competent contractor is employed to deliver the project.
(4) Inputs/costs: **Inputs:** high temp conductor (specs) and related accessories. **Costs**: ₦577,000,000.00	**Funding**: **Balance to complete**:	Fully funded LC/ Timely release of fund.
(5) **Others:** The project is necessary for; - power evacuation - reliability.		

TRANSMISSION PROJECT LOGICAL FRAMEWORK		TCN
Project Title : **Re-conductoring of Osogbo - Offa 132kV SC (50km) Transmission line using existing ROW with HTLS conductor**		**Date :** **Nov. 2013**
Project Narrative	**Indicators**	**Critical considerations**
(1)Programme Objective: To improve power delivery on the 132kV Transmission grid in Offa area of Kwara State	Improved bulk power transfer to Offa area of Kwara State .	Based on the MHI / TCN 10GW network study there is power flow limitation on the existing Osogbo - Offa 132kV Hyena conductor S.C line and will require re-conductoring with High Temp and Low Sag Conductor .
(2) Project Objective: Additional Power delivery on 132kv Transmission grid in Offa area of Kwara State.	Additional 100MW transmission line capacity to be utilised.	About 100 MW of bulk generated power to made available on 132kV transmission grid in Offa area of Kwara State .
(3) Scope/Outputs: Scope: a) Removal and re-drumming of 45km 100mm2 wolf conductor and re conductoring of same line with high temp conductor. Outputs : Increase in transmission capacity by 100 MW.	Extra 100 MW transmission capacity is available.	Competent contractor is employed to deliver the project.
(4) Inputs/costs: **Inputs:** high temp conductor (specs) and related accessories. **Costs**: ₦1,925,000,000.00	**Funding**: **Balance to complete**:	Fully funded LC/ Timely release of fund.
(5) **Others:** The project is necessary for; - power evacuation - reliability.		

TRANSMISSION PROJECT LOGICAL FRAMEWORK		TCN
Project Title : 2nd Gwagwalada – Shiroro / Katampe 330 kV double circuit line 330 kV double circuit line (40km) + line bay extensions.		
Project Narrative	**Indicators**	**Critical considerations**
(1)Programme Objective: To improve power delivery to Federal Capital Territory (FCT) and environs.	Stable / reliable supply to FCT and environs. Improved economic activity of Federal Capital Territory (FCT)	Thermal / Voltage violations for single outage (N-1) contingency on the SC tapping configuration of Gwagwalada to Shiroro - Katampe 330kV circuits according to the report of the 10GW network analysis by MHI/TCN. Tapping of both circuits of the Shiroro - Katampe 330kV D.C lines instead of one circuit will mitigate against the thermal / voltage violations.
(2) Project Objective: Power reliability and voltage stability improvement in FCT.	Additional 1,200MW transmission line will be available on the grid	Power reliability, stability and voltage regulation will be enhanced in FCT and environs.
(3) Scope/Outputs: Scope: a) Construction of 123km Ajaokuta - Lokoja – Gwagwalada 330 kV double circuit line (123km) extensions. b) Line bay extension at Ajaokuta, Lokoja and Gwagwalada 330/132KV Substations. Outputs : Increase in transmission capacity by 1200 MW.	Extra 1200 MW transmission redundancy is available.	Competent contractor is employed to deliver the project.
(4) Inputs/costs: **Inputs:** a) About 150 km of Bison conducators + 330kV Towers and related lines/substation accessories **Costs**: ₦2,320,000,000.00	**Funding**: **Balance to complete**:	Fully funded LC/ Timely release of fund.
(5) Others: The project is necessary for; - power evacuation - Bulk Supply to Lagos - Security & reliability of the grid.		

TRANSMISSION PROJECT LOGICAL FRAMEWORK		TCN
Project Title : **Olorunsogo - IkW / Osogbo 330kV DC turn - in - out (18kM) spur line**		
Project Narrative	**Indicators**	**Critical considerations**
(1)Programme Objective: To improve power evacuation from Olorunsogo power plant.	Evacuation of Olorunsogo Power Plant	Thermal / Voltage violations for single outage (N-1) contingency on the SC tapping configuration of Oshogbo - Ikeja West 330kV circuits according to the report of the MHI/TCN 10GW network analysis . Tapping of both circuits of the Oshogbo - Ikeja West 330kV instead of one circuit will mitigate against the thermal / voltage violations. Additional transmission route will be provided for evacuation of power from Olorunsogo to Ikeja West & Osogbo.
(2) Project Objective: Power evacuation from Olorunsogo Power Plant	Transmission capacity of 1000MW available	Over 500MW of power is available from Olorunsogo Power Plant to be evacuated into the grid.
(3) Scope/Outputs: Scope: a) Construction of 18km Olorunsogo - IKW / Osogbo spur 330 kV D.C line . b) Line bay extension at Olorunsogo 330/132KV Substations. Outputs : Increase in transmission capacity by 1200 MW.	Extra 1200 MW transmission is available.	Competent contractor is employed to deliver the project.
(4) Inputs/costs: **Inputs:** a) About 54 km of Bison conducators + 330kV Towers and related lines/substation accessories **Costs**: ₦1,385,000,000.00	**Funding**: **Balance to complete**:	Fully funded LC/ Timely release of fund.
(5) **Others:** The project is necessary for; - power evacuation - Bulk Supply to Lagos - Security & reliability of the grid.		

TRANSMISSION PROJECT LOGICAL FRAMEWORK		TCN
Project Title : Ugwuaji - Abakaliki 330kV DC Transmission Line (85kM).		**Date :**
Project Narrative	**Indicators**	**Critical Assumptions**
(1)Programme Objective: To provide bulk power supply to Abakaliki state capital of State.	Stimulation of economic activities in Abakaliki area of Ebonyi State.	No bulk power supply is available to the Abakaliki state capital of . The area has been earned for industrial development. There is urgent need to provide bulk 330kV transmission supply to the area.
(2) Project Objective: Bulk power delivery to Abakaliki area of Ebonyi State	1200MW transmission capacity available	About 1200MW of power is delivered to Abakaliki area of Ebonyi State.
(3) Scope /Outputs: Scope: Construction of 85kM 330kV transmission lines . Output: increased transmission capacity by 1200MW.	Availability of 1200MW 330kV transmission capacity.	Competent contractor is employed to deliver the project.
(4) Inputs / Costs: Input: 255kM Bison conductor and associated 330kV transmission line accessories Costs: ₦3,504,000,000.00	Funding: Balance to complete	Timely release of Fund / Fully Funded LC
Others: The project is necessary for - Power Evacuation - Bulk supply to Abakaliki area of Ebonyi State.		

TRANSMISSION PROJECT LOGICAL FRAMEWORK		TCN
Project Title : 2x150MVA, 330/132kV + 2x60MVA, 132/33kV substation at Abakaliki.		**Date :**
Project Narrative	**Indicators**	**Critical Considerations**
(1)Programme Objective: To improve power evacuation from Onitsha node and power supply improvement Abakaliki, Ebonyi State Capital.	More power would be evacuated from Onitsha area and improved economic activities in Abakaliki and environs.	There is the need to evacuation generation from Onitsha area and this will be done through the proposed Abakaliki 330/132/33kV substation. Another consideration is the constraint in existing power supply to Abakaliki, Ebonyi State capital; hence the urgent need to provide bulk 330/132/33kV supply to the area.
(2) Project Objective: Power evacuation from Onitsha area. power supply improvement in Abakaliki, Ebonyi State Capital.	Transformation available capacity increased	Over 1000MW of power is available from Onitsha area to be evacuated into the grid.
(3) Scope / Outputs: **Scope**: Construction of substation of 2x150MVA, 330/132kV+1x60MVA, 132/33kV and associated equipment. **Output:** Increased transformation capacity of 420MVA	Availability of 420MVA transformation capacity	Competent contractor is employed to deliver project.
(4) Inputs / Costs: **Input:** 2x 150MVA, 330/132KV Transformer and associated substation equipment. Costs : ₦5,839,200,000.00	**Funding** **Balance to complete**:	Timely release of fund / Fully Funded LC
(5) Others: Project is necessary for power evacuation + increased transformation capacity in Abakaliki, Ebonyi State Capital.		

TRANSMISSION PROJECT LOGICAL FRAMEWORK		**TCN**
Project Title : 2x150MVA, 330/132kV + 2x60MVA, 132/33kV substation at Awka.		**Date :**
Project Narrative	**Indicators**	**Critical Considerations**
(1)<u>Programme Objective:</u> To improve power evacuation from Onitsha node and power supply improvement Awka, Anambra State Capital.	More power would be evacuated from Onitsha area and improved economic activities in Awka and environs.	There is the need to evacuate generation from Onitsha area and this will be done through the proposed Awka 330/132/33kV substation. Another consideration is the constraint in existing power supply to Awka, Anambra State capital; hence the urgent need to provide bulk 330/132/33kV supply to the area.
(2) <u>Project Objective:</u> Power evacuation from Onitsha area. power supply improvement in Awka, Anambra State Capital.	Transformation available capacity increased	Over 1000MW of power is available from Onitsha area to be evacuated into the grid.
(3) <u>Scope / Outputs</u>: **Scope**: Construction of substation of 2x150MVA, 330/132kV+1x60MVA, 132/33kV and associated equipment. **Output:** Increased transformation capacity of 420MVA	Availability of 420MVA transformation capacity	Competent contractor is employed to deliver project.
(4) <u>Inputs / Costs:</u> **Input:** 2x 150MVA, 330/132KV Transformer and associated substation equipment. <u>Costs</u> : ₦5,839,200,000.00	**Funding** **Balance to complete**:	Timely release of fund / Fully Funded LC
(5) <u>Others:</u> Project is necessary for power evacuation + increased transformation capacity in Awka, Anambra State Capital.		

TRANSMISSION PROJECT LOGICAL FRAMEWORK		TCN
Project Title : **Re-conductoring of Afam – Port Harcourt 132kV SC Transmission line**		**Date :** **Nov. 2013**
Project Narrative	**Indicators**	**Critical considerations**
(1)Programme Objective: To improve power delivery of the Transmission grid.	Improved economic activity of the entire nation.	There is power evacuation constraint along Afam-Portharcourt Main 132KV SC line to Rivers State.
(2) Project Objective: Power evacuation from Afam Power Plant to Rivers State and the rest of the grid.	Additional 240MW transmission line capacity to be utilised.	About 200 MW of bulk generated power from the south to be evacuated to the rest of the grid.
(3) Scope/Outputs: Scope: a) Removal and re-drumming of …..km 100mm2 wolf conductor and re conductoring of same line with high temp conductor. Outputs : Increase in transmission capacity by 240 MW.	Extra 200 MW transmission capacity is available.	Competent contractor is employed to deliver the project.
(4) Inputs/costs: **Inputs:** high temp conductor (specs) and related accessories. **Costs**: N1,270,000,000.00	**Funding**: **Balance to complete**:	Fully funded LC/ Timely release of fund.
(5) Others: The project is necessary for; - power evacuation - reliability.		

TRANSMISSION PROJECT LOGICAL FRAMEWORK		TCN
Project Title : **2nd Ughelli - Efunrun - Benin 132kV DC Transmission Line (36kM) + 2 Line Bay Extension.**		
Project Narrative	**Indicators**	**Critical considerations**
(1)Programme Objective: To improve power delivery from the grid to Ughelli and Efunrun areas of Lagos State.	Improved economic in Ughelli and Efunrun areas of Lagos State.	There is constraint of power delivery to Ughelli and Efunrun areas of Lagos State.
(2) Project Objective: Bulk Power delivery to Ughelli and Efunrun areas of Lagos State.	Additional 240 MW transmission line capacity to be utilised.	About 200 MW of power to be delivered to Ughelli and Efunrun areas of Lagos State.
(3) Scope/Outputs: Scope: a) Construction of 36kM D.C Transmission line from Benin. Outputs : Increase in transmission capacity by 240 MW.	Extra 240 MW transmission capacity is available.	Competent contractor is employed to deliver the project.
(4) Inputs/costs: **Inputs:** a) About 108km of Bear conductor and associated 132kV transmission towers / accessories. b) Line bay extension at Ughelli, Effunrun and Benin. **Costs**: ₦1,100,000,000.00	**Funding**: **Balance to complete**:	Fully funded LC/ Timely release of fund.
(5) Others: The project is necessary for; - power evacuation - Bulk Supply to Ikorodu and Maryland areas of Lagos State.		

TRANSMISSION PROJECT LOGICAL FRAMEWORK		TCN
Project Title : **2nd Ugwuaji – Aliade – Makurdi - Jos 330 kV double circuit line 330 kV double circuit line (490km) + line bay extensions.**		
Project Narrative	**Indicators**	**Critical considerations**
(1)Programme Objective: To improve voltage quality and power delivery to North Central and North Eastern; Adamawa, Bauchi, Borno, Gombe, Taraba and Yobe and environs.	Improved economic activity in North Central / North East and voltage improvement.	In the 10GW network analysis power transfer across the following interfaces (1) Ugwuaji - Aliade - Makurdi - Jos 330kV D.C (2) Ajaokuta - Lokoja - Gwagwalada 330kV D.C from 1790MW to 3100MW for generation re-dispatch between hydro generation and thermal generation during dry season; loss of one circuit will cause the remaining circuits to be overloaded. Reinforcement with additional D.C 330kV circuits will serve as a mitigation measure against the voltage and thermal violations.
(2) Project Objective: Power evacuation from Ajaokuta and the south and eastern block to the rest of the grid.	Additional 1,200MW transmission line capacity to be utilised.	About 1,000 MW of bulk generated power from Niger Delta area to be evacuated to Adamawa, Bauchi, Borno, and Gombe, Taraba and Yobe and environs.
(3) Scope/Outputs: Scope: a) Construction of 490km Ugwuaji - Aliade – Makurdi 330 kV double circuit line Outputs : Increase in transmission capacity by 1200 MW.	Extra 1200 MW transmission capacity is available.	Competent contractor is employed to deliver the project.
(4) Inputs/costs: **Inputs:** a) About 1,470 km of Bison conducators + 330kV Towers and related lines/substation accessories b) Line bay extension at Ugwuaji, Aliade, Makurdi and Jos 330/132KV Substation. **Costs**: ₦28,420,000,000.00	**Funding**: **Balance to complete**:	Fully funded LC/ Timely release of fund.
(5) **Others:** The project is necessary for; - power evacuation - Voltage improvement - Bulk Supply to North Eastern; Adamawa, Bauchi, Borno, Gombe, Taraba and Yobe and environs.		

TRANSMISSION PROJECT LOGICAL FRAMEWORK		TCN
Project Title : 2nd Jos – Bauchi Gombe 330 kV D.C circuit line (264km) + line bay extensions at Jos, Bauchi and Gombe 330/132kV Substation**.**		
Project Narrative	**Indicators**	**Critical considerations**
(1)Programme Objective: To improve power delivery to North Eastern States; Adamawa, Bauchi, Borno, Gombe, Taraba and Yobe and environs.	Improved economic activity in North Central / North East and voltage improvement.	Reliability of supply to the north eastern state; Adamawa, Bauchi, Borno, Gombe, Taraba and Yobe and environs has been a major challenge because of radial single 330kV supply to the area. No alternative supply to the area; an outage on the existing 330kV single circuit often lead to days of total blackout of supply to the area.
(2) Project Objective: Power reliability and voltage improvement to North Eastern States; Adamawa, Bauchi, Borno, Gombe, Taraba and Yobe and environs.	Additional 1,200MW transmission line will be available on the grid	Power reliability, stability and voltage regulation will be enhanced North Eastern States; Adamawa, Bauchi, Borno, Gombe, Taraba and Yobe and environs.
(3) Scope/Outputs: Scope: a) Construction of 264km Jos – Bauchi- Gombe 330 kV DC line (264KM) between + line bay extension &330/132KV S/S at Jos, Bauchi and Gombe. Outputs : Increase in transmission capacity by 1200 MW.	Extra 1200 MW transmission redundancy is available.	Competent contractor is employed to deliver the project.
(4) Inputs/costs: **Inputs:** a) About 792 km of Bison conducators + 330kV Towers and related lines/substation accessories **Costs**: ₦15,312,000,000.00	**Funding**: **Balance to complete**:	Fully funded LC/ Timely release of fund.
(5) Others: The project is necessary for; - Voltage improvement - power evacuation - Bulk Supply to North Eastern States; Adamawa, Bauchi, Borno, Gombe, Taraba and Yobe and environs. - Security & reliability.		

TRANSMISSION PROJECT LOGICAL FRAMEWORK		**TCN**
Project Title : 2x150MVA, 330/132kV + 2x60MVA, 132/33kV substation at Bauchi with 2x330kV and 4x132kV line bays.		
Project Narrative	**Indicators**	**Critical Consideration**
(1)Programme Objective: To Improve Power delivery to north eastern region	Increase in industrial activities in the North eastern states, economic and commercial activities will also increase.	Limitation of bulk supply to Bauchi through the existing 132/33KV Substation as there is no 330kV supply in the area.
(2) Project Objective: Bulk Power supply to Bauchi and entirons.	Additional 300MVA Transformation capacity to be utilised.	About 200MW of power is delivered.
(3) Scope/Outputs: Construction of 2x150MVA, 330/132kV + 2x60MVA, 132/33kV substation at Bauchi with 2x330kV and 4x132kV line bays **Outputs:** Increase in transmission and transformation capacity by 1320mw and 300MVA	Extra transmission and transformation capacity of 300MVA and 1320MW Available	Competent contractor to be engaged for the project
(5) Inputs/Costs: 2 x 150MVA, 330/132kV Transformer and associated substation and line bays equipment. ₦3,814,033,428.98	Fully funded LC	Timely released of fund
(5) Others Project is necessary for Power evacuation + Reliability Voltage Improvement Interconnectivity Redundancy		

TRANSMISSION PROJECT LOGICAL FRAMEWORK		TCN
Project Title : **2nd Gombe – Damaturu 330 kV single circuit line (135km) + line bay extensions at** Gombe and Damaturu 330/132kV Substation**.**		
Project Narrative	**Indicators**	**Critical considerations**
(1)Programme Objective: To improve power delivery to North Eastern States; Adamawa, Bauchi, Borno, Gombe, Taraba and Yobe and environs.	Improved economic activity in North Central / North East and voltage improvement.	Reliability of supply to the north eastern state; Adamawa, Bauchi, Borno, Gombe, Taraba and Yobe and environs has been a major challenge because of radial single 330kV supply to the area. No alternative supply to the area; an outage on the existing 330kV single circuit often lead to days of total blackout of supply to the area.
(2) Project Objective: Power reliability and voltage improvement to North Eastern States; Adamawa, Bauchi, Borno, Gombe, Taraba and Yobe and environs.	Additional 600MW transmission line will be available on the grid	Power reliability, stability and voltage regulation will be enhanced North Eastern States; Adamawa, Bauchi, Borno, Gombe, Taraba and Yobe and environs.
(3) Scope/Outputs: Scope: a) Construction of 135km Gombe – Damaturu 330 kV DC line (135KM) between + line bay extension &330/132KV S/S at Gombe and Damaturu. Outputs : Increase in transmission capacity by 1200 MW.	Extra 600 MW transmission redundancy is available.	Competent contractor is employed to deliver the project.
(4) Inputs/costs: **Inputs:** a) About 405 km of Bison conducators + 330kV Towers and related lines/substation accessories **Costs**: **₦7,830,000,000.00**	**Funding**: **Balance to complete**:	Fully funded LC/ Timely release of fund.
(5) Others: The project is necessary for; - Voltage improvement - power evacuation - Bulk Supply to North Eastern States; Adamawa, Bauchi, Borno, Gombe, Taraba and Yobe and environs. - Security & reliability.		

TRANSMISSION PROJECT LOGICAL FRAMEWORK		TCN
Project Title : **2x 150MVA, 330/132KV Substation at Jalingo.**		
Project Narrative	**Indicators**	**Critical considerations**
(1)Programme Objective: To improve power delivery to Adamawa state.	Improve economic activity of Adamawa state. .	The existing 330KV Yola – Jalingo SC Transmission line is operated at 132KV level. 330/132kV transformation capacity will be required to utilize the 330kV transmission capacity that will be provided.
(2) Project Objective: Bulk Power supply to Adamawa State	Additional 300MVA Transformation capacity to be utilised.	About 200MW of power is delivered.
(3) Scope/Outputs: Scope: Upgrading the existing 132/33KV Substation by installation of2x 150MVA, 330/132KV Substation at Jalingo. Outputs : Increase in transformation capacity by 300 MVA.	Extra 300MVA transmission capacity is available.	Competent contractor is employed to deliver the project.
(4) Inputs/costs: Inputs : 2 x 150MVA, 330/132kV Transformer and associated substation equipment. Costs : ₦3,814,033,428.98	**Funding**: **Balance to complete**:	Fully funded LC/ Timely release of fund.
(5) Others: The project is necessary for - Bulk supply - Reliability - Voltage Improvement		

TRANSMISSION PROJECT LOGICAL FRAMEWORK		TCN
Project Title : Birnin Kebbi - Sokoto D.C 330kV line (140km) + 2 x 150MVA + 2 x 60MVA 132/33kV		**Date :**
Project Narrative	**Indicators**	**Critical Assumptions**
(1)Programme Objective: To Improve Power delivery to Sokoto and secure supply to the entire North West.	- Improved economic and commercial activities in Sokoto and entire North West.	Voltage related limitation in the North West occasioned by insufficient transmission capacity of the transmission network to carry the increased power transfer. According to the report of the 10GW analysis this limitation cannot be mitigated by reactive support and requires building of new transmission lines.
(2) Project Objective: Bulk power supply to Sokoto and the entire North west	Additional transmission and 300MVA transformation Capacity utilised	Over 200MW of power is delivered to Sokoto and the entire North West.
(3) Scope/Outputs: Construction of 140kM Birni Kebbi-Sokoto 330kV DC with 2 x 150MVA 330/132kV substation at Sokoto, 2 no. 330kV line bays and 4 no. Outgoing 132kV feeders at Sokoto **Outputs**: Increase in Transmission capacity by 1320mw and transformation capacity by 300MVA.	Extra transformation and transmission capacity of 300MVA and 1320MW made available respectively.	Competent contractor to be engaged for the project
(5) Inputs/Costs: N8,900,000,000.00	Fully funded LC	Timely released of fund
(5) **Others** Project is necessary for Power evacuation + Reliability Voltage Improvement Interconnectivity Redundancy		

TRANSMISSION PROJECT LOGICAL FRAMEWORK		TCN
Project Title Abeokuta Old;10MVAr, 33kV Fixed Shunt Capacitor		**Start Date : 2014** **Finish Date : 2016**
Project Narrative	**Indicators**	**Critical considerations**
(1)Programme Objective: To improve power quality in Abeokuta Old and Environs	Improve economic and commercial activities in Abeokuta Old and Environs	Poor voltage Profile in Abeokuta Old and Environs
(2) Project Objective: Bulk Power quality supply to Abeokuta Old and Environs	Power quality is guaranteed	Good voltage Profile in Abeokuta Old and Environs
(3) Scope/Outputs: Scope: Construction of Abeokuta Old;10MVAr, 33kV Fixed Shunt Capacitor Outputs : Power quality is guaranteed	Power quality is available .	Competent contractor is employed to deliver the project.
(4) Inputs/costs: Inputs : Construction of Abeokuta Old;10MVAr, 33kV Fixed Shunt Capacitor Costs :	**Funding**: **Balance to complete**:	Fully funded LC/ Timely release of fund.
(5) **Others:** The project is necessary for - power evacuation - Bulk supply - Reliability - Voltage Improvement.		

TRANSMISSION PROJECT LOGICAL FRAMEWORK		**TCN**
Project Title Akoka 50MVAr; 132kV Fixed Shunt Capacitor		**Start Date : 2014** **Finish Date : 2016**
Project Narrative	**Indicators**	**Critical considerations**
(1)Programme Objective: To improve power quality in Akoka and Environs	Improve economic and commercial activities of Akoka and Environs	Poor voltage Profile in Akoka and Environs
(2) Project Objective: Bulk Power quality supply to Akoka and Environs	Power quality is guaranteed	Good voltage Profile in Akoka and Environs
(3) Scope/Outputs: Scope: Construction of Akoka 50MVAr; 132kV Fixed Shunt Capacitor Outputs : Power quality is guaranteed	Power quality is available .	Competent contractor is employed to deliver the project.
(4) Inputs/costs: Inputs : Construction of Akoka 50MVAr; 132kV Fixed Shunt Capacitor Costs :	**Funding**: **Balance to complete**:	Fully funded LC/ Timely release of fund.
(5) Others: The project is necessary for - power evacuation - Bulk supply - Reliability - Voltage Improvement.		

TRANSMISSION PROJECT LOGICAL FRAMEWORK		**TCN**
Project Title Alausa 75MVAr; 132kV Fixed Shunt Capacitor		**Start Date : 2014** **Finish Date : 2016**
Project Narrative	**Indicators**	**Critical considerations**
(1)Programme Objective: To improve power quality in Alausa and Environs	Improve economic and commercial activities of Alausa and Environs	Poor voltage Profile in Alausa and Environs
(2) Project Objective: Bulk Power quality supply to Alausa and Environs	Power quality is guaranteed	Good voltage Profile in Alausa and Environs
(3) Scope/Outputs: Scope: Construction of Alausa 75MVAr; 132kV Fixed Shunt Capacitor Outputs : Power quality is guaranteed	Power quality is available .	Competent contractor is employed to deliver the project.
(4) Inputs/costs: Inputs : Construction of Alausa 75MVAr; 132kV Fixed Shunt Capacitor Costs :	**Funding**: **Balance to complete**:	Fully funded LC/ Timely release of fund.
(5) Others: The project is necessary for - power evacuation - Bulk supply - Reliability - Voltage Improvement.		

TRANSMISSION PROJECT LOGICAL FRAMEWORK		TCN
Project Title Bida; 40MVAr, 132kV Fixed Shunt Capacitor		**Start Date : 2014** **Finish Date : 2016**
Project Narrative	**Indicators**	**Critical considerations**
(1)Programme Objective: To improve power quality in Bida and Environs	Improve economic and commercial activities of Bida and Environs	Poor voltage Profile in Bida and Environs
(2) Project Objective: Bulk Power quality supply to Bida and Environs	Power quality is guaranteed	Good voltage Profile in Bida and Environs
(3) Scope/Outputs: Scope: Construction of Bida; 40MVAr, 132kV Fixed Shunt Capacitor Outputs : Power quality is guaranteed	Power quality is available .	Competent contractor is employed to deliver the project.
(4) Inputs/costs: Inputs : Construction of Bida; 40MVAr, 132kV Fixed Shunt Capacitor Costs :	**Funding**: **Balance to complete**:	Fully funded LC/ Timely release of fund.
(5) Others: The project is necessary for - power evacuation - Bulk supply - Reliability - Voltage Improvement.		

TRANSMISSION PROJECT LOGICAL FRAMEWORK		TCN
Project Title : Birnin Kebbi - Sokoto D.C 330kV line (140km) + 2 x 150MVA + 2 x 60MVA 132/33kV at Sokoto		**Start Date : 2013** **Finish Date : 2015**
Project Narrative	**Indicators**	**Critical considerations**
(1)Programme Objective: To improve power delivery to Sokoto state and Neighbouring states.	Economic and commercial activities will improve in Sokoto state. .	Limitation of bulk supply to the people of Sokoto state.
(2) Project Objective: Bulk Power supply to Sokoto state.	Additional 300MVA Transformation capacity to be utilised.	About 1320MW of power is delivered to Sokoto states
(3) Scope/Outputs: Scope: Construction of 2x 150MVA, 330/132KV Substation at Lafia with turn in out from Markurdi-Jos DC Transmission Line. Outputs : Increase in transformation capacity by 300 MVA.	Extra 300MVA transmission capacity is available.	Competent contractor is employed to deliver the project.
(4) Inputs/costs: Inputs : Construction of Birnin Kebbi - Sokoto D.C 330kV line (140km) + 2 x 150MVA + 2 x 60MVA 132/33kV at Sokoto Costs :	**Funding**: **Balance to complete**:	Fully funded LC/ Timely release of fund.
(5) Others: The project is necessary for - power evacuation - Bulk supply - Reliability - Voltage Improvement.		

TRANSMISSION PROJECT LOGICAL FRAMEWORK		**TCN**
Project Title Dakata; 70MVAr, 33kV Fixed Shunt Capacitor project		**Start Date : 2014** **Finish Date : 2016**
Project Narrative	**Indicators**	**Critical considerations**
(1)Programme Objective: To improve power quality in Dakata and Environs	Improve economic and commercial activities of Dakata and Environs	Poor voltage Profile in Dakata and Environs
(2) Project Objective: Bulk Power quality supply to Dakata and Environs	Power quality is guaranteed	Good voltage Profile in Dakata and Environs
(3) Scope/Outputs: Scope: Construction of Dakata; 70MVAr, 33kV Fixed Shunt Capacitor project Outputs : Power quality is guaranteed	Power quality is available .	Competent contractor is employed to deliver the project.
(4) Inputs/costs: Inputs : Construction of Dakata; 70MVAr, 33kV Fixed Shunt Capacitor project Costs :	**Funding**: **Balance to complete**:	Fully funded LC/ Timely release of fund.
(5) Others: The project is necessary for - power evacuation - Bulk supply - Reliability - Voltage Improvement.		

TRANSMISSION PROJECT LOGICAL FRAMEWORK		TCN
Project Title Dan Agundi; 85MVAr, 33kV Fixed Shunt Capacitor project		**Start Date : 2014** **Finish Date : 2016**
Project Narrative	**Indicators**	**Critical considerations**
(1)Programme Objective: To improve power quality in Dan Agundi and Environs	Improve economic and commercial activities of Dan Agundi and Environs	Poor voltage Profile in Dan Agundi and Environs
(2) Project Objective: Bulk Power quality supply to Dan Agundi and Environs	Power quality is guaranteed	Good voltage Profile in Dan Agundi and Environs
(3) Scope/Outputs: Scope: Construction of Dan Agundi; 85MVAr, 33kV Fixed Shunt Capacitor project project Outputs : Power quality is guaranteed	Power quality is available .	Competent contractor is employed to deliver the project.
(4) Inputs/costs: Inputs : Construction of Dan Agundi; 85MVAr, 33kV Fixed Shunt Capacitor project Costs :	**Funding**: **Balance to complete**:	Fully funded LC/ Timely release of fund.
(5) Others: The project is necessary for - power evacuation - Bulk supply - Reliability - Voltage Improvement.		

TRANSMISSION PROJECT LOGICAL FRAMEWORK		TCN
Project Title Dutse; 10MVAr, 33kV Fixed Shunt Capacitor project		**Start Date : 2014** **Finish Date : 2016**
Project Narrative	**Indicators**	**Critical considerations**
(1)Programme Objective: To improve power quality in Dutse and Environs	Improve economic and commercial activities of Dutse and Environs	Poor voltage Profile in Dutse and Environs
(2) Project Objective: Bulk Power quality supply to Dutse and Environs	Power quality is guaranteed	Good voltage Profile in Dutse and Environs
(3) Scope/Outputs: Scope: Construction of Dutse; 10MVAr, 33kV Fixed Shunt Capacitor project Outputs : Power quality is guaranteed	Power quality is available .	Competent contractor is employed to deliver the project.
(4) Inputs/costs: Inputs : Construction of Dutse; 10MVAr, 33kV Fixed Shunt Capacitor project Costs :	**Funding**: **Balance to complete**:	Fully funded LC/ Timely release of fund.
(5) Others: The project is necessary for - power evacuation - Bulk supply - Reliability - Voltage Improvement.		

TRANSMISSION PROJECT LOGICAL FRAMEWORK		TCN
Project Title Dutse; 45MVAr, 132kV Fixed Shunt Capacitor		**Start Date : 2014** **Finish Date : 2016**
Project Narrative	**Indicators**	**Critical considerations**
(1)Programme Objective: To improve power quality in Dutse and Environs	Improve economic and commercial activities of Dutse and Environs	Poor voltage Profile in Dutse and Environs
(2) Project Objective: Bulk Power quality supply to Dutse and Environs	Power quality is guaranteed	Good voltage Profile in Dutse and Environs
(3) Scope/Outputs: Scope: Construction of Dutse; 45MVAr, 132kV Fixed Shunt Capacitor Outputs : Power quality is guaranteed	Power quality is available .	Competent contractor is employed to deliver the project.
(4) Inputs/costs: Inputs : Construction of Dutse; 45MVAr, 132kV Fixed Shunt Capacitor Costs :	**Funding**: **Balance to complete**:	Fully funded LC/ Timely release of fund.
(5) Others: The project is necessary for - power evacuation - Bulk supply - Reliability - Voltage Improvement.		

TRANSMISSION PROJECT LOGICAL FRAMEWORK		TCN
Project Title Hadejia; 34MVAr, 132kV Fixed Shunt Capacitor		**Start Date : 2014** **Finish Date : 2016**
Project Narrative	**Indicators**	**Critical considerations**
(1)Programme Objective: To improve power quality in Hadejia and Environs	Improve economic and commercial activities of Hadejia and Environs	Poor voltage Profile in Hadejia and Environs
(2) Project Objective: Bulk Power quality supply to Hadejia and Environs	Power quality is guaranteed	Good voltage Profile in Hadejia and Environs
(3) Scope/Outputs: Scope: Construction of Hadejia; 34MVAr, 132kV Fixed Shunt Capacitor Outputs : Power quality is guaranteed	Power quality is available .	Competent contractor is employed to deliver the project.
(4) Inputs/costs: Inputs : Construction of Hadejia; 34MVAr, 132kV Fixed Shunt Capacitor Costs :	**Funding**: **Balance to complete**:	Fully funded LC/ Timely release of fund.
(5) **Others:** The project is necessary for - power evacuation - Bulk supply - Reliability - Voltage Improvement.		

TRANSMISSION PROJECT LOGICAL FRAMEWORK		TCN
Project Title IFE 1; 20MVAr, 132kV Fixed Shunt Capacitor		**Start Date : 2014** **Finish Date : 2016**
Project Narrative	**Indicators**	**Critical considerations**
(1)Programme Objective: To improve power quality in IFE 1Ikorodu and Environs	Improve economic and commercial activities in IFE 1 and Environs	Poor voltage Profile in IFE 1 and Environs
(2) Project Objective: Bulk Power quality supply to IFE 1and Environs	Power quality is guaranteed	Good voltage Profile in IFE 1and Environs
(3) Scope/Outputs: Scope: Construction of IFE 1; 20MVAr, 132kV Fixed Shunt Capacitor Outputs : Power quality is guaranteed	Power quality is available .	Competent contractor is employed to deliver the project.
(4) Inputs/costs: Inputs : Construction of IFE 1; 20MVAr, 132kV Fixed Shunt Capacitor Costs :	**Funding**: **Balance to complete**:	Fully funded LC/ Timely release of fund.
(5) Others: The project is necessary for - power evacuation - Bulk supply - Reliability - Voltage Improvement.		

TRANSMISSION PROJECT LOGICAL FRAMEWORK		TCN
Project Title Ikeja 50MVAr, 132kV Fixed Shunt Capacitor		**Start Date : 2014** **Finish Date : 2016**
Project Narrative	**Indicators**	**Critical considerations**
(1)Programme Objective: To improve power quality in Ikeja and Environs	Improve economic and commercial activities of Ikeja and Environs	Poor voltage Profile in Ikeja and Environs
(2) Project Objective: Bulk Power quality supply to Ikeja and Environs	Power quality is guaranteed	Good voltage Profile in Ikeja and Environs
(3) Scope/Outputs: Scope: Construction of Ikeja 50MVAr, 132kV Fixed Shunt Capacitor Outputs : Power quality is guaranteed	Power quality is available .	Competent contractor is employed to deliver the project.
(4) Inputs/costs: Inputs : Construction of Ikeja 50MVAr, 132kV Fixed Shunt Capacitor Costs :	**Funding**: **Balance to complete**:	Fully funded LC/ Timely release of fund.
(5) **Others:** The project is necessary for - power evacuation - Bulk supply - Reliability - Voltage Improvement.		

TRANSMISSION PROJECT LOGICAL FRAMEWORK		**TCN**
Project Title Ikorodu 20MVAr; 33kV Fixed Shunt Capacitor		**Start Date : 2014** **Finish Date : 2016**
Project Narrative	**Indicators**	**Critical considerations**
(1)Programme Objective: To improve power quality in Ikorodu and Environs	Improve economic and commercial activities in Ikorodu and Environs	Poor voltage Profile in Ikorodu and Environs
(2) Project Objective: Bulk Power quality supply to Ikorodu and Environs	Power quality is guaranteed	Good voltage Profile in Ikorodu and Environs
(3) Scope/Outputs: Scope: Construction of Ikorodu 20MVAr; 33kV Fixed Shunt Capacitor Outputs : Power quality is guaranteed	Power quality is available .	Competent contractor is employed to deliver the project.
(4) Inputs/costs: Inputs : Construction of Ikorodu 20MVAr; 33kV Fixed Shunt Capacitor Costs :	**Funding**: **Balance to complete**:	Fully funded LC/ Timely release of fund.
(5) Others: The project is necessary for - power evacuation - Bulk supply - Reliability - Voltage Improvement.		

TRANSMISSION PROJECT LOGICAL FRAMEWORK		TCN
Project Title Ilupeju 50MVAr, 11kV Fixed Shunt Capacitor		**Start Date : 2014** **Finish Date : 2016**
Project Narrative	**Indicators**	**Critical considerations**
(1)Programme Objective: To improve power quality in Ilupeju and Environs	Improve economic and commercial activities in Ilupeju and Environs	Poor voltage Profile in Ilupeju and Environs
(2) Project Objective: Bulk Power quality supply to Ilupeju and Environs	Power quality is guaranteed	Good voltage Profile in Ilupeju and Environs
(3) Scope/Outputs: Scope: Construction of Ilupeju 50MVAr, 11kV Fixed Shunt Capacitor Outputs : Power quality is guaranteed	Power quality is available .	Competent contractor is employed to deliver the project.
(4) Inputs/costs: Inputs : Construction of Ilupeju 50MVAr, 11kV Fixed Shunt Capacitor Costs :	**Funding**: **Balance to complete**:	Fully funded LC/ Timely release of fund.
(5) Others: The project is necessary for - power evacuation - Bulk supply - Reliability - Voltage Improvement.		

TRANSMISSION PROJECT LOGICAL FRAMEWORK		TCN
Project Title Itire 20MVAr; 11kV Fixed Shunt Capacitor		**Start Date : 2014** **Finish Date : 2016**
Project Narrative	**Indicators**	**Critical considerations**
(1)Programme Objective: To improve power quality in Itire and Environs	Improve economic and commercial activities in Itire and Environs	Poor voltage Profile in Itire and Environs
(2) Project Objective: Bulk Power quality supply to Itire and Environs	Power quality is guaranteed	Good voltage Profile in Itire and Environs
(3) Scope/Outputs: Scope: Construction of Itire 20MVAr; 11kV Fixed Shunt Capacitor Outputs : Power quality is guaranteed	Power quality is available .	Competent contractor is employed to deliver the project.
(4) Inputs/costs: Inputs : Construction of Itire 20MVAr; 11kV Fixed Shunt Capacitor Costs :	**Funding**: **Balance to complete**:	Fully funded LC/ Timely release of fund.
(5) Others: The project is necessary for - power evacuation - Bulk supply - Reliability - Voltage Improvement.		

TRANSMISSION PROJECT LOGICAL FRAMEWORK		TCN
Project Title Kankia; 15MVAr, 33kV Fixed Shunt Capacitor project		**Start Date : 2014** **Finish Date : 2016**
Project Narrative	**Indicators**	**Critical considerations**
(1)Programme Objective: To improve power quality in Kankia and Environs	Improve economic and commercial activities of kankia and Environs	Poor voltage Profile in kankia and Environs
(2) Project Objective: Bulk Power quality supply to Kankia and Environs	Power quality is guaranteed	Good voltage Profile in Kankia and Environs
(3) Scope/Outputs: Scope: Construction of Kankia; 15MVAr, 33kV Fixed Shunt Capacitor project Outputs : Power quality is guaranteed	Power quality is available .	Competent contractor is employed to deliver the project.
(4) Inputs/costs: Inputs : Construction of Kankia; 15MVAr, 33kV Fixed Shunt Capacitor project Costs :	**Funding**: **Balance to complete**:	Fully funded LC/ Timely release of fund.
(5) Others: The project is necessary for - power evacuation - Bulk supply - Reliability - Voltage Improvement.		

TRANSMISSION PROJECT LOGICAL FRAMEWORK		TCN
Project Title Kankia; 30MVAr, 132kV Fixed Shunt Capacitor		**Start Date : 2014** **Finish Date : 2016**
Project Narrative	**Indicators**	**Critical considerations**
(1)Programme Objective: To improve power quality in Kankia and Environs	Improve economic and commercial activities of Kankia and Environs	Poor voltage Profile in Kankia and Environs
(2) Project Objective: Bulk Power quality supply to Kankia and Environs	Power quality is guaranteed	Good voltage Profile in Bida and Environs
(3) Scope/Outputs: Scope: Construction of Kankia; 30MVAr, 132kV Fixed Shunt Capacitor Outputs : Power quality is guaranteed	Power quality is available .	Competent contractor is employed to deliver the project.
(4) Inputs/costs: Inputs : Construction of Kankia; 30MVAr, 132kV Fixed Shunt Capacitor Costs :	**Funding**: **Balance to complete**:	Fully funded LC/ Timely release of fund.
(5) **Others:** The project is necessary for - power evacuation - Bulk supply - Reliability - Voltage Improvement.		

TRANSMISSION PROJECT LOGICAL FRAMEWORK		**TCN**
Project Title : Kano SVC; 330kV, +35MVAr, -50MVAr		**Start Date : 2014** **Finish Date : 2016**
Project Narrative	**Indicators**	**Critical considerations**
(1)Programme Objective: To improve power quality in Kano and entire Northwest	Improve economic and commercial activities of Kano and entire Northwest .	Poor voltage Profile in Kano and entire Northwest
(2) Project Objective: Bulk Power quality supply to Kano and entire Northwest	Power quality is guaranteed	Good voltage Profile in Kano and entire Northwest
(3) Scope/Outputs: Scope: Construction of Kano SVC; 330kV, +35MVAr, -50MVA Outputs : Power quality is guaranteed	Power quality is available .	Competent contractor is employed to deliver the project.
(4) Inputs/costs: Inputs : Construction of Kano SVC; 330kV, +35MVAr, -50MVA Costs :	**Funding**: **Balance to complete**:	Fully funded LC/ Timely release of fund.
(5) Others: The project is necessary for - power evacuation - Bulk supply - Reliability - Voltage Improvement.		

TRANSMISSION PROJECT LOGICAL FRAMEWORK		TCN
Project Title Kano; 50MVAr, 132kV Fixed Shunt Capacitor		**Start Date : 2014** **Finish Date : 2016**
Project Narrative	**Indicators**	**Critical considerations**
(1)Programme Objective: To improve power quality in Kano and Environs	Improve economic and commercial activities of Kano and Environs	Poor voltage Profile in Kano and Environs
(2) Project Objective: Bulk Power quality supply to Kano and Environs	Power quality is guaranteed	Good voltage Profile in Bida and Environs
(3) Scope/Outputs: Scope: Construction of Kano; 50MVAr, 132kV Fixed Shunt Capacitor Outputs : Power quality is guaranteed	Power quality is available .	Competent contractor is employed to deliver the project.
(4) Inputs/costs: Inputs : Construction of Kano; 50MVAr, 132kV Fixed Shunt Capacitor Costs :	**Funding**: **Balance to complete**:	Fully funded LC/ Timely release of fund.
(5) Others: The project is necessary for - power evacuation - Bulk supply - Reliability - Voltage Improvement.		

TRANSMISSION PROJECT LOGICAL FRAMEWORK		TCN
Project Title : Kainji 1 x 150MVA 330/132kV & 2 x 30/40MVA Substation at New Bussa		**Date : 28/08/2013**
Project Narrative	**Indicators**	**Critical Consideration**
(1)Programme Objective: The project is **contributing** to **what** objective? To Improve Power delivery to Kainji and New Bussa Electricity Distribution companies.	About 120MW bulk power will be made available to the people of New Bussa area and Kainji. This will improve economic and commercial activities of the people.	There is inadequate bulk supply to New Bussa andKainji Area .
(2) Project Objective: What are the results **achieved** by the use of the outputs? About 120MW bulk power will be made available to the people of New Bussa and Kainji.	Additional transmission Capacity utilised.	Limitation of bulk supply to New Bussa and Kainji
(3) Scope/Outputs: What are the **deliverables** of the project? Kainji 1 x 150MVA 330/132kV & 2 x 30/40MVA Substation at New Bussa **Outputs**: Increased in transformation capacity by 150MVA	Extra transformation capacity of 150MVA Available	Competent contractor to be engaged for the project
(5) Inputs/Costs: What **resources** are **required**?	Fully funded LC	Timely released of fund
(5) Others Project is necessary for Power evacuation + Reliability Voltage Improvement Interconnectivity Redundancy		

TRANSMISSION PROJECT LOGICAL FRAMEWORK		TCN
Project Title : Kainji - New Bussa 132kV DC Transmission Line & 330KV SC River Crossing		**Date : 28/08/2013**
Project Narrative	**Indicators**	**Critical Consideration**
(1)Programme Objective: The project is **contributing** to **what** objective? To Improve Power delivery to New Bussa Electricity Distribution company.	About 100MW bulk power will be made available to the people of New Bussa area and its environs. This will improve economic and commercial activities of the people.	Limitation of bulk supply to New Bussa .
(2) Project Objective: What are the results **achieved** by the use of the outputs? About 100MW bulk power will be made available to the people of New Bussa area and its environs.	Additional transmission Capacity utilised.	Limitation of bulk supply to New Bussa .
(3) Scope/Outputs: What are the **deliverables** of the project? Kainji - New Bussa 132kV DC Transmission Line & 330KV SC River Crossing **Outputs**: Increased in transmission capacity by 100MW	Extra transmission capacity of 100MW Available	Competent contractor to be engaged for the project
(5) Inputs/Costs: What **resources** are **required**?	Fully funded LC	Timely released of fund
(5) Others Project is necessary for Power evacuation + Reliability Voltage Improvement Interconnectivity Redundancy		

TRANSMISSION PROJECT LOGICAL FRAMEWORK		TCN
Project Title : Umuahia - Mbalano 132KV Line		**Date : 28/08/2013**
Project Narrative	**Indicators**	**Critical Consideration**
<u>(1)Programme Objective:</u> The project is **contributing** to **what** objective? To Improve Power delivery to Enugu Electricity Distribution company .	About 80MW bulk power will be made available to the people of Mbalano. This will improve economic and commercial activities of the people.	Limitation of bulk supply to Mbalano .
<u>(2) Project Objective:</u> What are the results **achieved** by the use of the outputs? About 120MW of power will be delivered to Mbalano area and its environs.	Additional transmission Capacity utilised.	Limitation of bulk supply to Mbalano
<u>(3) Scope/Outputs</u>: What are the **deliverables** of the project? Umuahia - Mbalano 132KV Line **<u>Outputs</u>**: Increased in transmission capacity by 120MW	Extra transmission capacity of 80MW Available	Competent contractor to be engaged for the project
<u>(5) Inputs/Costs:</u> What **resources** are **required**?	Fully funded LC	Timely released of fund
(5) <u>Others</u> Project is necessary for Power evacuation + Reliability Voltage Improvement Interconnectivity Redundancy		

TRANSMISSION PROJECT LOGICAL FRAMEWORK		TCN
Project Title : 1x60MVA, 132/33kV substation reinforcement at Ukpilla substation, Edo State		**Date : 28/08/2013**
Project Narrative	**Indicators**	**Critical Consideration**
(1)Programme Objective: The project is **contributing** to **what** objective? To Improve Power delivery to Electricity Distribution companies in Ukpilla.	About 68MW bulk power will be made available to the people of Ukpilla. This will improve economic and commercial activities of the people.	Limitation of bulk supply to Ukpilla.
(2) Project Objective: What are the results **achieved** by the use of the outputs? About 68MW bulk power will be made available to the people of Ukpilla	Additional transformation Capacity utilised.	Limitation of bulk supply to Ukpilla.
(3) Scope/Outputs: What are the **deliverables** of the project? 1x60MVA, 132/33kV substation reinforcement at Ukpilla substation, Edo State **Outputs**: Increased in transformation capacity by 150MVA	Extra transformation capacity of 60MVA Available	Competent contractor to be engaged for the project
(5) Inputs/Costs: What **resources** are **required**?	Fully funded LC	Timely released of fund
(5) **Others** Project is necessary for Power evacuation + Reliability Voltage Improvement Interconnectivity Redundancy		

TRANSMISSION PROJECT LOGICAL FRAMEWORK		TCN
Project Title : 1 Kafanchan 132kv 2 x 60mva Substation Kaduna State		**Date : 28/08/2013**
Project Narrative	**Indicators**	**Critical Consideration**
(1)Programme Objective: The project is **contributing** to **what** objective? To Improve Power delivery to Kaduna South and Nassarawa States Electricity Distribution companies.	About 100MW bulk power will be made available to the people of Nassarawa & Southern Kaduna States. This will improve economic and commercial activities of the people.	Limitation of bulk supply to Nassarawa & Southern Kaduna states which includes the following 132KV substations @ Lafia, Akwanga, Keffi, Kwoi and Kachia.
(2) Project Objective: What are the results **achieved** by the use of the outputs? About 100MW bulk power will be made available to the people of Kaduna South and Nassarawa States.	Additional transformation Capacity utilised.	Limitation of bulk supply to Nassarawa & Southern Kaduna states which includes the following 132KV substations @ Lafia, Akwanga, Keffi, Kwoi and Kachia.
(3) Scope/Outputs: What are the **deliverables** of the project? Kafanchan 132kv 2 x 60mva Substation Kaduna State **Outputs**: Increased in transformation capacity by 120MW	Extra transformation capacity 120MVA Available	Competent contractor to be engaged for the project
(5) Inputs/Costs: What **resources** are **required**?	Fully funded LC	Timely released of fund
(5) Others Project is necessary for Power evacuation + Reliability Voltage Improvement Interconnectivity Redundancy		

TRANSMISSION PROJECT LOGICAL FRAMEWORK		**TCN**
Project Title : 2 X 150MVA 330/132Kv S/S and 2 X 60mva 132/33Kv ss Akure		**Date : 28/08/2013**
Project Narrative	**Indicators**	**Critical Consideration**
(1)Programme Objective: The project is **contributing** to **what** objective? To Improve Power delivery to Kaduna Electricity Distribution company .	Improved economic activities in Ondo and Ekiti States.	There is constraint in bulk supply to Ekiti State and environs.
(2) Project Objective: What are the results **achieved** by the use of the outputs? Additional 300MVA Transformation capacity to be utilised at Akure substation	Additional 300MVA Transformation capacity to be utilised at Akure substation.	There is constraint in bulk supply to Ekiti State and environs.
(3) Scope/Outputs: What are the **deliverables** of the project? 2 X 150MVA 330/132Kv S/S and 2 X 60mva 132/33Kv ss Akure **Outputs**: Increased in transmission capacity by 250MW	Extra transmission capacity of 250MW Available	Competent contractor to be engaged for the project
(5) Inputs/Costs: What **resources** are **required**?	Fully funded LC	Timely released of fund
(5) **Others** Project is necessary for Power evacuation + Reliability Voltage Improvement Interconnectivity Redundancy		

TRANSMISSION PROJECT LOGICAL FRAMEWORK		TCN
Project Title : 2 X 150MVA 330/132Kv S/S and 2 X 60mva 132/33Kv ss Akure		**Date : 28/08/2013**
Project Narrative	**Indicators**	**Critical Consideration**
<u>(1)Programme Objective:</u> The project is **contributing** to **what** objective? To Improve Power delivery to Akure Electricity Distribution company .	Improved economic activities in Ondo and Ekiti States.	There is constraint in bulk supply to Ekiti State and environs.
<u>(2) Project Objective:</u> What are the results **achieved** by the use of the outputs? Additional 300MVA Transformation capacity to be utilised at Akure substation	Additional 300MVA Transformation capacity to be utilised at Akure substation.	There is constraint in bulk supply to Ekiti State and environs.
<u>(3) Scope/Outputs</u>: What are the **deliverables** of the project? 2 X 150MVA 330/132Kv S/S and 2 X 60mva 132/33Kv ss Akure **<u>Outputs</u>**: Increased in transmission capacity by 250MW	Extra transmission capacity of 250MW Available	Competent contractor to be engaged for the project
<u>(5) Inputs/Costs:</u> What **resources** are **required**?	Fully funded LC	Timely released of fund
(5) <u>Others</u> Project is necessary for Power evacuation + Reliability Voltage Improvement Interconnectivity Redundancy		

TRANSMISSION PROJECT LOGICAL FRAMEWORK		TCN
Project Title : 2 X 150MVA 330/132Kv S/S and 2 X 60mva 132/33Kv ss Akure		**Date : 28/08/2013**
Project Narrative	**Indicators**	**Critical Consideration**
(1)Programme Objective: The project is **contributing** to **what** objective? To Improve Power delivery to Kaduna Electricity Distribution company .	- Improved economic activities in Ondo and Ekiti States.	- There is constraint in bulk supply to Ekiti State and environs.
(2) Project Objective: What are the results **achieved** by the use of the outputs? 250 MW of power from Kaduna Plant to be evacuated to the grid.	Additional 300MVA Transformation capacity to be utilised at Akure substation.	- There is constraint in bulk supply to Ekiti State and environs.
(3) Scope/Outputs: What are the **deliverables** of the project? 2 X 150MVA 330/132Kv S/S and 2 X 60mva 132/33Kv ss Akure **Outputs**: Increased in transmission capacity by 250MW	- Extra transmission capacity of 250MW Available	- Competent contractor to be engaged for the project
(5) Inputs/Costs: What **resources** are **required**?	Fully funded LC	Timely released of fund
(5) Others Project is necessary for Power evacuation + Reliability Voltage Improvement Interconnectivity Redundancy		

TRANSMISSION PROJECT LOGICAL FRAMEWORK		TCN
Project Title : Reconductoring of Calabar-Itu 132kV Line		**Date : 28/08/2013**
Project Narrative	**Indicators**	**Critical Consideration**
(1)Programme Objective: The project is **contributing** to **what** objective? To Improve Power delivery to Port Harcourt Distribution company.	- Additional 120MW bulk power will be available in Itu and Calabar for improved economic and commercial activities.	- This will enhance power transfer capability to Calabar. - Increased power Evacuation from Calabar NIPP power Plant to the Grid.
(2) Project Objective: What are the results **achieved** by the use of the outputs? Increased power Evacuation from Calabar NIPP power Plant to the Grid.	Additional transmission Capacity utilised.	- This will enhance power transfer capability to Calabar and environs.
(3) Scope/Outputs: What are the **deliverables** of the project? Construction of Ikorodu - Odogunyan - Shagamu 132kV DC Transmission Line **Outputs**: Increased in transmission capacity by 100MW.	- Extra transmission capacity of 100MW Available for transmission.	- Competent contractor to be engaged for the project
(5) Inputs/Costs: What **resources** are **required**?	Fully funded LC	Timely released of fund
(5) **Others** Project is necessary for Power evacuation + Reliability Voltage Improvement Interconnectivity Redundancy		

TRANSMISSION PROJECT LOGICAL FRAMEWORK		**TCN**
Project Title : Kaduna Power Plant to Mando Road and Substation Extension		**Date : 28/08/2013**
Project Narrative	**Indicators**	**Critical Consideration**
(1)Programme Objective: The project is **contributing** to **what** objective? To Improve Power delivery to Enugu Electricity Distribution company .	Improved economic activities expected in Kaduna and northern states.	There is evacuation constraint from Kaduna Power plant to the grid. 250 MW of power from Kaduna Plant to be evacuated to the grid.
(2) Project Objective: What are the results **achieved** by the use of the outputs? 250 MW of power from Kaduna Plant to be evacuated to the grid.	Additional transmission Capacity utilised.	There is evacuation constraint from Kaduna Power plant to the grid. 250 MW of power from Kaduna Plant to be evacuated to the grid.
(3) Scope/Outputs: What are the **deliverables** of the project? Kaduna Power Plant to Mando Road and Substation Extension **Outputs**: Increased in transmission capacity by 250MW	Extra transmission capacity of 250MW Available	Competent contractor to be engaged for the project
(5) Inputs/Costs: What **resources** are **required**?	Fully funded LC	Timely released of fund
(5) **Others** Project is necessary for Power evacuation + Reliability Voltage Improvement Interconnectivity Redundancy		

TRANSMISSION PROJECT LOGICAL FRAMEWORK		TCN
Project Title : Kaduna Power Plant to Mando Road and Substation Extension		**Date : 28/08/2013**
Project Narrative	**Indicators**	**Critical Consideration**
(1)Programme Objective: The project is **contributing** to **what** objective? To Improve Power delivery to Kaduna Electricity Distribution company .	- Improved economic activities expected in Kaduna and northern states.	- There is evacuation constraint from Kaduna Power plant to the grid. 250 MW of power from Kaduna Plant to be evacuated to the grid.
(2) Project Objective: What are the results **achieved** by the use of the outputs? 250 MW of power from Kaduna Plant to be evacuated to the grid.	Additional transmission Capacity utilised.	- There is evacuation constraint from Kaduna Power plant to the grid. 250 MW of power from Kaduna Plant to be evacuated to the grid.
(3) Scope/Outputs: What are the **deliverables** of the project? Kaduna Power Plant to Mando Road and Substation Extension **Outputs**: Increased in transmission capacity by 250MW	- Extra transmission capacity of 250MW Available	- Competent contractor to be engaged for the project
(5) Inputs/Costs: What **resources** are **required**?	Fully funded LC	Timely released of fund
(5) **Others** Project is necessary for Power evacuation + Reliability Voltage Improvement Interconnectivity Redundancy		

TRANSMISSION PROJECT LOGICAL FRAMEWORK		**TCN**
Project Title : Wayleave and Compensation for BeninNorth - Osogbo -330kV line and Ganmo - Ogbomoso 132kV lines		**Date : 28/08/2013**
Project Narrative	**Indicators**	**Critical Consideration**
(1)Programme Objective: The project is **contributing** to **what** objective? Necessary for the implementation of the projects	- Necessary for the implementation of the projects	- Necessary for the implementation of the projects
(2) Project Objective: What are the results **achieved** by the use of the outputs? Necessary for the implementation of the projects	- Necessary for the implementation of the projects .	- Necessary for the implementation of the projects
(3) Scope/Outputs: What are the **deliverables** of the project? Necessary for the implementation of the projects **Outputs**: Necessary for the implementation of the projects	- Necessary for the implementation of the projects	- Competent contractor to be engaged for the project
(5) Inputs/Costs: What **resources** are **required**?	Fully funded LC	Timely released of fund
(5) **Others** Project is necessary for Power evacuation + Reliability Voltage Improvement Interconnectivity Redundancy		

TRANSMISSION PROJECT LOGICAL FRAMEWORK		TCN
Project Title : 2 x 60MVA 132/33kV Substation at Ogbomosho		**Date : 28/08/2013**
Project Narrative	**Indicators**	**Critical Consideration**
(1)Programme Objective: The project is **contributing** to **what** objective? To Improve Power delivery to Distribution company in Ogbomosho	- Additional bulk power will be made available to the people of Ogbomosho for improved economic and commercial activities.	- Bulk power constraint to the people of Ogbomosho.
(2) Project Objective: What are the results **achieved** by the use of the outputs? Additional bulk power will be made available to the people of Ogbomosho	Additional transformation Capacity utilised.	- Bulk power constraint to the people of Ogbomosho.
(3) Scope/Outputs: What are the **deliverables** of the project? Construction 2 x 60MVA 132/33kV Substation at Ogbomosho **Outputs**: Increased in transformation capacity by 120MVA.	- Extra transformation capacity of 120MVA and 80MW Available for transmission.	- Competent contractor to be engaged for the project
(5) Inputs/Costs: What **resources** are **required**?	Fully funded LC	Timely released of fund
(5) **Others** Project is necessary for Power evacuation + Reliability Voltage Improvement Interconnectivity Redundancy		

TRANSMISSION PROJECT LOGICAL FRAMEWORK		**TCN**
Project Title : Yelwa - Yauri 2 x 30/40MVA S/S and 100KM of 33KV Line Kebbi State		**Date : 28/08/2013**
Project Narrative	**Indicators**	**Critical Consideration**
(1)Programme Objective: The project is **contributing** to **what** objective? To Improve Power delivery to Kebbi State Electricity Distribution company.	- Bulk power will be available to Yauri People for improved economic and commercial activities.	- Bulk power will be provided to the people of Yauri in Kebbi State to improve economic and commercial activities of people in the area. - Increased power Evacuation from Kainji power Plant to the Grid.
(2) Project Objective: What are the results **achieved** by the use of the outputs? Increased power Evacuation from Kainji power Plant to the Grid.	Additional transmission Capacity utilised.	- Bulk power will be provided to the people of Yauri in Kebbi State.
(3) Scope/Outputs: What are the **deliverables** of the project? Construction of Yelwa - Yauri 2 x 30/40MVA S/S and 100KM of 33KV Line Kebbi State **Outputs**: Increased in transmission and transformation capacity by 68MW and 80MVA	- Extra transmission and transformation capacity of 68MW and 80MVA Available for transmission.	- Competent contractor to be engaged for the project
(5) Inputs/Costs: What **resources** are **required**?	Fully funded LC	Timely released of fund
(5) Others Project is necessary for Power evacuation + Reliability Voltage Improvement Interconnectivity Redundancy		

TRANSMISSION PROJECT LOGICAL FRAMEWORK		TCN
Project Title : Re-conductoring of of Aba - Itu 132kV line.		**Date : 28/08/2013**
Project Narrative	**Indicators**	**Critical Consideration**
(1)Programme Objective: The project is **contributing** to **what** objective? To Improve Power delivery to Aba Electricity Distribution company .	About 120MW bulk power will be made available to the people of Aba and environs. This will improve economic and commercial activities of the people.	Improvement of power transfer capability to Aba.
(2) Project Objective: What are the results **achieved** by the use of the outputs? About 120MW bulk power will be made available to the people of Aba.	Additional transmission Capacity utilised.	Improvement of power transfer capability to Aba
(3) Scope/Outputs: What are the **deliverables** of the project? Re-conductoring of of Aba - Itu 132kV line. **Outputs:** Increased in transmission capacity by 120MW	Extra transmission capacity of 120MW Available	Competent contractor to be engaged for the project
(5) Inputs/Costs: What **resources** are **required**?	Fully funded LC	Timely released of fund
(5) Others Project is necessary for Power evacuation + Reliability Voltage Improvement Interconnectivity Redundancy		

Project Title : DC 132kV line from Alscon to Ibom Power and Switching Station to link the GIS at Alscon with associated bay extensions at Ibom Power - Akwa Ibom State		**Date : 28/08/2013**
Project Narrative	**Indicators**	**Critical Consideration**
<u>(1)Programme Objective:</u> The project is **contributing** to **what** objective? To Improve Power delivery to Distribution companies in Portharcourt zone.	Industries in South Southern states will be benefited, economic and commercial activities will increase in AkwaIbom States.	There is evacuation constraint from the Alscon Power Plant to the rest of the grid. About 200 MW of generated power from Alscon Power Plant will be evacuated to the rest of the grid for Improved economic activities in the nation.
<u>(2) Project Objective:</u> What are the results **achieved** by the use of the outputs? Increased power Evacuation from Alscon Power Plant to the grid.	Additional transmission Capacity utilised.	Limitation of bulk supply to Nassarawa & Southern Kaduna states which includes the following 132KV substations @ Lafia, Akwanga, Keffi, Kwoi and Kachia. Additional 100MW of power will be delivered .
<u>(3) Scope/Outputs</u>: What are the **deliverables** of the project? Construction of DC 132kV line from Alscon to Ibom Power and Switching Station to link the GIS at Alscon with associated bay extensions at Ibom Power - Akwa Ibom State **<u>Outputs</u>**: Increased in transmission capacity by 200MW.	Extra transmission capacity of 200MW Available for transmission.	Competent contractor to be engaged for the project
<u>(5) Inputs/Costs:</u> What **resources** are **required**?	Fully funded LC	Timely released of fund
(5) <u>Others</u> Project is necessary for Power evacuation + Reliability Voltage Improvement Interconnectivity Redundancy		

TRANSMISSION PROJECT LOGICAL FRAMEWORK		TCN
Project Title : Ikorodu - Odogunyan - Shagamu 132kV DC Transmission Line		**Date : 28/08/2013**
Project Narrative	**Indicators**	**Critical Consideration**
(1)Programme Objective: The project is **contributing** to **what** objective? To Improve Power delivery to Ikeja Distribution company.	- Additional 100MW will be delivered to Odogunyan and Shagamu industrial areas for improved economic and commercial activities.	- Limitation of bulk supply to Ikorodu industrial area of Lagos State. - Increased power Evacuation from Egbin power Plant to the Grid.
(2) Project Objective: What are the results **achieved** by the use of the outputs? Increased power Evacuation from Egbin power Plant to the Grid.	Additional transmission Capacity utilised.	- Limitation of bulk supply to Ikorodu industrial area of Lagos State.
(3) Scope/Outputs: What are the **deliverables** of the project? Construction of Ikorodu - Odogunyan - Shagamu 132kV DC Transmission Line **Outputs:** Increased in transformation capacity by 120MVA.	- Extra transmission capacity of 120MVA and 100MW Available for transmission.	- Competent contractor to be engaged for the project
(5) Inputs/Costs: What **resources** are **required**?	Fully funded LC	Timely released of fund
(5) Others Project is necessary for Power evacuation + Reliability Voltage Improvement Interconnectivity Redundancy		

TRANSMISSION PROJECT LOGICAL FRAMEWORK		TCN
Project Title : Ikorodu - Odogunyan - Shagamu 132kV DC Transmission Line		**Date : 28/08/2013**
Project Narrative	**Indicators**	**Critical Consideration**
(1)Programme Objective: The project is **contributing** to **what** objective? To Improve Power delivery to Ikeja Distribution company.	- Additional 100MW will be delivered to Odogunyan and Shagamu industrial areas for improved economic and commercial activities.	- Limitation of bulk supply to Ikorodu industrial area of Lagos State. - Increased power Evacuation from Egbin power Plant to the Grid.
(2) Project Objective: What are the results **achieved** by the use of the outputs? Increased power Evacuation from Egbin power Plant to the Grid.	Additional transmission Capacity utilised.	- Limitation of bulk supply to Ikorodu industrial area of Lagos State.
(3) Scope/Outputs: What are the **deliverables** of the project? Construction of Ikorodu - Odogunyan - Shagamu 132kV DC Transmission Line **Outputs:** Increased in transformation capacity by 120MVA.	- Extra transmission capacity of 120MVA and 100MW Available for transmission.	- Competent contractor to be engaged for the project
(5) Inputs/Costs: What **resources** are **required**?	Fully funded LC	Timely released of fund
(5) Others Project is necessary for Power evacuation + Reliability Voltage Improvement Interconnectivity Redundancy		

TRANSMISSION PROJECT LOGICAL FRAMEWORK		TCN
Project Title : Benin North-Oshogbo 330KV DC line with one SC turning in and out to New Akure substation		**Date : 28/08/2013**
Project Narrative	**Indicators**	**Critical Consideration**
(1)Programme Objective: The project is **contributing** to **what** objective? To Improve Power delivery to Oshogbo and Benin Electricity Distribution companies .	About 1,000 MW of bulk generated power from the south will be evacuated to the rest of the grid.	There is power evacuation constraint on the existing Existing Benin – Osogbo SC line to wheel the bulk of generation from the south and eastern block to Akure and the rest of the grid.
(2) Project Objective: What are the results **achieved** by the use of the outputs? Grid stability will be enhanced.	About 1,000 MW of bulk generated power from the south will be evacuated to the rest of the grid..	About 1,000 MW of bulk generated power from the south will be evacuated to the rest of the grid.
(3) Scope/Outputs: What are the **deliverables** of the project? Benin North-Oshogbo 330KV DC line with one SC turning in and out to New Akure substation **Outputs**: Grid stability will be enhanced; most of the system collapses are due to this link	Grid stability will be enhanced	Competent contractor to be engaged for the project
(5) Inputs/Costs: What **resources** are **required**?	Fully funded LC	Timely released of fund
(5) **Others** Project is necessary for Power evacuation + Reliability Voltage Improvement Interconnectivity Redundancy		

TRANSMISSION PROJECT LOGICAL FRAMEWORK		TCN
Project Title : Benin North-Oshogbo 330KV DC line with one SC turning in and out to New Akure substation		**Date : 28/08/2013**
Project Narrative	**Indicators**	**Critical Consideration**
(1)Programme Objective: The project is **contributing** to **what** objective? To Improve Power delivery to Akure Electricity Distribution company .	About 1,000 MW of bulk generated power from the south will be evacuated to the rest of the grid.	There is power evacuation constraint on the existing Existing Benin – Osogbo SC line to wheel the bulk of generation from the south and eastern block to Akure and the rest of the grid.
(2) Project Objective: What are the results **achieved** by the use of the outputs? Grid stability will be enhanced.	About 1,000 MW of bulk generated power from the south will be evacuated to the rest of the grid..	About 1,000 MW of bulk generated power from the south will be evacuated to the rest of the grid.
(3) Scope/Outputs: What are the **deliverables** of the project? Benin North-Oshogbo 330KV DC line with one SC turning in and out to New Akure substation **Outputs**: Grid stability will be enhanced; most of the system collapses are due to this link	Grid stability will be enhanced	Competent contractor to be engaged for the project
(5) Inputs/Costs: What **resources** are **required**?	Fully funded LC	Timely released of fund
(5) Others Project is necessary for Power evacuation + Reliability Voltage Improvement Interconnectivity Redundancy		

TRANSMISSION PROJECT LOGICAL FRAMEWORK		**TCN**
Project Title : Consultancy/Project Management & Supervision for transmission line and substation projects.		**Date : 28/08/2013**
Project Narrative	**Indicators**	**Critical Consideration**
(1)Programme Objective: The project is **contributing** to **what** objective? Necessary for the implementation of the projects	Necessary for the implementation of the projects	Necessary for the implementation of the projects
(2) Project Objective: What are the results **achieved** by the use of the outputs? Necessary for the implementation of the projects	Necessary for the implementation of the projects	Necessary for the implementation of the projects
(3) Scope/Outputs: What are the **deliverables** of the project? Construction Consultancy/Project Management & Supervision for transmission line and substation projects. **Outputs**: Necessary for the implementation of the projects	Necessary for the implementation of the projects	Competent contractor to be engaged for the project
(5) Inputs/Costs: What **resources** are **required**?	Fully funded LC	Timely released of fund
(5) Others Project is necessary for Power evacuation + Reliability Voltage Improvement Interconnectivity Redundancy		

TRANSMISSION PROJECT LOGICAL FRAMEWORK		TCN
Project Title : Damaturu 330/132kV Substation Yobe State		**Date : 28/08/2013**
Project Narrative	**Indicators**	**Critical Consideration**
(1)Programme Objective: The project is **contributing** to **what** objective? To Improve Power delivery to Distribution companies in Yola zone.	Industries in the Northeastern states will be benefited, economic and commercial activities will increase in Hadejia and Damaturu.	This station will enable the closing of the loop in the region for bulk supply reliability and improved economic activities in the area.
(2) Project Objective: What are the results **achieved** by the use of the outputs? This station will enable the closing of the loop in the region for bulk supply reliability and improved economic activities in the area.	Additional transformation Capacity utilised.	There is inadequate bulk power supply to Damaturu and Hadejia.
(3) Scope/Outputs: What are the **deliverables** of the project? Construction of Damaturu 1x150MVA, 330/132kV Substation Yobe State. **Outputs**: Increased in transformation capacity by 150MVA .	Extra transformation capacity of 150MVA and 128MW Available for transmission.	Competent contractor to be engaged for the project
(5) Inputs/Costs: What **resources** are **required**?	Fully funded LC	Timely released of fund
(5) Others Project is necessary for Power evacuation + Reliability Voltage Improvement Interconnectivity Redundancy		

TRANSMISSION PROJECT LOGICAL FRAMEWORK		TCN
Project Title : Kano- Walalambe 132KV Line (Turn in and out of Dan agundi-Dakata 132KV single Cct Line) and 2 x 30/40MVA S/S at Walalambe Kano State		**Date : 28/08/2013**
Project Narrative	**Indicators**	**Critical Consideration**
(1)Programme Objective: The project is **contributing** to **what** objective? To Improve Power delivery to Distribution companies in Kano zone.	Industries in the Northwestern states will be benefited, economic activities will increse in Walambe area of Kano.	There is Power constraint on the existing 132KV infrastructure in Kano and environs.
(2) Project Objective: What are the results **achieved** by the use of the outputs? Bulk supply will be provided to Walambe area of Kano and improved economic activities of people in the area.	Additional transformation and transmission Capacity utilised.	Bulk supply will be provided to Walambe area of Kano and improved economic activities of people in the area.
(3) Scope/Outputs: What are the **deliverables** of the project? Construction of Kano- Walalambe 132KV Line (Turn in and out of Dan agundi-Dakata 132KV single Cct Line) and 2 x 30/40MVA S/S at Walalambe Kano State **Outputs:** Increased in transformation and transmission capacity by 80MVA and 68MW .	Extra transformation capacity of 80MVA and 68MW Available for transmission.	Competent contractor to be engaged for the project
(5) Inputs/Costs: What **resources** are **required**?	Fully funded LC	Timely released of fund

(5) <u>Others</u> Project is necessary for Power evacuation + Reliability Voltage Improvement Interconnectivity Redundancy		

<table>
<tr><td colspan="2">Project Title :
1 x 150MVA 330/132kV transformer at Birnin Kebbi and Reinforcement at 330/132/33 kV substation, Kumbotso</td><td>Date : 28/08/2013</td></tr>
<tr><th>Project Narrative</th><th>Indicators</th><th>Critical Consideration</th></tr>
<tr><td><u>(1)Programme Objective:</u>

The project is contributing to what objective?
To Improve Power delivery to distribution Companies in Kebbi and Niger states.</td><td>• Economic activities will improve to the people of Kebbi and Niger states. About 120MW bulk Power will be made available to the people.</td><td>• There is inadequate bulk supply to Birnin Kebbi and Niger . About 120MW bulk power will be made available to the people ; this will improve economic activities of the people of Niger</td></tr>
<tr><td><u>(2) Project Objective:</u>

What are the results achieved by the use of the outputs?
Improvement of Power delivery Kebbi and Niger states.</td><td>Additional transformation Capacity utilised.</td><td>• There is inadequate bulk supply to Birnin Kebbi and Niger .</td></tr>
<tr><td><u>(3) Scope/Outputs</u>:

What are the deliverables of the project?
Installation of 1 x 150MVA 330/132kV transformer at Birnin Kebbi and Reinforcement at 330/132/33 kV substation, Kumbotso
<u>Outputs</u>: Increased in transformation capacity by 150MVA.</td><td>• Extra transformation capacity of 150MVA Available.</td><td>• Competent contractor to be engaged for the project</td></tr>
<tr><td><u>(4) Inputs/Costs:</u>
What resources are required?</td><td>Fully funded LC</td><td>Timely released of fund</td></tr>
<tr><td>(5) <u>Others</u>
Project is necessary for
Power evacuation + Reliability
Voltage Improvement
Interconnectivity
Redundancy</td><td></td><td></td></tr>
</table>

Project Title : Kukwaba 2x60MVA, 132/33kV substation		**Date : 28/08/2013**
Project Narrative	**Indicators**	**Critical Consideration**
<u>(1)Programme Objective:</u> The project is **contributing** to **what** objective? To Improve Power delivery to distribution Companies in FCT.	- This substation will provide bulk power to FCT for Improved economic activities.	- There is bulk power supply constraint to Kukwaba area of FCT. This substation will provide bulk power to FCT for Improved economic activities.
<u>(2) Project Objective:</u> What are the results **achieved** by the use of the outputs? Improvement of Power delivery to Kukwaba area of FCT.	Additional transformation Capacity utilised.	- There is bulk power supply constraint to Kukwaba area of FCT. This substation will provide bulk power to FCT for Improved economic activities.
<u>(3) Scope/Outputs</u>: What are the **deliverables** of the project? Kukwaba 2x60MVA, 132/33kV substation **<u>Outputs</u>**: Increased in transformation capacity by 120MVA.	- Extra transformation capacity of 120MVA Available.	- Competent contractor to be engaged for the project
<u>(4) Inputs/Costs:</u> What **resources** are **required**?	Fully funded LC	Timely released of fund
(5) <u>Others</u> Project is necessary for Power evacuation + Reliability Voltage Improvement Interconnectivity Redundancy		

TRANSMISSION PROJECT LOGICAL FRAMEWORK		**TCN**
Project Title : Re-conductoring of Kumbotso - DanAgund 132kV line.		**Date : 28/08/2013**
Project Narrative	**Indicators**	**Critical Consideration**
(1)Programme Objective: The project is **contributing** to **what** objective? To Improve Power delivery to Dan Agundi Electricity Distribution company .	- Economic and commercial activities will improve in Dan Agundi and environs.	- To improve power transfer capability to Dan Agundi.
(2) Project Objective: What are the results **achieved** by the use of the outputs? Grid stability will be enhanced.	- Additional 120MW bulk power will be Utilised.	- To improve power transfer capability to Dan Agundi
(3) Scope/Outputs: What are the **deliverables** of the project? Re-conductoring of Kunbotso - DanAgund 132kV line. **Outputs**: Additional 120MW bulk power will be available in Dan Agundi and environs...	- Additional 120MW bulk power will be available in Dan Agundi and environs.	- Competent contractor to be engaged for the project
(5) Inputs/Costs: What **resources** are **required**?	Fully funded LC	Timely released of fund
(5) Others Project is necessary for Power evacuation + Reliability Voltage Improvement Interconnectivity Redundancy		

TRANSMISSION PROJECT LOGICAL FRAMEWORK		**TCN**
Project Title : Maiduguri 330/132kv substation + 60MVA 132/33KV S/S- Borno State		**Date : 28/08/2013**
Project Narrative	**Indicators**	**Critical Consideration**
(1)Programme Objective: The project is **contributing** to **what** objective? To Improve Power delivery to Electricity Distribution company in Maiduguri	- About 200MW of power will be delivered to Maiduguri and its environs for improved economic and commercial activities.	- Limitation of bulk supply to Maiduguru through the existing 132KV infrastructure. About 200MW of power will be delivered to Maiduguru and its environs.
(2) Project Objective: What are the results **achieved** by the use of the outputs? Bulk power will be provided to the people of Maiduguri.	Additional transformation Capacity utilised.	- Limitation of bulk supply to Maiduguri
(3) Scope/Outputs: What are the **deliverables** of the project? Construction Maiduguri 330/132kv substation + 60MVA 132/33KV S/S- Borno State **Outputs**: Increased in transformation capacity by 210MVA	- Extra transformation capacity of 210MVA Available for transmission.	- Competent contractor to be engaged for the project
(5) Inputs/Costs: What **resources** are **required**?	Fully funded LC	Timely released of fund
(5) Others Project is necessary for Power evacuation + Reliability Voltage Improvement Interconnectivity Redundancy		

Project Title : Makeri - Pankshin 132KV DC Line Plateau State		**Date : 28/08/2013**
Project Narrative	**Indicators**	**Critical Consideration**
(1)Programme Objective: The project is **contributing** to **what** objective? To Improve Power delivery to distribution Companies in Jos zone.	Economic activities will improve to the people of Pankshin area and its environs.	Limitation of bulk supply to Pankshin area of Plateau State . About 120MW of power will be delivered to Pankshin area and its environs.
(2) Project Objective: What are the results **achieved** by the use of the outputs? Improvement of Power delivery to Pankshin area and its environs	Additional transmission Capacity utilised.	Limitation of bulk supply to Pankshin area of Plateau State . About 120MW of power will be delivered to Pankshin area and its environs.
(3) Scope/Outputs: What are the **deliverables** of the project? Construction of Makeri - Pankshin 132KV DC Line Plateau State **Outputs**: Increased in transmission capacity by 120MW.	Extra transmission capacity of 120MW Available.	Competent contractor to be engaged for the project
(4) Inputs/Costs: What **resources** are **required**?	Fully funded LC	Timely released of fund
(5) Others Project is necessary for Power evacuation + Reliability Voltage Improvement Interconnectivity Redundancy		

Project Title : Umuahia - Mbalano 132KV Line		**Date : 28/08/2013**
Project Narrative	**Indicators**	**Critical Consideration**
(1)Programme Objective: The project is **contributing** to **what** objective? To Improve Power delivery to distribution Companies in Enugu zone.	- Economic activities will improve to the people of Mbalano area and its environs.	- Limitation of bulk supply to Mbalano . About 120MW of power will be delivered to Mbalano area and its environs.
(2) Project Objective: What are the results **achieved** by the use of the outputs? Improvement of Power delivery to Mbalano area and its environs.	Additional transmission Capacity utilised.	- Limitation of bulk supply to Mbalano . About 120MW of power will be delivered to Mbalano area and its environs.
(3) Scope/Outputs: What are the **deliverables** of the project? Umuahia - Mbalano 132KV Line **Outputs**: Increased in transmission capacity by 120MW.	- Extra transmission capacity of 120MW Available.	- Competent contractor to be engaged for the project
(4) Inputs/Costs: What **resources** are **required**?	Fully funded LC	Timely released of fund
(5) Others Project is necessary for Power evacuation + Reliability Voltage Improvement Interconnectivity Redundancy		

Project Title : Katampe-National Stadium 132kv DC line, FCT, Abuja		**Date : 28/08/2013**
Project Narrative	**Indicators**	**Critical Consideration**
<u>(1)Programme Objective:</u> The project is **contributing** to **what** objective? To Improve Power delivery to National Stadium area of FCT.	This substation will provide bulk power to FCT for Improved economic activities.	There is bulk power supply constraint to National Stadium area of FCT.
<u>(2) Project Objective:</u> What are the results **achieved** by the use of the outputs? Improvement of Power delivery to National Stadium area of FCT.	Additional transmission Capacity utilised.	There is bulk power supply constraint to National Stadium area of FCT. This substation will provide bulk power to FCT for Improved economic activities.
<u>(3) Scope/Outputs</u>: What are the **deliverables** of the project? Construction of Katampe-National Stadium 132kv DC line, FCT, Abuja **<u>Outputs</u>**: Increased in transmission capacity by 200MW.	Extra transmission capacity of 200MW Available for transmission.	Competent contractor to be engaged for the project
<u>(4) Inputs/Costs:</u> What **resources** are **required**?	Fully funded LC	Timely released of fund
(5) <u>Others</u> Project is necessary for Power evacuation + Reliability Voltage Improvement Interconnectivity Redundancy		

Project Title : Okigwe 2x30/40MVA 132/33kV Substation, Imo		**Date : 28/08/2013**
Project Narrative	**Indicators**	**Critical Consideration**
(1)Programme Objective: The project is **contributing** to **what** objective? To Improve Power delivery to distribution Companies in Enugu zone.	- This will improve economic activities to the people of the state. About 68MW bulk power will be made available to the people of Okigwe.	- There is inadequate bulk supply to Okigwe and environ. About 68MW bulk power will be made available to the people ; this will improve economic activities of the people of the state
(2) Project Objective: What are the results **achieved** by the use of the outputs? Improvement of Power delivery to Okigwe area of Imo state.	Additional transformation Capacity utilised.	- There is inadequate bulk supply to Okigwe and environ. About 68MW bulk power will be made available to the people .
(3) Scope/Outputs: What are the **deliverables** of the project? Okigwe 2x30/40MVA 132/33kV Substation, Imo **Outputs**: Increased in transformation capacity by 80MVA.	- Extra transformation capacity of 80MVA Available.	- Competent contractor to be engaged for the project
(4) Inputs/Costs: What **resources** are **required**?	Fully funded LC	Timely released of fund
(5) Others Project is necessary for Power evacuation + Reliability Voltage Improvement Interconnectivity Redundancy		

TRANSMISSION PROJECT LOGICAL FRAMEWORK		TCN
Project Title : Port clearing charges		**Date : 28/08/2013**
Project Narrative	**Indicators**	**Critical Consideration**
(1)Programme Objective: The project is **contributing** to **what** objective? Necessary for the implementation of the projects	- Projects will be completed as scheduled	- Necessary for the implementation of the projects
(2) Project Objective: What are the results **achieved** by the use of the outputs? Necessary for the implementation of the projects	Projects will be completed as scheduled .	- Necessary for the implementation of the projects
(3) Scope/Outputs: What are the **deliverables** of the project? Port clearing charges **Outputs**: Projects will be completed as scheduled.	Projects will be completed as scheduled	- Competent contractor to be engaged for the project
(5) Inputs/Costs: What **resources** are **required**?	Fully funded LC	Timely released of fund
(5) **Others** Project is necessary for Power evacuation + Reliability Voltage Improvement Interconnectivity Redundancy		

TRANSMISSION PROJECT LOGICAL FRAMEWORK		TCN
Project Title : Reconductoring of Port Harcourt Main -Port Harcourt Town 132kV line		**Date : 28/08/2013**
Project Narrative	**Indicators**	**Critical Consideration**
(1)Programme Objective: The project is **contributing** to **what** objective? To Improve Power delivery to Port Harcourt Distribution company.	- Additional 100MW bulk power will be available in to Port Harcourt Town for improved economic and commercial activities.	- This will enhance power transfer capability to Port Harcourt Town. - Increased power Evacuation from Afam power Plant to the Grid.
(2) Project Objective: What are the results **achieved** by the use of the outputs? Increased power Evacuation from Afam power Plant to the Grid.	Additional transmission Capacity utilised.	- This will enhance power transfer capability to to Port Harcourt Town and environs.
(3) Scope/Outputs: What are the **deliverables** of the project? Construction of Reconductoring of Port Harcourt Main - Port Harcourt Town 132kV line **Outputs**: Increased in transmission capacity by 100MW.	- Extra transmission capacity of 100MW Available for transmission.	- Competent contractor to be engaged for the project
(5) Inputs/Costs: What **resources** are **required**?	Fully funded LC	Timely released of fund
(5) Others Project is necessary for Power evacuation + Reliability Voltage Improvement Interconnectivity Redundancy		

Project Title : Installation of 1 x 60MVA 132/33kV Transformer at Sokoto		**Date : 28/08/2013**
Project Narrative	**Indicators**	**Critical Consideration**
(1)Programme Objective: The project is **contributing** to **what** objective? To Improve Power delivery to distribution Companies in Sokoto.	Economic activities will improve to the people of sokoto area and its environs.	Limitation of bulk supply to Sokoto . About 40MW of power will be delivered to people of Sokoto and its environs. .
(2) Project Objective: What are the results **achieved** by the use of the outputs? Improvement of Power delivery to Sokoto state and its environs	Additional transformation Capacity utilised.	Limitation of bulk supply to Sokoto . About 40MW of power will be delivered to people of Sokoto and its environs.
(3) Scope/Outputs: What are the **deliverables** of the project? Installation of 1 x 60MVA 132/33kV Transformer at Sokoto **Outputs**: Increased in transformation capacity by 60MVA.	Extra transformation capacity of 60MVA Available.	Competent contractor to be engaged for the project
(4) Inputs/Costs: What **resources** are **required**?	Fully funded LC	Timely released of fund
(5) Others Project is necessary for Power evacuation + Reliability Voltage Improvement Interconnectivity Redundancy		

TRANSMISSION PROJECT LOGICAL FRAMEWORK		TCN
Project Title : 1 x 60MVA 132/33kV Substation each at Ughelli and Amukpe, Delta State		**Date : 28/08/2013**
Project Narrative	**Indicators**	**Critical Consideration**
(1)Programme Objective: The project is **contributing** to **what** objective? To Improve Power delivery to Ughelli and Amukpe Electricity Distribution companies .	About 80MW bulk power will be made available to the people of Ughelli and Amukpe. This will improve economic and commercial activities of the people.	Limitation of bulk supply to Ughelli and Amukpe areas of Delta State..
(2) Project Objective: What are the results **achieved** by the use of the outputs? About 80MW bulk power will be made available to the people of Ughelli and Amukpe.	Additional transmission and transformation Capacity utilised.	Limitation of bulk supply to Ughelli and Amukpe areas of Delta State..
(3) Scope/Outputs: What are the **deliverables** of the project? 1 x 60MVA 132/33kV Substation each at Ughelli and Amukpe, Delta State **Outputs**: Increased in transmission capacity by 120MW	Extra transmission and transformation capacity of 80MW and 120MVA Available	Competent contractor to be engaged for the project
(5) Inputs/Costs: What **resources** are **required**?	Fully funded LC	Timely released of fund
(5) Others Project is necessary for Power evacuation + Reliability Voltage Improvement Interconnectivity Redundancy		

TRANSMISSION PROJECT LOGICAL FRAMEWORK		TCN
Project Title Maryland 40MVAr; 33kV Fixed Shunt Capacitor		**Start Date : 2014** **Finish Date : 2016**
Project Narrative	**Indicators**	**Critical considerations**
(1)Programme Objective: To improve power quality in Maryland and Environs	Improve economic and commercial activities in Maryland and Environs	Poor voltage Profile in Maryland and Environs
(2) Project Objective: Bulk Power quality supply to Maryland and Environs	Power quality is guaranteed	Good voltage Profile in Maryland and Environs
(3) Scope/Outputs: Scope: Construction of Maryland 40MVAr; 33kV Fixed Shunt Capacitor Outputs : Power quality is guaranteed	Power quality is available .	Competent contractor is employed to deliver the project.
(4) Inputs/costs: Inputs : Construction of Maryland 40MVAr; 33kV Fixed Shunt Capacitor Costs :	**Funding**: **Balance to complete**:	Fully funded LC/ Timely release of fund.
(5) Others: The project is necessary for - power evacuation - Bulk supply - Reliability - Voltage Improvement.		

TRANSMISSION PROJECT LOGICAL FRAMEWORK		TCN
Project Title Maryland 60MVAr; 132kV Fixed Shunt Capacitor		**Start Date : 2014** **Finish Date : 2016**
Project Narrative	**Indicators**	**Critical considerations**
(1)Programme Objective: To improve power quality in Maryland and Environs	Improve economic and commercial activities in Maryland and Environs	Poor voltage Profile in Maryland and Environs
(2) Project Objective: Bulk Power quality supply to Maryland and Environs	Power quality is guaranteed	Good voltage Profile in Maryland and Environs
(3) Scope/Outputs: Scope: Construction of Maryland 60MVAr; 132kV Fixed Shunt Capacitor Outputs : Power quality is guaranteed	Power quality is available .	Competent contractor is employed to deliver the project.
(4) Inputs/costs: Inputs : Construction of Maryland 60MVAr; 132kV Fixed Shunt Capacitor Costs :	**Funding**: **Balance to complete**:	Fully funded LC/ Timely release of fund.
(5) Others: The project is necessary for - power evacuation - Bulk supply - Reliability - Voltage Improvement.		

TRANSMISSION PROJECT LOGICAL FRAMEWORK		TCN
Project Title Niamey; 25MVAr, 132kV Fixed Shunt Capacitor		**Start Date : 2014** **Finish Date : 2016**
Project Narrative	**Indicators**	**Critical considerations**
(1)Programme Objective: To improve power quality in Niamey and Environs	Improve economic and commercial activities of Niamey and Environs	Poor voltage Profile in Niamey and Environs
(2) Project Objective: Bulk Power quality supply to Niamey and Environs	Power quality is guaranteed	Good voltage Profile in Niamey and Environs
(3) Scope/Outputs: Scope: Construction of Niamey; 25MVAr, 132kV Fixed Shunt Capacitor Outputs : Power quality is guaranteed	Power quality is available .	Competent contractor is employed to deliver the project.
(4) Inputs/costs: Inputs : Construction of Niamey; 25MVAr, 132kV Fixed Shunt Capacitor Costs :	**Funding**: **Balance to complete**:	Fully funded LC/ Timely release of fund.
(5) Others: The project is necessary for - power evacuation - Bulk supply - Reliability - Voltage Improvement.		

TRANSMISSION PROJECT LOGICAL FRAMEWORK		TCN
Project Title Ogba 50MVAr; 132kV Fixed Shunt Capacitor		**Start Date : 2014** **Finish Date : 2016**
Project Narrative	**Indicators**	**Critical considerations**
(1)Programme Objective: To improve power quality in Ogba and Environs	Improve economic and commercial activities in Ogba and Environs	Poor voltage Profile in Ogba and Environs
(2) Project Objective: Bulk Power quality supply to Ogba and Environs	Power quality is guaranteed	Good voltage Profile in Ogba and Environs
(3) Scope/Outputs: Scope: Construction of Ogba 50MVAr; 132kV Fixed Shunt Capacitor Outputs : Power quality is guaranteed	Power quality is available .	Competent contractor is employed to deliver the project.
(4) Inputs/costs: Inputs : Construction of Ogba 50MVAr; 132kV Fixed Shunt Capacitor Costs :	**Funding**: **Balance to complete**:	Fully funded LC/ Timely release of fund.
(5) Others: The project is necessary for - power evacuation - Bulk supply - Reliability - Voltage Improvement.		

TRANSMISSION PROJECT LOGICAL FRAMEWORK		TCN
Project Title Oke_Aro 75MVAr; 132kV Fixed Shunt Capacitor		**Start Date : 2014** **Finish Date : 2016**
Project Narrative	**Indicators**	**Critical considerations**
(1)Programme Objective: To improve power quality in Oke_Aro and Environs	Improve economic and commercial activities in Oke_Aro and Environs	Poor voltage Profile in Oke_Aro and Environs
(2) Project Objective: Bulk Power quality supply to Oke_Aro and Environs	Power quality is guaranteed	Good voltage Profile in Oke_Aro and Environs
(3) Scope/Outputs: Scope: Construction of Oke_Aro 75MVAr; 132kV Fixed Shunt Capacitor Outputs : Power quality is guaranteed	Power quality is available .	Competent contractor is employed to deliver the project.
(4) Inputs/costs: Inputs : Construction of Oke_Aro 75MVAr; 132kV Fixed Shunt Capacitor Costs :	**Funding**: **Balance to complete**:	Fully funded LC/ Timely release of fund.
(5) Others: The project is necessary for - power evacuation - Bulk supply - Reliability - Voltage Improvement.		

TRANSMISSION PROJECT LOGICAL FRAMEWORK		TCN
Project Title Old Abeokuta 50MVAr; 132kV Fixed Shunt Capacitor		**Start Date : 2014** **Finish Date : 2016**
Project Narrative	**Indicators**	**Critical considerations**
(1)Programme Objective: To improve power quality in Old Abeokuta and Environs	Improve economic and commercial activities in Old Abeokuta and Environs	Poor voltage Profile in Old Abeokuta and Environs
(2) Project Objective: Bulk Power quality supply to Old Abeokuta and Environs	Power quality is guaranteed	Good voltage Profile in Old Abeokuta and Environs
(3) Scope/Outputs: Scope: Construction of Old Abeokuta 50MVAr; 132kV Fixed Shunt Capacitor Outputs : Power quality is guaranteed	Power quality is available .	Competent contractor is employed to deliver the project.
(4) Inputs/costs: Inputs : Construction of Old Abeokuta 50MVAr; 132kV Fixed Shunt Capacitor Costs :	**Funding**: **Balance to complete**:	Fully funded LC/ Timely release of fund.
(5) **Others:** The project is necessary for - power evacuation - Bulk supply - Reliability - Voltage Improvement.		

TRANSMISSION PROJECT LOGICAL FRAMEWORK		TCN
Project Title Omuaran; 30MVAr, 33kV Fixed Shunt Capacitor		**Start Date : 2014** **Finish Date : 2016**
Project Narrative	**Indicators**	**Critical considerations**
(1)Programme Objective: To improve power quality in Omuaran and Environs	Improve economic and commercial activities in Omuaran and Environs	Poor voltage Profile in Omuaran and Environs
(2) Project Objective: Bulk Power quality supply to Omuaran and Environs	Power quality is guaranteed	Good voltage Profile in Omuaran and Environs
(3) Scope/Outputs: Scope: Construction of Omuaran; 30MVAr, 33kV Fixed Shunt Capacitor Outputs : Power quality is guaranteed	Power quality is available .	Competent contractor is employed to deliver the project.
(4) Inputs/costs: Inputs : Construction of Omuaran; 30MVAr, 33kV Fixed Shunt Capacitor Costs :	**Funding**: **Balance to complete**:	Fully funded LC/ Timely release of fund.
(5) Others: The project is necessary for - power evacuation - Bulk supply - Reliability - Voltage Improvement.		

TRANSMISSION PROJECT LOGICAL FRAMEWORK		**TCN**
Project Title OSOGBO 1; 10MVAr, 132kV Fixed Shunt Capacitor		**Start Date : 2014** **Finish Date : 2016**
Project Narrative	**Indicators**	**Critical considerations**
(1)Programme Objective: To improve power quality in OSOGBO 1; and Environs	Improve economic and commercial activities in OSOGBO 1 and Environs	Poor voltage Profile in OSOGBO 1 and Environs
(2) Project Objective: Bulk Power quality supply to OSOGBO 1and Environs	Power quality is guaranteed	Good voltage Profile in OSOGBO 1and Environs
(3) Scope/Outputs: Scope: Construction of OSOGBO 1; 10MVAr, 132kV Fixed Shunt Capacitor Outputs : Power quality is guaranteed	Power quality is available .	Competent contractor is employed to deliver the project.
(4) Inputs/costs: Inputs : Construction of OSOGBO 1; 10MVAr, 132kV Fixed Shunt Capacitor Costs :	**Funding**: **Balance to complete**:	Fully funded LC/ Timely release of fund.
(5) Others: The project is necessary for - power evacuation - Bulk supply - Reliability - Voltage Improvement.		

TRANSMISSION PROJECT LOGICAL FRAMEWORK		TCN
Project Title Osogbo SVC; 330kV, +60MVAr, -75MVAr		**Start Date : 2014** **Finish Date : 2016**
Project Narrative	**Indicators**	**Critical considerations**
(1)Programme Objective: To improve power quality in Osogbo and Environs	Improve economic and commercial activities of Osogbo and Environs	Poor voltage Profile in Osogbo and Environs
(2) Project Objective: Bulk Power quality supply to Osogbo and Environs	Power quality is guaranteed	Good voltage Profile in Osogbo and Environs
(3) Scope/Outputs: Scope: Construction of Osogbo SVC; 330kV, +60MVAr, -75 Outputs : Power quality is guaranteed	Power quality is available .	Competent contractor is employed to deliver the project.
(4) Inputs/costs: Inputs : Construction of Osogbo SVC; 330kV, +60MVAr, -75MVAr Costs :	**Funding**: **Balance to complete**:	Fully funded LC/ Timely release of fund.
(5) **Others:** The project is necessary for - power evacuation - Bulk supply - Reliability - Voltage Improvement.		

TRANSMISSION PROJECT LOGICAL FRAMEWORK		TCN
Project Title Otta 50MVAr; 132kV Fixed Shunt Capacitor		**Start Date : 2014** **Finish Date : 2016**
Project Narrative	**Indicators**	**Critical considerations**
(1)Programme Objective: To improve power quality in Otta and Environs	Improve economic and commercial activities in Otta and Environs	Poor voltage Profile in Otta and Environs
(2) Project Objective: Bulk Power quality supply to Otta and Environs	Power quality is guaranteed	Good voltage Profile in Otta and Environs
(3) Scope/Outputs: Scope: Construction of Otta 50MVAr; 132kV Fixed Shunt Capacitor Outputs : Power quality is guaranteed	Power quality is available .	Competent contractor is employed to deliver the project.
(4) Inputs/costs: Inputs : Construction of Otta 50MVAr; 132kV Fixed Shunt Capacitor Costs :	**Funding**: **Balance to complete**:	Fully funded LC/ Timely release of fund.
(5) **Others:** The project is necessary for - power evacuation - Bulk supply - Reliability - Voltage Improvement.		

TRANSMISSION PROJECT LOGICAL FRAMEWORK		**TCN**
Project Title Oworosoki 50MVAr; 132kV Fixed Shunt Capacitor		**Start Date : 2014** **Finish Date : 2016**
Project Narrative	**Indicators**	**Critical considerations**
(1)Programme Objective: To improve power quality in Oworosoki and Environs	Improve economic and commercial activities in Oworosoki and Environs	Poor voltage Profile in Oworosoki and Environs
(2) Project Objective: Bulk Power quality supply to Oworosoki and Environs	Power quality is guaranteed	Good voltage Profile in Oworosoki and Environs
(3) Scope/Outputs: Scope: Construction of Oworosoki 50MVAr; 132kV Fixed Shunt Capacitor Outputs : Power quality is guaranteed	Power quality is available .	Competent contractor is employed to deliver the project.
(4) Inputs/costs: Inputs : Construction of Oworosoki 50MVAr; 132kV Fixed Shunt Capacitor Costs :	**Funding**: **Balance to complete**:	Fully funded LC/ Timely release of fund.
(5) **Others:** The project is necessary for - power evacuation - Bulk supply - Reliability - Voltage Improvement.		

TRANSMISSION PROJECT LOGICAL FRAMEWORK		TCN
Project Title Papalanto 50MVAr, 132kV Fixed Shunt Capacitor		**Start Date : 2014** **Finish Date : 2016**
Project Narrative	**Indicators**	**Critical considerations**
(1)Programme Objective: To improve power quality in Papalanto and Environs	Improve economic and commercial activities of Papalanto and Environs	Poor voltage Profile in Papalanto and Environs
(2) Project Objective: Bulk Power quality supply to Papalanto and Environs	Power quality is guaranteed	Good voltage Profile in Papalanto and Environs
(3) Scope/Outputs: Scope: Construction of Papalanto 50MVAr, 132kV Fixed Shunt Capaci Outputs : Power quality is guaranteed	Power quality is available .	Competent contractor is employed to deliver the project.
(4) Inputs/costs: Inputs : Construction of Papalanto 50MVAr, 132kV Fixed Shunt Capacitor Costs :	**Funding**: **Balance to complete**:	Fully funded LC/ Timely release of fund.
(5) Others: The project is necessary for - power evacuation - Bulk supply - Reliability - Voltage Improvement.		

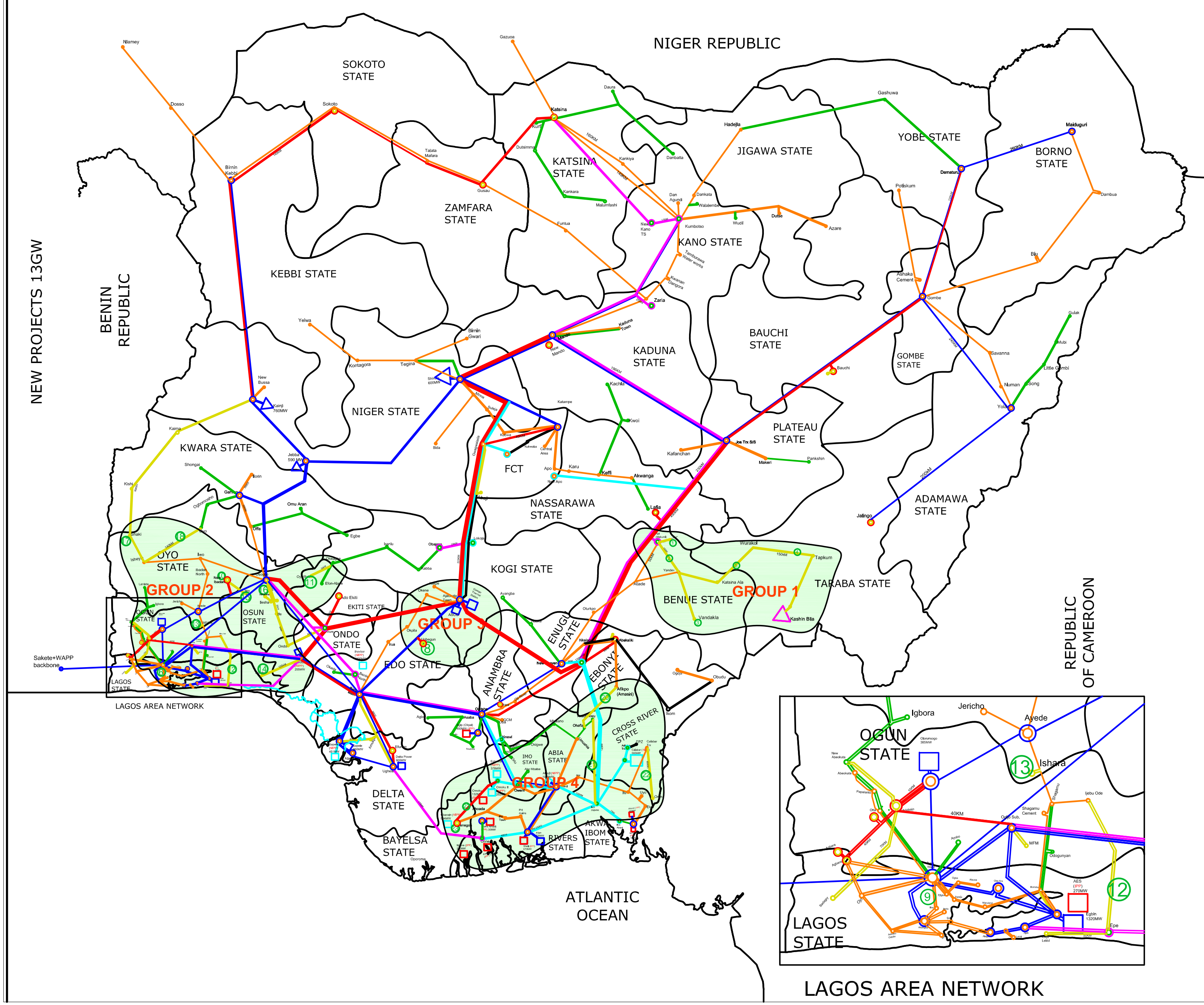
TRANSMISSION PROJECT LOGICAL FRAMEWORK		TCN
Project Title Tmafara; 35MVAr, 330kV Shunt Reactor project		**Start Date : 2014** **Finish Date : 2016**
Project Narrative	**Indicators**	**Critical considerations**
(1)Programme Objective: To improve power quality in Talata mafara and Environs	Improve economic and commercial activities of Talata mafara and Environs	Poor voltage Profile in Talata mafara and Environs
(2) Project Objective: Bulk Power quality supply to Talatamafara and Environs	Power quality is guaranteed	Good voltage Profile in Talata mafara and Environs
(3) Scope/Outputs: Scope: Construction of Tmafara; 35MVAr, 330kV Shunt Reactor project Outputs : Power quality is guaranteed	Power quality is available .	Competent contractor is employed to deliver the project.
(4) Inputs/costs: Inputs : Construction of Tmafara; 35MVAr, 330kV Shunt Reactor project Costs :	**Funding**: **Balance to complete**:	Fully funded LC/ Timely release of fund.
(5) Others: The project is necessary for - power evacuation - Bulk supply - Reliability - Voltage Improvement.		

Appendix D Financing Package 3 – Incremental Projects for 13 GW System

NIGERIA MAP

13GW MODEL

GRID MAP CONTAINING EXISTING / ON-GOING / COMMITTED 330 / 132KV TRANSMISSION PROJECTS AND NECESSARY NEW PROJECTS FOR 13GW TRANSMISSION CAPABILITY



LEGEND

- PROPOSED 330KV TRANSMISSION LINES
- ON-GOING 330KV TRANSMISSION LINES BY TCN
- ON-GOING 330KV TRANSMISSION LINES BY NIPP
- ON-GOING 330KV TRANSMISSION LINES BY FMP
- EXISTING 330KV TRANSMISSION LINES
- PROPOSED 132KV TRANSMISSION LINES
- ON-GOING 132KV TRANSMISSION LINES BY TCN
- ON-GOING 132KV TRANSMISSION LINES BY NIPP
- EXISTING 132KV TRANSMISSION LINES
- PROPOSED 330/132KV BULK S/S
- ON-GOING 330/132KV BULK S/S
- ON-GOING 330/132KV BULK S/S BY NIPP
- EXISTING 330/132KV BULK S/S
- PROPOSED 132KV BULK S/S
- ON-GOING 132KV BULK S/S
- EXISTING 132KV BULK S/S
- ON-GOING/COMMITTED HYDRO POWER STATION
- EXISTING HYDRO POWER STATION
- EXISTING THERMAL POWER STATION
- EXISTING NIPP THERMAL POWER STATION
- IPP THERMAL POWER STATION

POWER HOLDING COMPANY OF NIGERIA (PHCN) PLC

Title: Existing, On-Gong and Proposed

TCN/NIPP/IPP Projects

Prepared By	Power System Planning, Research & Development, TCN C/HQ	Scale: NOT TO SCALE
Checked By		
Recommended By		Date Feb, 2014
Approved By	GM (PSPD+R&D)	

Package-3 (New Projects for 13GW Network)

Group-1: Makurdi – Apir – North Bank 132kV line

S/N	DESCRIPTION	COST= NAIRA
1	Makurdi-Apir-North Bank 132kV DC line(30km), 2x60MVA, 132/33kV substation at North Bank and 132kV line bays extensions at Makurdi and Apir.	5,595,000,000
2	132kV DC Line from Makurdi - Yandev (100km)	3,850,000,000
3	Yandev-Vandakia 132kV DC line(80km), 2x60MVA, 132/33kV substation at Vandakia and 2x132kV line bays extension at Yandev.	5,780,000,000
4	Kashimbila - Tapkum - Wurakoi - Yandev(150km) + 2x60MVA 132/33kV substation	8,075,000,000
5	Yandev - Katsina Ala - Wukari 132kV DC Transmission Line(125km) + 2 x 60MVA 132/33kV Substation at Katsina Ala & Wukari	7,112,500,000
Total		**$190,078,125.00**

Package-3 (New Projects for 13GW Network)

Group- 2: 330/132kV Substation + 2 x 132/33kV substations at Igando

S/N	DESCRIPTION	COST= NAIRA
6	2 x 150MVA 330/132kV Substation + 2 x 100MVA 132/33kV substation at Igando + Construction of 5kM 330kV DC to turn-in-out of Ikeja West / Akangba 330kV DC Transmission Line	6,090,000,000.00
7	2x150MVA, 330/132kV + 2x60MVA, 132/33kV substation at New Ibadan, and turn-in-out of Oshogbo-Ayede 330KVSC line at New Ibadan + 25km New Ibadan - Asejire 132KV DC Transmission line and	6,090,000,000.00
8	2x60MVA, 132/33kV S/S at Ifaki/Oye + construction of 30km Ado Ekiti - Ifaki 132kv line.	3,455,000,000.00
9	Epe - Ijebu-Ode 132kV DC Transmission line (45km) + 2 line Bay Extension at Epe and Ijebu-Ode	5,020,000,000.00
10	Ayede - Ishara - Shagamu 132kV Transmission Line + 2 Line Bay Extension + 2 x 60MVA 132/33kV at Ishara-Remo	10,582,500,000.00
11	Omotosho - Agodo/Ibiade 132kV DC Transmission line(125km) + 2 line Bay Extension	7,512,500,000.00
12	New Ibadan - Asejire 132kV DC Transmission line(35km) + 2 line Bay Extension + 2x60MVA at Asejire	3,480,000,000.00
13	Ilesha - Ikinyinwa 132kV D.C Line (15km) + 2 x 60MVA 132/33kV S/S	2,877,500,000.00
14	Iseyin - Shaki 132kV DC Transmission line (140km)+ 2 x60MVA 132/33kV Substation @ Shaki	7,690,000,000.00
15	Ogbomosho - Oyo - Iseyin 132kV Transmission line(125km) with 2 x 60MVA Substation at Oyo	7,112,500,000.00
	Total	**$374,437,500.00**

Package- 3 (New Projects for 13GW Network)

Group-3: 330 kV double circuit line to Ugbegun +330/132kV Substation

S/N	DESCRIPTION	COST= NAIRA
16	Turn-in-out from Ajaokuta - Benin 330 kV double circuit line to Ugbegun +2x150MVA 330/132KV Substation at Ugbegun + 30km Ugbegun - Irrua 132KV DC Transmission line.	7,220,000,000.00
17	Amasiri-Ohafia 132kV DC line (80km) and 2x132kV line bays extension each at Amasiri and Ohafia.	3,880,000,000
18	Arochukwu-Ikot Ekpene 132kV DC line and 2x132kV line bays extension each at Arochukwu and Ikot Ekpene.	2,725,000,000
19	Omoku - Yenegoa 330 kV double circuit line Bison Conductor (150km)+ line bay extensions.	9,312,000,000
20	2 x 150MVA 330/132kV Substation at Yenegoa	3,500,000,000
21	Eket - Oron 132/33kV DC Transmission Line(50km) + 2 x 60MVA 132/33kV Substation at Oron + Bay Extension	3,897,500,000
	Total	**$190,840,625.00**

Package-3 (New Projects for 13GW Network)

Group-4: 330kV DC Line from Zungeru - Kaduna (190km) +132kV lines and substations + Reactive power compensation

S/N	DESCRIPTION	COST= NAIRA
22	330kV DC Line from Zungeru - Kaduna (190km)	3,814,033,430.98
23	Power transformers for Grid reinforcement, 132/33kV 60MVA - 21nos, 330/132kV 150MVA 14nos and 300MVA 16nos	23,953,094,400.00
24	Various 132/33kV lines and 132/33kV Substations Reinforcement and Reactive Power Compensation nationwide.	102,575,972,169.00
	Total	**$814,644,375.00**

PACKAGE 3: NEW PROJECTS FOR 13GW NETWORK - FUND UTILIZATION IN US$						
No.	**Project Titles**	**Estimated Total Project Costs in US$**	**2015**	**2016**	**2017**	
1	Makurdi-Apir-North Bank 132kV DC line(30km), 2x60MVA, 132/33kV substation at North Bank and 132kV line bays extensions at Makurdi and Apir.	34,968,750.00	24,478,125	6,993,750	3,496,875	
2	132kV DC Line from Makurdi - Yandev (100km)	24,062,500.00	16,843,750	4,812,500	2,406,250	
3	Yandev-Vandakia 132kV DC line(80km), 2x60MVA, 132/33kV substation at Vandakia and 2x132kV line bays extension at Yandev.	36,125,000.00	25,287,500	7,225,000	3,612,500	
4	Kashimbila - Tapkum - Wurakoi - Yandev(150km) + 2x60MVA 132/33kV substation	50,468,750.00	35,328,125	10,093,750	5,046,875	
5	Yandev - Katsina Ala - Wukari 132kV DC Transmission Line(125km) + 2 x 60MVA 132/33kV Substation at Katsina Ala & Wukari	44,453,125.00	31,117,188	8,890,625	4,445,313	
6	2 x 150MVA 330/132kV Substation + 2 x 100MVA 132/33kV substation at Igando + Construction of 5kM 330kV DC to turn-in-out of Ikeja West / Akangba 330kV DC Transmission Line	204,375.00	143,063	40,875	20,438	
7	2x150MVA, 330/132kV + 2x60MVA, 132/33kV substation at New Ibadan, and turn-in-out of Oshogbo-Ayede 330KVSC line at New Ibadan + 25km New Ibadan - Asejire 132KV DC Transmission line and 2x60MVA 132/33KV at Asejire.	38,062,500.00	26,643,750	7,612,500	3,806,250	
8	2x60MVA, 132/33kV S/S at Ifaki/Oye + construction of 30km Ado Ekiti - Ifaki 132kv line.	38,062,500.00	26,643,750	7,612,500	3,806,250	
9	Epe - Ijebu-Ode 132kV DC Transmission line (45km) + 2 line Bay Extension at Epe and Ijebu-Ode	21,593,750.00	15,115,625	4,318,750	2,159,375	
10	Ayede - Ishara - Shagamu 132kV Transmission Line + 2 Line Bay Extension + 2 x 60MVA 132/33kV at Ishara-Remo	31,375,000.00	21,962,500	6,275,000	3,137,500	
11	Omotosho - Agodo/Ibiade 132kV DC Transmission line(125km) + 2 line Bay Extension	66,140,625.00	46,298,438	13,228,125	6,614,063	
12	New Ibadan - Asejire 132kV DC Transmission line(35km) + 2 line Bay Extension + 2x60MVA at Asejire	46,953,125.00	32,867,188	9,390,625	4,695,313	
13	Ilesha - Ikinyinwa 132kV D.C Line (15km) + 2 x 60MVA 132/33kV S/S	21,750,000.00	15,225,000	4,350,000	2,175,000	
14	Iseyin - Shaki 132kV DC Transmission line (140km)+ 2 x60MVA 132/33kV Substation @ Shaki	17,984,375.00	12,589,063	3,596,875	1,798,438	
15	Ogbomosho - Oyo - Iseyin 132kV Transmission line(125km) with 2 x 60MVA Substation at Oyo	48,062,500.00	33,643,750	9,612,500	4,806,250	
16	Turn-in-out from Ajaokuta - Benin 330 kV double circuit line to Ugbegun +2x150MVA 330/132KV Substation at Ugbegun + 30km Ugbegun - Irrua 132KV DC Transmission line.	45,125,000.00	31,587,500	9,025,000	4,512,500	
17	Amasiri-Ohafia 132kV DC line (80km) and 2x132kV line bays extension	24,250,000.00	16,975,000	4,850,000	2,425,000	

PACKAGE 3: NEW PROJECTS FOR 13GW NETWORK - FUND UTILIZATION IN US$						
No.	**Project Titles**	**Estimated Total Project Costs in US$**	**2015**	**2016**	**2017**	
18	Arochukwu-Ikot Ekpene 132kV DC line and 2x132kV line bays extension each at Arochukwu and Ikot Ekpene.	17,031,250.00	11,921,875	3,406,250	1,703,125	
19	Omoku - Yenegoa 330 kV double circuit line Bison Conductor (150km)+ line bay extensions.	58,200,000.00	40,740,000	11,640,000	5,820,000	
20	2 x 150MVA 330/132kV Substation at Yenegoa	21,875,000.00	15,312,500	4,375,000	2,187,500	
21	Eket - Oron 132/33kV DC Transmission Line(50km) + 2 x 60MVA 132/33kV Substation at Oron + Bay Extension	24,359,375.00	17,051,563	4,871,875	2,435,938	
22	330kV DC Line from Zungeru - Kaduna (190km)	23,837,708.94	16,686,396	4,767,542	2,383,771	
23	Power transformers for Grid reinforcement, 132/33kV 60MVA - 21nos, 330/132kV 150MVA 14nos and 300MVA 16nos	189,706,840.00	132,794,788	37,941,368	18,970,684	
24	Various 132/33kV lines and 132/33kV Substations Reinforcement and reactive power compensation nationwide.	642,099,826.06	449,469,878	128,419,965	64,209,983	
	Total (Transmission + Substation)	**$1,566,751,875**	**$1,096,726,312**	**$313,350,375**	**$156,675,187**	
Grand Total project cost for 13GW		**$1,566,751,875**	**$1,096,726,312**	**$313,350,375**	**$156,675,187**	

TRANSMISSION PROJECT LOGICAL FRAMEWORK		TCN
132kV DC Line from Makurdi - Yandev (100km)		Start Date : 2014 Finish Date : 2016
Project Narrative	**Indicators**	**Critical considerations**
(1)Programme Objective: To improve power delivery to Yandev and environs	Economic and commercial activities will improve in Yandev and environs	Bulk Power Limitation to Yandev and environs
(2) Project Objective: Bulk Power supply to Yandev and environs	Additional 295MVA Transmission capacity to be utilised. About 120MVA Transformation capacity to be utilised.	About 250MW of power is delivered to Yandev and environs
(3) Scope/Outputs: Scope: Construction of 132kV DC Line from Makurdi - Yandev (100km) Outputs :Increase in transmission and transformation capacity by 295MVA and 120MVA	Extra 295MVA Transmission capacity is available. About 120MVA Transformation capacity is available.	Competent contractor is employed to deliver the project.
(4) Inputs/costs: Inputs : Construction of 132kV DC Line from Makurdi - Yandev (100km) Costs : 3, 850, 000,000	**Funding**: **Balance to complete**:	Fully funded LC/ Timely release of fund.
(5) Others: The project is necessary for - power evacuation - Bulk supply - Reliability - Voltage Improvement.		

TRANSMISSION PROJECT LOGICAL FRAMEWORK		TCN
Akure -Owo 132kV DC Transmission line (80km) + 2 line Bay Extension + 2x60MVA		**Start Date : 2014** **Finish Date : 2016**
Project Narrative	**Indicators**	**Critical considerations**
(1)Programme Objective: To improve power delivery to Owo	Economic and commercial activities will improve in Owo.	Bulk Power Limitation to Owo
(2) Project Objective: Bulk Power supply to Owo	Additional 295MVA Transmission capacity to be utilised. About 120MVA Transformation capacity to be utilised.	About 250MW of power is delivered to Owo
(3) Scope/Outputs: Scope: Akure -Owo 132kV DC Transmission line(80km) + 2 line Bay Extension + 2x60MVA Outputs : Increase in transmission and transformation capacity by 250MW and 120MVA	Extra 295MVA Transmission capacity is available. About 120MVA Transformation capacity is available.	Competent contractor is employed to deliver the project.
(4) Inputs/costs: Inputs : Akure -Owo 132kV DC Transmission line(80km) + 2 line Bay Extension + 2x60MVA Costs : 3,480,000,000	**Funding**: **Balance to complete**:	Fully funded LC/ Timely release of fund.
(5) **Others:** The project is necessary for - power evacuation - Bulk supply - Reliability - Voltage Improvement.		

TRANSMISSION PROJECT LOGICAL FRAMEWORK		TCN
Amasiri-Ohafia 132kV DC line (80km) and 2x132kV line bays extension each at Amasiri and Ohafia.		**Start Date : 2014** **Finish Date : 2016**
Project Narrative	**Indicators**	**Critical considerations**
(1)Programme Objective: To improve power delivery to Ohafia.	Economic and commercial activities will improve in Ohafia. .	Bulk Power Limitation to Ohafia.
(2) Project Objective: Bulk Power supply to Ohafia.	Additional 300MVA Transmission capacity to be utilised.	About 250MW of power is delivered to Ohafia.
(3) Scope/Outputs: Scope: Construction of Amasiri-Ohafia 132kV DC line (80km) and 2x132kV line bays extension each at Amasiri and Ohafia. Outputs : Increase in transmission capacity by 300MVA.	Extra 300MVA transmission capacity is available.	Competent contractor is employed to deliver the project.
(4) Inputs/costs: Inputs : Amasiri-Ohafia 132kV DC line (80km) and 2x132kV line bays extension each at Amasiri and Ohafia. Costs :	**Funding**: **Balance to complete**:	Fully funded LC/ Timely release of fund.
(5) Others: The project is necessary for - power evacuation - Bulk supply - Reliability - Voltage Improvement.		

TRANSMISSION PROJECT LOGICAL FRAMEWORK		TCN
Project Title : Arochukwu-Ikot Ekpene 132kV DC line and 2x132kV line bays extension each at Arochukwu and Ikot Ekpene.		**Start Date : 2014** **Finish Date : 2016**
Project Narrative	**Indicators**	**Critical considerations**
<u>(1)Programme Objective:</u> To improve power delivery to Akwa Ibom state and Neighbouring states.	Economic and commercial activities will improve in Ikot Ekpene .	Limitation of bulk supply to the people of Ikot Ekpene.
<u>(2) Project Objective:</u> Bulk Power supply to Akwa Ibom state.	Additional 300MVA Transmission capacity to be utilised.	About 240MW of power is delivered to Akwa Ibom
<u>(3) Scope/Outputs</u>: <u>Scope</u>: Construction of Arochukwu-Ikot Ekpene 132kV DC line and 2x132kV line bays extension each at Arochukwu and Ikot Ekpene. . <u>Outputs</u> : Increase in transformation capacity by 300 MVA.	Extra 300MVA transmission capacity is available.	Competent contractor is employed to deliver the project.
<u>(4) Inputs/costs:</u> <u>Inputs</u> : Construction of Arochukwu-Ikot Ekpene 132kV DC line and 2x132kV line bays extension each at Arochukwu and Ikot Ekpene. <u>Costs</u> :	**Funding**: **Balance to complete**:	Fully funded LC/ Timely release of fund.
(5) <u>Others:</u> The project is necessary for - power evacuation - Bulk supply - Reliability - Voltage Improvement.		

TRANSMISSION PROJECT LOGICAL FRAMEWORK		**TCN**
Ayede - Ishara - Shagamu 132kV Transmission Line + 2 Line Bay Extension + 2 x 60MVA 132/33kV at Ishara-Remo		**Start Date : 2014** **Finish Date : 2016**
Project Narrative	**Indicators**	**Critical considerations**
(1)Programme Objective: To improve power delivery to Ishara and Shagamu	Economic and commercial activities will improve in Ishara and Shagamu respectively.	Bulk Power Limitation to Ishara and Shagamu
(2) Project Objective: Bulk Power supply to Ishara and Shagamu	Additional 295MVA Transmission capacity to be utilised. About 120MVA Transformation capacity to be utilised	About 250MW of power is delivered to Ishara and Shagamu
(3) Scope/Outputs: Scope: Ayede - Ishara - Shagamu 132kV Transmission Line + 2 Line Bay Extension + 2 x 60MVA 132/33kV at Ishara-Remo Outputs : Increase in transformation and transmission capacity by 120MVA and 250MW	Extra 295MVA Transmission capacity is available. About 120MVA Transformation capacity is available.	Competent contractor is employed to deliver the project.
(4) Inputs/costs: Inputs : Ayede - Ishara - Shagamu 132kV Transmission Line + 2 Line Bay Extension + 2 x 60MVA 132/33kV at Ishara-Remo Costs : 10,582,500,000	**Funding**: **Balance to complete**:	Fully funded LC/ Timely release of fund.
(5) Others: The project is necessary for - power evacuation - Bulk supply - Reliability - Voltage Improvement.		

TRANSMISSION PROJECT LOGICAL FRAMEWORK		TCN
Project Title : Calabar - Oron 132/33kV DC Transmission Line (135km) + 2 x 60MVA 132/33kV Substation at Oron + Bay Extension		**Start Date : 2014** **Finish Date : 2016**
Project Narrative	**Indicators**	**Critical considerations**
(1)Programme Objective: To improve power delivery to Akwa Ibom state.	Economic and commercial activities will improve in Oron .	Limitation of bulk supply to the people of Oron in Akwa Ibom State.
(2) Project Objective: Bulk Power supply to Akwa Ibom state.	Additional 120MVA Transformation capacity to be utilised.	About 240MW of power is delivered to Akwa Ibom State
(3) Scope/Outputs: Scope: Construction of Calabar - Oron 132/33kV DC Transmission Line (135km) + 2 x 60MVA 132/33kV Substation at Oron + Bay Extension Outputs : Increase in transformation capacity by 120MVA.	Extra 120MVA transformation capacity is available.	Competent contractor is employed to deliver the project.
(4) Inputs/costs: Inputs : Calabar - Oron 132/33kV DC Transmission Line (135km) + 2 x 60MVA 132/33kV Substation at Oron + Bay Extension Costs :	**Funding**: **Balance to complete**:	Fully funded LC/ Timely release of fund.
(5) Others: The project is necessary for - power evacuation - Bulk supply - Reliability - Voltage Improvement.		

TRANSMISSION PROJECT LOGICAL FRAMEWORK		TCN
Epe - Ijebu-Ode 132kV DC Transmission line + 2 line Bay Extension at Epe and Ijebu-Ode		**Start Date : 2014** **Finish Date : 2016**
Project Narrative	**Indicators**	**Critical considerations**
(1)Programme Objective: To improve power delivery to Ijebu-Ode	Economic and commercial activities will improve in Ijebu-Ode	Bulk Power Limitation to Ijebu-Ode
(2) Project Objective: Bulk Power supply to Ijebu-Ode	Additional 295MVA Transmission capacity to be utilised.	About 250MW of power is delivered to Ijebu-Ode
(3) Scope/Outputs: Scope: Epe - Ijebu-Ode 132kV DC Transmission line + 2 line Bay Extension at Epe and Ijebu-Ode Outputs : Increase in transmission capacity by 250MW	Extra 295MVA Transmission capacity is available.	Competent contractor is employed to deliver the project.
(4) Inputs/costs: Inputs : Epe - Ijebu-Ode 132kV DC Transmission line + 2 line Bay Extension at Epe and Ijebu-Ode Costs : 5,020,000,000	**Funding**: **Balance to complete**:	Fully funded LC/ Timely release of fund.
(5) Others: The project is necessary for - power evacuation - Bulk supply - Reliability - Voltage Improvement.		

TRANSMISSION PROJECT LOGICAL FRAMEWORK		TCN
2x60MVA, 132/33kV S/S at Ifaki/Oye + construction of 30km 132kv DC Transmission line to Obajana/Okeagbe 132kv line		**Start Date : 2014** **Finish Date : 2016**
Project Narrative	**Indicators**	**Critical considerations**
(1)Programme Objective: To improve power delivery to Ifaki, Oye, Obajana and Okeagbe	Economic and commercial activities will improve in Ifaki, Oye, Obajana and Okeagbe	Bulk Power Limitation to Ifaki, Oye, Obajana and Okeagbe
(2) Project Objective: Bulk Power supply to Ifaki, Oye, Obajana and Okeagbe	Additional 120MVA Transformation capacity to be utilised.	About 250MW of power is delivered to Ifaki, Oye, Obajana and Okeagbe
(3) Scope/Outputs: Scope: 2x60MVA, 132/33kV S/S at Ifaki/Oye + construction of 30km 132kv DC Transmission line to Obajana/Okeagbe 132kv line Outputs : Increase in transformation and transmission capacity by 120MVA and 250MW	Extra 120MVA Transformation capacity is available.	Competent contractor is employed to deliver the project.
(4) Inputs/costs: Inputs : 2x60MVA, 132/33kV S/S at Ifaki/Oye + construction of 30km 132kv DC Transmission line to Obajana/Okeagbe 132kv line Costs : 3,455,000,000	**Funding**: **Balance to complete**:	Fully funded LC/ Timely release of fund.
(5) Others: The project is necessary for - power evacuation - Bulk supply - Reliability - Voltage Improvement.		

TRANSMISSION PROJECT LOGICAL FRAMEWORK		TCN
Ilesha - Ikinyinwa 132kV D.C Line (15km) + 2 x 60MVA 132/33kV S/S		**Start Date : 2014** **Finish Date : 2016**
Project Narrative	**Indicators**	**Critical considerations**
(1)Programme Objective: To improve power delivery to Ikinyinwa	Economic and commercial activities will improve in Ikinyinwa.	Bulk Power Limitation to Ikinyinwa
(2) Project Objective: Bulk Power supply to Ikinyinwa	Additional 295MVA Transmission capacity to be utilised. About 120MVA Transformation capacity to be utilised.	About 250MW of power is delivered to Ikinyinwa
(3) Scope/Outputs: Scope: Ilesha - Ikinyinwa 132kV D.C Line (15km) + 2 x 60MVA 132/33kV S/S Outputs : Increase in transmission and transformation capacity by 250MW and 120MVA	Extra 295MVA Transmission capacity is available. About 120MVA Transformation capacity is available.	Competent contractor is employed to deliver the project.
(4) Inputs/costs: Inputs : Ilesha - Ikinyinwa 132kV D.C Line (15km) + 2 x 60MVA 132/33kV S/S Costs : 2,877,500,000	**Funding**: **Balance to complete**:	Fully funded LC/ Timely release of fund.
(5) Others: The project is necessary for - power evacuation - Bulk supply - Reliability - Voltage Improvement.		

TRANSMISSION PROJECT LOGICAL FRAMEWORK		TCN
Iseyin - Shaki 132kV DC Transmission line (140km) + 2 x60MVA 132/33kV Substation @ Shaki		**Start Date : 2014** **Finish Date : 2016**
Project Narrative	**Indicators**	**Critical considerations**
(1)Programme Objective: To improve power delivery to Shaki	Economic and commercial activities will improve in Shaki.	Bulk Power Limitation to Shaki
(2) Project Objective: Bulk Power supply to Shaki	Additional 295MVA Transmission capacity to be utilised. About 120MVA Transformation capacity to be utilised.	About 250MW of power is delivered to Shaki
(3) Scope/Outputs: Scope: Iseyin - Shaki 132kV DC Transmission line (140km)+ 2 x60MVA 132/33kV Substation @ Shaki Outputs : Increase in transmission and transformation capacity by 250MW and 120MVA	Extra 295MVA Transmission capacity is available. About 120MVA Transformation capacity is available.	Competent contractor is employed to deliver the project.
(4) Inputs/costs: Inputs : Iseyin - Shaki 132kV DC Transmission line (140km)+ 2 x60MVA 132/33kV Substation @ Shaki Costs : 7,690,000,000	**Funding**: **Balance to complete**:	Fully funded LC/ Timely release of fund.
(5) Others: The project is necessary for - power evacuation - Bulk supply - Reliability - Voltage Improvement.		

TRANSMISSION PROJECT LOGICAL FRAMEWORK		TCN
Kashimbila - Tapkum - Wurakoi - Yandev(150km) + 2x60MVA 132/33kV substation		**Start Date : 2014** **Finish Date : 2016**
Project Narrative	**Indicators**	**Critical considerations**
(1)Programme Objective: To improve power delivery to Kashimbila,Tapkum and Wurakoi	Economic and commercial activities will improve in Kashimbila,Tapkum and Wurakoi	Bulk Power Limitation to Kashimbila,Tapkum and Wurakoi
(2) Project Objective: Bulk Power supply to Kashimbila,Tapkum and Wurakoi	Additional 295MVA Transmission capacity to be utilised. About 120MVA Transformation capacity to be utilised.	About 250MW of power is delivered to Kashimbila,Tapkum and Wurakoi
(3) Scope/Outputs: Scope: Kashimbila - Tapkum - Wurakoi - Yandev(150km) + 2x60MVA 132/33kV substation Outputs : Increase in transmission and transformation capacity by 295MVA and 120MVA	Extra 295MVA Transmission capacity is available. About 120MVA Transformation capacity is available.	Competent contractor is employed to deliver the project.
(4) Inputs/costs: Inputs : Kashimbila - Tapkum - Wurakoi - Yandev(150km) + 2x60MVA 132/33kV substation Costs : 8,075,000,000	**Funding**: **Balance to complete**:	Fully funded LC/ Timely release of fund.
(5) Others: The project is necessary for - power evacuation - Bulk supply - Reliability - Voltage Improvement.		

TRANSMISSION PROJECT LOGICAL FRAMEWORK		TCN
2x150MVA, 330/132kV + 2x60MVA, 132/33kV substation at New Ibadan, and turn-in-out of Oshogbo-Aiyede 330KVSC line at New Ibadan.		**Start Date : 2014** **Finish Date : 2016**
Project Narrative	**Indicators**	**Critical considerations**
(1)Programme Objective: To improve power delivery to New Ibadan	Economic and commercial activities will improve in New Ibadan .	Bulk Power Limitation to New Ibadan.
(2) Project Objective: Bulk Power supply to New Ibadan	Additional 300MVA Transformation capacity to be utilised.	About 255MW of power is delivered to New Ibadan
(3) Scope/Outputs: Scope: Construction of 2x150MVA, 330/132kV + 2x60MVA, 132/33kV substation at New Ibadan, and turn-in-out of Oshogbo-Ayede 330KVSC line at New Ibadan. Outputs : Increase in transformation capacity by 300MVA.	Extra 300MVA Transformation capacity is available.	Competent contractor is employed to deliver the project.
(4) Inputs/costs: Inputs : 2x150MVA, 330/132kV + 2x60MVA, 132/33kV substation at New Ibadan, and turn-in-out of Oshogbo-Ayede 330KVSC line at New Ibadan. Costs :	**Funding**: **Balance to complete**:	Fully funded LC/ Timely release of fund.
(5) **Others:** The project is necessary for - power evacuation - Bulk supply - Reliability - Voltage Improvement.		

TRANSMISSION PROJECT LOGICAL FRAMEWORK		TCN
Makurdi-Apir-North Bank 132kV DC line(30km), 2x60MVA, 132/33kV substation at North Bank and 132kV line bays extensions at Makurdi and Apir.		**Start Date : 2014** **Finish Date : 2016**
Project Narrative	**Indicators**	**Critical considerations**
(1)Programme Objective: To improve power delivery to Apir and North Bank of Benue State	Economic and commercial activities will improve in Apir and North Bank of Benue state	Bulk Power Limitation in Apir and North Bank
(2) Project Objective: Bulk Power supply to Apir and North Bank of Benue state	Additional 295MVA Transmission capacity to be utilised. About 120MVA Transformation capacity to be utilised.	About 250MW of power is delivered to Apir and North Bank
(3) Scope/Outputs: Scope: Makurdi-Apir-North Bank 132kV DC line(30km), 2x60MVA, 132/33kV substation at North Bank and 132kV line bays extensions at Makurdi and Apir. Outputs : Increase in transmission and transformation capacity by 295MVA and 120MVA	Extra 295MVA Transmission capacity is available. About 120MVA Transformation capacity is available.	Competent contractor is employed to deliver the project.
(4) Inputs/costs: Inputs : Makurdi-Apir-North Bank 132kV DC line(30km), 2x60MVA, 132/33kV substation at North Bank and 132kV line bays extensions at Makurdi and Apir. Costs : 5, 595, 000,000	**Funding**: **Balance to complete**:	Fully funded LC/ Timely release of fund.
(5) **Others:** The project is necessary for - power evacuation - Bulk supply - Reliability - Voltage Improvement.		

TRANSMISSION PROJECT LOGICAL FRAMEWORK		**TCN**
Ogbomosho - Oyo - Iseyin 132kV Transmission line (125km) with 2 x 60MVA Substation at Oyo		**Start Date : 2014** **Finish Date : 2016**
Project Narrative	**Indicators**	**Critical considerations**
(1)Programme Objective: To improve power delivery to Ogbomosho, Oyo and Iseyin	Economic and commercial activities will improve in Ogbomosho, Oyo and Iseyin	Bulk Power Limitation to Ogbomosho, Oyo and Iseyin
(2) Project Objective: Bulk Power supply to Ogbomosho, Oyo and Iseyin	Additional 295MVA Transmission capacity to be utilised. About 120MVA Transformation capacity to be utilised.	About 250MW of power is delivered to Ogbomosho, Oyo and Iseyin
(3) Scope/Outputs: Scope: Ogbomosho - Oyo - Iseyin 132kV Transmission line(125km) with 2 x 60MVA Substation at Oyo Outputs : Increase in transmission and transformation capacity by 295MVA and 120MVA	Extra 295MVA Transmission capacity is available. About 120MVA Transformation capacity is available.	Competent contractor is employed to deliver the project.
(4) Inputs/costs: Inputs : Ogbomosho - Oyo - Iseyin 132kV Transmission line(125km) with 2 x 60MVA Substation at Oyo Costs :7,112,500,000	**Funding**: **Balance to complete**:	Fully funded LC/ Timely release of fund.
(5) Others: The project is necessary for - power evacuation - Bulk supply - Reliability - Voltage Improvement.		

TRANSMISSION PROJECT LOGICAL FRAMEWORK		TCN
Project Title : Omoku - Yenegoa 330 kV double circuit line Bison Conductor (150km)+ line bay extensions.		**Start Date : 2013** **Finish Date : 2015**
Project Narrative	**Indicators**	**Critical considerations**
(1)Programme Objective: To improve power delivery to Bayelsa state.	Economic and commercial activities will improve in Yenogoa .	Limitation of bulk supply to the people of Yenogoa.
(2) Project Objective: Bulk Power supply to Bayelsa state.	Additional 1554MVA Transmission capacity to be utilised.	About 1320MW of power is delivered to Bayelsa
(3) Scope/Outputs: Scope: Construction of Omoku - Yenegoa 330 kV double circuit line Bison Conductor (150km)+ line bay extensions. Outputs : Increase in transmission capacity by 1554MVA.	Extra 1554MVA transmission capacity is available.	Competent contractor is employed to deliver the project.
(4) Inputs/costs: Inputs : Construction of Omoku - Yenegoa 330 kV double circuit line Bison Conductor (150km)+ line bay extensions. Costs :	**Funding**: **Balance to complete**:	Fully funded LC/ Timely release of fund.
(5) Others: The project is necessary for - power evacuation - Bulk supply - Reliability - Voltage Improvement.		

TRANSMISSION PROJECT LOGICAL FRAMEWORK		TCN
Omotosho - Agodo/Ibiade 132kV DC Transmission line (125km) + 2 line Bay Extension		**Start Date : 2014** **Finish Date : 2016**
Project Narrative	**Indicators**	**Critical considerations**
(1)Programme Objective: To improve power delivery to Agodo and Ibiade	Economic and commercial activities will improve in Agodo and Ibiade respectively.	Bulk Power Limitation to Agodo and Ibiade
(2) Project Objective: Bulk Power supply to Agodo and Ibiade	Additional 295MVA Transmission capacity to be utilised.	About 250MW of power is delivered to Agodo and Ibiade
(3) Scope/Outputs: Scope: Omotosho - Agodo/Ibiade 132kV DC Transmission line(125km) + 2 line Bay Extension Outputs : Increase in transmission capacity by 250MW	Extra 295MVA Transmission capacity is available.	Competent contractor is employed to deliver the project.
(4) Inputs/costs: Inputs : Omotosho - Agodo/Ibiade 132kV DC Transmission line(125km) + 2 line Bay Extension Costs : 7,512,500,000	**Funding**: **Balance to complete**:	Fully funded LC/ Timely release of fund.
(5) Others: The project is necessary for - power evacuation - Bulk supply - Reliability - Voltage Improvement.		

TRANSMISSION PROJECT LOGICAL FRAMEWORK		TCN
Project Title : 2 x 150MVA 330/132kV Substation at Yenegoa		**Start Date : 2014** **Finish Date : 2016**
Project Narrative	**Indicators**	**Critical considerations**
(1)Programme Objective: To improve power delivery to Bayelsa state.	Economic and commercial activities will improve in Yenogoa .	Limitation of bulk supply to the people of Yenogoa.
(2) Project Objective: Bulk Power supply to Bayelsa state.	Additional 300MVA Transformation capacity to be utilised.	About 255MW of power is delivered to Bayelsa
(3) Scope/Outputs: Scope: Construction of 2 x 150MVA 330/132kV Substation at Yenegoa Outputs : Increase in transformation capacity by 300MVA.	Extra 300MVA transformation capacity is available.	Competent contractor is employed to deliver the project.
(4) Inputs/costs: Inputs : 2 x 150MVA 330/132kV Substation at Yenegoa Costs :	**Funding**: **Balance to complete**:	Fully funded LC/ Timely release of fund.
(5) Others: The project is necessary for - power evacuation - Bulk supply - Reliability - Voltage Improvement.		

TRANSMISSION PROJECT LOGICAL FRAMEWORK		TCN
2 x 150MVA 330/132kV Substation + 2 x 60MVA 132/33kV substation at Igando + Construction of 5kM 330kV DC to turn-in-out of Ikeja West / Akangba 330kV DC Transmission Line		**Start Date : 2014** **Finish Date : 2016**
Project Narrative	**Indicators**	**Critical considerations**
(1)Programme Objective: To improve power delivery to Igando and Lagos State.	Economic and commercial activities will improve in Igando and Lagos State. .	Bulk Power Limitation to Igando and Lagos State.
(2) Project Objective: Bulk Power supply to Igando and Lagos State.	Additional 300MVA Transformation capacity to be utilised.	About 1320MW of power is delivered to Igando and Lagos State.
(3) Scope/Outputs: Scope: 2 x 150MVA 330/132kV Substation + 2 x 60MVA 132/33kV substation at Igando + Construction of 5kM 330kV DC to turn-in-out of Ikeja West / Akangba 330kV DC Transmission Line Outputs : Increase in transformation capacity by 300MVA.	Extra 300MVA Transformation capacity is available.	Competent contractor is employed to deliver the project.
(4) Inputs/costs: Inputs : 2 x 150MVA 330/132kV Substation + 2 x 60MVA 132/33kV substation at Igando + Construction of 5kM 330kV DC to turn-in-out of Ikeja West / Akangba 330kV DC Transmission Line Costs :	**Funding**: **Balance to complete**:	Fully funded LC/ Timely release of fund.
(5) Others: The project is necessary for - power evacuation - Bulk supply - Reliability - Voltage Improvement.		

TRANSMISSION PROJECT LOGICAL FRAMEWORK		TCN
Yandev - Katsina Ala - Wukari 132kV DC Transmission Line (125km) + 2 x 60MVA 132/33kV Substation at Katsina Ala & Wukari		**Start Date : 2014** **Finish Date : 2016**
Project Narrative	**Indicators**	**Critical considerations**
(1)Programme Objective: To improve power delivery to Katsina Ala and Wukari	Economic and commercial activities will improve in Katsina Ala and Wukari	Bulk Power Limitation to Katsina Ala and Wukari
(2) Project Objective: Bulk Power supply to Katsina Ala and Wukari	Additional 295MVA Transmission capacity to be utilised. About 120MVA Transformation capacity to be utilised.	About 250MW of power is delivered to Katsina Ala and Wukari
(3) Scope/Outputs: Scope: Yandev - Katsina Ala - Wukari 132kV DC Transmission Line(125km) + 2 x 60MVA 132/33kV Substation at Katsina Ala & Wukari Outputs :Increase in transmission and transformation capacity by 295MVA and 120MVA	Extra 295MVA Transmission capacity is available. About 120MVA Transformation capacity is available.	Competent contractor is employed to deliver the project.
(4) Inputs/costs: Inputs : Construction of Yandev - Katsina Ala - Wukari 132kV DC Transmission Line (125km) + 2 x 60MVA 132/33kV Substation at Katsina Ala & Wukari Costs : 7,112,500,000	**Funding**: **Balance to complete**:	Fully funded LC/ Timely release of fund.
(5) **Others:** The project is necessary for - power evacuation - Bulk supply - Reliability - Voltage Improvement.		

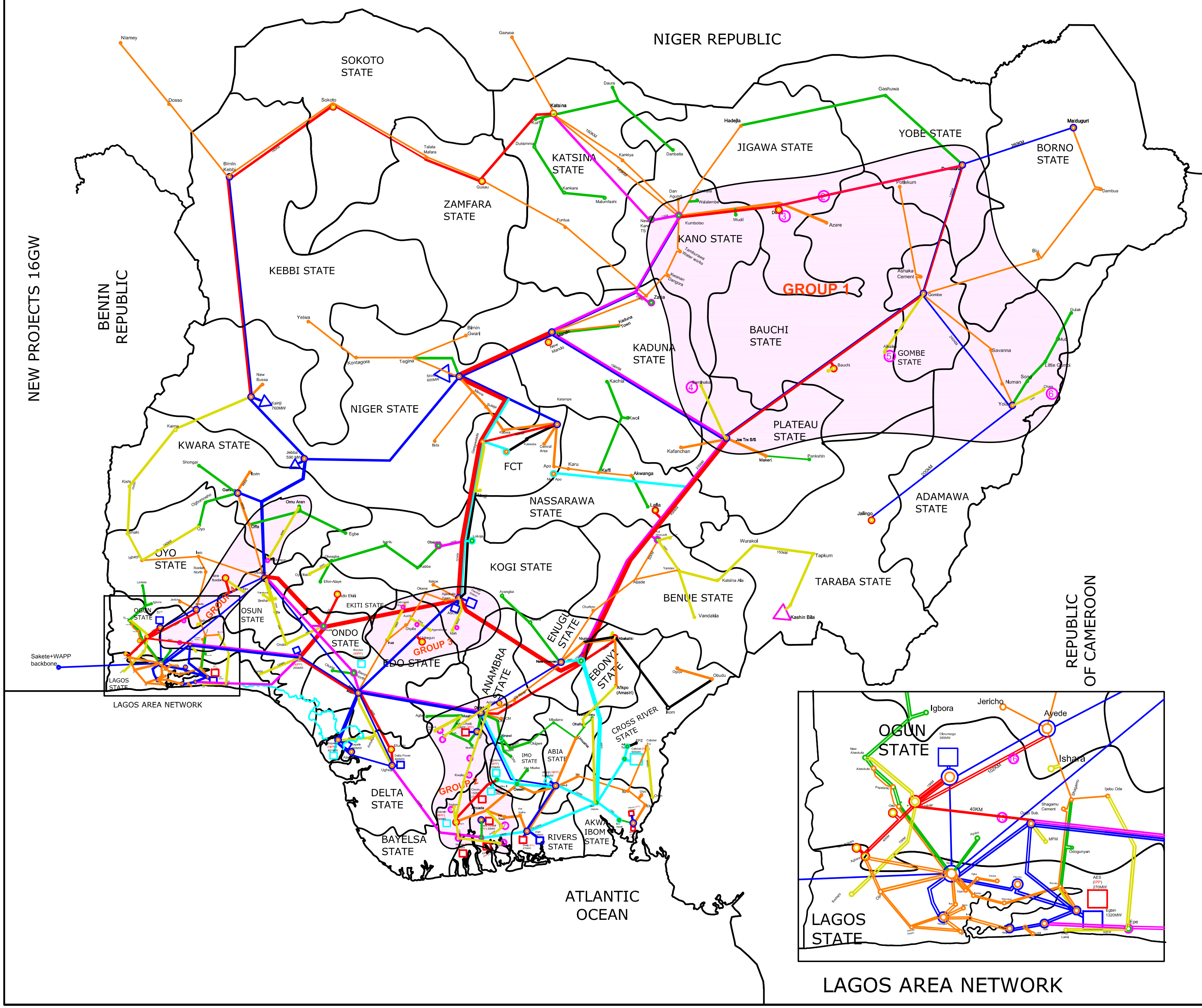
TRANSMISSION PROJECT LOGICAL FRAMEWORK		TCN
Yandev-Vandakia 132kV DC line(80km), 2x60MVA, 132/33kV substation at Vandakia and 2x132kV line bays extension at Yandev.		**Start Date : 2014** **Finish Date : 2016**
Project Narrative	**Indicators**	**Critical considerations**
(1)Programme Objective: To improve power delivery to Vandakia	Economic and commercial activities will improve in Vandakia	Bulk Power Limitation in Vandakia
(2) Project Objective: Bulk Power supply in Vandakia	Additional 295MVA Transmission capacity to be utilised. About 120MVA Transformation capacity to be utilised.	About 250MW of power is delivered to Vandakia
(3) Scope/Outputs: Scope: Yandev-Vandakia 132kV DC line(80km), 2x60MVA, 132/33kV substation at Vandakia and 2x132kV line bays extension at Yandev. Outputs : Increase in transmission and transformation capacity by 295MVA and 120MVA	Extra 295MVA Transmission capacity is available. About 120MVA Transformation capacity is available.	Competent contractor is employed to deliver the project.
(4) Inputs/costs: Inputs : Yandev-Vandakia 132kV DC line(80km), 2x60MVA, 132/33kV substation at Vandakia and 2x132kV line bays extension at Yandev. Costs : 5,780,000,000	**Funding**: **Balance to complete**:	Fully funded LC/ Timely release of fund.
(5) Others: The project is necessary for - power evacuation - Bulk supply - Reliability - Voltage Improvement.		

Appendix E Financing Package 4 – Incremental Projects for 16 GW System

NIGERIA MAP

16GW MODEL

GRID MAP CONTAINING EXISTING / ON-GOING / COMMITTED 330 / 132KV TRANSMISSION PROJECTS AND NECESSARY NEW PROJECTS FOR 16GW TRANSMISSION CAPABILITY



LAGOS AREA NETWORK

LEGEND

- PROPOSED 330KV TRANSMISSION LINES
- ON-GOING 330KV TRANSMISSION LINES BY TCN
- ON-GOING 330KV TRANSMISSION LINES BY NIPP
- ON-GOING 330KV TRANSMISSION LINES BY FMP
- EXISTING 330KV TRANSMISSION LINES
- PROPOSED 132KV TRANSMISSION LINES
- ON-GOING 132KV TRANSMISSION LINES BY TCN
- ON-GOING 132KV TRANSMISSION LINES BY NIPP
- EXISTING 132KV TRANSMISSION LINES
- PROPOSED 330/132KV BULK S/S
- ON-GOING 330/132KV BULK S/S
- ON-GOING 330/132KV BULK S/S BY NIPP
- EXISTING 330/132KV BULK S/S
- PROPOSED 132KV BULK S/S
- ON-GOING 132KV BULK S/S
- EXISTING 132KV BULK S/S
- ON-GOING/COMMITTED HYDRO POWER STATION
- EXISTING HYDRO POWER STATION
- EXISTING THERMAL POWER STATION
- EXISTING NIPP THERMAL POWER STATION
- IPP THERMAL POWER STATION

POWER HOLDING COMPANY OF NIGERIA (PHCN) PLC

Title: Existing, On-Gong and Proposed TCN/NIPP/IPP Projects

Prepared By	Power System Planning, Research & Development, TCN C/HQ	Scale: NOT TO SCALE
Checked By		
Recommended By		Date Feb, 2014
Approved By	GM (PSPD+R&D)	

Package-4 (New Projects for 16GW Network)

Group-1: Kano - Dutse - Damaturu 330kV Line

S/N	DESCRIPTION	COST= NAIRA
	Project Titles	**Estimated Total Project Costs**
1	Kano – Dutse- Damaturu 330KV DC transmission line(380km)	148,837,709
2	2X150MVA, 330/132kV substation at Dutse	21,875,000
Total		**$170,712,709.04**

Package-4 (New Projects for 16GW Network)
Group- 2: 132kV DC Line Jos - Samenaka

S/N	DESCRIPTION	COST= NAIRA
3	132kV DC Line from Jos - Samenaka (86km)+2x60MVA at Samenaka	34,443,750
4	Turn-in-Out from Jos - Bauchi - Gombe 132kV line to Alkaleri +2x60MVA (15km)	17,984,375
5	Turn-in-Out from Gombe - Yola 132Kv line to Cham+2X60mva at Chan (25km)	20,390,625
Total		**$72,818,750.00**

Package-4 (New Projects for 16GW Network)
Group- 3: Ahoada - Degema 132kV DC Line

S/N	DESCRIPTION	COST= $
6	Ahoada - Degema 132kV DC Transmission line (120km)+ 2 x 132kV Line Bay Extensions	43,250,000
7	Yenogoa - Sagbama 132kV DC Transmission Line (80km)+ 2 x 60MVA 132/33kV Substation at Sagbama	33,625,000
8	2X150MVA, 330/132kV and 2x60MVA 132/33KV substation at Okpai/Kwale	36,250,000
9	Kwale - Nsukwa 132kV Transmission Line(40km) + 2 x 60MVA 132/33kV Substation at Nsukka .	26,406,250
10	Nsukwa - Achalla - Ibuzo 132kV Transmission Line(40km) + 2 x 60MVA 132/33kV Substation at Achalla -Ibusa.	26,406,250
11	Asaba - Ogwashi Ukwu - Achala Ibuso132kV Transmission Line(60km) + 2 x 60MVA 132/33kV Substation at Ogwashi Ukwu.	26,406,250
12	Kwale - Abraka 132kV Transmission Line(60km) + 2 x 60MVA 132/33kV Substation at Abraka	30,781,250
13	Ughelli - Patani - Bomadi 132kV Transmission Line(60km) + 2 x 60MVA 132/33kV Substation each at Patani & Bomadi.	32,031,250
14	Ughelli - Oleh - Ivorogbo 132kV Transmission Line(60km) + 2 x 60MVA 132/33kV Substation each at Oleh & Ivorogbo.	43,281,250
15	Yenagoa - Otuoke -Nembe(45+40km) 132kV Transmission Line + 2 x 60MVA 132/33kV Substation each at Otuoke & Nembe.	43,281,250
16	Yenagoa - Okubie(75km) 132kV Transmission Line) + 2 x 60MVA 132/33kV Substation at Okubie.	43,281,250
19	Irua-Sabongadi Ora 132kV DC Transmission line (60)+ 2 x60MVA 132/33kV Substation Sabongadi Ora	26,406,250
20	Auchi-Agenebode 132kV DC Transmission line (50km)+ 2 x60MVA 132/33kV Substation Agenebode	26,406,250
	Total	**$437,812,500.00**

PACKAGE 4: NEW PROJECTS FOR 16GW NETWORK - FUND UTILIZATION IN US$						
No.	**Project Titles**	**Estimated Total Project Costs in US$**	**2015**	**2016**	**2017**	
1	Kano – Dutse- Damaturu 330KV DC transmission line(380km)	148,837,709	104,186,396	29,767,542	14,883,771	
2	2X150MVA, 330/132kV substation at Dutse	21,875,000	15,312,500	4,375,000	2,187,500	
3	132kV DC Line from Jos - Samenaka (86km)+2x60MVA at Samenaka	34,443,750	24,110,625	6,888,750	3,444,375	
4	Turn-in-Out from Jos - Bauchi - Gombe 132kV line to Alkaleri +2x60MVA (15km)	17,984,375	12,589,063	3,596,875	1,798,438	
5	Turn-in-Out from Gombe - Yola 132Kv line to Cham+2X60mva at Chan (25km)	20,390,625	14,273,438	4,078,125	2,039,063	
6	Ahoada - Degema 132kV DC Transmission line (120km)+ 2 x 132kV Line Bay Extensions	43,250,000	30,275,000	8,650,000	4,325,000	
7	Yenogoa - Sagbama 132kV DC Transmission Line (80km)+ 2 x 60MVA 132/33kV Substation at Sagbama	33,625,000	23,537,500	6,725,000	3,362,500	
8	2X150MVA, 330/132kV and 2x60MVA 132/33KV substation at Okpai/Kwale	36,250,000	25,375,000	7,250,000	3,625,000	
9	Kwale - Nsukwa 132kV Transmission Line(40km) + 2 x 60MVA 132/33kV Substation at Nsukka .	26,406,250	18,484,375	5,281,250	2,640,625	
10	Nsukwa - Achalla - Ibuzo 132kV Transmission Line(40km) + 2 x 60MVA 132/33kV Substation at Achalla -Ibusa.	26,406,250	18,484,375	5,281,250	2,640,625	
11	Asaba - Ogwashi Ukwu - Achala Ibuso132kV Transmission Line(60km) + 2 x 60MVA 132/33kV Substation at Ogwashi Ukwu.	26,406,250	18,484,375	5,281,250	2,640,625	
12	Kwale - Abraka 132kV Transmission Line(60km) + 2 x 60MVA 132/33kV Substation at Abraka	30,781,250	21,546,875	6,156,250	3,078,125	
13	Ughelli - Patani - Bomadi 132kV Transmission Line(60km) + 2 x 60MVA 132/33kV Substation each at Patani & Bomadi.	32,031,250	22,421,875	6,406,250	3,203,125	
14	Ughelli - Oleh - Ivorogbo 132kV Transmission Line(60km) + 2 x 60MVA 132/33kV Substation each at Oleh & Ivorogbo.	43,281,250	30,296,875	8,656,250	4,328,125	
15	Yenagoa - Otuoke -Nembe(45+40km) 132kV Transmission Line + 2 x 60MVA 132/33kV Substation each at Otuoke & Nembe.	43,281,250	30,296,875	8,656,250	4,328,125	
16	Yenagoa - Okubie(75km) 132kV Transmission Line) + 2 x 60MVA 132/33kV Substation at Okubie.	43,281,250	30,296,875	8,656,250	4,328,125	
17	2nd Arigbajo -Ayede 330kV D/C transmission line (102km).	36,975,000	25,882,500	7,395,000	3,697,500	
18	Ajaokuta-Idah 132kV DC Transmission line (80km) + 2 x60MVA 132/33kV Substation Idah	33,625,000	23,537,500	6,725,000	3,362,500	
19	Irua-Sabongadi Ora 132kV DC Transmission line (60)+ 2 x60MVA 132/33kV Substation Sabongadi Ora	26,406,250	18,484,375	5,281,250	2,640,625	
20	Auchi-Agenebode 132kV DC Transmission line (50km)+ 2 x60MVA 132/33kV Substation Agenebode	26,406,250	18,484,375	5,281,250	2,640,625	
21	Omu Aran - Ila Orangun 132kV Transmission line (80km)with 2 x 60MVA Substation at Ila Orangun	33,625,000	23,537,500	6,725,000	3,362,500	
22	Reactive Power Compensations + 132/33kV Substation reinforcements	183,562,500	128,493,750	36,712,500	18,356,250	
	Total (Transmission + Substation)	**$969,131,459**	**$678,392,021**	**$193,826,292**	**$96,913,146**	
Grand Total project cost for 16GW		**$969,131,459**	**$678,392,021**	**$193,826,292**	**$96,913,146**	

TRANSMISSION PROJECT LOGICAL FRAMEWORK		TCN
Project Title: 132KV 2 X 60MVA at Oporoma		**Start Date : 2017** **Finish Date : 2018**
Project Narrative	**Indicators**	**Critical considerations**
(1)Programme Objective: To improve power delivery to Oporoma and environs	Economic and commercial activities will improve in Oporoma and environs	Limitation of bulk power supply to Oporoma and environs
(2) Project Objective: Bulk Power supply to Kwale and Environs	Additional 120MVA transformation capacity to be utilised.	About 255MW of power is delivered to Oporoma and Environs
(3) Scope/Outputs: Scope: Construction of 132KV 2 X 60MVA at Oporoma Outputs :Increase in transformation capacity by 120MVA	Extra 120MVA transformation capacity is available.	Competent contractor is employed to deliver the project.
(4) Inputs/costs: Inputs : Construction of 132KV 2 X 60MVA at Oporoma Costs : 2,300,000,000	**Funding**: **Balance to complete**:	Fully funded LC/ Timely release of fund.
(5) **Others:** The project is necessary for - power evacuation - Bulk supply - Reliability - Voltage Improvement.		

TRANSMISSION PROJECT LOGICAL FRAMEWORK		TCN
Project Title : 132kV DC Line from Jos - Samenaka (86km)+2x60MVA at Samenaka		**Start Date : 2017** **Finish Date : 2018**
Project Narrative	**Indicators**	**Critical considerations**
(1)Programme Objective: To improve power delivery to Samenaka	Economic and commercial activities will improve in Samenaka	Limitation of bulk supply to Samenaka
(2) Project Objective: Bulk Power supply to Samenaka	Additional 120MVA Transformation capacity to be utilised.	About 255MW of power is delivered to Samenaka
(3) Scope/Outputs: Scope: Construction of 132kV DC Line from Jos - Samenaka (86km)+2x60MVA at Samenaka Outputs :Increase in transmission capacity by 300MVA.	Extra 300MVA transmission capacity is available.	Competent contractor is employed to deliver the project.
(4) Inputs/costs: Inputs : Construction of 132kV DC Line from Jos - Samenaka (86km)+2x60MVA at Samenaka Costs : 5,511,000,000	**Funding**: **Balance to complete**:	Fully funded LC/ Timely release of fund.
(5) **Others:** The project is necessary for - power evacuation - Bulk supply - Reliability - Voltage Improvement.		

TRANSMISSION PROJECT LOGICAL FRAMEWORK		TCN
Project Title: 2nd Arigbajo -Ayede 330kV D/C transmission line (102km).		**Start Date : 2017** **Finish Date : 2018**
Project Narrative	**Indicators**	**Critical considerations**
(1)Programme Objective: To improve power delivery to the Grid, Arigbajo and Environs	Economic and commercial activities will improve in Arigbajo and Environs	Power Evacuation constraint to the Grid. Limitation of bulk power supply to Arigbajo and environs
(2) Project Objective: Bulk Power supply to Arigbajo and Environs	Additional 1554MVA Transmission capacity to be utilised.	About 1320MW of power is delivered to the National Grid and to the people of Arigbajo
(3) Scope/Outputs: Scope: Construction of 2nd Arigbajo -Ayede 330kV D/C transmission line (102km). Outputs :Increase in transmission capacity by 1554MVA.	Extra 1554MVA transmission capacity is available.	Competent contractor is employed to deliver the project.
(4) Inputs/costs: Inputs : Construction of 2nd Arigbajo -Ayede 330kV D/C transmission line (102km). Costs : 5, 916, 000,000	**Funding**: **Balance to complete**:	Fully funded LC/ Timely release of fund.
(5) Others: The project is necessary for - power evacuation - Bulk supply - Reliability - Voltage Improvement.		

TRANSMISSION PROJECT LOGICAL FRAMEWORK		TCN
Project Title: Auchi-Agenebode 132kV DC Transmission line (50km)+ 2 x60MVA 132/33kV Substation Agenebode		**Start Date : 2017** **Finish Date : 2018**
Project Narrative	**Indicators**	**Critical considerations**
(1)Programme Objective: To improve power delivery to Agenebode and environs	Economic and commercial activities will improve in Agenebode and environs	Limitation of bulk power supply to Agenebode and environs
(2) Project Objective: Bulk Power supply to Agenebode and Environs	Additional 120MVA Transformation capacity to be utilised. About 300MVA transmission Capacity to be utilised	About 255MW of power is delivered to Agenebode and Environs
(3) Scope/Outputs: Scope: Construction of Auchi-Agenebode 132kV DC Transmission line (50km)+ 2 x60MVA 132/33kV Substation Agenebode Outputs :Increase in transformation and transmission capacities by 120MVA and 300MVA	Extra 120MVA transformation capacity is available. About 300MVA transmission Capacity is available	Competent contractor is employed to deliver the project.
(4) Inputs/costs: Inputs : Construction of Auchi-Agenebode 132kV DC Transmission line (50km)+ 2 x60MVA 132/33kV Substation Agenebode Costs : 4,225,000,000	**Funding**: **Balance to complete**:	Fully funded LC/ Timely release of fund.
(5) Others: The project is necessary for - power evacuation - Bulk supply - Reliability - Voltage Improvement.		

TRANSMISSION PROJECT LOGICAL FRAMEWORK		TCN
Project Title : Kano – Dutse- Damaturu 330KV DC transmission line(380km)		**Start Date : 2017** **Finish Date : 2018**
Project Narrative	**Indicators**	**Critical considerations**
(1)Programme Objective: To improve power delivery to Dutse and Damaturu	Economic and commercial activities will improve in Dutse and Damaturu .	Limitation of bulk supply to Dutse and Damaturu
(2) Project Objective: Bulk Power supply to Dutse and Damaturu	Additional 1554MVA Transmission capacity to be utilised.	About 1320MW of power is delivered to Dutse and Damaturu.
(3) Scope/Outputs: Scope: Construction of Kano – Dutse- Damaturu 330KV DC transmission line(380km) Increase in transmission capacity by 1554MVA.	Extra 1554MVA transmission capacity is available.	Competent contractor is employed to deliver the project.
(4) Inputs/costs: Inputs : Construction of of Kano – Dutse- Damaturu 330KV DC transmission line(380km) Costs : 23,814,033,446	**Funding**: **Balance to complete**:	Fully funded LC/ Timely release of fund.
(5) Others: The project is necessary for - power evacuation - Bulk supply - Reliability - Voltage Improvement.		

TRANSMISSION PROJECT LOGICAL FRAMEWORK		TCN
Project Title: Ogijo -Arigbajo 330KV DC Line (40km).		**Start Date : 2017** **Finish Date : 2018**
Project Narrative	**Indicators**	**Critical considerations**
(1)Programme Objective: To improve power delivery to the Grid, Arigbajo and Environs	Economic and commercial activities will improve in Arigbajo and Environs	Power Evacuation constraint to the Grid. Limitation of bulk power supply to Arigbajo and environs
(2) Project Objective: Bulk Power supply to the Grid, Arigbajo and Environs	Additional 1554MVA Transmission capacity to be utilised.	About 1320MW of power is delivered to the National Grid and to the people of Arigbajo
(3) Scope/Outputs: Scope: Construction of Ogijo -Arigbajo 330KV DC Line (40km). Outputs :Increase in transmission capacity by 1554MVA.	Extra 1554MVA transmission capacity is available.	Competent contractor is employed to deliver the project.
(4) Inputs/costs: Inputs : Construction of Ogijo -Arigbajo 330KV DC Line (40km). Costs : 2,320,000,000	**Funding**: **Balance to complete**:	Fully funded LC/ Timely release of fund.
(5) Others: The project is necessary for - power evacuation - Bulk supply - Reliability - Voltage Improvement.		

TRANSMISSION PROJECT LOGICAL FRAMEWORK		TCN
Project Title : Gwagwalada - Abaji 132KV DC Transmission Line (80km) + 2 x 60MVA 132/33kV Substation at Abaji + 2 Line Bay Extension		**Start Date : 2017** **Finish Date : 2018**
Project Narrative	**Indicators**	**Critical considerations**
(1)Programme Objective: To improve power delivery to Abaji	Economic and commercial activities will improve in Abaji .	Limitation of bulk supply to Abaji area council
(2) Project Objective: Bulk Power supply to Abaji area council	Additional 300MVA Transmission capacity to be utilised.	About 255MW of power is delivered to Abaji Area council.
(3) Scope/Outputs: Scope: Construction of Gwagwalada - Abaji 132KV DC Transmission Line (80km) + 2 x 60MVA 132/33kV Substation at Abaji + 2 Line Bay Extension Outputs : Increase in transmission capacity by 300MVA.	Extra 120MVA transformation capacity is available.	Competent contractor is employed to deliver the project.
(4) Inputs/costs: Inputs : Construction of of Gwagwalada - Abaji 132KV DC Transmission Line (80km) + 2 x 60MVA 132/33kV Substation at Abaji + 2 Line Bay Extension Costs : 5,780,000,000	**Funding**: **Balance to complete**:	Fully funded LC/ Timely release of fund.
(5) Others: The project is necessary for - power evacuation - Bulk supply - Reliability - Voltage Improvement.		

TRANSMISSION PROJECT LOGICAL FRAMEWORK		TCN
Project Title: Kwale - Achalla - Ibusa 132kV Transmission Line(165km) + 2 x 60MVA 132/33kV Substation at Achalla & Ibusa + 6 Line Bay Extensions		**Start Date : 2017** **Finish Date : 2018**
Project Narrative	**Indicators**	**Critical considerations**
(1)Programme Objective: To improve power delivery to Kwale , Achalla and Ibusa	Economic and commercial activities will improve Kwale , Achalla and Ibusa	Limitation of bulk power supply to Kwale , Achalla and Ibusa
(2) Project Objective: Bulk Power supply Kwale , Achalla and Ibusa	Additional 300MVA Transmission capacity to be utilised.	About 255MW of power is delivered to Kwale , Achalla and Ibusa
(3) Scope/Outputs: Scope: Construction of Kwale - Achalla - Ibusa 132kV Transmission Line(165km) + 2 x 60MVA 132/33kV Substation at Achalla & Ibusa + 6 Line Bay Extensions Outputs :Increase in transmission and transformation capacities by 300MVA and 120MVA	Extra 120MVA transformer capacity is available.	Competent contractor is employed to deliver the project.
(4) Inputs/costs: Inputs : Construction of Kwale - Achalla - Ibusa 132kV Transmission Line(165km) + 2 x 60MVA 132/33kV Substation at Achalla & Ibusa + 6 Line Bay Extensions Costs : 12,152,500,000	**Funding**: **Balance to complete**:	Fully funded LC/ Timely release of fund.
(5) Others: The project is necessary for - power evacuation - Bulk supply - Reliability - Voltage Improvement.		

TRANSMISSION PROJECT LOGICAL FRAMEWORK		TCN
Project Title : 2X150MVA, 330/132kV substation at Dutse		**Start Date : 2017** **Finish Date : 2018**
Project Narrative	**Indicators**	**Critical considerations**
(1)Programme Objective: To improve power delivery to Dutse	Economic and commercial activities will improve in Dutse	Limitation of bulk supply to Dutse
(2) Project Objective: Bulk Power supply to Dutse	Additional 300MVA Transformation capacity to be utilised.	About 1320MW of power is delivered to Dutse
(3) Scope/Outputs: Scope: Construction of 2X150MVA, 330/132kV substation at Dutse .Outputs :Increase in transformation capacity by 300MVA.	Extra 300MVA transformation capacity is available.	Competent contractor is employed to deliver the project.
(4) Inputs/costs: Inputs : Construction of 2X150MVA, 330/132kV substation at Dutse Costs : 3, 500, 000,000	**Funding**: **Balance to complete**:	Fully funded LC/ Timely release of fund.
(5) Others: The project is necessary for - power evacuation - Bulk supply - Reliability - Voltage Improvement.		

TRANSMISSION PROJECT LOGICAL FRAMEWORK		TCN
Project Title: 2X150MVA, 330/132kV and 2x60MVA 132/33KV substation at Kwale		**Start Date : 2017** **Finish Date : 2018**
Project Narrative	**Indicators**	**Critical considerations**
(1)Programme Objective: To improve power delivery to Kwale and environs	Economic and commercial activities will improve in Kwale and environs	Limitation of bulk power supply to Kwale and environs
(2) Project Objective: Bulk Power supply to Kwale and Environs	Additional 300MVA Transformation capacity to be utilised.	About 255MW of power is delivered to Kwale and Environs
(3) Scope/Outputs: Scope: Construction of 2X150MVA, 330/132kV and 2x60MVA 132/33KV substation at Kwale Outputs :Increase in transformation capacity by 300MVA .	Extra 300MVA transformation capacity is available.	Competent contractor is employed to deliver the project.
(4) Inputs/costs: Inputs : Construction of 2X150MVA, 330/132kV and 2x60MVA 132/33KV substation at Kwale Costs : 5, 380, 000,000	**Funding**: **Balance to complete**:	Fully funded LC/ Timely release of fund.
(5) Others: The project is necessary for - power evacuation - Bulk supply - Reliability - Voltage Improvement.		

TRANSMISSION PROJECT LOGICAL FRAMEWORK		**TCN**
Project Title: Yenogoa - Sagbama 132kV DC Transmission Line (80km)+ 2 x 60MVA 132/33kV Substation at Sagbama		**Start Date : 2017** **Finish Date : 2018**
Project Narrative	**Indicators**	**Critical considerations**
(1)Programme Objective: To improve power delivery to Sagbama and environs	Economic and commercial activities will improve in Sagbama and environs	Limitation of bulk power supply to Sagbama and environs
(2) Project Objective: Bulk Power supply to Sagbama and Environs	Additional 300MVA Transmission capacity to be utilised.	About 1320MW of power is delivered to Sagbama and Environs
(3) Scope/Outputs: Scope: Construction of Yenogoa - Sagbama 132kV DC Transmission Line (80km)+ 2 x 60MVA 132/33kV Substation at Sagbama Outputs :Increase in transmission and transformation capacities by 300MVA and 120MVA	Extra 120MVA transformation capacity is available.	Competent contractor is employed to deliver the project.
(4) Inputs/costs: Inputs : Construction of Yenogoa - Sagbama 132kV DC Transmission Line (80km)+ 2 x 60MVA 132/33kV Substation at Sagbama Costs : 5, 380, 000,000	**Funding**: **Balance to complete**:	Fully funded LC/ Timely release of fund.
(5) Others: The project is necessary for - power evacuation - Bulk supply - Reliability - Voltage Improvement.		

TRANSMISSION PROJECT LOGICAL FRAMEWORK		TCN
Project Title: Irua-Sabongadi Ora 132kV DC Transmission line (60)+ 2 x60MVA 132/33kV Substation Sabongadi Ora		**Start Date : 2017** **Finish Date : 2018**
Project Narrative	**Indicators**	**Critical considerations**
(1)Programme Objective: To improve power delivery to Sabongadi Ora and environs	Economic and commercial activities will improve in Sabongadi Ora and environs	Limitation of bulk power supply to Sabongadi Ora and environs
(2) Project Objective: Bulk Power supply to Sabongadi Ora and Environs	Additional 120MVA Transformation capacity to be utilised. About 300MVA transmission Capacity to be utilised	About 255MW of power is delivered to Sabongadi Ora and Environs
(3) Scope/Outputs: Scope: Construction of Irua-Sabongadi Ora 132kV DC Transmission line (60)+ 2 x60MVA 132/33kV Substation Sabongadi Ora Outputs :Increase in transformation and transmission capacities by 120MVA and 300MVA	Extra 120MVA transformation capacity is available. About 300MVA transmission Capacity is available	Competent contractor is employed to deliver the project.
(4) Inputs/costs: Inputs : Construction of Irua-Sabongadi Ora 132kV DC Transmission line (60)+ 2 x60MVA 132/33kV Substation Sabongadi Ora Costs : 4,225,000,000	**Funding**: **Balance to complete**:	Fully funded LC/ Timely release of fund.
(5) Others: The project is necessary for - power evacuation - Bulk supply - Reliability - Voltage Improvement.		

TRANSMISSION PROJECT LOGICAL FRAMEWORK		**TCN**
Project Title: Ahoada - Degema 132kV DC Transmission line (120km)+ 2 x 132kV Line Bay Extensions		**Start Date : 2017** **Finish Date : 2018**
Project Narrative	**Indicators**	**Critical considerations**
(1)Programme Objective: To improve power delivery to Degema and environs	Economic and commercial activities will improve in Degema and environs	Limitation of bulk power supply to Degema and environs
(2) Project Objective: Bulk Power supply to Degema and Environs	Additional300MVA Transmission capacity to be utilised.	About 255MW of power is delivered to Degema and Environs
(3) Scope/Outputs: Scope: Construction of Ahoada - Degema 132kV DC Transmission line (120km)+ 2 x 132kV Line Bay Extensions Outputs :Increase in transmission capacity by 300MVA.	Extra 300MVA transmission capacity is available.	Competent contractor is employed to deliver the project.
(4) Inputs/costs: Inputs : Construction of Ahoada - Degema 132kV DC Transmission line (120km)+ 2 x 132kV Line Bay Extensions Costs :6,920,000,000	**Funding**: **Balance to complete**:	Fully funded LC/ Timely release of fund.
(5) Others: The project is necessary for - power evacuation - Bulk supply - Reliability - Voltage Improvement.		

TRANSMISSION PROJECT LOGICAL FRAMEWORK		TCN
Project Title : Turn-in-Out from Gombe - Yola 132Kv line to Chan+2X60mva at Chan (25km)		**Start Date : 2017** **Finish Date : 2018**
Project Narrative	**Indicators**	**Critical considerations**
(1)Programme Objective: To improve power delivery to Yola and Chan	Economic and commercial activities will improve in Yola and Chan	Limitation of bulk supply to Yola and Chan
(2) Project Objective: Bulk Power supply to Yola and Chan	Additional 120MVA Transformation capacity to be utilised.	About 255MW of power is delivered to Yola and Chan
(3) Scope/Outputs: Scope: Construction of Turn-in-Out from Gombe - Yola 132Kv line to Chan+2X60mva at Chan (25km) Outputs :Increase in transmission capacity by 300MVA.	Extra 300MVA transmission capacity is available.	Competent contractor is employed to deliver the project.
(4) Inputs/costs: Inputs : Construction of Turn-in-Out from Gombe - Yola 132Kv line to Chan+2X60mva at Chan (25km) Costs : 3,262,500,000	**Funding**: **Balance to complete**:	Fully funded LC/ Timely release of fund.
(5) Others: The project is necessary for - power evacuation - Bulk supply - Reliability - Voltage Improvement.		

TRANSMISSION PROJECT LOGICAL FRAMEWORK		**TCN**
Project Title : Turn-in-Out from Jos - Bauchi - Gombe 132kV line to Alkaleri +2x60MVA (15km)		**Start Date : 2017** **Finish Date : 2018**
Project Narrative	**Indicators**	**Critical considerations**
(1)Programme Objective: To improve power delivery to Alkaleri	Economic and commercial activities will improve in Alkaleri	Limitation of bulk supply to Alkaleri
(2) Project Objective: Bulk Power supply to Alkaleri	Additional 120MVA Transformation capacity to be utilised.	About 255MW of power is delivered to Alkaleri
(3) Scope/Outputs: Scope: Construction of Turn-in-Out from Jos - Bauchi - Gombe 132kV line to Alkaleri +2x60MVA (15km) Outputs :Increase in transmission capacity by 300MVA.	Extra 300MVA transmission capacity is available.	Competent contractor is employed to deliver the project.
(4) Inputs/costs: Inputs : Construction of Turn-in-Out from Jos - Bauchi - Gombe 132kV line to Alkaleri +2x60MVA (15km) Costs : 2,877,500,000	**Funding**: **Balance to complete**:	Fully funded LC/ Timely release of fund.
(5) Others: The project is necessary for - power evacuation - Bulk supply - Reliability - Voltage Improvement.		

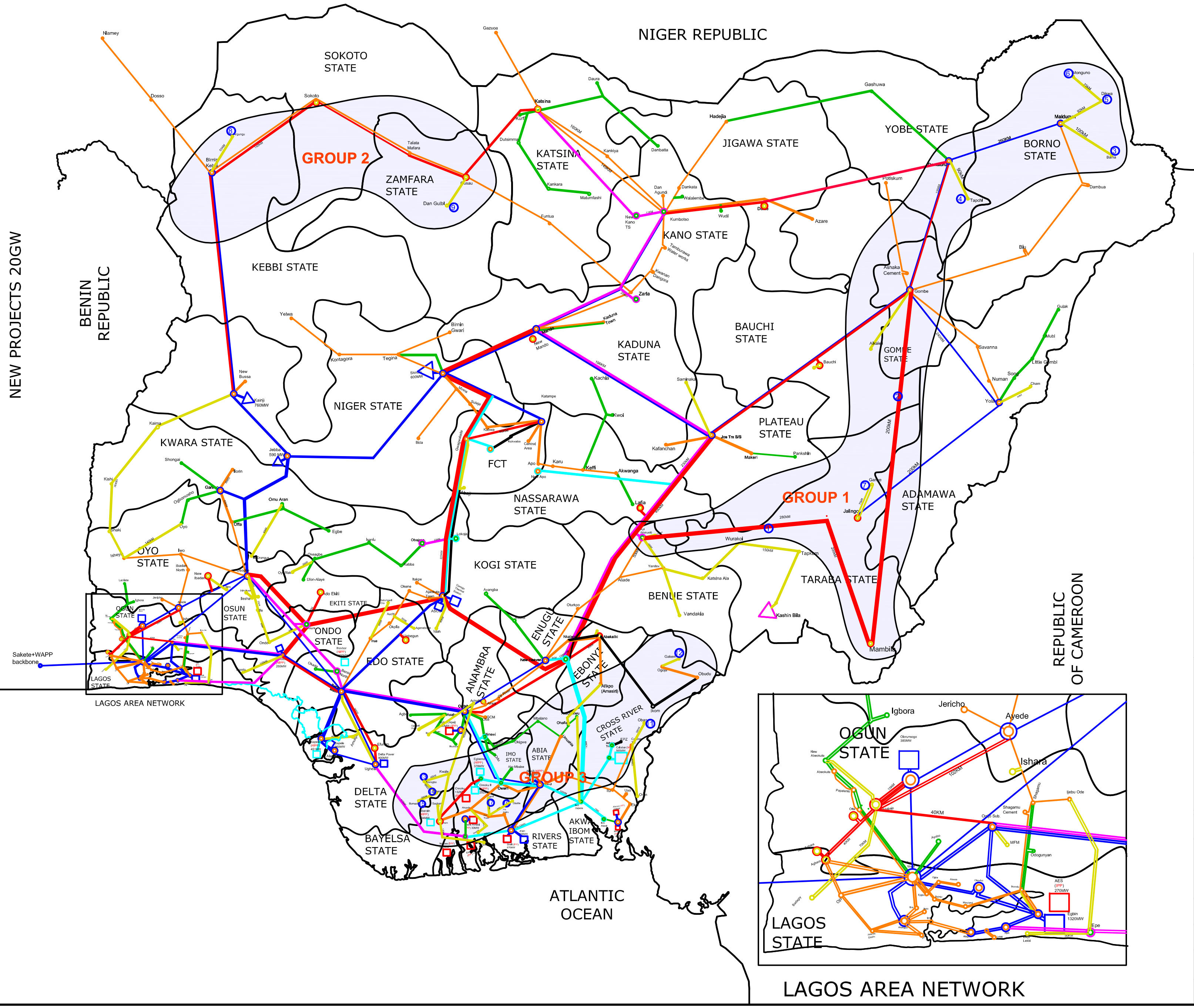
TRANSMISSION PROJECT LOGICAL FRAMEWORK		**TCN**
Project Title: 132Kv DC Line from Yenagoa - Oporoma(120km)		**Start Date : 2017** **Finish Date : 2018**
Project Narrative	**Indicators**	**Critical considerations**
(1)Programme Objective: To improve power delivery to Oporoma and environs	Economic and commercial activities will improve in Oporoma and environs	Limitation of bulk power supply to Oporoma and environs
(2) Project Objective: Bulk Power supply to Oporoma and Environs	Additional 300MVA Transmission capacity to be utilised.	About 255MW of power is delivered to Oporoma and Environs
(3) Scope/Outputs: Scope: Construction of 132Kv DC Line from Yenagoa - Oporoma(120km) Outputs :Increase in transmission capacity by 300MVA	Extra 300MVA transmission capacity is available.	Competent contractor is employed to deliver the project.
(4) Inputs/costs: Inputs : Construction of 132Kv DC Line from Yenagoa - Oporoma(120km) Costs : 4, 620, 000,000	**Funding**: **Balance to complete**:	Fully funded LC/ Timely release of fund.
(5) Others: The project is necessary for - power evacuation - Bulk supply - Reliability - Voltage Improvement.		

Appendix F Financing Package 5 – Incremental Projects for 20 GW System

NIGERIA MAP

20GW MODEL

GRID MAP CONTAINING EXISTING / ON-GOING / COMMITTED 330 / 132KV TRANSMISSION PROJECTS AND NECESSARY NEW PROJECTS FOR 20GW TRANSMISSION CAPABILITY



LEGEND

	PROPOSED 330KV TRANSMISSION LINES
	ON-GOING 330KV TRANSMISSION LINES BY TCN
	ON-GOING 330KV TRANSMISSION LINES BY NIPP
	ON-GOING 330KV TRANSMISSION LINES BY FMP
	EXISTING 330KV TRANSMISSION LINES
	PROPOSED 132KV TRANSMISSION LINES
	ON-GOING 132KV TRANSMISSION LINES BY TCN
	ON-GOING 132KV TRANSMISSION LINES BY NIPP
	EXISTING 132KV TRANSMISSION LINES
	PROPOSED 330/132KV BULK S/S
	ON-GOING 330/132KV BULK S/S
	ON-GOING 330/132KV BULK S/S BY NIPP
	EXISTING 330/132KV BULK S/S
	PROPOSED 132KV BULK S/S
	ON-GOING 132KV BULK S/S
	EXISTING 132KV BULK S/S
	ON-GOING/COMMITTED HYDRO POWER STATION
	EXISTING HYDRO POWER STATION
	EXISTING THERMAL POWER STATION
	EXISTING NIPP THERMAL POWER STATION
	IPP THERMAL POWER STATION

POWER HOLDING COMPANY OF NIGERIA (PHCN) PLC

Title: Existing, On-Gong and Proposed

TCN/NIPP/IPP Projects

Prepared By	Power System Planning, Research & Development, TCN C/HQ	Scale: NOT TO SCALE
Checked By		
Recommended By		Date Feb, 2014
Approved By	GM (PSPD+R&D)	

GROUP 1

Package-5 (New Projects for 20GW Network)

Group-1: Mambila - Makurdi 330kV DC QUAD Conductor

TYPES	S/N	PROJECT DESCRIPTION	COST
TRANSMISSION LINES AND SUBSTATION	1	Mambila - Makurdi – 330 kV double circuit line QUAD Conductor (280km)+ line bay extensions.	177,625,000.00
	2	Mambila -Gombe 330 kV double circuit line QUAD Conductor (200km)+ line bay extensions.	126,950,000
	3	Maiduguri-Bama132kV DC line (100km)and 2x60MVA, 132/33kV substation at Bama with 2x132kV line bay extension atMaiduguri	43,112,500
	4	Damaturu-Tapchi 132kV DC line (90km)and 2x60MVA, 132/33kV substation at Tapchi with 2x132kV line bay extension at Damaturu	39,975,000
	5	Maiduguri-Dikwa 132kV DC line(92km) and 2x60MVA, 132/33kV substation at Dikwa with 2x132kV line bay extension at Maiduguri	43,531,250
	6	Dikwa-Monguno 132kV DC line (75km) and 2x60MVA, 132/33kV substation at Mnguno with 2x132kV line bay extension at Dikwa	34,921,875
	7	Jalingo-Ganye 132kV DC line (75km) and 2x60MVA, 132/33kV substation at Ganye with 2x132kV line bay extension at Jalingo.	38,531,250
	8	Jalingo-Mutum biyo - Wukari 132kV DC line (120+ 80km) and 2x60MVA, 132/33kV substation at Mutum biyo with 2x132kV line bay extension at Jalingo.	34,921,875
			539,568,750.00

GROUP 2

Package-5 (New Projects for 20GW Network)
Group-2: Birnin Kebbi - Arugungu 132kV DC Line

TYPES	S/N	PROJECT DESCRIPTION	COST
TRANSMISSION LINES AND SUBSTATION	8	Birnin Kebbi-Arugungu 132kV DC line (53km) and 2x60MVA, 132/33kV substation at Argungu with 2x132kV line bay extension at Birni Kebbi.	29,628,125
	9	Gusau-Dan Gulbi 132kV DC line(83km) and 2x60MVA, 132/33kV substation atDan Gulbi with 2x132kV line bay extension at Gusau.	36,846,875
			66,475,000

GROUP 3

Package-5 (New Projects for 20GW Network)

Group-3: Calabar - Oban 132kV DC Line

TYPES	S/N	PROJECT DESCRIPTION	COST
TRANSMISSION LINES AND SUBSTATION	11	Calabar-Oban 132kV DC line (58km)and 2x60MVA, 132/33kV substation at Obanwith 2x132kV line bay extension at Calabar	30,831,250
	10	2nd Akangba-Amuwo 132kV DC line(15km) .	3,609,375
	12	Ogoja-Gakem 132kV DC line (30km) and 2x60MVA, 132/33kV substation at Gakem with 2x132kV line bay extension at Ogoja.	24,093,750
	15	Ogbomoso - Ejigbo 132kV DC line (30km) and 2x60MVA, 132/33kV substation at Ejigbo with 2x132kV line bay extension at Ogbomoso	24,093,750
	14	Ivorogbo-Patani 132kV DC line (30km) and 2x60MVA, 132/33kV substation atPatani with 2x132kV line bay extension at Ivorogbo	24,093,750
	15	Patani-Bomadi 132kV DC line (30km) and 2x60MVA, 132/33kV substation at Bomadi with 2x132kV line bay extension at Patani	24,093,750
	16	PH-Obehie 132kV DC line (30km) and 2x60MVA, 132/33kV substation at Obehi with 2x132kV line bay extension at PH	24,093,750
	17	PH-Ogoni 132kV DC line(35km) and 2x60MVA, 132/33kV substation at Ogoni with 2x132kV line bay extension at PH	25,296,875
			180,206,250

PACKAGE 5: NEW PROJECTS FOR 20GW NETWORK - FUND UTILIZATION IN US$						
No.	**Project Titles**	**Estimated Total Project Costs in US$**	**2015**	**2016**	**2017**	
1	Mambila - Makurdi – 330 kV double circuit line QUAD Conductor (280km)+ line bay extensions.	177,625,000.00	124,337,500	35,525,000	17,762,500	
2	Mambila -Gombe 330 kV double circuit line QUAD Conductor (200km)+ line bay extensions.	126,950,000	88,865,000	25,390,000	12,695,000	
3	Maiduguri-Bama132kV DC line (100km)and 2x60MVA, 132/33kV substation at Bama with 2x132kV line bay extension atMaiduguri	43,112,500	30,178,750	8,622,500	4,311,250	
4	Damaturu-Tapchi 132kV DC line (90km)and 2x60MVA, 132/33kV substation at Tapchi with 2x132kV line bay extension at Damaturu	39,975,000	27,982,500	7,995,000	3,997,500	
5	Maiduguri-Manguno 132kV DC line(150km) and 2x60MVA, 132/33kV substation at Dikwa with 2x132kV line bay extension at Maiduguri	43,531,250	30,471,875	8,706,250	4,353,125	
6	Maiduguri - Benisheikh 132kV DC line (75km) and 2x60MVA, 132/33kV substation at Benisheikh with 2x132kV line bay extension atMaiduguri.	34,921,875	24,445,313	6,984,375	3,492,188	
7	Jalingo-Mayobelewa - Ganye 132kV DC line (120+ 50km) and 2x60MVA, 132/33kV substation at Mutum biyo with 2x132kV line bay extension at Jalingo.	38,531,250	26,971,875	7,706,250	3,853,125	
8	Jalingo-Mutum biyo - Wukari 132kV DC line (120+ 80km) and 2x60MVA, 132/33kV substation at Mutum biyo with 2x132kV line bay extension at Jalingo.	34,921,875	24,445,313	6,984,375	3,492,188	
9	Birnin Kebbi-Arugungu 132kV DC line (53km) and 2x60MVA, 132/33kV substation at Argungu with 2x132kV line bay extension at Birni Kebbi.	29,628,125	20,739,688	5,925,625	2,962,813	
10	Gusau-Dan Gulbi 132kV DC line(83km) and 2x60MVA, 132/33kV substation atDan Gulbi with 2x132kV line bay extension at Gusau.	36,846,875	25,792,813	7,369,375	3,684,688	
11	2nd Akangba-Amuwo 132kV DC line(15km) .	3,609,375	2,526,563	721,875	360,938	
12	Calaba-Oban 132kV DC line (58km)and 2x60MVA, 132/33kV substation at Obanwith 2x132kV line bay extension at Calabar	30,831,250	21,581,875	6,166,250	3,083,125	
13	Ogoja-Gakem 132kV DC line (30km) and 2x60MVA, 132/33kV substation at Gakem with 2x132kV line bay extension at Ogoja.	24,093,750	16,865,625	4,818,750	2,409,375	
14	Ivorogbo-Patani 132kV DC line (30km) and 2x60MVA, 132/33kV substation atPatani with 2x132kV line bay extension at Ivorogbo	24,093,750	16,865,625	4,818,750	2,409,375	
15	Ogbomoso - Ejigbo 132kV DC line (30km) and 2x60MVA, 132/33kV substation at Ejigbo with 2x132kV line bay extension at Ogbomoso	24,093,750	16,865,625	4,818,750	2,409,375	
16	PH-Obehie 132kV DC line (30km) and 2x60MVA, 132/33kV substation at Obehi with 2x132kV line bay extension at PH	24,093,750	16,865,625	4,818,750	2,409,375	
17	PH-Ogoni 132kV DC line(35km) and 2x60MVA, 132/33kV substation at Ogoni with 2x132kV line bay extension at PH	25,296,875	17,707,813	5,059,375	2,529,688	
	Total (Transmission + Substation)	**$762,156,250**	**$533,511,390**	**$152,433,266**	**$76,217,642**	
Grand Total project cost for 20GW		**$762,156,250**	**$533,511,390**	**$152,433,266**	**$76,217,642**	

TRANSMISSION PROJECT LOGICAL FRAMEWORK		TCN
Project Title : 2nd Akangba-Amuwo 132kV DC line(15km) .		**Start Date : 2016** **Finish Date : 2018**
Project Narrative	**Indicators**	**Critical considerations**
(1)Programme Objective: To improve power delivery to Amuwo and environs	Economic and commercial activities will improve in Amuwo and environs	Limitation of bulk supply to the people of Amuwo and environs
(2) Project Objective: Bulk Power supply to Amuwo and environs	Additional 300MVA Transmission capacity to be utilised.	About 255MW of power is delivered to Amuwo and environs
(3) Scope/Outputs: Scope: 2nd Akangba-Amuwo 132kV DC line(15km) Outputs : Increase in transmission capacities by 300MVA	Extra 300MVA transmission capacity is available.	Competent contractor is employed to deliver the project.
(4) Inputs/costs: Inputs 2nd Akangba-Amuwo 132kV DC line(15km) Costs : 577,500,000	**Funding**: **Balance to complete**:	Fully funded LC/ Timely release of fund.
(5) Others: The project is necessary for - power evacuation - Bulk supply - Reliability - Voltage Improvement.		

TRANSMISSION PROJECT LOGICAL FRAMEWORK		**TCN**
Project Title : Dikwa-Monguno 132kV DC line (75km) and 2x60MVA, 132/33kV substation at Mnguno with 2x132kV line bay extension at Dikwa		**Start Date : 2016** **Finish Date : 2018**
Project Narrative	**Indicators**	**Critical considerations**
(1)Programme Objective: To improve power delivery to Monguno and Environs	Economic and commercial activities will improve in Monguno and environs.	Limitation of bulk supply to Monguno and Environs
(2) Project Objective: Bulk Power supply will be available to the people of Monguno	Additional transmission and transformation capacities of 300MVA and 120MVA to be utilised.	About 255MW is delivered to the people of Monguno
(3) Scope/Outputs: Scope: Construction of Dikwa-Monguno 132kV DC line (75km) and 2x60MVA, 132/33kV substation at Mnguno with 2x132kV line bay extension at Dikwa Outputs :Increase in Transmission and transformation capacities by 300MVA and 120MVA	Extra transmission and transformation capacities of 300MVA and 120MVA is available.	Competent contractor is employed to deliver the project.
(4) Inputs/costs: Inputs Construction of Dikwa-Monguno 132kV DC line (75km) and 2x60MVA, 132/33kV substation at Mnguno with 2x132kV line bay extension at Dikwa Costs :	**Funding**: **Balance to complete**:	Fully funded LC/ Timely release of fund.
(5) Others: The project is necessary for - power evacuation - Bulk supply - Reliability - Voltage Improvement.		

TRANSMISSION PROJECT LOGICAL FRAMEWORK		TCN
Project Title : Mambila -Gombe 330 kV double circuit line QUAD Conductor (200km)+ line bay extensions.		**Start Date : 2016** **Finish Date : 2018**
Project Narrative	**Indicators**	**Critical considerations**
(1)Programme Objective: To improve power delivery to Nigerians	Economic and commercial activities will improve in Nigeria and Neighbouring Countries.	Power Evacuation constraint from Mambila to the grid.
(2) Project Objective: Bulk Power will be available to Nigerians	Additional 2600MW to be utilised.	About 2600MW of power will be delivered to the grid
(3) Scope/Outputs: Scope: Construction of Mambila - Makurdi – 330 kV double circuit line QUAD Conductor (280km)+ line bay extensions. Outputs : Increase in Transmission and Generation capacities by 300MVA and 2600MW	Extra 2600MW is available.	Competent contractor is employed to deliver the project.
(4) Inputs/costs: Inputs Construction Mambila - Makurdi – 330 kV double circuit line QUAD Conductor (280km)+ line bay extensions. Costs :	**Funding**: **Balance to complete**:	Fully funded LC/ Timely release of fund.
(5) **Others:** The project is necessary for - power evacuation - Bulk supply - Reliability - Voltage Improvement.		

TRANSMISSION PROJECT LOGICAL FRAMEWORK		TCN
Project Title : Mambila - Makurdi – 330 kV double circuit line QUAD Conductor (280km)+ line bay extensions.		**Start Date : 2016** **Finish Date : 2018**
Project Narrative	**Indicators**	**Critical considerations**
(1)Programme Objective: To improve power delivery to Nigerians	Economic and commercial activities will improve in Nigeria and Neighbouring Countries.	Power Evacuation constraint from Mambila to the grid.
(2) Project Objective: Bulk Power will be available to Nigerians	Additional 2600MW to be utilised.	About 2600MW of power will be delivered to the grid
(3) Scope/Outputs: Scope: Construction of Mambila - Makurdi – 330 kV double circuit line QUAD Conductor (280km)+ line bay extensions. Outputs : Increase in Transmission and Generation capacities by 300MVA and 2600MW	Extra 2600MW is available.	Competent contractor is employed to deliver the project.
(4) Inputs/costs: Inputs Construction of Mambila - Makurdi – 330 kV double circuit line QUAD Conductor (280km)+ line bay extensions. Costs :	**Funding**: **Balance to complete**:	Fully funded LC/ Timely release of fund.
(5) **Others:** The project is necessary for - power evacuation - Bulk supply - Reliability - Voltage Improvement.		

TRANSMISSION PROJECT LOGICAL FRAMEWORK		TCN
Project Title : Birnin Kebbi-Arugungu 132kV DC line (53km) and 2x60MVA, 132/33kV substation at Argungu with 2x132kV line bay extension at Birnin Kebbi.		**Start Date : 2016** **Finish Date : 2018**
Project Narrative	**Indicators**	**Critical considerations**
(1)Programme Objective: To improve power delivery to Arugungu and environs	Economic and commercial activities will improve in Arugungu and environs.	Limitation of bulk supply to the people of Arugungu and environs
(2) Project Objective: Bulk Power supply to Arugungu and environs	Additional 300MVA Transmission capacity to be utilised. About 120MVA transformation capacity to be utilised	About 255MW of power is delivered to Arugungu and environs
(3) Scope/Outputs: Scope: Construction of Birnin Kebbi-Arugungu 132kV DC line (53km) and 2x60MVA, 132/33kV substation at Argungu with 2x132kV line bay extension at Birnin Kebbi. Outputs : Increase in transformation and transmission capacities by 120 MVA and 300MVA	Extra 300MVA transmission capacity is available. About 120MVA transformation capacity is available	Competent contractor is employed to deliver the project.
(4) Inputs/costs: Inputs : Construction of Birnin Kebbi-Arugungu 132kV DC line (53km) and 2x60MVA, 132/33kV substation at Argungu with 2x132kV line bay extension at Birnin Kebbi. Costs : 4,740,500,000	**Funding**: **Balance to complete**:	Fully funded LC/ Timely release of fund.
(5) Others: The project is necessary for - power evacuation - Bulk supply - Reliability - Voltage Improvement.		

TRANSMISSION PROJECT LOGICAL FRAMEWORK		TCN
Project Title : Maiduguri-Bama132kV DC line (100km)and 2x60MVA, 132/33kV substation at Bama with 2x132kV line bay extension at Maiduguri		**Start Date : 2016** **Finish Date : 2018**
Project Narrative	**Indicators**	**Critical considerations**
(1)Programme Objective: To improve power delivery to Bama and Environs	Economic and commercial activities will improve in Bama and environs.	Limitation of bulk supply to Bama and Environs
(2) Project Objective: Bulk Power supply will be available to the people of Bama	Additional transmission and transformation capacities of 300MVA and 120MVA to be utilised.	About 255MW is delivered to the people of Bama
(3) Scope/Outputs: Scope: Construction of Maiduguri-Bama132kV DC line (100km)and 2x60MVA, 132/33kV substation at Bama with 2x132kV line bay extension at Maiduguri Outputs :Increase in Transmission and transformation capacities by 300MVA and 120MVA	Extra transmission and transformation capacities of 300MVA and 120MVA is available.	Competent contractor is employed to deliver the project.
(4) Inputs/costs: Inputs Construction of Maiduguri-Bama132kV DC line (100km) and 2x60MVA, 132/33kV substation at Bama with 2x132kV line bay extension at Maiduguri Costs :	**Funding**: **Balance to complete**:	Fully funded LC/ Timely release of fund.
(5) **Others:** The project is necessary for - power evacuation - Bulk supply - Reliability - Voltage Improvement.		

TRANSMISSION PROJECT LOGICAL FRAMEWORK		TCN
Project Title : Patani-Bomadi 132kV DC line (30km) and 2x60MVA, 132/33kV substation at Bomadi with 2x132kV line bay extension at Patani		**Start Date : 2016** **Finish Date : 2018**
Project Narrative	**Indicators**	**Critical considerations**
(1)Programme Objective: To improve power delivery to Bomadi and environs	Economic and commercial activities will improve in Bomadi and environs	Limitation of bulk supply to the people of Bomadi and environs
(2) Project Objective: Bulk Power supply to Bomadi and environs	Additional 300MVA Transmission capacity to be utilised. About 120MVA transformation capacity to be utilised	About 255MW of power is delivered to Bomadi and environs
(3) Scope/Outputs: Scope: Construction of Patani-Bomadi 132kV DC line (30km) and 2x60MVA, 132/33kV substation at Bomadi with 2x132kV line bay extension at Patani Outputs : Increase in transformation and transmission capacities by 120 MVA and 300MVA	Extra 300MVA transmission capacity is available. About 120MVA transformation capacity is available	Competent contractor is employed to deliver the project.
(4) Inputs/costs: Inputs : Patani-Bomadi 132kV DC line (30km) and 2x60MVA, 132/33kV substation at Bomadi with 2x132kV line bay extension at Patani Costs : 3, 855, 000,000	**Funding**: **Balance to complete**:	Fully funded LC/ Timely release of fund.
(5) Others: The project is necessary for - power evacuation - Bulk supply - Reliability - Voltage Improvement.		

TRANSMISSION PROJECT LOGICAL FRAMEWORK		**TCN**
Project Title : Gusau-Dan Gulbi 132kV DC line (83km) and 2x60MVA, 132/33kV substation at Dan Gulbi with 2x132kV line bay extension at Gusau.		**Start Date : 2016** **Finish Date : 2018**
Project Narrative	**Indicators**	**Critical considerations**
(1)Programme Objective: To improve power delivery to Dan Gulbi and environs	Economic and commercial activities will improve in Dan Gulbi and environs	Limitation of bulk supply to the people of Dan Gulbi and environs
(2) Project Objective: Bulk Power supply to Dan Gulbi and environs	Additional 300MVA Transmission capacity to be utilised. About 120MVA transformation capacity to be utilised	About 255MW of power is delivered to Dan Gulbi and environs
(3) Scope/Outputs: Scope: Construction of Gusau-Dan Gulbi 132kV DC line(83km) and 2x60MVA, 132/33kV substation at Dan Gulbi with 2x132kV line bay extension at Gusau. Outputs : Increase in transformation and transmission capacities by 120 MVA and 300MVA	Extra 300MVA transmission capacity is available. About 120MVA transformation capacity is available	Competent contractor is employed to deliver the project.
(4) Inputs/costs: Inputs : Construction of Gusau-Dan Gulbi 132kV DC line(83km) and 2x60MVA, 132/33kV substation at Dan Gulbi with 2x132kV line bay extension at Gusau. Costs : 5,895,500,000	**Funding**: **Balance to complete**:	Fully funded LC/ Timely release of fund.
(5) **Others:** The project is necessary for - power evacuation - Bulk supply - Reliability - Voltage Improvement.		

TRANSMISSION PROJECT LOGICAL FRAMEWORK		TCN
Project Title : Maiduguri-Dikwa 132kV DC line(92km) and 2x60MVA, 132/33kV substation at Dikwa with 2x132kV line bay extension at Maiduguri		**Start Date : 2016** **Finish Date : 2018**
Project Narrative	**Indicators**	**Critical considerations**
(1)Programme Objective: To improve power delivery to Dikwa and Environs	Economic and commercial activities will improve in Dikwa and environs.	Limitation of bulk supply to Dikwa and Environs
(2) Project Objective: Bulk Power supply will be available to the people of Dikwa	Additional transmission and transformation capacities of 300MVA and 120MVA to be utilised.	About 255MW is delivered to the people of Dikwa
(3) Scope/Outputs: Scope: Construction of Maiduguri-Bama132kV DC line (100km)and 2x60MVA, 132/33kV substation at Bama with 2x132kV line bay extension at Maiduguri Outputs :Increase in Transmission and transformation capacities by 300MVA and 120MVA	Extra transmission and transformation capacities of 300MVA and 120MVA is available.	Competent contractor is employed to deliver the project.
(4) Inputs/costs: Inputs Construction of Maiduguri-Bama132kV DC line (100km) and 2x60MVA, 132/33kV substation at Bama with 2x132kV line bay extension at Maiduguri Costs :	**Funding**: **Balance to complete**:	Fully funded LC/ Timely release of fund.
(5) **Others:** The project is necessary for - power evacuation - Bulk supply - Reliability - Voltage Improvement.		

TRANSMISSION PROJECT LOGICAL FRAMEWORK		**TCN**
Project Title : Ogoja-Gakem 132kV DC line (30km) and 2x60MVA, 132/33kV substation at Gakem with 2x132kV line bay extension at Ogoja.		**Start Date : 2016** **Finish Date : 2018**
Project Narrative	**Indicators**	**Critical considerations**
(1)Programme Objective: To improve power delivery to Gakem and environs	Economic and commercial activities will improve in Gakem and environs	Limitation of bulk supply to the people of Gakem and environs
(2) Project Objective: Bulk Power supply to Gakem and environs	Additional 300MVA Transmission capacity to be utilised. About 120MVA transformation capacity to be utilised	About 255MW of power is delivered to Gakem and environs
(3) Scope/Outputs: Scope: Construction of Ogoja-Gakem 132kV DC line (30km) and 2x60MVA, 132/33kV substation at Gakem with 2x132kV line bay extension at Ogoja. Outputs : Increase in transformation and transmission capacities by 120 MVA and 300MVA	Extra 300MVA transmission capacity is available. About 120MVA transformation capacity is available	Competent contractor is employed to deliver the project.
(4) Inputs/costs: Inputs : Construction of Ogoja-Gakem 132kV DC line (30km) and 2x60MVA, 132/33kV substation at Gakem with 2x132kV line bay extension at Ogoja. Costs : 3,855,000,000	**Funding**: **Balance to complete**:	Fully funded LC/ Timely release of fund.
(5) Others: The project is necessary for - power evacuation - Bulk supply - Reliability - Voltage Improvement.		

TRANSMISSION PROJECT LOGICAL FRAMEWORK		TCN
Project Title : Jalingo-Ganye 132kV DC line (75km) and 2x60MVA, 132/33kV substation at Ganye with 2x132kV line bay extension at Jalingo.		**Start Date : 2016** **Finish Date : 2018**
Project Narrative	**Indicators**	**Critical considerations**
(1)Programme Objective: To improve power delivery to Ganye and Environs	Economic and commercial activities will improve in Ganye and environs.	Limitation of bulk supply to Ganye and Environs
(2) Project Objective: Bulk Power supply will be available to the people of Ganye	Additional transmission and transformation capacities of 300MVA and 120MVA to be utilised.	About 255MW is delivered to the people of Ganye
(3) Scope/Outputs: Scope: Construction of Jalingo-Ganye 132kV DC line (75km) and 2x60MVA, 132/33kV substation at Ganye with 2x132kV line bay extension at Jalingo. Outputs :Increase in Transmission and transformation capacities by 300MVA and 120MVA	Extra transmission and transformation capacities of 300MVA and 120MVA is available.	Competent contractor is employed to deliver the project.
(4) Inputs/costs: Inputs Construction of Jalingo-Ganye 132kV DC line (75km) and 2x60MVA, 132/33kV substation at Ganye with 2x132kV line bay extension at Jalingo. Costs :	**Funding**: **Balance to complete**:	Fully funded LC/ Timely release of fund.
(5) Others: The project is necessary for - power evacuation - Bulk supply - Reliability - Voltage Improvement.		

TRANSMISSION PROJECT LOGICAL FRAMEWORK		TCN
Project Title : Kwale-Ivorogbo 132kV DC line (45km) and 2x60MVA, 132/33kV substation at Ivorogbo with 2x132kV line bay extension at Kwale		**Start Date : 2016** **Finish Date : 2018**
Project Narrative	**Indicators**	**Critical considerations**
(1)Programme Objective: To improve power delivery to Ivorogbo and environs	Economic and commercial activities will improve in Ivorogbo and environs	Limitation of bulk supply to the people of Ivorogbo and environs
(2) Project Objective: Bulk Power supply to Ivorogbo and environs	Additional 300MVA Transmission capacity to be utilised. About 120MVA transformation capacity to be utilised	About 255MW of power is delivered to Ivorogbo and environs
(3) Scope/Outputs: Scope:Construction of Kwale-Ivorogbo 132kV DC line (45km) and 2x60MVA, 132/33kV substation at Ivorogbo with 2x132kV line bay extension at Kwale Outputs : Increase in transformation and transmission capacities by 120 MVA and 300MVA	Extra 300MVA transmission capacity is available. About 120MVA transformation capacity is available	Competent contractor is employed to deliver the project.
(4) Inputs/costs: Inputs : Kwale-Ivorogbo 132kV DC line (45km) and 2x60MVA, 132/33kV substation at Ivorogbo with 2x132kV line bay extension at Kwale Costs : 4,432,500,000	**Funding**: **Balance to complete**:	Fully funded LC/ Timely release of fund.
(5) Others: The project is necessary for - power evacuation - Bulk supply - Reliability - Voltage Improvement.		

TRANSMISSION PROJECT LOGICAL FRAMEWORK		TCN
Project Title : Calabar-Oban 132kV DC line (58km) and 2x60MVA, 132/33kV substation at Oban with 2x132kV line bay extension at Calabar		**Start Date : 2016** **Finish Date : 2018**
Project Narrative	**Indicators**	**Critical considerations**
(1)Programme Objective: To improve power delivery to Oban and environs	Economic and commercial activities will improve in Oban and environs	Limitation of bulk supply to the people of Oban and environs
(2) Project Objective: Bulk Power supply to Oban and environs	Additional 300MVA Transmission capacity to be utilised. About 120MVA transformation capacity to be utilised	About 255MW of power is delivered to Oban and environs
(3) Scope/Outputs: Scope: Construction of Calabar-Oban 132kV DC line (58km) and 2x60MVA, 132/33kV substation at Oban with 2x132kV line bay extension at Calabar Outputs : Increase in transformation and transmission capacities by 120 MVA and 300MVA	Extra 300MVA transmission capacity is available. About 120MVA transformation capacity is available	Competent contractor is employed to deliver the project.
(4) Inputs/costs: Inputs : Calabar-Oban 132kV DC line (58km)and 2x60MVA, 132/33kV substation at Oban with 2x132kV line bay extension at Calabar Costs : 4, 933, 000,000	**Funding**: **Balance to complete**:	Fully funded LC/ Timely release of fund.
(5) Others: The project is necessary for - power evacuation - Bulk supply - Reliability - Voltage Improvement.		

TRANSMISSION PROJECT LOGICAL FRAMEWORK		TCN
Project Title : PH-Obehie 132kV DC line (30km) and 2x60MVA, 132/33kV substation at Obehi with 2x132kV line bay extension at PH		**Start Date : 2016** **Finish Date : 2018**
Project Narrative	**Indicators**	**Critical considerations**
(1)Programme Objective: To improve power delivery to Obehie and environs	Economic and commercial activities will improve in Obehie and environs	Limitation of bulk supply to the people of Obehie and environs
(2) Project Objective: Bulk Power supply to Obehie and environs	Additional 300MVA Transmission capacity to be utilised. About 120MVA transformation capacity to be utilised	About 255MW of power is delivered to Obehie and environs
(3) Scope/Outputs: Scope: Construction of PH-Obehie 132kV DC line (30km) and 2x60MVA, 132/33kV substation at Obehi with 2x132kV line bay extension at PH Outputs : Increase in transformation and transmission capacities by 120 MVA and 300MVA	Extra 300MVA transmission capacity is available. About 120MVA transformation capacity is available	Competent contractor is employed to deliver the project.
(4) Inputs/costs: Inputs PH-Obehie 132kV DC line (30km) and 2x60MVA, 132/33kV substation at Obehi with 2x132kV line bay extension at PH Costs : 3, 855, 000,000	**Funding**: **Balance to complete**:	Fully funded LC/ Timely release of fund.
(5) Others: The project is necessary for - power evacuation - Bulk supply - Reliability - Voltage Improvement.		

TRANSMISSION PROJECT LOGICAL FRAMEWORK		TCN
Project Title : PH-Ogoni 132kV DC line(35km) and 2x60MVA, 132/33kV substation at Ogoni with 2x132kV line bay extension at PH		**Start Date : 2016** **Finish Date : 2018**
Project Narrative	**Indicators**	**Critical considerations**
(1)Programme Objective: To improve power delivery to Ogoni and environs	Economic and commercial activities will improve in Ogoni and environs	Limitation of bulk supply to the people of Ogoni and environs
(2) Project Objective: Bulk Power supply to Ogoni and environs	Additional 300MVA Transmission capacity to be utilised. About 120MVA transformation capacity to be utilised	About 255MW of power is delivered to Ogoni and environs
(3) Scope/Outputs: Scope: Construction of PH-Ogoni 132kV DC line(35km) and 2x60MVA, 132/33kV substation at Ogoni with 2x132kV line bay extension at PH Outputs : Increase in transformation and transmission capacities by 120 MVA and 300MVA	Extra 300MVA transmission capacity is available. About 120MVA transformation capacity is available	Competent contractor is employed to deliver the project.
(4) Inputs/costs: Inputs Construction of PH-Ogoni 132kV DC line(35km) and 2x60MVA, 132/33kV substation at Ogoni with 2x132kV line bay extension at PH Costs : 4,047,500,000	**Funding**: **Balance to complete**:	Fully funded LC/ Timely release of fund.
(5) **Others:** The project is necessary for - power evacuation - Bulk supply - Reliability - Voltage Improvement.		

TRANSMISSION PROJECT LOGICAL FRAMEWORK		TCN
Project Title : Ivorogbo-Patani 132kV DC line (30km) and 2x60MVA, 132/33kV substation atPatani with 2x132kV line bay extension at Ivorogbo		**Start Date : 2016** **Finish Date : 2018**
Project Narrative	**Indicators**	**Critical considerations**
(1)Programme Objective: To improve power delivery to Patani and environs	Economic and commercial activities will improve in Patani and environs	Limitation of bulk supply to the people of Patani and environs
(2) Project Objective: Bulk Power supply to Patani and environs	Additional 300MVA Transmission capacity to be utilised. About 120MVA transformation capacity to be utilised	About 255MW of power is delivered to Patani and environs
(3) Scope/Outputs: Scope: Construction of Ivorogbo-Patani 132kV DC line (30km) and 2x60MVA, 132/33kV substation atPatani with 2x132kV line bay extension at Ivorogbo Outputs : Increase in transformation and transmission capacities by 120 MVA and 300MVA	Extra 300MVA transmission capacity is available. About 120MVA transformation capacity is available	Competent contractor is employed to deliver the project.
(4) Inputs/costs: Inputs : Construction of Ivorogbo-Patani 132kV DC line (30km) and 2x60MVA, 132/33kV substation atPatani with 2x132kV line bay extension at Ivorogbo Costs : 3, 855, 000,000	**Funding**: **Balance to complete**:	Fully funded LC/ Timely release of fund.
(5) **Others:** The project is necessary for - power evacuation - Bulk supply - Reliability - Voltage Improvement.		

TRANSMISSION PROJECT LOGICAL FRAMEWORK		TCN
Project Title : Damaturu-Tapchi 132kV DC line (90km)and 2x60MVA, 132/33kV substation at Tapchi with 2x132kV line bay extension at Damaturu		**Start Date : 2016** **Finish Date : 2018**
Project Narrative	**Indicators**	**Critical considerations**
(1)Programme Objective: To improve power delivery to Tapchi and Environs	Economic and commercial activities will improve in Tapchi and environs.	Limitation of bulk supply to Tapchi and Environs
(2) Project Objective: Bulk Power supply will be available to the people of Tapchi	Additional transmission and transformation capacities of 300MVA and 120MVA to be utilised.	About 255MW is delivered to the people of Tapchi
(3) Scope/Outputs: Scope: Construction of Damaturu-Tapchi 132kV DC line (90km)and 2x60MVA, 132/33kV substation at Tapchi with 2x132kV line bay extension at Damaturu Outputs :Increase in Transmission and transformation capacities by 300MVA and 120MVA	Extra transmission and transformation capacities of 300MVA and 120MVA is available.	Competent contractor is employed to deliver the project.
(4) Inputs/costs: Inputs Construction of Damaturu-Tapchi 132kV DC line (90km)and 2x60MVA, 132/33kV substation at Tapchi with 2x132kV line bay extension at Damaturu Costs :	**Funding**: **Balance to complete**:	Fully funded LC/ Timely release of fund.
(5) **Others:** The project is necessary for - power evacuation - Bulk supply - Reliability - Voltage Improvement.		

Appendix G NIAF Assumptions for Project Cost Estimates

[Section redacted]

The following sections are excerpted from the report "Transmission Costing Requirements Study for TCN" (NIAF, September 2013)

4 TSP CAPEX AND MAINTENANCE MODEL

4.1 Types of project

The importance of, and distinction between, new assets, substation expansion, refurbishment and maintenance is intellectually clear. However to ensure comprehensive coverage and aid modelling the following detailed distinctions are required.

Lines

- New line construction involves the building from new on a greenfield site of a new line.
- A five year line refurbishment is included for all existing lines given chronically poor maintenance over a long period. This involves:
  - Either, the overhaul of existing components keeping specifications constant;
  - Or, the replacement of existing components keeping specifications constant where refurbishment is not considered economical.

  In the very limited number of cases (three), existing 66kV line refurbishment costs are estimated on the basis of 132kV costs.
- Annual line maintenance costs are estimated on the basis of maintaining suitably refurbished lines. These are included throughout the entire period for existing assets and from the year after commissioning for new assets. In the very limited number of cases (three) existing 66kV line maintenance, costs are estimated on the basis of 132kV costs.

Substations

- New substation construction involves the building from new on a greenfield site of a new substation.
- Substation expansion involves the addition of new circuits and/or new transformers at existing voltages at existing substations. (Transformers currently housed in the relevant substation remain in place.)
- Substation refurbishment is included for all existing substations given chronically poor maintenance over a long period. This involves:
  - either the overhaul of existing components keeping specifications constant;
  - or the replacement of existing components keeping specifications constant where refurbishment is not considered economical.

  The exception to this is where components (particularly transformers) do not follow current TCN standards for voltage (e.g. 132/11kV) or capacity (e.g. 40MVA at 132/33kV). In these cases refurbishment costs are estimated on the basis of standardisation upward to the nearest standard size.

In addition we have included provision for the installation of additional reactors and capacitors to support voltage around the network. This has been included under refurbishment.

- Yearly substation maintenance costs are estimated on the basis of maintaining suitably refurbished substations. These are included throughout the entire period for existing assets and from the year after commissioning for new assets.

There are a number of important implications that should be highlighted as a result:

- The expansion of an existing transmission line is not expected under any circumstance given the lack of redundancy in the system currently. It is currently not possible to temporarily decommission a line without the whole grid going down and this situation is not expected to change until late into the costing period. Therefore any increase in transmission capacity along an existing corridor is costed as a new line (see next bullet).
- New lines that are constructed along existing corridors are priced as new including corridor clearance and wayleaves. This is only likely to occur when higher line voltages are required. In this situation the corridor is likely to have to be wider than currently exists so some additional corridor clearance and wayleave costs can be expected in any case.
- The addition of new circuits at different voltages to existing substations is excluded from substation expansion. This is therefore been costed as a new substation consisting of the additional circuits added to the substation.
- The replacement of existing transformers with higher capacity transformers is excluded from substation expansion due to the standardisation aspect of refurbishment which has a similar effect.
- Any on-going TCN transmission project expected to be completed by end-2013 is treated as an existing asset at the start of our model period (2014-2023).
- Any on-going TCN transmission project not expected to be completed by end-2013 is costed as a completely new asset however close to reaching completion it is considered to be. This assumption is made given significant uncertainties as to project progress and supplier competencies in each individual case. There is also a risk that that future government allocations to complete such projects will not be forthcoming, as has been the case in the past.
- Given the chronic lack of reactors and capacitors around the network (currently 29), and the fact that substantially increasing this number is not adequately captured in any of the categories above, a separate analysis of voltage support costs has been included.

4.2 Cost drivers

For both lines and substations we have identified the following cost drivers (this has been partially determined by the structure of unit cost data obtained see section 4.4.1):

- For lines:
  - route survey and corridor clearance;
  - wayleaves;

    towers;
  - insulators; and
  - Wires
- For substations:
  - circuit breaker bays (CBBs);
  - transformers;
  - reactors and capacitors;
  - substation general.

These cost drivers were identified as a compromise between the need to keep the costing model as simple and understandable as possible, while also including sufficient detail to ensure that modelled costs vary as they do in reality.

Design costs were not included as a cost driver given the structure of our unit cost data (see section 4.4.1).

Lines

To demonstrate the comprehensiveness of our line cost drivers it is simply necessary to consider the basic tasks towards commissioning a transmission line.

1) A preliminary survey is conducted. These costs are included in our first cost driver.
2) This is followed by tower spotting (a more detailed survey where the position of the towers is decided). These costs are included in our first cost driver.
3) The right of way is procured. Related wayleave costs are our second cost driver. This is likely to result in some design changes which are again excluded given the structure of our unit cost data.
4) A final survey is conducted. These costs are included in our first cost driver.
5) A corridor (generally 50m wide) is cleared including bush clearing and the cutting of dangerous trees. The access road to the route and the one along the route is also built. These costs are included in our first cost driver.
6) The tower foundations are dug and filled and towers are constructed on the foundations. These costs are included in our third cost driver.
7) The insulator strings are hung from the towers. These costs are included in our fourth cost driver.
8) The wires are strung through the insulator strings and then tensioned. These costs are included in our fifth cost driver.

At this stage the line is complete and just needs to be connected up to the substations and commissioned.

Substations

Costs were allocated to the four cost drivers as follows:

- Circuit Breaker Bays (CBBs) – Items included here were the CBs themselves, appropriate numbers of isolators and earth switches, sections of busbar, control/protection panels, CTs, VTs, plinths and other minor items. The choice of allocating by CB bay rather than allocating some of these items to the substation generally allows more efficient and accurate costing of different sized substations.
- Transformers – Included here were the transformers themselves, protection panels, connections, supports, oil separators and earthing reactors.
- Reactors and capacitors – Items included here were the reactors and capacitors themselves, protection panels, connections, supports, and oil separators.
- Substation general – The remaining items were allocated to substation general costs. This included: the substation service transformer and automation, the busbar protection systems, the data analysis station, the remote digital fault recorder and locator, the diesel generator set and batteries with charger, etc.

Land right costs were considered very small and were not included in our costings. It should be noted that there remains some relation between these categories as defined. For example, when including a reactor, for example, the cost of a circuit breaker bay, as well as the cost of the reactor, should also be included.

4.3 Mapping types of project and cost drivers

The following tables show how cost drivers have been combined for different types of project.

Lines

	Route survey and corridor clearance	Towers	Insulators	Wires	Wayleaves
New lines	Included	Included	Included	Included	Included
NIPP lines	Included	Included	Included	Included	Included
Line Refurbishment		Included	Included	Included	

	Route survey and corridor clearance	Towers	Insulators	Wires	Wayleaves
Line Maintenance	Included	Included	Included	Included	

Substations

	Substation general	Transformers	Circuit Breaker Bays	Reactors and Capacitors
New substations	Included	Included	Included	Included
NIPP substations	Included	Included	Included	Included
Substation Expansion		Included	Included	Included but calculated independently
Substation Refurbishment	Included	Included	Included	Included
Maintenance	Included	Included	Included	Included

4.4 Modelling new build requirements

4.4.1 Available data

Over the last decade NIPP has by far been the largest constructor of transmission assets. We have been able to obtain actual bill-of-quantity (BoQ) costs from NIPP that we consider to be by far the best source of Nigeria-specific new-build unit-cost information.

The structure of NIPP BoQ costs has informed our costing structure. On a NIPP BoQ for each line item costs are given for:

- "Cost and Freight (C+F)" – The cost of purchasing an item at the port of entry in Nigeria. Shipping and customs charges are therefore included here. Units are US Dollars (USD);
- "Erection (E)" – The cost of erection in foreign currency (USD);
- "Local Transportation and Erection (LTE)" – The cost of transportation to site and erection in Nigerian Naira (NGN).

NIPP contracts out all construction; contracts are generally 'Engineering, Procurement and Construction (EPC)'; and the cost information we obtained was all on this basis. We have therefore assumed a similar contractual structure.

The information we obtained from NIPP was averaged over the following NIPP contracts. The list of projects implies a varied set of contractors and consultants.

LOT	PROJECT DESCRIPTION
Lot1A	330/132/33kV SS Makurdi
Lot2A	330kV DC T/L Mkd-Aliade
Lot2B	330kV DC T/L Aliade- Ugwuaji
Lot 3D	330kV DC T/L Ugwuaji- New Haven
Lot4A	330kV DC T/L Afam –Ikot -Ekpene
Lot4C	330kV SS Ikot-Ekpene
Lot5A	330/132/33kV SS Iokt-Abasi
Lot9A	330/132/33kV SS Ganmo

Lot17-1	330/132/33kV SS Onne
Lot17-2A	330kV DC T/L
Lot17-2B	132kV DC T/C
Lot19-2	330/132/33kV SS
Lot22-2	330kV DC T/L Ajakuta-Lokoja-Gwagwalada

It should be noted that engineering design costs are not stated explicitly (instead being built into unit costs) but surveying and corridor clearance are however included as separate line items. Our estimates follow this convention.

Where NIPP bill of quantity information is not available either another source has been used or costs have been estimated given scaling relative to known costs from NIPP. These cases are clearly documented below.

Following discussions with TSP staff towards the end of the study some costs have been revised away from the NIPP numbers. Where this has occurred is clearly documented below.

4.4.2 New line unit costs

Environmental and social impact assessments

At the request of TSP, Environmental Impact Assessment (EIA) and Social Impact Assessment (SIA) costs have been included, in line with the EIA Act 86 of 1992, the Federal Ministry of Environment (FMENV) Sectoral Guidelines for Infrastructures (Power Transmission lines) projects and World Bank/International Finance Corporation (IFC) guidelines.

In our view EIA and SIA costs will be in the region of NGN150m per line. This should however vary by length. Given 165 new lines are included in our model, with a total length of 10,270km, we have included an average cost per km of NGN2.4m.

Route survey

Survey and clearance costs were obtained from NIPP, for both high and low wind cases for both 132kV and 330kV lines. Given limited variation averages were used and simplified to two categories, route survey and corridor clearance per km. The category ‘survey costs’ includes:

1. preliminary route survey;
2. alignment route survey and profile (tower spotting); and
3. survey including staking.

The actual costs obtained by NIPP are given in table below. Given the relatively small variation between 330kV and 132kV costs the average was used.

Survey	Total (NGN)		Total (NGN)
330kV high wind total costs (per km)	*330,000*	*132kV high wind total costs per km*	*294,895*
Preliminary route survey per km	110,000	Preliminary route survey per km	73,750
Tower spotting per km	110,000	Tower spotting per km	98,350
Final survey per km	110,000	Final survey per km	122,795
330kV low wind total costs (per km)	*300,000*	*132kV low wind total costs per km*	*241,650*
Preliminary route survey per km	100,000	Preliminary route survey per km	64,500
Tower spotting per km	100,000	Tower spotting per km	65,800
Final survey per km	100,000	Final survey per km	111,350
330kV Average	**315,000**	**132kV Average**	**254,773**
Average (used in Model)	**284,886**		

Subsequently addition information was received from TCN on survey cost per km is given below. Given the relatively small variation between average survey cost we obtained from NIPP and from TCN, we have used NIPP costs in our model to ensure consistency across cost types.

TCN Regions	Survey costs per km (NGN)
Benin	270,000
Bauchi	291,000
Enugu	291,000
Kaduna	270,000
Lagos	291,000
Oshogbo	291,000
Port Harcourt	291,000
Shiroro	270,000
Average	**283,125**

Corridor clearance

The category 'corridor clearance costs' includes:

- 50m wide right of way including construction access;
- additional route bush clearing per 5m width;
- cutting of dangerous trees (20 assumed per kilometre);
- access road along the route and access road to the route.

The actual costs obtained from NIPP are given in the table below. This is one of the few times that NIPP costs did make intuitive sense (particularly regarding the large variation between high and low wind scenarios for 132kV highlighted red). NIPP subsequently confirmed these costs to us. We therefore decided to take the average numbers over high and low wind scenarios for both 330kV and 132kV cases.

330kV high and low wind cases	Total (NGN)	132kV high and low wind cases	Total (NGN)
Total 330kV high wind per km	*818,000*	*Total 132kV high wind per km*	*856,975*
50m wide right of way including construction access	295,000	50m wide right of way including construction access	280,725
additional route bush clearing per 5m width	110,000	additional route bush clearing per 5m width	46,750
cutting of dangerous trees (assuming 20 per km)	93,000	cutting of dangerous trees (assuming 20 per km)	249,500
access road along the route	195,000	access road along the route	155,000
access road to the route	125,000	access road to the route	125,000
Total 330kV low wind per km	*738,000*	*Total 132kV low wind per km*	*434,750*
50m wide right of way including construction access	275,000	50m wide right of way including construction access	269,750
additional route bush clearing per 5m width	100,000	additional route bush clearing per 5m width	31,500
cutting of dangerous trees (assuming 20 per km)	93,000	cutting of dangerous trees (assuming 20 per km)	70,000
access road along the route	165,000	access road along the route	25,000
access road to the route	105,000	access road to the route	38,500

330kV Average	**778,000**	**132kV Average**	**645,863**

Subsequently, corridor clearance costs were obtained from TCN by region given in the table below. We have used NIPP corridor clearance cost in our model because of relatively small variation between NIPP and TCN average corridor clearance costs and to ensure consistency across cost types.

TCN Regions	330kV line clearance costs (NGN)	132kV line clearance costs (NGN)
Benin	700,000	500,000
Bauchi	750,000	600,000
Enugu	750,000	600,000
Kaduna	700,000	500,000
Lagos	800,000	650,000
Oshogbo	750,000	600,000
Port Harcourt	800,000	650,000
Shiroro	700,000	600,000
Average	**743,750**	**587,500**

Towers

Tower costs were obtained from NIPP for 330kV double circuit, double conductor; and for 132kV double circuit single conductor. In both cases high and low wind zones were also distinguished. In each of the four cases, costs were provided for five tower types:

- "AAH" type - 0 to 2° suspension;
- "BBH" type - 2 to 10° strain;
- "CCH" type - 10 to 30° strain;
- "DDH" type - 30 to 60° strain;
- "EEH" type - 60 to 90° strain.

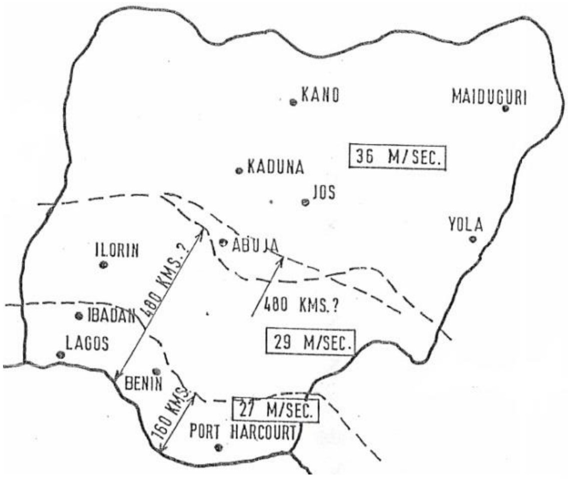
For each of these tower types, costs were provided for seven foundation types: R, 1, 2, 3, 4, 5 and S (i.e. from rock to swamp with increasing cost). For each tower type an average of the foundation costs was used.

For each voltage and wind zone case, tower types were simplified to “suspension” and “tension”. Suspension cost is taken as the average of types AAH and BBH above and Tension is the average of types CCH, DDH and EEH.

Lines were categorised by TCN region and regions were designated wind zone A or wind zone B as follows:

- Wind zone A (low wind): Benin, Enugu, Lagos, Osogbo and Port Harcourt regions
- Wind zone B (high wind): Bauchi, Kaduna and Shiroro regions.

This is demonstrated in the maps below. While not exact, the mapping is close to actuality.



Source: TCN Design and Construction Department

Source: TCN

The resulting costing, based on NIPP numbers is given below. The detailed breakdown of what is included in these numbers is given in Annex 7:.

Type	Voltage	Circuits	Conductors	Zone	C+F (USD)	Erection (USD)	LTE (NGN)
Susp	330kV	2	2	A	20,277	1,110	3,787,332
Susp	330kV	2	2	B	34,357	2,831	4,037,623
Ten	330kV	2	2	A	30,011	1,168	4,362,308
Ten	330kV	2	2	B	65,255	5,221	6,908,958
Susp	132kV	2	1	A	10,942	1,504	1,142,031
Susp	132kV	2	1	B	8,176	1,364	1,430,465
Ten	132kV	2	1	A	17,729	2,398	1,700,127
Ten	132kV	2	1	B	14,600	2,408	2,332,433

Costs for other voltage, circuit and conductor cases were derived from the two cases provided by NIPP by the application of ratios at 330kV and 132kV to allow for the reduced/increased steel costs required to support fewer/more conductors respectively. 330kV and 132kV were treated independently as voltage is by far the most significant factor affecting tower costs. The table below gives the ratio of conductors for each of these cases. In our engineering judgement 25% increase in cost for the circuit physical load increase is reasonable (which is equivalent to 20% decrease in cost for the circuit physical load decrease) given that voltage (and not conductors) is the most significant factor affecting tower cost.

Voltage	Change	Initial Conductors	New Conductors	Ratio	Cost Percentage	Factor
330kV	DC:2 conductor to 4 conductor	14	26	1.86	25%	1.25
330kV	Double Circuit to Single Circuit (2 con)	14	8	1/1.75	-20%	0.80
132kV	DC: 1 conductor to 2 conductor	7	13	1.86	25%	1.25
132kV	SC: 1 conductor to 2 conductor	4	7	1.75	25%	1.25
132kV	Double Circuit to Single Circuit (1 con)	7	4	1/1.75	-20%	0.80

Subsequently, TSP provided us with tonnage of steel per tower for 330kV double circuit, double conductor suspension towers by region given below. We allocated these to wind zones in accordance with the discussion on regions above.

Region	Wind zone	Tonnes per tower
Benin	B	18.00
Bauchi	A	15.00
Enugu	A	15.00

Kaduna	B	17.00
Lagos	A	15.00
Oshogbo	A	15.00
Port Harcourt	A	15.00
Shiroro	B	17.00
Average – Wind zone A		**15.00**
Average – Wind zone B		**17.33**

Also provided were the following conversion factors for computing tonnage for other voltage, circuit and conductor cases. Where comparable with the ratios applied to NIPP cost cases they are broadly inline.

- Suspension to Tension tower (any voltage, circuit or conductor case) – Add 40%
- 330kV, double circuit, double conductor to 330kV, single circuit, single conductor – Apply the ratio 16/18
- 330kV, double circuit, double conductor to 132kV, double circuit, double conductor – Apply the ratio 10/15
- 330kV, double circuit, double conductor to 132kV, single circuit, single conductor – Apply the ratio 8/15

TCN provided a cost and freight (C&F) price on the basis of $2000/tonne. World steel prices for "Structural Sections & Beams" have stood at about $800/tonne for the last few years with hot rolled plate at $700/tonne (Source: http://www.worldsteelprices.com). Given the primary tower type is a 330kV double circuit, double conductor suspension tower in low wind, we have chosen a C+F steel price of $1350/tonne so as its TCN cost estimate broadly aligns with the NIPP cost. Given the NIPP costs have come from multiple successful tenders and it brings steel prices to a more reasonable level we consider this reasonable.

The table below gives cost and freight (C&F) prices according to both NIPP and TCN numbers for a variety of tower types.

Voltage	Type	Circuits	Conductors	Zone	NIPP ($/tower)	TCN @ $1350/tonne	Difference
330	Sus	2	2	A	$20,277	$20,250	$27
330	Sus	2	2	B	$34,357	$23,400	$10,957
330	Ten	2	2	A	$30,011	$28,350	$1,661
330	Ten	2	2	B	$65,255	$32,760	$32,495
132	Sus	2	2	A	$13,677	$13,500	$177
132	Sus	2	2	B	$10,220	$15,600	-$5,380
132	Ten	2	2	A	$22,161	$18,900	$3,261
132	Ten	2	2	B	$18,250	$21,840	-$3,590

The NIPP C&F costs for high wind towers (highlighted red) appear somewhat erratic: very high for 330kV and below low wind for 132kV. We have therefore elected to use the TCN tonnages at $1350/tonne for C&F. These values are close to the NIPP values but more internally consistent. For voltage, circuit and conductor configurations where we required values not provided by TCN, the ratios utilized to calculate alternate configurations from the NIPP base data (discussed above) were utilized. The exception to this was the cases of 132kV double circuit, single conductor and 132kV single circuit, double conductor where the use of these ratios resulted in both configurations having C+F costs equal to the 132kV single circuit, single conductor configuration. In both these cases a revised ratio of 0.89 from the 132kV double circuit, double conductor case was used. This ratio was calculated as the geometric mid-point between 1 and 0.8 (which is the ratio from 132kV double circuit, double conductor to 132kV single circuit, single conductor implied by the information provided by TCN).

The resulting tower unit costs used as part of the model are:

	Suspension Towers	C+F (USD)	Erection (USD)	LTE (NGN)
Suspension - Wind zone A	330kV Double Circuit - four conductors per phase	25,313	1,387	4,734,165
	330kV Double Circuit - two conductors per phase	20,250	1,110	3,787,332
	330kV Single Circuit - two conductors per phase	16,200	888	3,029,865
	132kV Double Circuit - two conductors per phase	13,500	1,880	1,427,539
	132kV Double Circuit - one conductor per phase	12,075	1,504	1,142,031
	132kV Single Circuit - two conductors per phase	12,075	1,504	1,142,031
	132kV Single Circuit - one conductor per phase	10,800	1,203	913,625
Suspension - Wind zone B	330kV Double Circuit - four conductors per phase	29,250	3,539	5,047,028
	330kV Double Circuit - two conductors per phase	23,400	2,831	4,037,623
	330kV Single Circuit - two conductors per phase	29,250	2,265	3,230,098
	132kV Double Circuit - two conductors per phase	15,600	1,705	1,788,081
	132kV Double Circuit - one conductor per phase	13,953	1,364	1,430,465
	132kV Single Circuit - two conductors per phase	13,953	1,364	1,430,465
	132kV Single Circuit - one conductor per phase	12,738	1,091	1,144,372
Tension - Wind zone A	330kV Double Circuit - four conductors per phase	35,438	1,460	5,452,886
	330kV Double Circuit - two conductors per phase	28,350	1,168	4,362,308
	330kV Single Circuit - two conductors per phase	22,680	934	3,489,847
	132kV Double Circuit - two conductors per phase	18,900	2,997	2,125,159
	132kV Double Circuit - one conductor per phase	16,905	2,398	1,700,127
	132kV Single Circuit - two conductors per phase	16,905	2,398	1,700,127
	132kV Single Circuit - one conductor per phase	15,120	1,918	1,360,101
Tension - Wind zone B	330kV Double Circuit - four conductors per phase	40,950	6,526	8,636,198
	330kV Double Circuit - two conductors per phase	32,760	5,221	6,908,958
	330kV Single Circuit - two conductors per phase	26,208	4,177	5,527,167
	132kV Double Circuit - two conductors per phase	21,840	3,011	2,915,541
	132kV Double Circuit - one conductor per phase	19,534	2,408	2,332,433
	132kV Single Circuit - two conductors per phase	19,534	2,408	2,332,433
	132kV Single Circuit - one conductor per phase	17,834	1,927	1,865,946

Note: On initial inspection foreign erection costs for 132kV suspension towers appear problematic. (High wind should not be cheaper than low wind.) This is however corrected once the total local and foreign erection costs are considered. This correction also applies for foreign erection costs for 330kV tension towers compared with 132kV tension towers which, on initial inspection, appears problematic.

Insulators

Costs of insulator strings were obtained from NIPP for 330kV and 132kV for tension and suspension towers. For tension towers the strings were doubled up and were approximately twice the cost of single suspension strings. Hence an average cost for a single string for each voltage was calculated and tension towers treated as having twice as many insulator strings. No data was available on how insulator string costs vary by number of conductors. In our engineering view this would be comparatively small hence number of conductors was ignored as a factor affecting insulator costs. The resulting insulator string unit costs used as part of the model are:

	C+F USD)	E (USD)	LTE (NGN)
330kV insulator per unit	621	72	1,291
132kV insulator per unit	408	15	707

The detailed breakdown of what is included in these numbers is given in Annex 7:.

Wires

Wire costs were obtained from NIPP per conductor per km for each cable type (Bison and Buffalo). Earth wires were slightly cheaper and OPGW (Optical Fibre Ground Wire) was slightly more expensive. Averages of the standard line configuration were used: for 330kV the average of twelve conductors, one ground wire and one OPGW; and for 132kV six conductors and one OPWG. Small accessories were included in the wire cost calculation per kilometre on a reasonable engineering basis. The resulting wire unit costs used as part of the model are:

	C+F USD)	E (USD)	LTE (NGN)
330kV wire per km	6,563	770	115,678
132kV wire per km	3,302	264	67,927

The detailed breakdown of what is included in these numbers is given in Annex 7:.

Wayleaves

Wayleave costs in Nigeria are high. They vary significantly by region and indeed within regions. There have been cases where the incumbents have asked for greater wayleaves than the cost of the line – in which case TCN or NIPP would chose a different route. The percentages below were provided by NIPP and agreed with TCN.

Average wayleave costs as a percentage of total line asset costs for each region are:

Wayleave Costs	Benin	Bauchi	Enugu	Kaduna	Lagos	Oshogbo	Port Harcourt	Shiroro
Wayleave Costs as % of total construction cost	20%	33%	33%	20%	40%	20%	40%	20%

4.4.3 New substation unit costs

The substation data from NIPP was provided to us broken into 128 different cost items. From these we derived the costs for the cost drivers discussed in section 4.2. For those items where we did not have costs quoted directly we used cost ratios (derived from NIPP and UK data) in terms of size (MVA/MVAr) and voltage. These were 132/33kV 100MVA transformers, 40MVAr 132kV capacitors and 20MVAr 33kV capacitors.

Circuit breaker bays (CB)

The total costs it the three categories for 330kV, 132kV and 33kV circuit breaker bays are as follows:

DESCRIPTION	C+F (USD)	E (USD)	LTE (NGN)
330kV CB Bay	522,256	47,390	21,626,999
132kV CB Bay	198,258	27,377	10,777,143
33kV CB Bay	125,459	5,033	5,327,791

See Annex 7: for a more detailed breakdown of included costs.

Transformers

The total costs it the four categories for 330/132kV 300 and 150MVA transformers, and 132/33kV 100 and 60MVA transformers are as follows:

DESCRIPTION	C+F (USD)	E (USD)	LTE (NGN)
330/132kV 300MVA TX	2,986,294	78,391	43,392,289
330/132kV 150MVA TX	2,395,919	63,024	33,837,289
132/33kV 100MVA TX- *derived*	1,313,915	44,084	16,741,034
132/33kV 60MVA TX	1,125,149	37,750	14,335,900

See Annex 7: for a more detailed breakdown of included costs.

The 132/33kV 100MVA transformer cost was derived from the 132/33kV 60MVA transformer cost using an increase of 16.67% which is linearly derived from the increase in price between the 330/132kV transformers.

Reactors and Capacitors

The total costs it the three categories for 330kV 75MVAR reactor, 132kV 40MVAR and 33kV 20MVA capacitors are as follows:

DESCRIPTION	C+F (USD)	E (USD)	LTE (NGN)
330kV 75MVA Reactor	1,520,913	36,974	30,030,000
132kV 40MVA Capacitor - *derived*	1,044,867	25,401	20,630,610
33KV 20MVA Capacitor - *derived*	696,578	16,934	13,753,740

See Annex 7: for a more detailed breakdown of included costs.

The 132kV 40MVA capacitor cost was derived from the equivalent cost in the UK multiplied by a factor of 1.51 (derived from comparing the 330/132kV 150MVA transformer cost with its equivalent UK cost). The 33KV 20MVA capacitor was derived from the 132kV 40MVA capacitor using a reduction of 33% (derived from equivalent UK costs).

Substation general

The total costs it the four categories for 330/132/33kV, 330/132kV, 330kV and 132/33kV substations are as follows:

DESCRIPTION	C+F (USD)	E (USD)	LTE (NGN)
330/132/33kV Substation	927,408	242,946	7,941,400
330/132kV Substation	927,408	242,946	7,941,400
330kV Substation	816,229	225,272	7,941,400
132/33kV Substation	795,534	220,503	7,491,400

See Annex 7: for a more detailed breakdown of included costs.

Compared to our substation cost of around $1.25m TCN quoted a figure of around $6m. We believe this to be due to classification differences. If we include foundations, busbar steelwork control panels (included in our circuit breaker bay costs) in substation general we get a cost of around $5.5m.

4.4.4 Substation expansion unit costs

As previous noted substation expansion was defined as the addition of new circuits and/or new transformers at existing voltages at existing substations. Costs were therefore limited to transformers and circuit breaker bays as defined above.

4.4.5 Modelling assumptions

Lines

For each new line under consideration additional characteristics were calculated based on the following assumptions:

- Total number of towers based upon tower spacing of 452m for 330kV and 316m for 132kV. These are actual numbers calculated as the average number of towers per km for TCN existing lines;
- Number of suspension towers and tension towers based upon assumptions that 12.5% of all towers are tension towers. These estimates are based on advice from TCN.
- Total numbers of insulators for each line was calculated by a combination of:
  - the number of suspension towers;
  - the number of tension towers;
  - the number of insulators per suspension tower based on one insulator string per phase;
  - the number of insulators per tension tower based on two insulator strings per phase.
- The total number of conductors for each line was calculated (number of circuits times three phases per circuit times number of conductors per phase). In addition one additional conductor was added to allow for one Optical Ground Wire (OPGW) at 132kV and two additional conductors were added to allow for one OPGW and one earth wire at 330kV. The costs of OPGW and earth wires are comparable to copper conductors (see section 4.4.2).

Substations

For each individual substation under consideration additional characteristics were calculated to allow costing based on the following assumptions:

- The number of reactors and capacitors was estimated at one wherever transformers have inputs or outputs at the respective voltage and zero elsewhere.
- The number of circuit breaker bays required.
  - For 330kV and 132kV this was estimated to be: the number of circuits at the respective voltage; plus the number of reactors and capacitors at the respective voltage; plus the number of transformers with inputs or outputs at the respective voltage; all times by 1.5 and rounded up to the nearest whole number.
  - For 33kV this was estimated to be: the number of transformers with outputs at the 33kV times by 1.5 and rounded up to the nearest whole number; plus the number of 33kV capacitors.

4.4.6 Timing of cash requirements

We have followed the practice currently used by NIPP when structuring payment terms within EPC contracts. This is as follows:

EPC Foreign (USD) costs:

- 15% on contract signing. We have assumed this is two years before the commissioning date;
- 85% on procurement start on receipt of a letter of credit. Further release conditions exist to draw down against the letter of credit however given the requirement to release funds upfront, we have assumed this is also two years before the commissioning date. It is required to be this way given one-year periods in the model.

EPC Local (NGN) costs:

Local costs are claimable as incurred up to 95% of the total local cost component of the EPC contract. 5% of the total is withheld as a success fee following commissioning of the asset. Experience on NIPP demonstrates the following schedule is appropriate:

- 15% two years before the commissioning date;

- 40% one year before the commissioning date;
- 40% the year of the commissioning date;
- 5% success fee one year after the commissioning date.

Wayleave costs

The timing of NIPP payments for wayleaves is not so clear-cut and indeed on occasion they have been left until after construction has started (making more onerous demands far more likely). For the purposes of this study we have assumed that wayleaves will be secured before the start of procurement and construction but after contract signing. We have therefore assumed wayleave costs fall two years before the commissioning date of the line in question.

Partially costed projects at the end of the study period

One result of these new build cost timings should be noted. We have included transmission projects in our costing that we consider necessary up to 2026 based on our loadflow. However, as result of our timing assumptions any project with a commission year of 2023 or later is not fully costed in our model as some or all costs do not fall into the study costing period. The following percentages of costs have been excluded by commission year (330kV transmission lines with relevant commission years have also been included for illustrative purposes).

Commission year	% of project costs excluded from total costing		330kV transmission lines with expected commission date in relevant years
	USD Costs	NGN Costs	
2023	0%	5%	SOKOTO – TMAFARA line (330kV; 2 circuit; 2 conductor; 125km) TMAFARA – GUSAU line (330kV; 2 circuit; 2 conductor; 85km)
2024	0%	40%	BALI – JALINGO line (330kV; 2 circuit; 2 conductor; 294km) GUSAU – KATSINA line (330kV; 2 circuit; 2 conductor; 125km) BALI – MAMBILLA line 1 (330kV; 2 circuit; 4 conductor; 139km) BALI – MAMBILLA line 2 (330kV; 2 circuit; 4 conductor; 139km)
2025	0%	75%	BALI – MAKURDI line (330kV; 2 circuit; 4 conductor; 139km)
2026	100%	100%	

4.5 Modelling NIPP buyout requirements

As previously stated explained in section 1.3, any existing or currently under construction NIPP transmission asset will, at some point, be handed over to the TSP. Estimating the cost to the TSP of building these assets from scratch provides an upper bound to the cost TSP should rationally be willing to pay for such assets if required to make such a payment.

4.5.1 Unit costs

The unit costs used for to model the value of NIPP assets are the same as those used to cost new build assets (see section 4.4).

4.5.2 Modelling assumptions

The modelling assumptions used for to model the value of NIPP assets are the same as those used to cost new build assets (see section 4.4.5) with the exception of reactors and capacitors. It was assumed that NIPP has not installed any reactors or capacitors at the substations they have built or expanded.

4.5.3 Timing of cash requirements

Any payments for NIPP assets have been treated as non-period specific. Costs have therefore been included as a one-off cost to be included or excluded as required.

4.6 Modelling refurbishment requirements

4.6.1 Unit costs

TCN transmission assets have suffered from decades of insufficient investment making refurbishment a vital short-term activity. A full estimation of refurbishment costs would require asset specific information on the physical condition of each asset and was therefore not undertaken. We have, however, estimated refurbishment costs on the basis of the age of individual assets. While this approach may not give an accurate refurbishment costing for each individual asset, we consider the total cost to be of acceptable accuracy.

Transmission refurbishment unit cost data for Nigeria is understandably scarce so percentages of new capital cost were applied according to three age categories. Percentages applied vary across the different types of line and substation cost to ensure as accurate a picture as possible. These percentages and justifications are given below.

		New (<10yrs)	Medium (10-24yrs)	Old (>=25yrs)	Justification
Lines	Route survey and corridor clearance	10%	35%	40%	No meaningful corridor clearance has been taking place. Given high growth rates and weather driven deterioration of access roads a significant percentage of original costs is required. With high growth rates even new circuits need refurbishment
	Towers	0%	3%	5%	Low percentage driven largely by vandalism.
	Insulators	2%	20%	100%	No maintenance – given corrosion and general damage would expect replacement in 25 years.
	Wires	0%	6%	30%	Annealing over time, sagging and hotspots.
Substations	Transformers – Loading =<60%	2%	15%	60%	No meaningful maintenance - copper hotspots, iron magnetic circuit breaks and general deterioration – heavy duty on tap-changers is a particular problem.
	Transformers – Loading >60%	2%	25%	80%	Loading increases wear and tear.
	Circuit Breaker Bays	5%	30%	80%	Continuous tripping leads to massive duty hence nearly full replacement after 25 years
	Reactors	2%	20%	50%	Similar to transformers but without tap-changers
	Capacitors	4%	30%	75%	capacitors have a much higher duty than reactors and are more fragile mechanically and electrically
	Substation General	0%	40%	60%	Sub-station buildings, fences etc. are massively below standard and most/all auxiliary items such as batteries are broken/missing.

4.6.2 Voltage support requirements

As stated in section 3.7, we consider it necessary in our engineering view to add new reactors and capacitors around the network as part of the refurbishment programme, in addition to the refurbishment of existing assets. The list of new reactors and capacitors is given in Annex 5: and is derived from our loadflow. The costs of these additional reactors and capacitors (as well as the associated additional circuit breaker bays) were calculated separately.

4.6.3 Modelling assumptions

For each individual existing line under consideration additional characteristics were calculated exactly as for new lines (see section 4.4.5). Despite being provided actual numbers of towers by TCN for a substantial proportion of existing lines the data was not comprehensive and therefore could not be used. (It was however used to generate the assumptions around tower spacing.)

For substations actual numbers of reactors and capacitors were used. The number of circuit breaker bays was estimated using the same logic as for new substations.

4.6.4 Timing of cash requirements

We have assumed that the refurbishment programme will last five years from 2014 to 2018. Without detailed information on the condition of individual assets prioritisation (and therefore timing) is not possible. Total estimated costs for each project have therefore been split evenly over the five year period on the assumption that overall the refurbishment programme is conducted at an even rate over the period.

4.7 Modelling maintenance requirements

4.7.1 Unit costs

TCN has a very poor maintenance record. Ensuring the required funds are available so adequate maintenance can be conducted is vital. While we managed to obtain TCN records on maintenance costs by asset we did not consider the numbers to be reliable. In our engineering view, overall costs were far too low, but in some individual cases costs were considered to be too high. We therefore elected to base maintenance costs on fractions of new capital cost in a similar fashion to refurbishment (see above). The following assumptions were made:

- The cost of patrolling lines is NGN500,000 per km
- The cost of maintaining corridors is NGN100,000 for 330kV lines and NGN50,000 for 132kV lines.
- Insulators have a 25 year replacement period. Given corrosion and general damage we would expect replacement in this period.
- Yearly maintenance of 330kV and 132kV towers is around 1.5% of new build capital cost. We had originally considered extracting foundation costs however following discussions with TCN we realised that we had not allowed for erosion effects so we left then in to compensate. This is largely driven by vandalism/theft – tower members are removed until they fall and the circuit grounds out then Tower and wires are stolen.
- Yearly maintenance of 330kV wire is around 2.5% of new build capital cost. This is linked with towers above also there is clearance and maintaining access roads.
- Yearly maintenance of 132kV wire is around 3.5% of new build capital cost. Lower voltage makes vandalism/theft easier.
- Yearly maintenance of 330kV circuit breaker bays is approximately 3.5% of new build capital cost. Very regular tripping leads to massive duty hence a high maintenance cost for the active part of the circuit breaker bay.
- Yearly maintenance of 132kV circuit breaker bays is approximately 4.5% of new build capital cost. There are significantly more trips per year at 132kV than at 330kV.
- Yearly maintenance of 33kV circuit breaker bays is approximately 8% of new build capital cost. There are significantly more trips per year at 33kV than at 132kV.
- Yearly maintenance of transformers is around 2.5% of new build capital cost. High loading on transformers and heavy tap-changing increases the maintenance on these relatively robust items.
- Yearly maintenance of reactors is around 2% of new build capital cost. Similar to transformer costs but without tap-changers.

- Yearly maintenance capacitors is around 5% of new build capital cost. Similar to transformer costs but capacitors require significantly more maintenance.
- Yearly maintenance of other substation items is around 2.5% of new build capital cost. A varied pot of items some such as A/Cs probably need replacement within 10 years whereas buildings are more robust, other items such as batteries etc. will depend upon duty and care.

4.7.2 Modelling assumptions

Additional asset characteristics were derived as previously discussed according to the type of asset (existing, NIPP or new). For these treatments see sections 4.6.3, 4.5.2 and 4.4.5 respectively.

4.7.3 Timing of cash requirements

Maintenance cost timings follow the following logic:

- For existing assets yearly maintenance costs were included for every year. In the first five years this is in addition to any refurbishment costs;
- For new build assets (including any new assets resulting from substation expansion) yearly maintenance costs start the year after commissioning;
- For NIPP assets yearly maintenance costs start the year after commissioning or the start of the period whichever is later. This is in line with the assumption made in section 1.3 on the treatment of maintenance of NIPP assets.

The only exception to this logic is the case of additional reactors and capacitors (and associated circuit breaker bays) included for voltage support as part of the refurbishment programme. Given their categorisation as refurbishment costs they are not time specific but in contrast to the rest of the refurbishment programme they include the installation of new assets. For simplicity we have assumed that they are all installed in year two and yearly maintenance costs should start in year three.

5 ANCILLARY SERVICES

Ancillary services are provided by generators to ensure that the power system is operated at stable frequency and voltage and that it can be returned from a complete system collapse. This is a major cost item for the system operator. The three services and their cost drivers are:

4. Frequency control and reserve provision – This requires operating generating units not fully loaded which decreases their efficiency. It also implies increased wear and tear of continually increasing and decreasing output increases maintenance.
5. Voltage Control and MVAR – This requires operating generating units at higher rotor, stator and transformer currents to provide or absorb MVAR in order to control system voltages. This increases losses and maintenance costs.
6. Black Start – In order to start the system from dead power stations must have auxiliary generation capacity and associated batteries. This capability must be tested regularly and staff must be trained in the process and procedures which leads to on-going costs for the generator that need to be paid for, irrespective of whether the capability is utilized. When a black start occurs the generator must also be paid for the costs of doing it.

These costs were modelled independent of the main costing model, based on spreadsheets previously devised for TCN by NIAF. Costs are based on the following assertions:

a. Frequency control and reserve provision:
b. We estimate hydro generation reserve cost at 750 NGN/MW/hr. We estimate 100MW of hydro generation reserve is required between 2014-19 and140MW between 2020-23.
c. We estimate steamer reserve cost at 1200 NGN/MW/hr – this is higher due to increased maintenance cost. We estimate 100MW of steamer generation reserve is required between 2014-19 and140MW between 2020-23.

d. We estimate OCGT reserve cost at 2250 NGN/MW/hr – the efficiency drop on deloading for gas turbines is 6 times that for steamers. We estimate 100MW of OCGT generation reserve is required between 2014-19 and140MW between 2020-23.

e. We estimate standby reserve price at 200 NGN/MW/hr. We estimate 300MW of re generation reserve is needed between 2014-19 and 400MW between 2020-23.

2. Voltage Control and MVAR:

   a. We estimate the cost for exported MVAR is 200.85 NGN/MVARh and exported MVARs will increase from 225 in 2014 to 3048 by 2023.

   b. We estimate the cost for imported MVAR is 129.7 NGN/MVARh and imported MVARs will increase from 0 in 2014 to 656 by 2023.

3. Black Start:

   a. We estimate the monthly charge is 4,589,091 NGN

   b. We estimate the average successful black start charge as 8,580,000 NGN per station. The number of black starts is expected to fall from 20 in 2014 to 3 in 2023.

   c. We estimate the successful black start test charge is 5,728,091 NGN. Only one test is expected to be needed between 2014-23 given high numbers of actual black starts. This falls in 2023.

6 Other Capital Requirements

While the vast majority of TCN capex will be undertaken by the TSP in the form of new build and refurbishment, there are a number of relatively small, but crucial investments that must also be made over the period.

6.1 Other TSP Capex

In discussion with TSP staff three areas for additional TSP capital investment were identified, namely:

- Planning specific IT investment (particularly software licences);
- Geographical Information System (GIS); and
- Management Information System (MIS).

6.1.1 Planning specific IT investment

For the purposes of this exercise we have assumed that the SO purchase five PSSE licences (or equivalent) in year 1 and two PSSE licences in year 2. They cost around $50,000 each.

We have assumed they will need to be repeated in five years' time.

6.1.2 Geographical information system

Our GIS costs are based on estimates provided by NIAF's GIS expert. Assuming 10 transmission planning staff will need access to GIS software the costs have been calculated as follows.

	Unit	Price per unit	No. of units	Costs (GBP)
Arc GIS desktop	one user	7,000	10	70,000
ARC GIS server	one server	20,000	1	20,000
MS SQL server	five users	2,000	2	4,000
Total Cost				94,000

This has been included as a one off cost in 2014 as USD141,000.

6.1.3 Management information system

Despite the wishes of TSP staff to see a management information system (MIS) included in the budget they were unable to provide a costing or a specification of requirements to allow independent costing.

No cost was therefore included in the model for this element.

6.2 SO Capex

We identified four areas for SO capital investment, namely:

- SCADA
- Telecoms
- New National Control Centre
- Planning specific IT investment (particularly software licences)

6.2.1 SCADA

A SCADA (Supervisory Control And Data Acquisition) system is vital for the proper control of a modern power system. The current SCADA implementation project started in 2005 when a contract was signed with Siemens Nigeria. It suffered three main problems:

- Arguments around funds resulted in the project grinding to a halt in 2010;
- TCN did not complete all the wiring of sub-stations in connecting the measurement, indication and control points to the RTUs due to a lack of funding; and
- Almost all of the equipment put in by the contractor was obsolete on installation.

As a result, a recovery project has been put in place with the following features: Siemens Germany was brought in to reactivate the complete SCADA System; and TCN instituted a programme in complete the wiring in sub-stations. It is intended that 330kV substations and power stations will be fully reactivated by December 2013 although it is growing increasing unlikely that this deadline will be met completely.

This reactivation project does not however cover replacing the obsolete equipment, which needs to be done in parallel with the creation of a new national control centre and an additional regional control centre (see below) and the energy management system functionalities of the SCADA system needs to cover all the requirements of a fully proficient SO. Our SCADA expert (currently advising TCN) has costed the implementation of these requirements in detail and we have a capital expenditure of US$3,887,000 in 2014 and of US$32,500,000 in 2015.

Given the growth in the system and ongoing upgrading of SCADA capability our SCADA expert's view is that there will be a need for an annual capital expenditure of US$4 million. It is expected that towards the end of the study the SO will institute a project to replace the obsolete components within the SCADA system. We have allowed a capital expenditure of US$35 million in 2023 for implementation of this project.

6.2.2 Telecoms

Robust, reliable and redundant telecoms are a necessity for the operation of a power system. This results from the basic need to give verbal instruction to other operators on the system, up to the requirement to flow the data and the controls in the SCADA system. Quality modern power systems have multiple telecoms systems (there are examples of having up to eight across the network). The primary reason is that when the power system is lost this lack of power will often shut down parts or all of the various telecom systems: this is at a time when reliable communication is most vital.

The NIAF recommendation is for a minimum of three fully independent telecoms systems and the current telephone landline network is unreliable; indeed practically non-existent. Mobile telephony is not considered a viable solution since it is barely acceptable for verbal instructions (given bad sound quality and lack of recording) and is of little use for data handling. The primary media used by power companies is fibre-optics embedded in the earthing wire of overhead lines but in Nigeria this is also problematic given problems with vandalism and maintenance. Other methods are microwave which is independent of the power system and power line carrier which utilises the primary line conductors. All three of these methods are being used but in general the methodologies used are out-of-date and the equipment is sub-standard and often broken.

NIAF's telecoms expert (currently advising TCN) has put in place a detailed recovery plan for TCN and estimated the costs. There is a capital expenditure of US$22,325,000 in 2014 and of US$ 1,170,000 in 2015 to overhaul the telecoms system in support of the SCADA reinstatement.

We expect that there will be ongoing telecoms capital expenditure as the system expands and have allowed US$2 million per year to cover this. We have also put in a capital expenditure of US$20 million in 2022 to cover upgrading the telecoms system to support the future SCADA system

6.2.3 New National Control Centre

As part of the current SCADA implementation project a new control centre was built and completed in 2010, however considered wholly insufficient by NIAF advisers for the following reasons:

- The control room is very cramped with barely space for three control engineers to perform their duties.
- There is no specialist training room to allow operators to practice and gain skills in an insulated control room environment.
- There are no meeting/presentation rooms.
- Telecoms and SCADA equipment rooms are cramped.
- The office room provided are barely enough for telecoms, SCADA and general IT staff.
- The NCC manager, the operational planning department and all the other day staff have to be housed in the old decrepit control centre building.
- The standby electricity supplies are not considered adequate redundancy and indeed are only just functional.
- Perhaps most importantly, for the new electricity market the system operator will be required to support the market operator this will mean the need for a separate economic control room – which must be housed as well.

As part of the SCADA refurbishment there is a plan in place to put in a new control centre which our SCADA expert has costed as US$72,800,000 falling in 2015. These costs cover a fully functional building, fully redundant standby generation, moving the SCADA equipment, and other required costs.

6.2.4 New Regional Control Centre

Currently, the Delta area is a significant load centre in the Nigerian power network and it is expected to grow, in order to improve the economic network operation of this area, it is proposed that a new separated regional control centre to be built in the Delta Area at the same time as the new national control centre. The cost is expected to be US$80,000,000, which will cover a fully functional building, fully redundant standby generation, SCADA and telecommunication equipment and other required costs. This has been scheduled for 2015, the same year as the new National Control Centre to allow both control centres to be contracted simultaneously.

6.2.5 Planning specific IT investment

For the purposes of this exercise we have assumed that the SO purchase five PSSE licences (or equivalent) in year 1 and two PSSE licences in year 2. They cost around $50,000 each.

We have assumed they will need to be repeated in five years' time.

6.3 MO Capex

We have identified two areas for MO capital investment, namely:

- Settlement System
- Automatic Meter Reading (AMR) System

6.3.1 Settlement system

A settlement system is operated by an electricity system market operator to correlate and aggregate meter and other data concerning electricity flows, purchases and sales on the power system. Typically the basic output is a monthly settlement to each participant telling them in detail what electricity they have flowed onto and out of the system. The amount of data flowing is normally large and its commercial importance is high hence the settlement system is a non-trivial budget item. Settlement System capital cost in a slightly complex market can run up to hundreds of millions of dollars. A significant reason for these costs is that the software is essentially bespoke given the exact rules of an individual electricity market. In addition the settlement system must have full cross-checking and verification and a secure IT hardware environment.

For the Transition Electricity Market (soon to be put in place) the settlement system covers the monthly energy flows of participants and the daily capacity of generating units. It also covers their payments to service providers, being: SO, MO, TSP, NBET and NERC.

A settlement system has been put in place by the MO, however we have no evidence of it being successfully tested and are not convinced it will be adequate for the market. In addition the current market rules do not allow for distribution company imbalances which will significantly increase the complexity of the market rules and hence the settlement system. We have put US$10 million capital costs for a new settlement system in 2015.

6.3.2 Automatic Meter Reading (AMR) System

An Automatic Meter Reading system is an IT system for remotely and automatically collecting data from the commercial meters on the system and then storing the data in a database.

An AMR has been purchased by TCN and is being made operational. However as the system expands new meters will come online and new linkages will need to be put in place. The new connecter will be required to put commercial metering in place at the connection boundary points. These meters must be capable of communicating with the external world using mobile telephony. The MO will need to put in place the actual communication and update the AMR. Then it and its communication with the AMR must be tested. There are about twenty five new commercial metering systems being put in place each year so we have included an annual capital spend of US$100,000 per year to allow for this.

[Section redacted]

Annex 2

Economic Benefit Assessment of Financing Package 2 Projects

Annex 2

Economic Benefit Assessment of Financing Package 2

1 Assumptions and Conditions for Benefit-Cost Assessment

In this pre-feasibility study, benefit-cost analyses are carried out by comparing the economic benefits and costs in two cases, one “with project” and the other “without project.” Costs and benefits are estimated for each project group (1 to 5) of Financing Package 2 and analyses are also carried out respectively. The economic internal rate of return (EIRR) is used as the evaluation index, and the economic net present value (ENPV) and benefit-cost ratio (B/C) are also presented for reference.

Table 1 Indexes Used in Benefit-Cost Assessment

Index	Outline
EIRR	The discount rate by which the aggregate present values of economic benefits and costs are discounted to be equal
ENPV	Aggregate present values (which are discounted at given discount rate) of the yearly differences between economic benefits and costs
B/C	The aggregate present values (which are discounted at given discount rate) of economic benefits divided by the aggregate present values of economic costs.

1.1 Assumptions and Conditions for Estimation of Economic Benefits

In general, benefits of transmission expansion projects are represented by (i) increased electricity distribution, (ii) improved reliability, (iii) stabilized system voltage and (iv) reduced system losses. To simplify the estimation, only direct and quantifiable benefits generated by the project are counted in this study.

The national electrification rate of Nigeria remains at only around 25%, and even in the already electrified areas, power supplies are absolutely short to cover the demands. Presently, families and manufacturers in the areas without access to electricity depend on the self-generation from diesel and petrol generators to gain the electric power. However, self-generation is much more costly than the electricity supply from the grid. By the implementation of the project, Nigerians are able to enjoy more electricity with lower cost.

These gaps between the price of self-generation and grid electricity are assumed as the economic benefit in “with project” case in this study. And at the same time, the projects, especially transmission lines, will occupy the lands which could be used for other purposes if the projects are not carried out. The economic values of those occupied lands are taken as the economic benefit of “without project” case. The economic benefit of “without case” will be deducted from the economic benefit of “with case” as same as the various costs of the projects. The assumptions of benefits in the “with case” and “without case” will be described in the following sections.

1.2 Economic Benefit of “With Case”

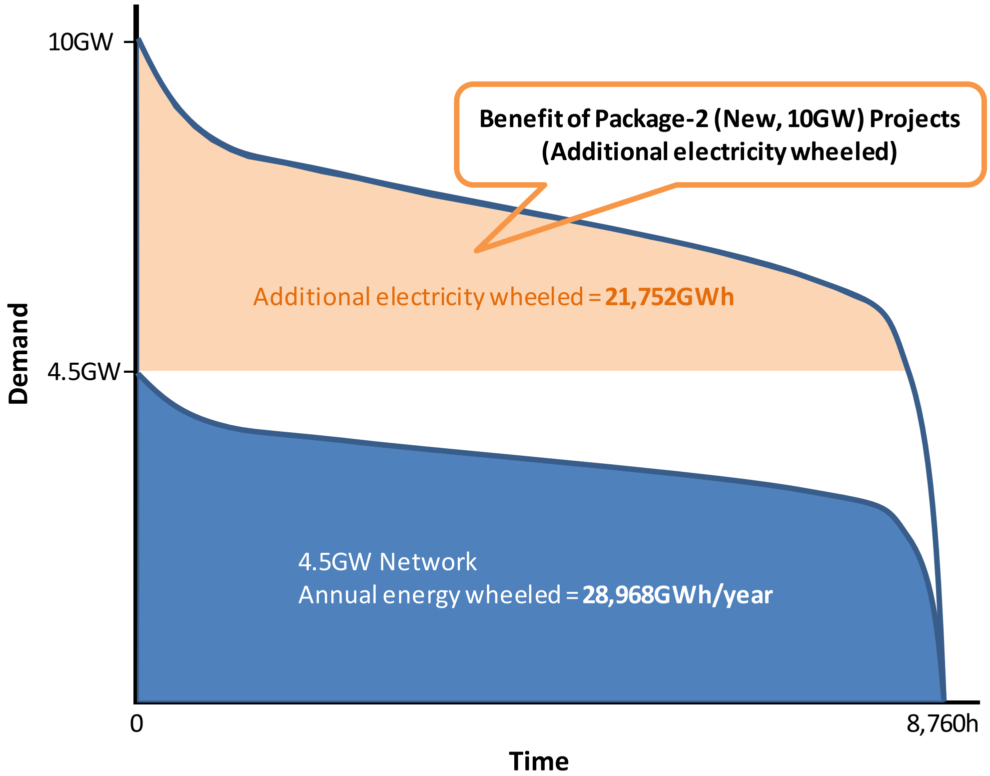
1.2.1 Estimation of Increased Annual Electricity

Increased amount of electricity by the projects is estimated under the following assumptions.

- Amount of wheeled electricity increased by the projects are estimated from the differences of 10 GW transmission capacity model (project package 2) and 4.5 GW transmission capacity model (current condition).
- Electricity demands in each project area of Group 1-5 are high enough to absorb whole increased volume of electricity generated by the projects from the 1st year of the operation (2019).
- Load factor is 70%.

Following figure shows the concept of increased amount of wheeled electricity by the projects.

Figure 1 Load Duration Curve of Nigerian Power System



Increased annual electricity wheeled in each Group is as follows.

Table 2 Increased Annual Electricity by Project Groups (GWh / year)

Group	Areas	Increased annual electricity
Group-1	Kainji-Birnin Kebbi-Gusau	5,253
Group-2	Lagos	9,510
Group-3	Jos-Gombe-Damaturu	2,256
Group-4	Awka-Ugwuaji-Jos	3,104
Group-5	Benin-Katampe	1,629
Total		21,752

1.2.2 Electricity Tariff

The Nigerian electricity industry is comprised of following three sectors: power generation companies, transmission company and distribution companies. In evaluation of economic benefit, only the charges on the customers should be considered, therefore the charges of distribution companies were focused in the calculation. There are 11 distribution companies operating in each region, which are Abuja, Benin, Eko, Enugu, Ibadan, Ikeja, Jos, Kaduna, Kano, Port Harcourt and Yola. Distribution companies corresponding to each transmission project group are as follows.

Table 3 Corresponding Distribution Companies of Project Groups

Group	Distribution Company
Group-1	Kaduna, Kano
Group-2	Eko, Ibadan, Ikeja
Group-3	Jos, Yola
Group-4	Benin, Enugu
Group-5	Abuja, Benin

MYTO II was referred to calculate the tariffs of each distribution company, though it only settles the tariffs for up to 2016. The future tariffs from 2017 to 2046 were estimated under the assumption that the tariff rises annually by the average increasing rate of the tariffs from 2012 to 2016. Tariffs of distribution companies are varied by 14 categories of customer types. Future electricity consumption and customer populations by each category are estimated by the current values obtained from the final report of “National Load Demand Study (2009)” conducted by the Power Holding Company of Nigeria (PHCN).

1.2.3 Self-Generation Cost

The fuels such as diesel and petrol to operate the generators are to be the cost for the self-generation. N60/kWh which is indicated in the “Roadmap for Power Sector Reform (2010)” prepared by Nigerian Government was adopted in this study.

1.3 Economic Benefit of “Without Case”

1.3.1 Occupied Areas for Projects

At least 50m width of lands along the transmission lines should be seized for the exclusive use of the projects. Areas to be occupied with planned transmission lines in each project group are roughly estimated as presented in the following table.

Table 4 Estimated Occupied Areas (ha)

Group	Estimated Occupied Areas
Group-1	6,575
Group-2	4,240
Group-3	1,995
Group-4	5,630
Group-5	3,125

1.3.2 Economic Values of Lands

Economic values of lands are estimated based on the most likely purpose of land use in “without case”. Since as much as 70% of population engage in agriculture in Nigeria, the agricultural use is the most likely purpose for the lands. In this study, economic values of lands were evaluated based on the domestic market price of maize, which is the most prevailing cultivated crop in Nigeria. As for the yield of maize, cereal yield data of World Bank was alternatively used in this study. Assumption basis are as follows.

Table 5 Assumption Basis of Land Economic Value

Group	Estimated Occupied Areas
Domestic Market Price of Maize1)	92,593 NGN/1000kg
Cereal Yield (2012)2)	1,363kg/ha

Source: 1) West-African Market Information Network[1] 2) World Bank

[1] http://www.resimao.org/html

2 Assumptions and Conditions for Estimation of Economic Costs

2.1 Initial Investment Cost

Initial investment costs of each group are as follows.

Table 6 Estimated Initial Investment Cost of Project

Group	Initial Investment Cost (million USD)
Group-1	438
Group-2	548
Group-3	246
Group-4	618
Group-5	385
Total	2,235

To conduct the cost-benefit analysis, project costs should be converted into economic values with consideration of the existence of shadow rates such as minimum wages of unskilled labour. In this study, 0.95 was adopted as the standard conversion factor into the economic cost according to the final report of “WAPP North Core 330 kV Project” conducted by PHCN in 2007.

2.2 O&M Cost

O&M cost was settled as 1% of the initial investment cost for the transmission lines and 1.5% for the substations according to the report of “WAPP North Core 330 kV Project”.

3 Benefit-Cost Analysis Results

3.1 General Assumptions

General assumptions of the analysis are presented as follows.

Table 7 General Assumptions for Economic Analysis

Element	Value
Analysis Period	2017–2046 (30 years)
Construction Period	2014–2016 (3 years) Initial investment costs were allocated 70% for the 1st year of construction, 20% for the 2nd year, 10% for the 3rd year.
Residual Value	10% of construction cost
Discount rate to evaluate ENPV and B/C	12% (settled with reference to the monetary policy rate of FGN and previous studies carried by TCN)
Exchange Rate	1 USD = 158.228 NGN

3.2 Benefit Cost Results

Results of benefit-cost assessment are presented in the following table.

Table 8 Results of Benefit-Cost Assessment

Group	EIRR	ENPV (million USD)	B/C	ENPV/C
Group-1	23.94%	637	2.35	1.35
Group-2	37.92%	2293	5.07	4.07
Group-3	20.92%	261	2.03	1.03
Group-4	16.36%	299	1.47	0.47
Group-5	17.60%	245	1.62	0.62

Group 2 scores the highest EIRR of 37.92% and one of the reasons of it is because the project areas of Group 2 are located in Lagos and its surrounding areas, which are most densely populated areas in this country, therefore potential demands and expected increased electricity compared to the project costs are relatively high. Overall, EIRR of all groups are higher than the provided discount rate of 12%. It means that the economic benefits overtake the opportunity costs of the capital. Hence, all project groups can be assessed as economically valid judged from the results of benefit-cost analyses.

3.3 Sensitivity Analysis Results

Table 9 presents the results of sensitive analyses which were carried out by re-assessment of EIRRs under the assumptions of ±10%, ±20% of initial investment cost and benefit respectively. Results are as follows.

Table 9 Results of Sensitivity Analysis of Benefit-Cost Assessment

	Project Cost				**Benefit**			
Group	**-20%**	**-10%**	**+10%**	**+20%**	**-20%**	**-10%**	**+10%**	**+20%**
Group-1	27.83%	25.72%	22.41%	21.08%	20.25%	22.14%	25.66%	27.31%
Group-2	43.50%	40.48%	35.72%	33.81%	32.82%	35.44%	40.29%	42.56%
Group-3	24.39%	22.51%	19.56%	18.39%	17.73%	19.37%	22.41%	23.84%
Group-4	19.17%	17.64%	15.25%	14.28%	13.71%	15.07%	17.58%	18.76%
Group-5	20.59%	18.96%	16.42%	15.40%	14.82%	16.25%	18.89%	20.13%

Even in the sensitive analyses, evaluated EIRRs are all exceeding 12% and indicating the validity of the projects from the economic viewpoint. EIRRs of Group 1 and 2 secure 20% at lowest and it can be said these project groups are robust enough from the economic aspect. EIRRs of Group 4 and 5 mark the lower values: 13.71% of Group 4 and 14.82% of Group 5, the values just above the discount rate 12%. Both are resulted from the analyses with -20% benefits. In implementation of Group 4 and 5, the economic benefit as well as costs should be re-assessed carefully.

Annex 3

Financial Analysis of Financing Package 2 Projects

Financial Analysis of Financing Package 2 Projects

This Annex presents the financial analysis of the five project groups of package 2 of projects for TSP.

Methodology

1. The project financial analysis is carried out by comparing project revenues and the various project costs in constant 2013 US dollars over project life (30 years) to assess their profitability.

2. Annual project revenues for each group from project commissioning in 2018 are computed according to the following formula:

   - Bulk energy supply, multiplied by
   - Average tariff of TSP, multiplied by
   - Billing collection rate

3. Annual project costs for each group comprise of:

   - Capital investment costs as per disbursement profiles indicated in Table 1 below, plus
   - Operations and maintenance (O&M) costs, from project commissioning, equivalent to 1% of capital investment costs, plus
   - Corporate income tax on profits.

4. Financing costs are not considered as project financial viability is considered from an investor/owner perspective.

5. The base case results of the financial analysis are considered in terms of the financial internal rate of return (FIRR), financial net present value (FNPV), benefits to cost ration (B/C) and simple payback period. The results of various scenarios are presented in terms of FIRR.

Investment Costs

6. The estimated project costs and disbursement profiles for each group of the five packages are summarized in Table 1 below.

Table 1: Investment Costs in 2013 US$ millions

	2015	2016	2017	Total
Group 1	306	88	44	438
Group 2	384	110	55	548
Group 3	172	49	25	246
Group 4	432	123	62	617
Group 5	297	59	30	385
Total Package 2	1,591	429	215	2,235

Wheeled Energy & Bulk Supply

7. Table 2 below shows the estimated energy wheeled and bulk supply for each group of investments.

Table 2: Wheeled Energy & Bulk Supply

Investment Groups >	1	2	3	4	5	Total
Wheeling capacity (MW)	902	1,633	387	533	280	3,734
Load factor	0.70	0.70	0.70	0.70	0.70	
Wheeled energy (GWh)	5,529	10,011	2,375	3,267	1,715	22,897
Transmission losses	5.0%	5.0%	5.0%	5.0%	5.0%	
Bulk supply to DisCos (GWh)	5,253	9,510	2,256	3,104	1,629	21,752

8. It is assumed that no gas constraints will apply as from 2018 and that electricity demand in each project group area will be high enough to utilize in full the added wheeling capacity of each project group from the first year of operation (i.e. 2018 onwards).

Tariffs & Revenues

9. The following two alternative tariff scenarios for TSP have been considered in estimating revenues:

- MYTO II tariffs

- Fully cost reflective tariffs

10. MYTO II tariffs apply until May 2017 as per existing NERC Order. These tariffs have been adjusted by removing assumed price escalations. Thereafter, tariffs are assumed to increase annually by 1% in real terms. Fully cost reflective tariffs, which have been estimated to 2018, reflect in full the amounts needed to adequately maintain and operate the network and to grow the infrastructure in step with rapid expansion of generation and load. The resulting tariffs are significantly higher than existing MYTO tariffs. Tariffs from 2019 onwards are assumed to increase annually by 1% in real terms.

11. The average tariffs in 2018 (in 2013 prices) under the two tariff scenarios are indicated in Table 3 below.

Table 3: Average TSP Tariffs in 2018 (in 2013 prices)

In 2013 prices	NGN/MWh	US$/MWh
MYTO II	1,144	7.372
Fully cost reflective	3,690	23.774
Gap	223%	223%

12. It is assumed that TSP will collect 100% of its billings from 2018 onwards when the projects are commissioned.

O&M Costs and Corporate Income Tax

13. Operations and maintenance costs for each project group is estimated at 1% of the applicable capital investment costs.

14. The Corporate income tax – 32% (including 2% education tax). Investment allowance of 10% per annum (i.e. for 10 years). Accumulated tax losses carried-forward for set-off against future taxable profits (it is assumed that the company as a whole will generate profits in the future)

Results of Project Financial Analysis

15. Table 4 below shows the results of the financial analysis for each project group and all project groups combined under the two tariff scenarios described above.

Table 4: Results of Project Financial Analysis

	MYTO II Tariffs				Fully Cost Reflective Tariffs			
	FIRR	FNPV	B/C	Simple Payback (Years)	FIRR	FNPV	B/C	Simple Payback (Years)
Group 1	5.6%	-71	0.84	11	17.7%	517	1.74	4
Group 2	8.8%	66	1.11	8	23.2%	1,110	2.01	2
Group 3	3.6%	-78	0.67	15	14.3%	180	1.52	5
Group 4	-0.1%	-351	0.39	Over 30	8.2%	38	1.06	8
Group 5	-1.3%	-243	0.32	Over 30	6.6%	-31	0.92	10
All Groups	4.0%	-643	0.71	14	15.0%	1,834	1.57	4

16. Each group is considered to be financially viable if its Financial Internal Rate of Return (FIRR) is equal to or greater than the Weighted Average Cost of Capital (WACC), estimated at 7.49% (real after tax as per NERC estimates for MYTO tariff evaluation).

17. Results if MYTO II tariffs applied - Only investment Group 2 meets the minimum FIRR criteria of 7.49%. In descending order of financial performance, Group 2 is followed by Group 1, Group 3, Group 4 and lastly Group 5. The only positive FNPV and benefits/cost ratio exceeding 1.0 times applies to Group 2. These results clearly indicate that 4 out 5 Groups of investments will not be financially viable if MYTO tariffs applied. All Groups combined also do not meet the minimum FIRR.

18. Results if fully cost reflective tariffs applied – Under these conditions, the collected revenues will provide the required positive financial results for all Groups except marginally for Group 5.

19. The above results illustrate the need for an urgent review and revision of tariffs that will make the proposed transmission projects financially attractive to prospective donors and investors.

20. Apart from the increase in wheeling capacity and reduced transmission losses, which have been assessed above, in terms of their financial benefits, there are other benefits resulting from the investments which cannot be easily assessed in financial terms. Such benefits include improvements in system reliability and stabilization of system voltage.

Sensitivities

21. Table 5 below shows the results in terms of FIRR of sensitivities applied to the Base Case assumptions for Project Costs and Revenues detailed above. With MYTO II tariffs, Group 2 meets the minimum criteria in all cases (except for marginally lower FIRR of 7.3% with +20% project costs), indicating the robustness of this particular group of investments.

Table 5: Results of Sensitivities

	MYTO II Tariffs (FIRR)					Fully Cost Reflective Tariffs (FIRR)				
Project Costs	Base	+ 10%	+ 20%	- 10%	- 20%	Base	+ 10%	+ 20%	- 10%	- 20%
Group 1	5.6%	4.9%	4.4%	6.4%	7.3%	17.7%	16.5%	15.5%	19.1%	20.8%
Group 2	8.8%	8.0%	7.3%	9.7%	10.8%	23.2%	21.7%	20.4%	24.9%	26.9%
Group 3	3.6%	3.0%	2.5%	4.3%	5.0%	14.3%	13.3%	12.4%	15.5%	17.0%
Group 4	-0.1%	-0.6%	-1.0%	0.4%	0.9%	8.2%	7.4%	6.7%	9.1%	10.1%
Group 5	-1.3%	-1.8%	-2.2%	-0.7%	-0.1%	6.6%	5.9%	5.3%	7.4%	8.4%
All Groups	4.0%	3.6%	3.1%	4.9%	5.7%	15.0%	14.0%	13.0%	16.3%	17.7%
Revenue	Base	+ 10%	+ 20%	- 10%	- 20%	Base	+ 10%	+ 20%	- 10%	- 20%
Group 1	5.6%	6.4%	7.1%	4.8%	3.9%	17.7%	19.0%	20.3%	16.3%	14.9%
Group 2	8.8%	9.7%	10.6%	7.8%	6.8%	23.2%	24.8%	26.3%	21.5%	19.7%
Group 3	3.6%	4.3%	4.9%	2.9%	2.1%	14.3%	15.5%	16.6%	13.1%	11.9%
Group 4	-0.1%	0.4%	0.9%	-0.8%	-1.7%	8.2%	9.0%	9.9%	7.2%	6.2%
Group 5	-1.3%	-0.6%	0.0%	-2.0%	-2.9%	6.6%	7.4%	8.2%	5.7%	4.8%
All Groups	4.0%	4.9%	5.6%	3.4%	2.6%	15.0%	16.2%	17.3%	13.8%	12.5%

22. Variations in project costs have a direct impact on O&M costs as these estimates are linked. The sensitivity results relating to project costs reflects this linkage.

Annex 4

Financial Assessment of TCN

ANNEX 4 – FINANCIAL ASSESSMENT OF TCN

1. INTRODUCTION

This Annex presents the financial assessment of TCN covering the recent past performance (2011 to 2013) and a “Minimum Funding” cash constrained operating budgets for TCN for 2014-15. The forecasts are prepared under the assumption that there will be no tariff increase in 2014-15 (i.e. MYTO II tariffs will apply throughout). TCN’s historical financial statements have not yet been audited and there is fundamental uncertainty regarding the reliability of these financial statements.

2. RECENT PERFORMANCE

Operational Performance

1. TCN’s key operational performance indicators over the last three years are indicated in Table 1 and Figure 1 below.

Table 1: Operational Indicators 2011-13

	2011	2012	2013
Peak generation (MW)	4,089	4,518	4,458
Average generation (MW)	3,082	3,298	3,297
Growth in peak generation	7.5%	10.5%	-1.3%
Energy wheeled (sent out by stations) (GWh)	26,999	28,890	28,879
Growth in energy sent out	10.8%	7.0%	0.0%
Transmission losses (%)	10.4%	12.1%	12.1%
Bulk supply to DisCos (GWh)	24,205	25,385	25,373
Number of staff at December 31	3,334	3,958	4,210
Energy wheeled (GWh) per staff	8.1	7.3	6.9

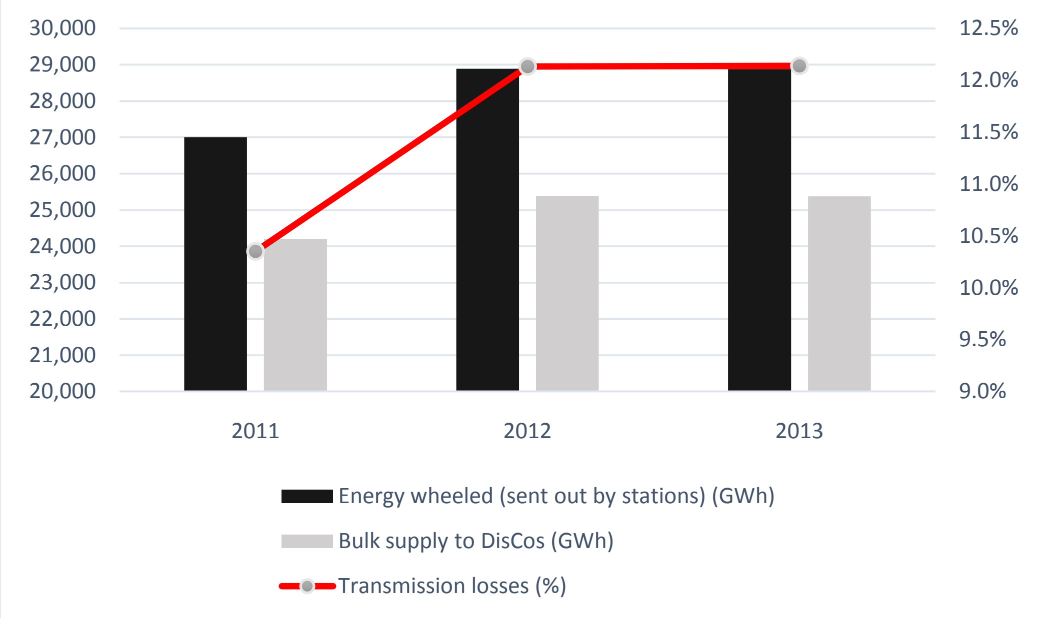


Figure 1: Operational Indicators 2011-13

2. Peak generation of around 4,500 MW in the last two years was more or less equal to the capacity of the transmission network to transmit the available generation to the distribution companies (DisCos).

3. Energy wheeled (sent out by stations) registered growth rates of 10.8% in 2011, 7.0% in 2012 and remained almost unchanged in 2013. Total wheeled energy in 2013 reached 28,879GWh. Performance in terms of transmission losses has deteriorated since 2011, increasing from 10.4% in 2011 to 12.1% in 2012/13. The high losses include non-technical losses attributable to illegal connections by some large industrial consumers. Inadequate maintenance of the transmission network over the years has resulted in high technical losses.

4. The number of staff employed by TCN increased from 3,334 in 2011 to around 4,210 by end 2013. The increase in staff numbers was far greater than the growth in wheeled energy and as a result the energy wheeled per staff declined from 8.1GWh in 2011 to 6.9GWh in 2013.

Financial Performance

5. TCN is technically insolvent as the existing MYTO transmission tariffs and billing collections are inadequate for the company to finance its operations. The company is consistently unable to meet its obligations to suppliers/contractors in compliance with terms of contracts. TCN is fortunate that the company has FGN backing. The present financial situation of the company is not sustainable.

6. Non-collection of tariff charges is a significant recurring problem for TCN. The Interim Market Rules (pre-TEM) provides for collection of 70% for TSP and 60% for SO and MO. However, the overall average collection rate in 2013 was

around 60%. Retail billing collections by DisCos have dropped to 45% in the last two months and this will impact on all the Market Participants and Service Providers, including TCN.   Shows the monthly billing collection performance in 2013.

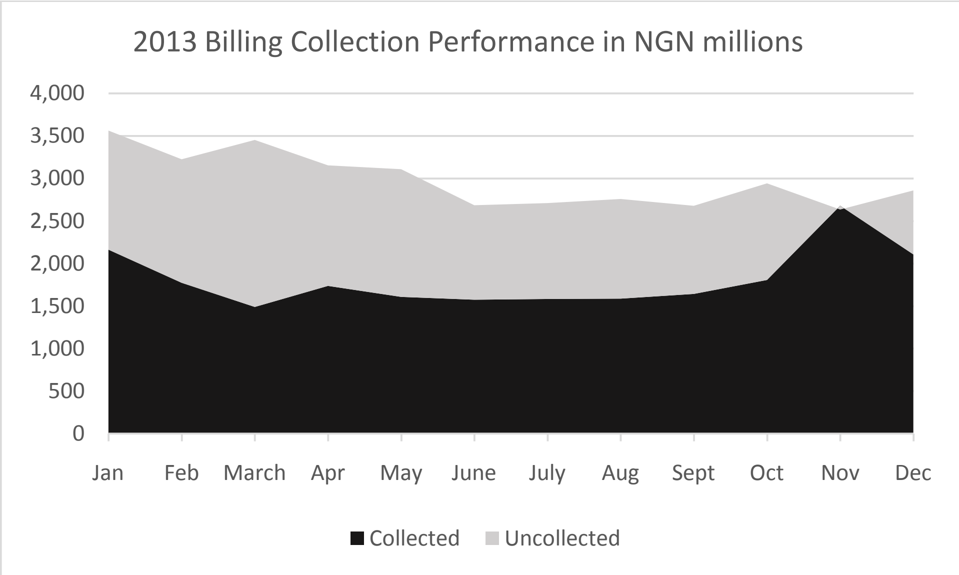


Figure 2: 2013 Monthly Billing Collection Performance

7. The company's unpaid billing due from the market fund as at December 31, 2013 amounted to NGN50 billion (US$315 million), equivalent to 138% – or 16 months – of TCN of 2013 annual revenues.

8. Table 2 below provides the key financial performance indicators over the past three years.

Table 2: Financial Indicators 2011-13

	2011	2012	2013
Av tariff (NGN/MWh)	1,331	1,445	1,490
Av tariff (US$/MWh)	8.73	9.25	9.57
Av operating profit/(loss) (NGN/MWh)	449	(269)	(278)
Av operating profit/(loss) (US$/MWh)	2.94	(1.72)	(1.79)
Net profit/(loss) (NGN millions)	10,968	(6,718)	(7,005)
Net profit/(loss) (US$ millions)	72	(43)	(45)
Operating margin	29.5%	-18.1%	-18.2%
Return on equity	3.5%	-2.2%	-2.1%
Current ratio (times)		4.5	2.9
Debt/equity ratio		9.0%	11.2%

9. Transmission tariffs were applied in accordance with MYTO II tariffs pre-determined by NERC for the period June 2012 to May 2017. Although the revenue requirements of TCN are mostly of a fixed nature, the transmission

tariff determined by NERC is based on the volume of bulk supply to distribution companies. This means that TCN carries an element of generation risk. The company is financially exposed due to non-availability of expected generation capacity. The average transmission tariff increased by 11.9% compared with domestic inflation of 21.7% during the last two years to end 2013.

10. TCN made pre-tax losses of FGN13.7 billion (US$88 million) in 2012/13 with negative operative margin of around 18%, based on unaudited financial statements. The company had a low debt/equity ratio of 11% as at December 31, 2013.

3. FINANCIAL OUTLOOK 2014/15

11. The financial outlook over the next few years will largely depend on the availability of generation capacity (and thus wheeled energy), refurbishment of existing the transmission network in the short-term, expansion of the transmission network in the medium-term, efficiency improvements in terms of transmission losses and operating expenses, financing costs of planned investments and tariff levels in particular.

Conclusions

12. The collected cash revenue is inadequate for TCN to embark on the required program of transformation. For the remainder of 2014 and into 2015, TCN will continue to operate under severe cash constraints if the existing MYTO II tariffs regime applied and tariffs are not revised upwards. The main takeaway is that existing tariff levels and cash collections on billed revenues are much too low to fund the operational and capital expenditures necessary for TCN to adequately perform its functions. Until the situation turns around, a minimum funding regime and strict austerity will have to be implemented.

13. TCN will make an application to NERC for higher tariffs to reflect changes since 2012. These include:

- Poor billing collections (MYTO II assumes 100% collections)
- Much higher annual network maintenance & operating requirements for proper operations
- Depreciation on assets in service and returns on capital employed:
- Planned heavy network investments (US$7.7 billion) to 2018
- Anticipated transfer of NIPP assets (US$2.0 billion) in 2014
- Transfer of transmission assets (US$467 million) recorded in PHCN books
- Transfer of transmission assets ($147 million) recorded in PMU books

14. In view of the uncertainties concerning the outcome of the forthcoming tariff negotiations, the Minimum Funding financial projections of TCN presented in this Annex are limited to 2014-15.

Tariffs

15. MYTO II tariffs, which were pre-determined by NERC for 2012-17, are shown in Table 3 below. Tariffs are revised every June 1 and the percentages changes shown are implemented as per MYTO rules. Tariffs were reduced by 6.5% effective June 2013 and are expected to be reduced by 1.6% in June 2014 and revised upwards by 9.3% & 11.7% in June 2015 & 2016 respectively.

Table 3: MYTO II Tariffs 2012-16

	MYTO II Tariffs				
	June 2102	June 2103	June 2104	June 2105	June 2106
TSP wheeling charges	1,216	1,137	1,119	1,224	1,367
SO services	195	182	179	196	219
MO services	51	48	47	52	58
TCN charges	1,462	1,367	1,346	1,472	1,643
Ancilliary charges	21	19	19	21	23
NERC fees	38	36	35	38	43
Transmission tariff	1,521	1,422	1,400	1,531	1,709
Change in tariff		-6.5%	-1.6%	9.3%	11.7%

16. The above tariffs have been assumed in the projected financial outcomes presented in this Annex.

Key Performance Indicators 2014-15

17. Table 4 below provides a summary of energy wheeled, revenues, operating costs, capital investments funded from internally generated revenues (IGR) and cash flows under the Minimum Funding projections for 2014-15 together with estimated actuals for 2013.

Table 4: Energy, Revenues & Cash Flows 2013-15

	Est Actual	Minimum Funding MYTO II Tariffs	
	2013	2014	2015
Energy			
Transmission losses	12.1%	10.0%	9.5%
Bulk supply to DisCos (GWh)	25,373	31,895	33,172
Growth in bulk supply	0.0%	25.7%	4.0%
Tariffs (excl Ancilliary & NERC charges)			
Date of tariff increase	June 1	June 1	June 1
Tariff increase	-6.5%	-1.6%	9.3%
Average tariff after increase (NGN/MWh)	1,367	1,346	1,472
Average tariff in year (NGN/MWh)	1,432	1,355	1,419
All figures in NGN billions			
Wheeling revenue:			
Billed	36.3	43.2	47.1
% collected/billed	61%	51%	75%
Operating costs	24.8	27.2	30.6
Capital expenditure from IGR	2.1	0.9	4.0
Incr/(decr) in inventory	(4.5)	(1.4)	0.0
Net cash inflow/(outflow)	1.1	(6.7)	0.2
Cash balance at Dec 31:			
As forecast	8.4	1.7	1.9
Minimum required		1.7	1.9
Cash surplus/(shortfall)		0.0	0.0

18. The following observations can be made concerning the figures shown in the foregoing table:

- Energy wheeled is forecast on the basis of constrained gas supply. The increase in bulk supply to DisCos is projected to increase by 22.7% in 2014 and by 3.4% in 2015. The increases are due to a combination of additional generation capacities coming online and reduction in transmission losses. The energy losses are projected to decline by 2% in 2014 by targeting non-technical losses (i.e. theft by some major industrial consumers) and investments in the refurbishment of the network, a modest reduction of 0.5% is assumed in 2015.

- MYTO II tariffs are revised every June 1 and the percentage changes shown are implemented as per MYTO order. It should be noted that tariffs were reduced by 6.5% effective June 1, 2013 and are expected to be reduced by 1.6% effective June 1, 2014. MYTO II tariffs are expected to be revised upwards by 9.3% effective June 1, 2015.

- Billing collection rates are assumed under all scenarios at 45% from January to July 2014, 60% from August to December 2014 and 75% in 2015. The 45% figure represents the fact that retail billing collections by DisCos have dropped to 45% in the last two months and this will impact on all the Market Participants and Service Providers, including TCN. Non-collection of tariff charges is a persistent problem for TCN. The Interim Market Rules (pre-TEM), which provide for collection of 70% for TSP and 60% for SO and MO effective November 2013, have not been followed to date. The overall average collection rate in 2013 was around 61%

- TCN's collected revenue varies directly with the amount of energy wheeled, whereas TCN's costs are nearly 100% fixed. Under the existing tariff levels and collection rates, the energy wheeled would need to be more than double the current amount to generate enough cash for proper funding of the business. Table 5 below provides a sensitivity showing the change in cash flows for changes to the amount of wheeled energy.

19. Operating costs and investments funded from internally generated revenues (IGR) have had to be scaled back significantly to levels that are affordable in terms of forecast cash inflows under the Minimum Funding budgets. Required minimum cash balances are maintained in 2014-15.

20. TCN will have to operate under a tight financial regime or risk defaulting on cash obligations. Net cash outflows of NGN6,704 million in 2014 are forecast under the Minimum Funding budgets (MYTO II tariffs) and the cash balance by December 2014 declines to NGN1,731 million, which is equal to the minimum requirement.

Sensitivities to Minimum Funding Budgets

21. The Minimum Funding cash flows presented above were subjected to several key sensitivity tests and the results of these sensitivities are presented in Table 5 below.

Table 5: Cash Flow Impacts of Key Sensitivities 2014-15

	NGN millions			US$ millions		
	2014	2015	Total	2014	2015	Total
Wheeled energy						
High Case	3,395	6,285	9,680	22	39	61
Low Case	(3,378)	(6,253)	(9,631)	(21)	(39)	(60)
Transmission losses						
Minimum Funding	10.0%	9.5%				
2013 level (i.e. no improvements)	12.0%	12.0%				
Lower losses (i.e. higher efficiency gains)	9.0%	8.0%				
Cash flow impact:						
2013 level (i.e. no improvements)	(411)	(933)	(1,345)	(3)	(6)	(8)
Lower losses (i.e. higher efficiency gains)	206	548	754	1	3	5
Collection rates (2013 = 61%, Dec 2013-Jan 2014 = 45%):						
Minimum Funding	51.3%	75.0%				
2013 level	61.0%	61.0%				
Present (Dec 2013/Jan 2014) level	45.0%	45.0%				
Improved collections	75.0%	90.0%				
Cash flow impact:						
2013 level	4,103	(6,606)	(2,503)	26	(41)	(15)
Present (Dec 2013/Jan 2014) level	(2,630)	(13,934)	(16,564)	(17)	(87)	(103)
Improved collections	9,995	6,967	16,961	64	43	107

22. Changes in assumptions relating to wheeled energy, transmission losses and collection rates have significant impacts on the financial outcomes for TCN. This is clearly illustrated in the results indicated in the above table.

TCN Financial Statements 2012-15

23. The unaudited draft financial statements of TCN for 2012 and 2013 and forecasts prepared under the Minimum Funding Budgets are presented in the following pages.

Transmission Company Of Nigeria (TCN) Income Statements (in NGN millions)				
	2012	2013	2014	2015
	Actual	Est Actual	Forecast	Forecast
	Unaudited	Unaudited	Minimum Funding	
Energy wheeled (sent out by stations) (GWh)	28,890	28,879	35,439	36,654
Transmission losses (%)	12.1%	12.1%	10.0%	9.5%
Bulk supply to DisCos (GWh)	25,385	25,373	31,895	33,172
Average tariff (incl Ancilliary & NERC charges)				
NGN/MWh	1,439	1,454	1,409	1,476
US$/MWh	9.214	9.338	8.970	9.167
Operating revenue				
Wheeling charges	32,414	30,281	35,942	39,157
SO & MO administration services	3,982	6,044	7,274	7,924
SO ancilliary services	145	575	616	671
NERC regulatory charges	148	908	1,124	1,224
Other operating revenue	972	882	954	1,021
Total operating revenue	37,661	38,690	45,909	49,997
Operating expenses				
Payroll	16,018	13,503	17,828	20,056
Repairs & maintenance	6,000	3,733	3,553	3,997
Ancilliary services costs	145	575	616	671
Regulatory fees	148	908	1,124	1,224
Administration & overheads	4,091	7,593	5,835	6,564
Operating expenses before depreciation & provisions	26,402	26,311	28,955	32,513
Depreciation	10,679	12,034	17,566	24,492
Provisions for bad debts	7,415	7,401	21,067	11,770
Total operating expenses	44,496	45,746	67,589	68,775
Operating profit/(loss)	(6,835)	(7,056)	(21,680)	(18,778)
Net finance charges	(118)	(51)	414	694
Profit/(loss) before taxation	(6,718)	(7,005)	(22,094)	(19,471)
Taxation	0	0	0	0
Profit/(loss) after taxation	(6,718)	(7,005)	(22,094)	(19,471)
Ratios				
Av. operating profit/(loss) N/MWh	(269)	(278)	(680)	(566)
Av. operating profit/(loss) US$/MWh	(1.724)	(1.786)	(4.326)	(3.514)
Operating margin (%)	-18.1%	-18.2%	-47.2%	-37.6%
Return on equity (%)	-2.2%	-2.1%	-3.8%	-2.2%

Transmission Company Of Nigeria (TCN) Balance Sheets (in NGN millions)	2012	2013	2014	2015
	Actual	Est Actual	Forecast	Forecast
	Unaudited	Unaudited	Minimum Funding	
Fixed & other long-term assets				
Tangible assets at cost/valuation	281,614	374,557	877,914	1,299,841
Less: Accumulated depreciation	21,654	33,688	51,254	75,746
Net book value of fixed assets	259,961	340,870	826,660	1,224,095
Liquidiy facility (AFD)	0	0	0	2,143
Project funds & advances	44,296	54,060	38,060	38,060
Total long-term assets	304,256	394,930	864,720	1,264,299
Current assets				
Inventory	9,811	14,269	12,862	12,862
Customer accounts receivable	5,567	6,514	7,095	7,571
Other debtors & prepayments	898	5,805	6,281	6,721
Cash at bank and in hand	7,371	8,435	1,731	1,887
Total current assets	23,647	35,023	27,969	29,041
Current liabilities (amounts falling due within one year)				
Creditors	5,295	12,027	7,294	7,294
Bank overdraft	0	0	0	0
Debt service due	0	0	0	1,527
Current Portion of long-term loans	0	0	2,094	2,608
Total current liabilities	5,295	12,027	9,389	11,429
Net current assets/(liabilities)	18,353	22,997	18,581	17,612
Total assets less current liabilities	322,609	417,927	883,301	1,281,911
Creditors (amounts falling due after more than one year)				
Long-term loans	25,872	41,872	73,005	339,603
Less: Current portion	0	0	2,094	2,608
Long-term portion	25,872	41,872	70,911	336,995
Legacy liabilities	1,300	1,300	1,300	1,300
Employee benefits scheme	1,981	3,671	6,345	9,354
Total creditors (amounts falling due after more than one year)	29,153	46,843	78,556	347,649
Net assets employed	293,456	371,084	804,745	934,262
Capital and reserves				
Capital & reserves	193,323	186,299	164,206	144,735
Grants & Government contribution for investments	100,133	184,784	640,539	789,527
Shareholders' equity	293,456	371,084	804,745	934,262
Ratios				
Current ratio (times)	4.5	2.9	3.0	2.5
Debt/equity ratio	9%	11%	9%	27%

Transmission Company Of Nigeria (TCN) **Cash Flows (in FGN millions)**			
	2013	2014	2015
	Est Actual	Forecast	Forecast
	Unaudited	Minimum Funding	
Net cash inflow/(outflow) from operating activities:			
Operating profit/(loss)	(7,056)	(21,680)	(18,778)
Depreciation	12,034	17,566	24,492
(Increase)/decrease in stocks	(4,457)	1,407	0
(Increase)/decrease in debtors	(5,854)	(1,056)	(916)
Increase/(decrease) in creditors	8,422	(2,059)	3,008
Other	(18)	0	0
Net cash inflow/(outflow) from operating activities	3,070	(5,822)	7,806
Returns from investments and servicing of finance:			
Interest received	51	0	21
Interest paid	0	(0)	(480)
Net cash outflow for returns on investments & servicing of finance	51	(0)	(459)
Taxation paid	0	0	0
Investing activities:			
Payments to acquire tangible fixed assets	(20,480)	(191,622)	(415,621)
Project funds & advances	(9,765)	16,000	0
Net cash outflow from investing activities	(30,245)	(175,622)	(415,621)
Net cash inflow/(outflow) before financing	(27,124)	(181,443)	(408,274)
Financing activities:			
Grants & Government contribution for investments	12,188	145,355	148,988
Borrowing	16,000	29,385	262,632
Borrowing repaid	0	0	(1,047)
Liquidiy facility (AFD)	0	0	(2,143)
Net cash inflow from financing activities	28,188	174,740	408,430
Increase/(decrease) in cash and cash equivalents	1,064	(6,704)	156
Cash and cash equivalents at beginning of year	7,371	8,435	1,731
Cash and cash equivalents at end of year	8,435	1,731	1,887
Ratios			
Self-financing ratio (%)	4%	-3%	1%

Annex 5

Guidelines for Competitive Procurement and Contracting

Section 1:	Nigeria Public Procurement Act, 2007
Section 2:	Nine Essential Steps in Public Procurement
Section 3:	Bureau of Public Procurement Thresholds for Service-wide Public Procurement

PUBLUC PROCUREMENT ACT, 2007

ARRANGEMENT OF SECTIONS

SECTION :

PUBLUC PROCUREMENT ACT, 2007

2007 ACT No. 14

AN ACT TO ESTABLISH THE NATIONAL COUNCIL ON PUBLIC PROCUREMENT AND THE BUREAU OF PUBLIC PROCUREMENT AS THE REGULATORY AUTIIORITIES RESPONSIBLE FOR THE MONITORING AND OVERSIGHT OF PUBLIC PROCUREMENT, HARMONIZING THE EXISTING GOVERNMENT POLICIES AND PRACTICSES BY REGULATING, SETTING STANDARDS AND DEVELOPING THE LEGAL FRAMEWORK AND PROFESSIONAL CAPACITY FOR PUBLIC PROCUREMENT IN NIGERIA , AND FOR RELATED MATTERS.

[4th Day of June, 2007] **Commencement**

ENACTED by the National Assembly of the Federal Republic of Nigeria:

PART I-ESTABLISHMENT OF NATIONAL COUNCIL ON PUBLIC PROCUREMENT

Establishment of the national council on Public Procurement and its membership

1. **(I)** There is established the National Council on Public Procurement (in this Act referred to as "the Council").

(2) The Council shall consist of :

(a) the Minister of Finance as Chairman

(B) the Attorney-General and Minister of Justice of the Federation

(c) the Secretary to the Government of the Federation

(d) the Head of Service of the Federation;

(e) the Economic Adviser to the President

(f) six part-time members to represent;

(i) Nigeria Institute of Purchasing and Supply Management

(ii) Nigeria Bar Association;

(iii) Nigeria Association of Chambers of Commerce, Industry, Mines and Agriculture ;

(iv) Nigeria Society of Engineers ;

(v) Civil Society;

(vi) the Media; and

(g) the Director-General of the Bureau who shall be the Secretary of the Council.

(3) Notwithstanding the provisions of Section (2), the council may co-opt any person to attend its meeting but the person so co-opted shall not have a casting vote or be counted towards quorum.

(4) The Chairman and other members of the Council shall be appointed by the President.

(5) Subject to subsection (2) of this Section. a member of the Council being;

(a) the holder of an elective office under the Constitution of Nigeria, shall hold office for a period he remains so elected and no more ; and

(b) the Director-General of the Bureau, shall hold office on such terms and conditions as may be specified in his letter of appointment.

Functions of the Council.

2. The Council shall :

(a) consider, approve and amend the monetary and prior review thresholds for the application of the provisions of this Act by procuring entities

(b) consider and approve policies on public procurement;

(c) approve the appointment of the Directors of the Bureau

(d) receive and consider, for approval, the audited accounts of the Bureau of Public Procurement ; and

(e) "approve changes in the procurement process to adapt to improvements in modern technology"

(f) give such other directives and perform such other functions as may be necessary to achieve the objectives of this Act.

P ART II- ESTABLISHMENT OF THE BUREAU OF PUBLIC PROCUREMENT

The establishment of the Bereau of Public Procurement

3(I) There is established an agency to be known as the Bureau of Public Procurement in this Act referred to as "the Bureau".

(2) The Bureau :

(a) shall be a body corporate with perpetual succession and a common seal

(b) may sue and be sued in its corporate name ; and

(c) may acquire, hold or dispose of any property, movable or immovable for the purpose of carrying out any of its functions under this Act.

Objectives of the Bureau

4. The objectives of the Bureau are:

(a) the harmonization of existing government policies and practices on public procurement and ensuring probity, accountability and transparency in the procurement process ;

(b) the establishment of pricing standards and benchmarks;

(c) ensuring the application of fair, competitive, transparent. value-for-money standards and practices for the procurement and disposal of public assets and services ; and

(d) the attainment of transparency, competitiveness, cost effectiveness and professionalism in the public sector procurement system.

Functions of the Bureau

5. The Bureau shall :

(a) formulate the general policies and guidelines relating to public sector procurement for the approval of the Council ;

(b) publicize and explain the provisions of this Act;

(c) subject to thresholds as may be set by the Council, certify Federal procurement prior to the award of contract ;

(d) supervise the implementation of established procurement policies ;

(e) monitor the prices of tendered items and keep a national database of standard prices ;

(f) publish the details of major contracts in the procurement journal ;

(g) publish paper and electronic editions of the procurement journal and maintain an archival system for the procurement journal ;

(h) maintain a national database of the particulars and classification and categorization of federal contractors and service providers ;

(i) collate and maintain in an archival system, all federal procurement plans and information ;

(j) undertake procurement research and surveys :

(k) organize training and development programmes for procurement professionals ;

(I) periodically review the socio-economic effect of the policies on procurement and advise the Council accordingly ;

(m) prepare and update standard bidding and contract documents ;

(n) prevent fraudulent and unfair procurement and where necessary apply administrative sanctions

(0) review the procurement and award of contract procedures of every entity to which this Act applies ;

(p) perform procurement audits and submit such report to the National Assembly bi-annually ;

(q) introduce, develop, update and maintain related database and technology;

(r) establish a single internet portal that shall, subject to Section 16 (21) to this Act serve as a primary and definitive source of all information on government procurement containing and displaying all public sector procurement information at all times ; and

(s) co-ordinate relevant training programs to build institutional capacity.

Powers of the Bereau

6.- **(I)** The Bureau shall have the power to :

(a) enforce the monetary and prior review thresholds set by the Council for the application of the provisions of this Act by the procuring entities ;

(b) subject to the paragraph (a) of this subsection, issue certificate of "No Objection" for Contract Award" within the prior review threshold for all procurements within the purview of this Act :

(c) from time to time stipulate to all procuring entities the procedures and documentation pre- requisite for the issuance of Certificate of 'No Objection' under this Act ;

(d) where a reason exist:

(I) cause to be inspected or reviewed any procurement transaction to ensure compliance with the provisions of this Act,

(ii) review and determine whether any procuring entity has violated any provision of this Act ;

(e) debar any supplier, contractor or service provider that contravenes any provision of this Act and regulations made pursuant to this Act ;

(j) maintain a national database of federal contractors and service providers and to the exclusion of all procuring entities prescribe classifications and categorizations for the companies on the register ;

(g) maintain a list of firms and persons that have been debarred from participating in public procurement activity and publish them in the procurement journal ;

(h) call for such information, documents, records and reports in respect of any aspect of any procurement proceeding where a breach, wrongdoing, default, mismanagement and or collusion has been alleged, reported or proved against a procuring entity or service provider ;

(i) recommend to the Council, where there are persistent or serious breaches of this Act or regulations or guidelines made under this Act for .

(I) the suspension of officers concerned with the procurement or disposal proceeding in issue ;

(ii) the replacement of the head or any of the members of the procuring or disposal unit of any entity or the Chairperson of the Tenders Board as the case may be ;

(iii) the discipline of the Accounting Officer of any procuring entity ;

(iv) the temporary transfer of the procuring and disposal function of a procuring and disposing entity to a third party procurement agency or consultant ; or

(v) any other sanction that the Bureau may consider of appropriate ;

(j) call for the production of books of accounts, plans, documents, and examine persons or parties in connection with any procurement proceeding ;

(K) act upon complaints in accordance with the procedures set out in this Act ;

(j) nullify the whole or any part of any procurement proceeding or award which is in contravention of this Act ;:

(m) do such other things as are necessary for the efficient performance of its functions under this Act

(2) The Bureau shall serve as the Secretariat for the Council.

(3) The Bureau shall, subject to the approval of the Council, have power to

(a) enter into contract or partnership with any company, firm or person which in its opinion will facilitate the discharge of its functions ;

(b) request for and obtain from any procurement entity information including

reports, memoranda and audited accounts, and other information relevant to its functions under this Act ; and

(c) liaise with relevant bodies or institutions national and international for effective performance of its functions under this Act.

Director - General and staff of the Bureau

7.-(I) There shall be for the Bureau, a Director-General who shall be appointed by the President, on the recommendation of the Council after competitive selections.

(2) The 'Director-General shall be :

(a) the Chief Executive and accounting officer of the Bureau

(b) responsible for the execution of the policy and day to day administration of the affairs of the Bureau; and

(c) a person who possesscs the relevant and adequate professional qualification and shall have been so qualified for a period of not less than 15 years.

(3) The Director-General shall hold office:

(a) for a term of 4 years in the first instance and may be re-appointed for a further term of 4 years and no more ; and

(b) on such terms and conditions as may be specified in his letter of appointment.

(4) Without prejudice to the provisions of this Act, the Director-General of the Bureau may be removed from office at the instance of the President on the basis of gross misconduct of financial impropriety, fraud, and manifested incompetence proven by the Council.

Principal officers of the Bureau

8.-(I) The Council shall appoint the principal officers for the Bureau after competitive selection process.

(2) The principal officers appointed under Section 9 (I) of this Section shall each have the requisite qualification and experience required for the effective performance of the functions of their respective Departments and the Bureau as specified under this Act.

(3) The Council shall have power to modify the operational structure of the Bureau as may be necessary to enhance the Bureau's duties and functions under this Act.

Other staff of the Bureau

9.-(I) The Council may appoint such officers and other employees as may, from time to time, deem necessary for the purposes of the Bureau.

(2) Subject to the Pension Reform Act, the terms and conditions of service (including remuneration, allowances, benefits and pensions) of officers and employees of the Bureau shall be as determined by the Council.

(3) Without prejudice to the generality of subsection this Section, the Council shall have power to appoint either on transfer or on secondment from any public service in the Federation, such number of employees as may, be required to assist the Bureau in the discharge of any of its functions under the Act and persons so employed shall be remunerated (including allowances) as the Council may consider appropriate.

Staff Regulations.

10.-(1) The Council may, subject to the provisions of this Act and within six months of the inauguration, make staff regulations relating generally to the conditions of service of the employees of the Bureau and without prejudice to the foregoing, such regulations may provide for :

(a) the appointment, promotion and disciplinary control (including dismissal) of employees of the Bureau ; and

(b) appeals by such employees against dismissal or other disciplinary measures.

(2) Until such regulations are made, any instrument relating to the conditions of service of officers in the civil service of the Federation shall be applicable.

Pensin provisions

II. Employees of the Bureau shall be entitled to pensions, and other retirement benefits as prescribed under the Pension Act.

Funds of the Bureau

12.-(1) The Bureau shall establish and maintain a Fund. to be approved by the Council into which shall be paid and credited:

(A) the sums appropriated by the National Assembly for the running of the Bureau ;

(b) all subventions, fees and charges for services rendered or publications made by the Bureau ; and

(c) all other assets which may from time to time accrue to the Bureau.

(2) The Bureau shall charge its fund to meet all its expenditure.

(3) The Council may make regulations for the Bureau :

(a) specifying the manner in which assets or the fund of the Bureau are to be held, and regulating the making of payment into and out of the fund; and

(b) requiring the keeping of proper accounts and records for the purposes of the fund in such form as may be specified in the rules.

(4) The Bureau may, from time to time, apply the proceeds of the fund for :

(a) the cost of administration of the Bureau;

(b) the payments of salaries, fees and other remuneration, employees of the Bureau or experts or professionals appointed by the Bureau ;

(c) the maintenance of any property acquired by or vested in the Bureau; and

(d) any matter connected with all or any of the functions of the Bureau under his Act.

(e) the payments of salaries, fees, and other remuneration, of employees of the Bureau or experts or professionals appointed by the Bureau ; and

(J) any expenditure connected with all or any of the functions of the Bureau under this Act.

Financial year, budgeting and annual report

13.-(I) The financial year of the Bureau shall be the same as that of the Federal Government.

(2) Not later than 6 months before the end of the financial year, the Bureau shall submit to the Council an estimate of its expenditure and projected income during the next succeeding year.

(3) The Bureau shall keep proper accounts and records of its receipts, payments, assets and liabilities and shall in respect of each financial year prepare a statement of account in such form as the Council may direct.

(4) The Bureau shall within 6 months after the end of the financial year to which the accounts relate cause the accounts to be audited in accordance with guidelines supplied by the Auditor-General of the Federation.

(5) The Bureau shall at the end of each financial year, prepare and submit to the Council a report in such form as shall accurately capture all the activities of the Bureau during the preceding year and shall include in the report a copy of the audited accounts of the Bureau for that year.

Legal proceedings

14.-(I) Subject to the provisions of this Act, no suit shall be commenced against the Bureau before the expiration of 30 days after written notice of an intention to commence the suit shall have been served upon the Bureau by, the intending plaintiff or his agent; and the notice shall clearly and explicitly state .

(a) the cause of action ;
(b) the particulars Of the claim;
(c) the name and address of legal practitioner of the intending plaintiff; and
(d) the relief being sought.

(2) The Director-General of the Bureau, its officers, employees or agents shall not personally be subject to any action, claim or demand by, or liable to any person in respect of anything done or omitted to be done in exercise of any functions or power conferred by this Act upon the Bureau, its Director-General, officers, employees or agents.

(3) A member of the Bureau or the Director-General or any officer or employee of the Bureau shall be indemnified out of the assets of the Bureau against any liability incurred by him in defending any proceeding, whether civil or criminal, if the proceeding is brought against him in his capacity as a member, Director-General, officer or other employee of the Bureau.

(4) A notice, summons or other documents required or authorized to be served upon the Bureau under the provisions of this Act or any other law enactment may be served by delivering it to the Director-General or by sending it by registered post and addressed to the Director-General at the principal office of the Bureau.

PART III - SCOPE OF APPLICATION

Scope of applicartion.

15.-(I) The provisions of this Act shall apply to all procurement of goods, works, and services carried out by :

(a) the Federal Government of Nigeria and all procurement entities;

(b) all entities outside the foregoing description which derive at least 35% of the funds appropriated or proposed to be appropriated for any type of procurement described in this Act from the Federation share of Consolidated Revenue Fund.

(2) The provisions of this Act shall not apply to the procurement of special goods; works and services involving national defense or national security unless the President's express approval has been first sought and obtained.

PART IV-FUNDAMENTAL PRINCIPLES FOR PROCUREMENTS

Fundamental principles for procurement.

16.-(I) Subject to any exemption allowed by this Act, all public procurement shall be conducted :

(a) subject to the prior review thresholds as may from time to time be set by the Bureau pursuant to Section 7(1) *(a)-(b) ;*

(b) based only on procurement plans supported by prior budgetary appropriations and no procurement proceedings shall be formalized until the procuring entity has ensured that funds are available to meet the obligations and subject to the threshold in the regulations made by the Bureau, has obtained a"Certificate of ' No Objection' to Contract Award" from the Bureau;

(c) by open competitive bidding ;

(*d*) in a manner which is transparent, timely, equitable for ensuring accountability and conformity with this Act and regulations deriving therefrom ;

(e) with the aim of achieving value for money and fitness for purpose ;

(*f*) in a manner which promotes competition, economy and efficiency; and

(*g*) in accordance with the procedures and time-line laid down in this Act and as may be specified by the Bureau from time to time.

(2) Where the Bureau has set prior review thresholds in the procurement regulations, no funds shall be disbursed from the Treasury or Federation Account or any bank account of any procuring entity for any procurement falling above the set thresholds unless the cheque, payments or other form of request for payments is accompanied by a certificate of "No Objection" to an award of contract duly issued by the Bureau.

(3) For all cases where the Bureau shall set a prior review threshold. the Bureau shall prescribe by regulation, guidelines and the conditions precedent to the award of Certificate of "No Objection" under this Act.

(4) Subject to the prior review thresholds as may be set by the Bureau, any procurement purported to be awarded without a "Certificate of ‘No Objection' to Contract Award" duly issued by the Bureau shall be null and void.

(5) A supplier, contractor or service provider may be a natural person, a legal person or a combination of the two. Suppliers, contractors or service providers acting jointly are jointly and severally liable for all obligations and or responsibility arising from this Act and the non-performance or improper performance of any contract awarded pursuant to this Act.

(6) All bidders in addition to requirements contained in any solicitation documents shall :

(a) possess the necessary;

(i) professional and technical qualifications to carry out particular procurements ;

(ii) financial capability ;

(iii) equipment and other relevant infrastructure ;

(iv) shall have adequate personnel to perform the obligations of the procurement contracts.

(b) possess the legal capacity to enter into the procurement contract;

(c) not be in receivership, the subject of any form of insolvency or bankruptcy proceedings or the subject of any form of winding up petition or proceedings;

(d) have fulfilled all its obligations to pay taxes, pensions and social security contributions

(e) not have any director who has been convicted in any country for any criminal offence relating to fraud or financial impropriety or criminal misrepresentation or falsification off acts relating to any matter;

(f) accompany every bid with an affidavit disclosing whether or not any officer of the relevant committees of the procurement entity or Bureau is a former or present director, shareholder or has any pecuniary interest in the bidder and confirm that all information presented in its bid are true and correct in all particulars.

(7) The procuring entity may require a bidder to provide documentary evidence or other information it considers necessary as proof that the bidder is qualified in accordance with this Act and the solicitation documents and for this purpose any such requirements shall apply equally to all bidders.

(8) Whenever it is established by a procuring entity or the Bureau that any or a combination of the situations set out exist, a bidder may have its bid or tender excluded from any particular procurement proceeding if :

(a) there is verifiable evidence that any supplier, contractor or consultant has given or promised a gi ft of money or any tangible item, or has promised, offered or given employment or any other benefit, item or a service that can be quantified in monetary terms to a current or former employee of a procuring entity or the Bureau, in an attempt to influence any action, or decision making of any procurement activity ;

(b) a supplier, contractor or consultant during the last three years prior to the commencement of the procurement proceedings in issue, failed to perform or to provide due care in performance of any public procurement ;

(c) the bidder is in receivership or is the subject of any type of insolvency proceedings or if being a private company under the Companies and Allied Matters Act, is controlled by a. person or persons who are subject to any bankruptcy proceedings or who have been declared bankrupt and or have made any compromises with their creditors within two calendar-years prior to the initiation of the procurement proceeding ;

(d) the bidder is in arrears regarding payment of due taxes, charges, pensions, or social insurance contributions, unless such bidders have obtained a lawful permits with respect to allowance, difference of such outstanding payments or payment thereof in installments;

(e) the bidder has been validly sentence for a crime committed in connection with a procurement proceeding, or any other crime committed to gain financial profit;

(f) the bidder has in its management or is in any portion owned by any person that has been validly sentence for a crime committed in connection with a procurement proceeding, or other crime committed to gain financial profit ; and

(g) the bidder fails to submit a statement regarding its dominating or subsidiary relationships with respect to other parties to the proceedings and persons acting on behalf of the procuring entity participating in same proceeding or whom remains in subordinate relationship with other participants to the proceedings.

(9) In such cases the procuring entity shall inform the Bureau and person referred to in subsection (8) *(a)-(g)* of this Section, in writing that the bid or tender in question has been excluded and the grounds for the exclusion and to keep a record of same in the file pertaining to the public procurement proceeding in question.

(10) All communications and documents issued by procuring entities and the Bureau shall be in English language.

(11) All communications regarding any matter deriving from this Act or proceedings of public procurement shall be in writing or such other form as may be stipulated by the Bureau.

(12) Every procuring entity shall maintain both file and electronic records of all procurement proceedings made within each financial year and the procurement records shall be maintained for a period often years from the date of the award.

(13) Copies of all procurement records shall be transmitted to the Bureau not later than 3 months after the end of the financial year and shall show :

(a) information identifying the procuring entity and the contractors

(b) the date of the contract award ;

(c) the value of the contract : and

(d) the detailed records of the procurement proceedings.

(14) All unclassified procurement records shall be open to inspection by the public at the cost of copying and certifying the documents plus an administrative charge as may be prescribed from time to time by the Bureau.

(15) The criteria stipulated as the basis upon which suppliers or contractors would be evaluated shall not be changed in the course of any procurement proceeding.

(16) The burden of proving fulfillment of the requirements for participation in any procurement proceeding shall lie on the supplier or contractor.

(17) A contract shall be awarded to the lowest evaluated responsive bid from the bidders substantially responsive to the bid solicitation.

(18) Notwithstanding subsection (16) of this Section, the Bureau may refuse to issue a 'Certificate of "No Objection" to Contract Award' on the grounds that the price is excessive.

(19) Pursuant to subsection (17) of this Section, the Bureau may direct either that the procurement proceedings be entirely cancelled or that the procuring entity conduct a re-tender.

(20) Pursuant to subsection (18) of this Section, the Bureau may either direct that the procurement proceedings be entirely cancelled or that the procuring entity conduct a re-tender.

(21) The accounting officer of a procuring entity and any officer to whom responsibility is delegated are responsible and accountable for any actions taken or omitted to be taken either in compliance with or in contravention of this Act.

(22) The accounting officer of a procuring entity has the responsibility to ensure that the provisions of this Act and the regulations laid down by the Bureau are complied with, and concurrent approval by any Tenders Board shall not absolve the accounting officer from accountability for anything done in contravention of this Act or the regulations laid down hereunder. ..

(23) Procurement and disposal decisions of a procuring entity shall be taken in strict adherence to the provisions of this Act and any regulations as may from time to time be laid down by the Bureau.

(24) Persons who have been engaged in preparing for a procurement or part of the proceedings thereof may neither bid for the procurement in question or any part thereof either as main contractor or sub-contractor nor may they cooperate in any manner with bidders in the course of preparing their tenders.

(25) A procuring entity shall not request or stipulate that a bidder should engage a particular subcontractor as a requirement for participating in any procurement proceedings.

(26) All procurement contracts shall contain provisions for arbitral proceedings as the primary forms of dispute resolution.

(27) The values in procurement documents shall be stated in Nigerian currency and where stated in a foreign currency shall be converted to Nigerian currency using the exchange rate of the Central Bank of Nigeria valid on the day of opening a tender or bid.

(28) All procurement contracts shall contain warranties for durability of goods, exercise of requisite skills in service provision and use of genuine materials and inputs in execution.

PART V-ORGANISATION OF PROCUREMENTS

Approving authority

17. Subject to the monetary and prior review thresholds for procuremet this Act as may from time to time be determined by the Council, the following the approving authority for the conduct of public procurement :

(A) in the case of :

(i) a government agency parastatal, or corporation, a Parastatals Tenders, Board ; and,

(ii) a ministry or extra-ministerial entity, the Ministerial Tender Board.

Procurement planning

18. Subject to regulations as may from time to time be made by the But under the direction of the Council, a procuring entity shall plan its procurement

(a) preparing the needs assessment and evaluation;

(b) identifying the goods, works or services required;

(c) carrying appropriate market and statistical surveys and on that basis prepare analysis of the cost implications of the proposed procurement ;

(d) aggregating its requirements whenever possible, both within the procurement entity and between procuring entities, to obtain economy of scale and reduce procurement cost;

(e) integrating its procurement expenditure into its yearly budget ;

(f) prescribing any method for effecting the procurement subject to the necessary approval under this Act; and

(g) ensuring that the procurement entity functions stipulated in this Section shall be carried out by the Procurement Planning Committee.

Procurement implementation

19. Subject to regulations as may from time to time be made by the Bur, under direction of Council, a procuring entity shall, in implementing its procurement plans :

(a) advertise and solicit for bids in adherence to this Act and guidelines as may be issued by the Bureau from time to time;

(b) to invite two credible persons as observers in every procurement process one person each representing a recognized ;

(i) private sector professional organization whose expertise is relevant the particular goods or service being procured, and

(ii) non-governmental organisation working in transparency, accountability and anti-corruption areas, and the observers shall not intervene in the procurement process but shall have right to submit their observation report to any relevant agency or body including their own organizations or associations;

(c) receive, evaluate and make a selection of the bids received in adherence to this Act and guidelines as may be issued by the Bureau from time to time;

(d) obtain approval of the approving authority before making an award;

(e) debrief the bid losers on request;

(f) resolve complaints and disputes if any;

(g) obtain and confirm the validity of any performance guarantee

(h) obtain a "Certificate of ' No Objection' to Contract Award" from the Bureau within the prior review threshold as stipulated in Section 3 *(a)* of this Act ;

(i) execute all Contract Agreements ; and

(j) Announce and publicize the award in the format stipulated by this Act and guidelines as may be issued by the Bureau from time to time.

20.-(I) The accounting officer of a procuring entity shall be the person charged with line supervision of the conduct of all procurement processes ; in the case of ministries the Permanent Secretary and in the case of extra-ministerial departments and corporations the Director-General or officer of co-ordinate responsibility.

(2) The accounting officer of every procuring entity shall have overall responsibility for the planning of, organization of tenders, evaluation of tenders and execution of all procurements and in particular shall be responsible for :

(a) ensuring compliance with the provisions of this Act by his entity and liable in person for the breach or contravention of this Act or any regulation made hereunder whether or not the act or omission was carried out by him personally or any of his subordinates and it shall not be material that he had delegated any function duty or power to any person or group of persons ;

(b) constituting the Procurement Committee and its decisions ;

(c) ensuring that adequate appropriation is provided specifically for the procurement in the Federal budget ;

(d) integrating his entity's procurement expenditure into its yearly budget ;

(e) ensuring that no reduction of values or splitting of procurements is carried

out such as to evade the use of the appropriate procurement method;

(j) constituting the Evaluation Committee ;

(g) liaising with the Bureau to ensure the implementation of its regulations.

21.- (I) For each financial year each procuring entity shall establish a Procurement Planning Committee. Planning committee.

Procurement Planing committe

(2) The Procurement Planning Committee shall consist of

(a) the accounting officer of the procuring entity or his representative who shall chair the Committee;

(b) a representative of :

(i) the procurement unit of the procuring entity who shall be the Secretary,

(ii) the unit directly in requirement of the procurement,

(iii) the financial unit of the procuring entity,

(iv) the planning, research and statistics unit of the procuring entity,

(v) technical personnel of the procuring entity with expertise in the subject Matter for each particular procurement, and

(vi) the legal unit of the procuring entity. .

22.-(I) There is hereby established by this Act in each procuring entity tenders board (in this Act referred to as "the Tenders Board").

Tenders board

(2) Subject to the approval of the Council, the Bureau shall. from time to time prescribe guidelines for the membership of the Tenders Board.

(3) The Tenders Board shall be responsible for the award of procurements goods, works and services within the threshold set in the regulations.

(4) In all cases where there is a need for pre-qualification, the Chairman of the Tenders Board shall constitute a technical evaluation sub-committee of the Tender Board charged with the responsibility for the evaluation of bids which shall be mad up of professional staff of the procuring entity and the Secretary of the Tender Board who shall also be the Chair of the Evaluation Sub-committee.

(5) The decision of the Tenders Board shall be communicated to the Minister for implementation. Prequalification

Prequalification of bidders

23.-(I) Where a procuring entity has made a decision with respect to the of bidders. minimum qualifications of suppliers, contractors or service providers by requesting! interested persons to submit applications, to pre-qualify, it shall set out precise criterial upon which it seeks to give consideration to the applications *and* in reaching decision as to which supplier, contractor or service provider qualifies, *shall* apply only the criteria set out in the prequalification documents and no more. Tenders board.

(2) Procuring entities shall supply a set of prequalification documents to each supplier, contractor or consultant that request them, and the price that a procurement entity may charge for the prequalification documents shall reflect only the cost printing and provision to suppliers or contractors and consultants.

(3) The prequalification document shall include:

(a) instructions to prepare and submit prequalification application

(b) a summary of the main terms and conditions required for the procurement

contract to be entered into as a result of the procurement proceedings :

(c) any documentary evidence or other information that must he submitted b)

suppliers, contractors or consultants to demonstrate their qualifications :

(d) the manner and place for the submission of applications to pre-qualify and the deadline for the submission, expressed as a specific date and time which allows sufficient time for suppliers, contractors or consultants to prepare and submit their applications, taking into account the reasonable need of the procuring entity ; and

(e) any other requirement that may be established by the procuring entity in conformity with this Act and procurement regulations relating to the preparation and submission of applications to pre-qualify and to the prequalification proceedings.

(4) The procurement entity shall respond to any request by a supplier, contractor or consultant for clarification of the prequalification documents if the request is made at least ten days before the deadline for the submission of applications to pre-qualify.

(5) The response by the procuring entity shall be given within a reasonable time and in any event within a period of at most seven working days so as to enable the supplier, contractor or consultant to make a timely submission of its application to prequalify.

(6) The response to any request that might reasonably be expected to be of interest to other supplier, contractor or consultant shall, without identifying the source of the request, be communicated to other suppliers or contractors or consultants provided with the prequalification documents by the procuring entity.

(7) A procuring entity shall promptly notify each supplier, contractor or consultant which submitted an application to pre-qualify of whether or not it has been pre-qualified and shall make available to any member of the general public upon request, the names of the suppliers, contractors or consultants who have been pre-qualified.

(8) Suppliers, contractors or consultants who have been pre-qualified may Participate further in the procurement proceeding .

(9) The procuring entity shall upon request communicate to suppliers, contractors or consultants who have not been pre-qualified, the grounds. for disqualification.

(10) The procuring entity may require a supplier, contractor or service provider who has been pre-qualified to demonstrate its qualifications again in accordance with the same criteria used to pre-qualify the supplier, contractor or consultant.

(11) The procuring entity shall promptly notify each supplier, contractor or service provider requested to demonstrate its qualifications again whether or not the supplier, contractor or consultant has done so to the satisfaction of the procuring entity.

(12) The procuring entity shall disqualify any supplier, contractor or service provider who fails to demonstrate its qualification again if requested to do so.

PART VI-PROCUREMENT METHODS (GOODS AND SERVICES)

Open compatitive budding

24.- (I) Except as provided by this Act, all procurements of goods and works Open by all procuring entities shall be conducted by open competitive bidding. Competitive bidding,

(2) Any reference to open competitive bidding in this Act means the process by which a procuring entity based on previously defined criteria, effects public procurements by offering to every interested bidder. equal simultaneous information and opportunity to offer the goods and works needed.

(3) The winning bid shall be that which is the lowest evaluated responsive bid which has been responsive to the bid with regards to work specification and standard.

Invitations to bid

25. -(I) Invitations to bid may be either by way of National Competitive Bidding or International Competitive Bidding and the Bureau shall from time to time set the monetary thresholds for which procurements shall fall under either system.

(2) Every invitation to an open competitive bid shall :

(i) in the case of goods and works under International Competitive Bidding, the invitation for bids shall be advertised in at least two national newspapers and one relevant internationally recognised publication, any official websites of the procuring entity and the Bureau as well as the procurement journal not less than six weeks before the deadline for submission of the bids for the goods and works,

(ii) in the case of goods and works valued under National Competitive Bidding, the invitation for bids shall be advertised on the notice board of the procuring entity, any official web sites of the procuring entity, at least two national newspapers, and in the procurement journal not less than six weeks before the deadline for submission of the bids for the goods and works.

26.--(I) Subject to the monetary and prior review thresholds as may from time to time be set by the Bureau all procurements valued in excess of the sums prescribed by the Bureau shall require a bid security in an amount not more than 2% of the bid price by way of a bank guarantee issued by a reputable bank acceptable to the procuring entity.

(2) The Bureau shall from time to time specify the principal terms and conditions of the required bid security in the tender documents.

(3) When the procuring entity, requires suppliers or contractors submitting tenders to provide a bid security the requirement shall apply to *each* supplier or Contractor. Submission of

27.--(I) All bids in response to an invitation to open competitive bidding shall be submitted in writing and in addition to any other format stipulated in the tender documents, signed by an official authorized to bind the bidder to a contract and placed in a sealed envelop.

(2) All submitted bids shall be deposited in a secured tamper-proof bid-box.
(3) All bids submitted shall be in English language.
(4) The procuring entity shall issue a receipt showing the date and time the bid was delivered. Bid security. Rejection of bids.
(5) Any bid received after the deadline for the submission of bids shall not be opened and must be returned to the supplier or contractor which submitted it.
(6) No communication shall take place between procuring entities and any supplier or contractor after the publication of a bid solicitation other than as provided in this Act.
28. A procuring entity may :

(a) reject all bids at any time prior to the acceptance of a bid, without incurring thereby any liability to the bidders ; and

(b) cancel the procurement proceedings in the public interest, without incurring any liability to the bidders.

Validity period of bids, modification and withdrawal of tenders.

29.-(I) The period of validity for a bid shall be the period specified in the tender documents.

(2) A procuring entity may request suppliers or contractors to extend the period of validity for an additional specified period of time.

(3) A supplier or contractor may refuse the request for the extension of bid, in which case the effectiveness of its bid will terminate upon the expiration of the unextended period of effectiveness.

(4) A supplier or contractor may modify or withdraw its bid prior to the deadline for the submission of bids.

(5) The modification or notice of withdrawal is effective if it is received by the procurement entity before the deadline for the submission of tenders.

Bid opening

30. All bids shall be submitted before the deadline or date specified in the tender documents or any extension of the deadline for submission and the procuring entity shall:

(a) permit attendees to examine the envelopes in which the bids have been submitted to ascertain that the bids have not been tampered with ;

(b) cause all the bids to be opened in public, in the presence of the bidders or their representatives and any interested member of the public ;

(c) ensure that the bid opening takes place immediately following the deadline stipulated for the submission of bids or any extension thereof ;

(d) ensure that a register is taken of the names and addresses of all those present at the bid opening and the organizations they represent which is recorded by the Secretary of the tenders board ; and

(e) call-over to the hearing of all present, the name and address of each bidder, the total amount of each bid, the bid currency and shall ensure that these details are recorded by the Secretary of the Tenders board or his delegate in the minutes of the bid opening.

Examination of bids

31. -(I) All bids shall be first examined to determine if they :

(a) meet the minimum eligibility requirements stipulated in the bidding documents

(b) have been duly signed ;

(c) are substantially responsive to the bidding documents ; and

(d) are generally in order.

(2) A procuring entity may ask a supplier or a contractor for clarification of its bid submission in order to assist in the examination, evaluation and comparison of bids.

(3) The following shall not be sought, offered or permitted

(a) changes in prices ;

(b) changes of substance in a bid ; and

(c) changes to make an unresponsive bid responsive

(4) Notwithstanding sub-Section **(3)** of this Section, the procuring entity may correct purely arithmetical errors that are discovered during the examination of tenders.

(5) The procuring entity shall give prompt notice of the correction to the supplier or contractor that submitted the tender.

(6) A major deviation shall result in a rejection of bid while a minor deviation shall be subject to clarification.

(7) The following shall be considered as major deviations

(a) with respect to clauses in an offer ;

(i) unacceptable sub-contracting,

(ii) unacceptable time schedule if time is of essence,

(iii) unacceptable alternative design, and

(iv) unacceptable price adjustment.

(b) with respect to the status of the bidder

(i) the fact that he is ineligible or not pre-qualified, and

(ii) the fact that he is uninvited ;

(c) with respect to bid documents an unsigned bid :

(d) with respect to time, date and location for submission

(i) any bid received after the date and time for submission stipulated in the solicitation document,

(ii) any bid submitted at the wrong location.

(8) In cases of major deviations, bids shall not be considered any further and, where unopened, shall be returned as such to the bidder.

(9) In all cases of rejection, a letter stipulating the reasons for rejection shall be sent, and the bidder shall not be permitted to amend his bid to become compliant.

(10) Subject to any provision to the contrary, the following shall be considered as minor deviations :

(a) the use of codes :

(b) the difference in standards

(c) the difference in materials

(d) alternative design :

(e) alternative workmanship

(f) modified liquidated damages

(g) omission in minor items ;

(h) discovery of arithmetical errors

(i) sub-contracting that is unclear and questionable

(j) different methods of construction

(k) difference in final delivery date;
(/) difference in delivery schedule;
(m) completion period where these are not of essence
(n) non-compliance with some technical local regulation
(o) payment terms; and
(p) any other condition that has little impact on the bid.

(11) In cases not mentioned above and where there exists a doubt as to whether a particular condition in a bid is a major or a minor deviation, the following rules shall apply:

(a) where the impact on the costs is major, it shall be regarded as a major deviation ; and

(b) where the impact on the costs is minor, it shall be regarded as a minor deviation.

(12) In cases of minor deviations, written clarification may be obtained from the supplier or contractor and, where applicable, an offer made for the correction of the minor deviation.

(I 3) Where a supplier or contractor does not accept the correction of a minor deviation, his bid shall be rejected.

(14) At the stage of evaluation and comparison, all minor. deviations shall be quantified in monetary terms.

(15) For the rejection of a bid, a written notice shall be given promptly to the supplier.

32.-(I) For the evaluation and comparison of bids that have been adjudged as valid for the purposes of evaluation, no other method or criteria shall be used except those stipulated in the solicitation documents.

(2) The objective of bid evaluation shall be to determine and select the lowest evaluated responsive bid from bidders that have responded to the bid solicitation.

(3) In the course of its determination of the lowest evaluated responsive bid from the bidders that have responded to the bid solicitation the Tenders Board shall, in particular, undertake the following processes as applicable: .

(a) checking of deviations ;
(B) checking of omissions with quantification of same *(c)* application of discounts, as applicable ;
(d) clarification with bidders of questionable minor deviations'
(e) quantification in monetary terms of such questionable deviations:
(j) conversion to common currency ;
(g) calculation and tabulation of bid amount with domestic preference where applicable;
(h) determination of the lowest calculated prices in order of rank ;

(i) post-qualification of bidders, where applicable
(J) listing of rejection of bids, where applicable ;.
(k) decision of rejection of all bids where justifiable
(I) recommendation for award ; and
(M) writing up of the bid evaluation report.

(4) All relevant factors, in addition to price, that will be considered for the purposes of bid evaluation and the manner in which such factors will be applied shall be stipulated in the solicitation documents.

(5) Such factors shall be calculated in monetary terms as stipulated in the solicitation documents and shall include :

(a) for goods, among others, costs of transportation and insurance, payment schedule, delivery time, operating costs, efficiency, compatibility of the equipment, availability of services and spare parts, related training, safety, environmental benefits or losses by damages ;

(b) for works, in addition to factors stipulated in Section 34(I) of this Act, and subject to Section 34(2) of this Act, if time is a critical factor, the value of early completion ; and

(c) the value of early completion under Section 35(2) of this Act shall not be taken into account unless, in conformity with criteria pre-set in the bidding documents, the conditions of contract provide for commensurate penalties in case of late delivery.

(6) When bid prices are expressed in two or more currencies, the prices of all bids shall be converted to Nigerian currency, according to the rate and date of rate specified in the solicitation documents. .

(7) I f suppliers were pre-qualified, verification of the information provided in the submission for prequalification shall be confirmed at the time of award of contract and award may be denied to a bidder who no longer has the capability or resources to Successfully perform the contract.

(8) After opening of bids, information relating to the examination, clarification and evaluation of bids and recommendations concerning award shall not be disclosed to bidders or to persons not officially concerned with the evaluation process until the successful bidder is notified of the award.

33.-(I) The successful bid shall be that submitted by the lowest cost bidder from the bidders responsive as to the bid solicitation.

(2) Notwithstanding subsection of: this Section, the selected bidder needs not be the lowest cost bidder provided the procuring entity can show good grounds derived from the provisions of this Act to that effect.

(3) Notice of the acceptance of the bid shall immediately be given to the successful bidder, *Domestic preferences*

34.-(I) A procuring entity may grant a margin of preference in the evaluation of tenders. when comparing tenders from domestic bidders with those from foreign bidders or when comparing tenders from domestic suppliers offering goods manufactured locally with those offering goods manufactured abroad.

(2) Where a procuring entity intends to allow domestic preferences, the bidding documents shall clearly indicate any preference to be granted to domestic suppliers and contractors and the information required to establish the eligibility of a bid for such preference.

(3) Margins of preference shall apply only to tenders under international competitive bidding.

(4) The Bureau shall by regulation from time to time set the limits and the formulae for the computation of margins of preference and determine the contents of goods manufactured locally.

Mobilization fees

35.- (I) In addition to any other regulations as may be prescribed by the Bureau, a mobilization fee of not more than 15% may be paid to a supplier or contract or -supported by the following .:

(a) in the case of National Competitive Bidding - an unconditional bank guarantee or insurance bond issued by an institution acceptable to the procuring entity ; and

(b) in the case of International Competitive Bidding - an unconditional bank guarantee issued by a banking institution acceptable to the procuring entity.

(2) Once a mobilization fee has been paid to any supplier or contractor, no further payment shall be made to the supplier or contractor without an interim performance certificate issued in accordance with the contract agreement.

Contract performance guarrantee

36. The provision of a Performance Guarantee shall be a precondition for the award of any procurement contract upon which any mobilization fee is to be paid, provided however it shall not be less than 10% of the contract value in any case or an amount equivalent to the mobilization fee requested by the supplier or contractor whichever is higher.

Interest on delayed payments

37.-(1) Payment for the procurement of goods, works, and services shall be settled promptly and diligently.

(2) Any payment due tor more than sixty days from the date Of the submission of the invoice, valuation certificate or confirmation or authentication by the Ministry, Extra-Ministerial Office, government agency, parastatal or corporation shall be deem a delayed payment.

(3) All delayed payments shall attract interest at the rate specified in the contract document.

(4) All contracts shall include terms, specifying the interest for late payment of more than sixty days.

Recorded, Procurement proceedings

38.-(I) Every procuring entity shall maintain a record of the comprehensive procurement proceedings.

(2) The portion of the record referred to in this Section shall. on request, be made available to:

(a) any person after a tender, proposal, offer or quotation has been accepted or after procurement proceedings have been terminated without resulting in a procurement contract; and

(b) Suppliers, contractors or consultants that submitted tenders, proposals. offers or quotations. or applied for prequalification, after a tender, proposal, offer or quotation has been accepted or procurement proceeding have been terminated without resulting in a procurement contract.

(3) A disclosure of procurement proceeding records, prior to award of contract may be ordered by a court, provided that when ordered to do so by a court. the procurement entity shall not disclose such information, if its disclosure would

(a) be contrary to law;
(b) impede law enforcement; or
(c) prejudice legitimate commercial interests of the parties.

(4) The procuring entity shall not be liable to suppliers. contractors or service providers for damages owing solely to failure to maintain a record of the procurement proceedings in accordance with this Section.

(5) The records and documents maintained by procuring entities on procurement shall be made available for inspection by the Bureau, an investigator appointed by the Bureau and the Auditor-General upon request and where donor funds have been used for the procurement, donor officials shall also have access upon request to procurement files for the purpose of audit and review.

PART VII-SPECIAL AND RESTRICTED METHODS OF PROCUREMENT

Two stage tendering

39.-(I) Notwithstanding the provisions of this Act,. the Bureau may issue Certificate of No Objection' upon conditions hereinafter prescribed.

(2) A procuring entity shall engage in procurement by two-stage tendering:

(a) where it is not feasible for the procuring entity to formulate detailed specifications for the goods or works or, in the case of services. to identify their characteristics and where it seeks tenders, proposals or offers on various means of meeting its needs in order to obtain the most satisfactory solution to its procurement needs;

(b) where the character of the goods or works arc subject to rapid technological advances; where the procuring entity seeks to enter into a contract for research, experiment, study or development, except where the contract includes the production of goods in sufficient quantities to establish their commercial viability or to recover research and development costs, where the procuring entity applies this Act to procurement concerned with national security and determines that the selected method is the most appropriate method of procurement; or

(c) where the tender proceedings have been utilized but were not successful or the tenders were rejected by the procuring entity under an open competitive bid procedure and the procuring entity considers that engaging in new tendering proceedings will not result in a procurement contract.

(3) The provisions of this Act as regards the process for open competitive bidding shall apply to two-stage tendering proceedings except to the extent that those provisions vary this Section.

(4) The invitation documents:

(a) shall call upon suppliers or contractors to submit, in the first stage of two stage tendering proceedings, initial tenders which contain their proposals without a tender price ; and

(b) may solicit proposals that relate to technical, quality or other characteristics of the goods, works or services as well as contractual terms and conditions of supply and may stipulate the professional competence and technical qualifications of the suppliers or contractors.

(5) The procuring entity may, in the first stage, engage in negotiations with any supplier or contractor whose tender has not been rejected under an open competitive bidding procedure with respect to any aspect of its tender.

(6) In the second stage of the two tender proceedings the procuring entity:

a) shall invite suppliers or contractors whose tenders have not been rejected to submit final tenders with prices on a single set of specifications;

(b) may, in formulating the specifications, delete or modify any aspect of the technical or quality characteristics of the goods, works or services to be procedure together with any criterion originally set out in these documents, evaluate and compare tenders and ascertain the successful tender;

(c) may add new characteristics or criteria that conform with this Act:

(d) shall communicate to suppliers or contractors in the invitation to submit firm tenders, any deletion, modification or addition; and

(e) may permit a supplier or contractor who does not wish to submit a final tender to withdraw from the tendering proceedings.

(7) The final tenders shall be evaluated and compared in order to ascertain the successful tender as defined in an open competitive bid.

Restricted Tendering

40. **(I)** Subject to the approval by the Bureau, a procuring entity may for reasons of economy and efficiency engage in procurement by means of restricted tendering if:

(a) the goods, works or services are available only from a limited number of suppliers or contractors;

(b) the time and cost required to examine and evaluate a large number of tenders is disproportionate to the value of the goods, works or services to be procured; or *(c)* the procedure is used as an exception rather than norm.

(2) where a procuring entity engages in restricted tendering on the basis that:

(a) the good works and services are available only from a limited number of suppliers or contractors, it shall invite tenders from all the suppliers and contractors who can provide the goods, works or services ; and

(b) the time and cost required to examine and evaluate a large number of tenders is disproportionate to the value of the goods, works or services, it shall select in a non-discriminatory manner of the number of suppliers or contractors to ensure effective competition;

(3) For the purposes of subsection (2), of this Section, the procuring entity shall cause a notice of the selected tendering proceedings to be published in the procurement journal.

Request for quotations

(4) The provisions of this Act regarding the open competitive bidding procedure shall apply to the selective tendering proceedings, except to the extent that those provisions are varied by this Section.

41.-(1) A procuring entity may carry out procurements by requesting for quotations from suppliers or contractors where the value of the goods or works to be procured does not exceed a sum that shall be set in the procurement regulation.

(2) Generally quotations shall be obtained from at least 3 unrelated contractors or suppliers.

(3) Each contractor or supplier from whom a quotation is requested shall

(a) be informed whether any factors other than the charges for the goods, works or services themselves, such as any applicable transportation and insurance charges, customs duties and taxes are to be included in the price; and

(b) give only one quotation and shall not be allowed to change or vary the quotation.

(4) No negotiation shall take place between a procuring entity and a contractor or supplier with respect to a quotation.

(5) The procurement shall be awarded to the qualified contractor or supplier that gives the lowest priced responsive quotation.

(6) Where the total value of the procurement is not more than a sum that shall be set in the regulation, the procurement entity may not obtain the Bureau's approval.

Direct procurement.

42.-{1) A procuring entity may carry out any emergency procurement where:

(a) goods, works or services are only available from a particular supplier or contractor, or if a particular supplier or contractor has exclusive rights in respect of the goods, works-or services, and no reasonable alternative or substitute exits; or

(b) there is an urgent need for the goods, works or services and engaging in tender proceedings or any other method of procurement is impractical due to unforeseeable circumstances giving rise to the urgency which is not the result of dilatory conduct on the part of the procuring entity;

unforeseeable circumstances giving rise to the urgency which is not the result of dilatory conduct of the part of the procuring entity;

(*c*) owing to a catastrophic event, there is an urgent need for the goods, works or services, making it impractical to use other methods of procurement because of the time involved in using those methods;

(d) a procuring entity which has procured goods, equipment, technology or services from a supplier or contractor, determines that :

(i) additional supplies need to be procured from that supplier or contractor because of standardization,

(*ii*) there is a need for compatibility with existing goods, equipment, technology or services, taking into account the effectiveness of the original procurement in meeting the needs of the procurement entity,

(iii) the limited size of the proposed procurement in relation to the original procurement provides justification,

(iv) the reasonableness of the price and the unsuitability of alternatives to the goods or services in question merits the decision.

(e) the procuring entity seeks to enter into a contract with the supplier or contractor for research, experiment, study or development, except where the contract includes the production of goods in quantities to establish commercial viability or recover research and development costs ; or

(f) the procuring entity applies this Act for procurement that concerns national security, and determines that single-source procurement is the most appropriate method of procurement.

(2) The procuring entity:

(a) may procure the goods, works or services by inviting a proposal or price quotation from a single supplier or contractor.

Emergency procurement

(b) shall include in the record of procurement proceedings a statement of the grounds for its decision and the circumstances in justification of single source procurement.

43.-(I) A procuring entity may for the purpose of this Act, carry out an emergency procurement where:

(a) the country is either seriously threatened by or actually confronted with a disaster, catastrophe, war, insurrection or Act of God ;

(b) the condition or quality of goods, equipment, building or publicly owned capital goods may seriously deteriorate unless action is urgently and necessarily taken to maintain them in their actual value or usefulness ; or

(c) a public project may be seriously delayed for want of an item of a minor value.

(2) In an emergency situation, a procuring entity may engage in direct contracting of goods, works and services.

(3) All procurements made under emergencies shall be handled with expedition but along principles of accountability, due consideration being given to the gravity of each emergency.

(4) Immediately after the cessation of the situation warranting any emergency procurement, the procuring entity shall file a detailed report thereof with the Bureau which shall verify same and if appropriate issue a Certificate of ' No Objection'.

PART VIII-PROCUREMENT OF CONSULTANT (SERVICES)

Expressions of interrest to provide services for ascertained needs

44. Where a procuring entity wishes to procure services for its needs which are precise and ascertainable:

(a) it shall solicit for expressions of interest or applications to pre-qualify to provide the services by publishing a notice to that effect in at least 2 national newspapers and the procurement journal ;

(b) where the value of the services to be procured is less than one million naira, or with the approval of the Bureau, of such a low value that only national consultants would be interested, the procuring entity may without placing any notice request at least 3 and not more than 10 consultants or service providers to make proposals for the provision of the services in a format stipulating:

(i) a statement of qualifications of the consultant to provide the service:

(ii) a statement of understanding of the procuring entity's needs;

(iii) the methodology for providing the service;

(iv) the time frame for providing the service; and

(v) the cost or fee for the service.

Request for proposals to provide services for unascertained needs.

45.-(1) A procuring entity wishing to procure services for its needs may do so by requesting for proposals when it intends to enter into a contract for the purpose of research, experiment, study or development, except where the contract includes the production of goods in quantities sufficient to establish their commercial viability or to recover research and development cost.

(2) The procuring entities shall procure the services of consultants by soliciting for expressions of interest by publishing a notice to that effect in 2 national newspapers and the procurement journal.

(3) A procuring entity may make direct requests to a limited number of consultants. requesting proposals for the provision of a service if :

(a) the services are only available from no more than 3 consultants:

(b) the time and cost required to examine and evaluate a large number of proposals would be disproportionate to the value of the services to be performed. provided that it invites enough consultants to ensure transparent competition ; or

(c) it is in the interest of national defense and security or similar reason of confidentiality.

46.-(I) Request for proposals shall include: Content of the requests for proposals.

(A) the name and address of the procurement entity;

(b) a requirement that the proposals are to be prepared in the English language;

(c) the manner, place and deadline for the submission of proposals ;

(d) a statement to the effect that the procuring entity reserves the right to reject proposals ;

(e) the criteria and procedures for the evaluation of the qualifications of the consultants ;

(f) the requirements on documentary evidence or other information that shall be submitted by consultants to demonstrate their qualifications ;

(g) the nature and required characteristics of the services to be procured including the location where the services are to be provided and the time when the services are to be provided ;

(h) whether the procuring entity is seeking proposals on various possible ways of meeting its needs ;

(i) a requirement that the proposal price is to be expressed in Nigerian currency;

(j) the manner in which the proposal price is to be expressed, including a statement on whether the price covers elements apart from the cost of services, such as reimbursement for transportation, lodging, insurance, use of equipment, duties or taxes;

(k) whether the procedure to ascertain the successful proposal shall be based on the lowest cost or quality and cost or a combination of the lowest cost, quality and criteria other than cost but stipulated in the request for proposals ; and

(l) a short list to be made of only national consultants for consulting assignment, contract within a set threshold in the procurement regulation provided that national consultants possess such requisite skills.

(2) The procuring entity shall provide the same information to every consultant requested to submit proposals.

47.-(I) A consultant shall be allowed to request for clarification on the request from the procuring entity and such request may be made within a reasonable time to be specified. **Clarification and modification of requests for proposals.**

(2) A procuring entity may, whether on its initiative or as a result of a request for clarification by a consultant, modify the request for proposals by issuing an addendum at any time prior to the deadline for submission of proposals.

(3) The addendum shall be communicated promptly before the deadline for the submission of proposals to the short listed consultants to whom the procuring entity has provided the request for proposals and shall be binding on those consultants.

(4) If the procuring entity convenes a meeting of consultants, it shall prepare minutes of the meeting containing the issues submitted at the meeting for clarification of the request for proposal and its responses to those issues, without identifying the sources of the requests for clarifications.

of the request for proposal and its responses to those issues, without identifying the sources of the request for clarification.

(5) The minutes shall be provided promptly before the deadlines for the submission of proposals to the consultants participating in the selection proceedings to enable them take the minutes into account in prepare their proposals.

Submission of Proposals

48. (I) the procuring entity shall allow sufficient time for the preparation and submission of the requested proposals but shall in no case give less than 30 days between the issue of the notice or request and the deadline for submission.

(2) The technical and financial proposals shall be submitted simultaneously but in separate envelops.

(3) A proposal received after the deadline for submission of proposals shall be returned to the sender unopened.

(4) Immediately after the deadline for submission of proposals, the technical proposals shall be opened for evaluation whilst the financial proposals shall remain sealed and kept in a secure bid-box until they are opened publicly.

(5) The technical evaluation committee shall not have access to or insights to the financial proposals until the evaluations including any Tender Boards review are concluded.

Criteria for evaluation of proposals

49.-(I) the procuring entity shall establish criteria to evaluate the proposals and prescribe the relative weight to be accorded to each criterion and the manner in which they are to be applied in the evaluation of:

(a) the qualification experience reliability professional and managerial competence of the consultant or service provider and of the personnel to be involved in providing the services ;

(b) the effectiveness of the proposal submitted by the consultant or service provider in meeting the needs of the procuring entity;

(c) the proposal price, including any ancillary or related cost;

(d) the effect that the acceptance of the proposal will have on the balance of payments position and foreign reserves of the government, the extent of participation by local personnel, the economic development potential offered by the proposal, including domestic investment or other business activity, the encouragement of employment, the transfer of technology, the development of managerial, scientific and operational skills and the counter trade arrangements offered by consultant or service providers ; and

(e) national defense and security considerations.

(2) A procuring entity may accord a margin of preference for domestic consultants or service providers, which shall be calculated in accordance with the regulations and guidelines as issued from time to time by the Bureau and shall be reflected in the record of the procurement proceedings.

General selection procedure (services)

50. (I) The procuring entity shall select the successful proposal by either choosing the proposal with:

(i) the lowest evaluated price, or

(ii) the best combined evaluation in terms of the general criteria set out in the request for proposals and the price quoted.

(2) The procuring entity shall include in the record of procurement a statement of the grounds and circumstances on which it relied to select either of the procedures in subsection (I) of this Section.

(3) Nothing in this Section shall prevent the procuring entity from resorting to the use of any impartial panel of experts to make the selection.

Procedure for selection of proposal where price is a factor

51. (I) Where the procuring entity elects to choose the successful proposal based on technical and price factors, it shall establish a weight with respect to quality and technical price factors of the proposals in accordance with the criteria other than price as might have been set out in the request for proposals and rate each proposal in accordance with such criteria and the relative weight and manner of application of the criteria as stipulated in the request for proposals; and then

(2) The procuring entity shall compare the prices of those proposals that have attained a rating at or above the threshold;

(3) The procuring entity shall notify the consultants whose proposals did not meet the minimum qualifying mark or were non responsive to the invitation for proposals and terms of reference after the evaluation of quality is completed within a period of 14 working days after the decision has been taken by the procurement entity

(4) The name of the qualifying consultants, the quality scores for the technical component of the proposal shall be read aloud and recorded alongside the price proposed by each consultant or service provider when the financial proposals are opened ;

(5) The procuring entity shall prepare the minutes of public opening of financial proposals which shall be part of the evaluation report and shall retain this record.

(6) The successful proposals shall be:

(a) the proposals with the best combined evaluation in terms of the criteria established under subsection (I) of this Section from price in the case of quality and cost-based selection ;

(b) the proposals with the lowest price in the case of least-cost selection; or

(c) the highest ranked technical proposal within the budget.

(7) The Consultants with the winning proposal shall be invited for negotiations, which shall focus mainly on the technical proposals.

(8) The proposed unit rates for staff-months and reimbursable shall not be negotiated unless there are exceptional reasons.

Selection procedure where price is not a factors

52.-(I) Where the procuring entity elects to make a quality-based selection, based on consultant's qualifications or single-source selection, it shall engage in negotiations with consultants in accordance with this Section.

(2) The procurement entity shall:

(i) establish a weight with respect to quality and price of the proposals;

(ii) invite for negotiations on the price of its proposal, the Consultant that has attained the best rating in accordance with subsection (1) of this Section ;

(iii) inform the Consultants that attained ratings above the weight that may be considered for negotiations if the negotiations with the consultant with the best rating do not result in a procurement contract; and

(iv) inform the Consultant with the best rating, that it is terminating the negotiations if it becomes apparent to the procuring entity that the negotiations with that Consultant, invited under subsection *(b),* will not result in a procurement contract.

(3) The procuring entity shall, if negotiations with the consultant with the best rating fails, invite the Consultant that obtained the second best rating, and if the negotiations with that Consultant do not result in a procurement contract, the procuring entity shall invite the other suppliers or contractors for negotiations on the basis of their rating until it arrives at a contract or rejects the remaining proposals.

Criteria for evaluation of proposals

(4) The procuring entity shall treat proposals and any negotiations on selection, procedure as confidential and avoid the disclosure of their contents to competing consultants.

PART IX-PROCUREMENT SURVEILLANCE AND REVIEW

Bureau to recommend investigation

53.-(I) The Bureau may review and recommend for investigation by any relevant authority any matter related to the conduct of procurement proceedings by a procuring entity, or the conclusion or operation of a procurement contract if it considers that a criminal investigation is necessary or desirable to prevent or detect a contravention of this Act.

(2) The relevant authority may in the course of investigation:

(a) require an officer, employee or agent of the procuring entity or bidder, supplier. contractor, or consultant to produce any books, records, accounts or documents ;

(b) search premises for any books, records, accounts or documents :

(c) examine and make extracts from and copies of books, records, accounts or documents of any procuring entity, bidder, supplier, contractor or consultant ;

(d) remove books, records, accounts or documents of the procuring entity, bidder, supplier, contractor or consultant for as long as may be necessary to examine them or make extracts from or copies of them but the investigator shall give a detailed receipt for the books, records, accounts or documents removed;

(e) require an officer, employee or agent of the procurement entity or bidder, supplier, or contractor or consultant:

(*i*) to explain an entry in the books, records, accounts or documents;

(ii) to provide the investigator with information concerning the management or activities of the procurement entity or bidders as may be reasonably required ;

(*f)* explain an entry in the books, records, accounts or documents; and

(g) provide the investigator with information concerning the management or activities of the procurement entity or bidders as may be reasonably required.

(3) The Bureau may, pursuant to the advice of the procuring entity, results of its review of a procurement or report of investigation by a relevant government agency issue a variation order requiring a contractor at his own expense to repair, replace, or to do anything in his or her contract left undone or found to have been carried out with inferior or defective materials or with less skill and expertise than required by the contract of award.

(4) The Bureau shall, if satisfied that there has been a contravention of this Act or any regulations in relation to procurement proceedings or procurement contracts, take action to rectify the contravention which action shall include:

(a) nullification of the procurement proceedings;

(b) cancellation of the procurement contract;

(c) ratification of anything done in relation to the proceedings; or

(*d)* a declaration consistent with any relevant provisions of this Act.

(5) On completion of the investigation, the relevant authority shall if an offence is disclosed, take all necessary steps to commence prosecution and inform, the Bureau and the procurement entity accordingly, but where no offence is disclosed, the file shall be closed and the Bureau and procuring entity shall be duly informed.

Administ-rative review

54.-(1) A bidder may seek administrative review for any omission or breach by a procuring or disposing entity under the provisions of this Act, or any regulations or guidelines made under this Act or the provisions of bidding documents.

(1) A complaint by a bidder against a procuring or disposing entity shall first be submitted in writing to the accounting officer who shall:

(a) within fifteen working days from the date the bidder first became aware of the circumstances giving rise to the complaint or should have become aware of the circumstances, whichever is earlier;

(b) on reviewing a complaint, the accounting officer shall make a decision in writing within 15 working days indicating the corrective measures to be taken if any, including the suspension of the proceedings where he deems it necessary and giving reasons for his decision ; or

(c) where the accounting officer does not make a decision within the period specified in sub-Section *(2)(b).*

Selection procedure where price is not a factor5

(3) The bidder is not satisfied with the decision of the accounting officer, the bidder may make a complaint to the Bureau within 10 working days from the date of communication of the decision of the accounting officer.

(4) Upon receipt of a complaint, the Bureau shall promptly:

(a) give notice of the complaint to the respective procuring or disposing entity and suspend any further action by the procuring or disposing entity until the Bureau has settled the matter ;

(b) unless it dismisses the complaint:

(i) prohibit a procuring or disposing entity from taking any further action

(ii) nullify in whole or in part an unlawful act or decision made by the procuring or disposing entity

(iii) declare the rules or principles that govern the subject matter of the complaint ; and

(iv) revise an improper decision by the procuring or disposing entity or substitute its own decision for such a decision.

(5) Before taking any decision on a complaint, the Bureau shall notify all interested bidders of the complaint and may take into account representations from the bidders and from the respective procuring or disposing entity.

(6) The Bureau shall make its decision within twenty-one working days after receiving the complaint, stating the reasons for its decisions and remedies granted, if any.

(7) Where the Bureau fails to render its decision within the stipulated time, or the bidder is not satisfied with decision of the Bureau, the bidder may appeal to the Federal-High Court within 30 days after the receipt of the decision of the Bureau, or expiration of the time stipulated for the Bureau to deliver a decision.

PART X-DISPOSAL OF PUBLIC PROPERTY

Disposal of public property

55.-(I) This Section shall apply subject to the Public Enterprises (Commercialization and Commercialization) Act 1999.

(2) For the purposes of this Act every procuring entity shall also be disposing entity.

(3) The open competitive bidding shall be the primary source of receiving offers for the purchase of any public property offered for sale.

(4) The Bureau shall, with the approval of the Council:

(a) determine the applicable policies and practices in relation to the disposal of all public property ;

(b) issue guidelines detailing operational principles and organizational modalities to be adopted by all procuring entities engaged in the disposal of public property and

(c) issue standardized document, monitor implementation, enforce compliance and set reporting standards that shall be used by all procuring entities involved in the disposal of public property.

(5) For the purposes of this Act, public property is defined as resources in the form of tangible and non-tangible assets (ranging from serviceable to the unserviceable)

(a) created through public expenditure

(b) acquired as a gift or through deeds

(c) acquired in respect of intellectual or proprietary rights

(d) acquired on financial instruments (including shares, stocks, bonds, etc) ; and

(e) acquired by good will and any other gifts of the Federal Government.

(6) The means of the disposal of public assets shall include

(a) sale and rental ;

(b) lease and hire purchase

(c) licenses and tenancies;

(d) franchise and auction ;

(e) transfers from one government department to another with or without financial adjustments; and

(f) offer to the public at an authorized variation.

Planning of disposals

56.-(I) Before slating any public property for disposal, the accounting officer (whether acting in his own authority or at the direction of any superior or other authority) in charge of any public property set for disposal shall authorize the preparation of a valuation report for such property by an independent Evaluator, or such professional with the appropriate competence to carry out the valuation.

(2) The disposal of assets whether or not listed in the Assets register for a procuring entity shall be planned and integrated into the income and expenditure budget projection of the procuring entity.

(3) The disposal of assets referred to in subsection (2) of this Section shall be timed to take place when the most advantageous returns can be obtained for the asset in order to maximize revenue accruing to the government.

(4) A II procuring entities shall distribute responsibilities for the disposal of public property between the procurement unit and the Tenders Board.

PART Xl - CODE OF CONDUCT

Code of conduct for public procure-ment.

57. (1) The Bureau shall, with the approval of the Council, stipulate a Code of Conduct for all public officers, suppliers, contractors and service providers with regards to their standards of conduct acceptable in matters involving the procurement and disposal of public assets.

(2) The conduct of all persons involved with public procurement, whether as official of the Bureau, a procuring entity, supplier, contractor or service provider shall at all times be governed by principles of honesty, accountability, transparency, fairness and equity.

(3) All officers of the Bureau, members of Tenders Boards and other persons that may come to act regarding the conduct of public procurements shall subscribe to an oath as approved by Council.

(4) All persons in whose hands public funds may be entrusted for whatever purpose should bear in mind that its utilization should be judicious.

(5) Where a transaction involves the disposal of assets, principles of honesty, accountability, transparency, fairness and equity shall continue to apply to the same extent as where it involves procurement.

(6) These principles shall apply at all times, particularly when:

(a*)* making requisition for or planning of procurements ;

(b) preparing solicitation documents;

(c) receiving offers in response to any form of solicitation towards a procurement or disposal ;

(d) evaluating and comparing offers confidentially and in complete neutrality;

(e) protecting the interest of all parties without fear or favor ; and

(f) obviating all situations likely to render an officer vulnerable to embarrassment or undue influence.

(7) All public officers shall handle public procurement and disposal of assets by

(a) ensuring adequate time for preparing offers;

(b) complying with this Act and all derivative regulations ; and

(*c)* receiving strict confidentiality until completion of a contract.

(8) All public officers involved in public procurement and disposal of assets shall maintain the highest standards of ethics in their relationships with persons real or corporate who seek government commerce whether as a bidder, supplier, contractor or service provider by developing transparent, honest and professional relationships with such persons.

(9) Every public officer involved directly or indirectly in matters of public procurement and disposal of assets shall:

(a) divest himself of any interest or relationships which are actually or potentially . inimical or detrimental to the best interest of government and the underlining principles of this Act; and

(b) not engage or participate in any commercial transaction involving the federal government, its ministries, extra-ministerial departments, corporations where his capacity as public officer is likely to confer any unfair advantage - pecuniary or otherwise on him or any person directly related to him.

(10) Any person engaged in the public procurement and disposal of assets who has assumed, or is about to assume, a financial or other business outside business relationship that might involve a conflict of interest, must immediately declare to the authorities any actual or potential interest.

(11) Such a declaration shall be given such consideration at the relevant level as is necessary so that, where it is seen that remedial action is taken, a conflict of interest is present.

(12) A conflict of interest exists where a person

(a) possesses an interest outside his official duties that materially encroaches on the time or attention which should otherwise be devoted to affairs of government;

(b) possesses a direct or indirect interest in or relationship with a bidder, supplier, contractor or service provider that is inherently unethical or that may be implied or constructed to be, or make possible personal gain due to the person's ability to influence dealings;

(e) entertains relationships which are unethical, rendering his attitude partial toward the outsider for personal reasons or otherwise inhibit the impartiality of the person's business judgments ;

(d) places by acts or omissions the procuring entity he represents or the Government in an equivocal, embarrassing or ethically questionable position;

(e) entertains relationships compromising the reputation or integrity of the procuring entity he represents or the Government;

(j) receives benefits by taking personal advantage of an opportunity that properly belongs to the procuring entity he represents or the Government;

(g) creates a source of personal revenue or advantage by using public property which comes into his hands either in course of his work or otherwise ; and

(h*)* discloses confidential information being either the property of his procuring entity, the Government or to a supplier, contractor or service provider to unauthorized persons.

(13) A person involved in the disposal of assets, shall not either by a third party or by himself be interested in any manner in buying directly or indirectly these assets and shall not have or obtain any type of advantage or revenue from the disposal for a period of three years after the disposal.

PART XII-OFFENCES

Offence relating to public procurement

58.-(I) Any natural person not being a public officer who contravenes any provision of this Act commits an offence and is liable on conviction to a term of imprisonment not less than 5 calendar years but not exceeding 10 calendar years without an option

(2) Any offence in contravention of this Act shall be tried by the Federal High Court.

(3) Prosecution of offences under this Act shall be instituted in the name of the Federal Republic of Nigeria by the Attorney-General of the Federation or such other officer of the Federal Ministry of Justice as he may authorize so to do, and in addition, without prejudice to the Constitution of the Federal Republic of Nigeria 1999, he may:

(a) after consultation with the Attorney-General of any state of the federation, authorize the Attorney-General or any other officer of the Ministry of Justice of that state; or

(b) if the relevant authority so requests, authorize any legal practitioner in Nigeria to undertake such prosecution directly or assist therein.

(4) The following shall also constitute offences under this Act:

(a) entering or attempting to enter into a collusive agreement, whether enforceable or not, with a supplier, contractor or consultant where the prices quoted in their respective tenders, proposals or quotations are or would be higher than would have been the case has there not been collusion between the persons concerned ;

(b) conducting or attempting to conduct procurement fraud by means of fraudulent and corrupt acts, unlawful influence, undue interest, favor, agreement, bribery or corruption ;

(c) directly, indirectly or attempting to influence in any manner the procurement process to obtain an unfair advantage in the award of a procurement contract ;

(d) splitting of tenders to enable the evasion of monetary thresholds set;

(e) bid-rigging;

(f) altering any procurement document with intent to influence the outcome of a tender proceeding ;

(g) uttering or using fake documents or encouraging their use; and

(h) willful refusal to allow the Bureau or its officers to have access to any procurement records.

(5) Any person who while carrying out his duties as an officer of the Bureau, or any procuring entity who contravenes any provision of this Act commits an offence and is liable on conviction to a cumulative punishment of:

(a) a term of imprisonment of not less than 5 calendar years without any option of fine ; and

(b) summary dismissal from government services.

(6) Any legal person that contravenes any provision of this Act commits an offence and is liable on conviction to a cumulative penalty of :

(a) debarment from all public procurements for a period not less than 5 calendar years; and

(b) a fine equivalent to 25% of the value of the procurement in issue.

(7) Where any legal person shall be convicted pursuant to subsection (4) of this Section, every director of the company as listed on its records at the Corporate Affairs Commission shall be guilty of an offence and is liable on conviction to a term of imprisonment not less than 3 calendar years but not exceeding 5 calendar years without an option of fine.

(8) An alternation pursuant to subsection 4(*f*) shall include:

(b) insertion of documents such as bid security or tax clearance certificate which were not submitted at bid opening ; and

(c) request for clarification in a manner not permitted under this Act.

(9) Collusion shall be presumed from a set of acts from which it can be assumed that there was an understanding, implicit, formal or informal, overt or covert under which each person involved reasonably expected that the other would adopt a particular course of action which would interfere with the faithful and proper application of the provisions of this Act.

(10) Bid-rigging pursuant to subsection *4(e)* means an agreement between persons whereby:

(a) offers submitted have been pre-arranged between them; or

(b) their conduct has had the effect of directly or indirectly restricting free and open competition, distorting the competitiveness of the procurement process and leading to and escalation or increase in costs or loss of value to the national treasury.

(11) For the purposes of the presumption under Section 51 (7) of this Section, consideration shall be given to a suspect's ability to control the procurement proceedings or to control a solicitation or the conditions of the contract in question, whether total or partial.

(12) For the purposes of Section 59(5) of this Section, it shall be sufficient to prove that a reasonable business person should have known that his action would result in his company or firm having an undue advantage over other bidders to the detriment of the national treasury.

PART XIII-MISCELLANEOUS

Miscellan-eous

59.-(I) The fixing of the seal of the Bureau shall be authenticated by the signature of the Chairman, the Director-General or of any other person authorized generally or specially to act for that purpose by the Council

(2) Any contract or instrument which, if made or executed by a person not being a body corporate, would not be required to be under seal may be made or executed on behalf of the Bureau by the Director-General or any person generally or specially authorized to act for that purpose by the Council.

(3) Any document purporting to be a document duly executed under the seal of the Bureau shall be received in evidence and shall, unless and until the contrary is proved. be presumed to be so executed.

(4) The validity of any proceeding of Council or of a committee thereof shall not be adversely affected by any vacancy in the membership of the Councilor committee. or by any defect in the appointment of a member of the Council or of a Committee. or by reason that a person not entitled to do so took part in the proceedings of the Council or Committee.

Interpretation 60. In this Act:

"Accounting officer" means the person charged with line supervision or the conduct of all procurement processes;

"Approving authority" means the person charged with overall responsibility for the functioning of a ministry, extra-ministerial department or corporation;

"Assets" includes tangible and intangible things which have been or may be sold or procured for consideration;

"Bid security" means a form of security assuring the bidder shall not withdraw a bid within the period specified for acceptance and shall execute a written contract within the time specified in the bid;

"Debar" means the placing of a firm company or natural person on a list of person ineligible to participate in any procurement proceedings under this Act;

"Certificate of No Objection" means the document evidencing and authenticating that due process and .the letters of this Act have been followed in the conduct of a procurement proceeding and allowing for the procuring entity to enter into contract or effect payments to contractors or suppliers from the treasury;

"Contract" means an agreement entered in writing;

"Contractor or supplier" means any potential party to a procurement contract with the procuring entity and includes any corporation, partnership, individual, sole proprietor, joint stock company, joint venture or any other legal entity through which business is conducted; "Excessive price" means a monetary value proposed by a bidder for any procurement which is in the estimation of the Bureau unreasonable and injudicious after consideration of the actual value of the item in question plus all reasonable imputations of cost and profit;

"Goods" means objects of every kind and description including raw materials, products and equipment and objects in solid, liquid or gaseous form and electricity as well as services incidental to the supply of the goods;

"Interim Performance Certificates" means evidence that a contractor or supplier as performed its obligations under a procurement contract up to a level stipulated by the contractor but not meaning completion;

"International Competitive Bidding" means the solicitation of bids from both domestic and foreign contractors and suppliers;

"Lowest evaluated responsive bid" is the lowest price bid amongst the bids that meets all the technical requirements and standards as contained in the tender document.

"Margin of Preference" means the extra mark up on price allowed any domestic contractor or supplier bidding under International Competitive Bidding without being otherwise disadvantageous to the bid in terms of price ;

"Minor Value" means a monetary value which is not in excess of the monetary thresholds set for any approving authority by the Bureau;

"Monetary Threshold" means the value limit in Naira set by the Bureau outside of which an approving authority may not award a procurement contract;

"National Competitive Bidding" means the solicitation of bids from domestic contractors and suppliers registered or incorporated to carry on business under Nigeria Law;

"Negotiation" means discussions to determine the terms and conditions of a contract or procurement ;

"Open Competitive Bidding" means the offer of prices by individuals or firms competing for a contract, privilege or right to supply specified goods, works, construction or services ;

"Procurement" means acquisition;

"Procurement proceedings" means the initiation of the process of effecting a procurement up to award of a procurement contract;

'Procuring entity" means any public body engaged in procurement and includes a Ministry, Extra-Ministerial office, government agency, parastatal and corporation; "Public Procurement" means the acquisition by any means of goods, works or services by the government ;

"Relevant authority" includes Economic and Financial Crimes Commission and Independent corrupt Practices Commission;

"Services" means the rendering by a contractor or supplier of his time and effort and includes any object of procurement other than goods, works or construction;

"Solicitation Documents" means the bid solicitation documents or any other documents for solicitation of offers proposals or quotations;

"Special Purpose Goods" means any objects of armaments ammunition mechanical electrical equipment or other thing as may be determined by the President needed by the Armed Forces or Police Force as well as the services incidental to the supply of the objects;

"Substantially Responsive" means the response to bid solicitations which virtually answers to all the needs of a procuring entity as stipulated in the bid solicitation documents;

"Supplier" means a real or legal person that provides supply of goods, contracting of works or consultants;

"Threshold" refers only to the approving and not the actual process of ward;

"Validity Period" means the period during which a bidder agrees not to increase the cost of its bid or to remove any components of the bid;

Works" means all works associated with the construction, reconstruction, demolition, repair or renovation of a building, structure or works, such as site preparation, excavation, erection, building, installation of equipment or materials, decoration and finishing, as well as services incidental to construction such as drilling, mapping, satellite photography, seismic investigation and similar services provided pursuant to the procurement of contract, where the value of those services does not exceed that of the construction itself.

Shor title

61. This Act may be cited as the Public Procurement Act, 2007.

I Certify, in accordance with Section 2 (I) of the Acts Authentication Act, Cap. 4, Laws of the federation of Nigeria 1990, that this is a true copy of the Bill passed by both Houses of the National Assembly.

NASIRU IBRAIIIM ARAB,
Clerk to the National Assembly
1st Day of June, 2007.

EXPLANATORY MEMORANDUM

This Act establishes the National Council on Public Procurement and the Bureau of Public Procurement as the regulatory authorities responsible for the monitoring: and oversight of public procurement, harmonizing the existing government policies and practices by regulating, setting standards and developing the legal framework and professional capacity for Public Procurement in Nigeria.

SCHEDULE TO PUBLIC PROCUREMENT BILL, 2007

(I) *Short title of the Bill*	(2) *Long title of the Bill*	(3) *Sumlllary of the contents of the Bill*	(4) *Date passed By the Senate*	(5) *Date passed by the House of Representatives*
Public Procurement Bill, 2007.	An Act to establish .the National Council on Public procurement and the Bureau of Public Procurement as the regulatory authorities responsible for the monitoring and oversight of public procurement, Harmonizing the existing Government policies and practices by regulating, setting standards and developing the legal Framework and professional Capacity for public procurement in Nigeria: and for related matters.	This Bill establishes the. National. Council on Public Procurement and the Bureau on Public procurement as the regulatory authorities responsible for the monitoring and oversight of public procurement, harmonizing the existing Government policies and practices by regulating, setting standards and developing the legal framework and professional' capacity for public procurement in Nigeria.	17th May, 2007.	30th May, 2007.

I certify that this Bill has been carefully compared by me with the decision reached by the National Assembly and found by me to be true and correct decision of the Houses and is in accordance with the provisions of the Acts Authentication Act Cap. 4, Laws of the Federation of Nigeria, 1990.

I ASSENT

LS

NASIRU IBRAHIM ARAB,
Clerk to the National Assembly
1st Day of June, 2007

AUIAJI UMARLJ MUSA Y AR' ADUA, GCFR
President of the Federal Republic of Nigeria
4th Day of June, 2007.

Nine Essential Steps in Public Procurement

Step 1	Efficient Procurement Plan driven by needs assessment
Step 2	Adequate Appropriation
Step 3	Advertisement
Step 4	Transparent Prequalification / Tender
Step 5	Bid Submission / Opening
Step 6	Bid Evaluation – Technical & Financial
Step 7	Tender Board / FEC Approval
Step 8	Contract Award / Execution
Step 9	Project Implementation

BUREAU OF PUBLIC PROCUREMENT (BPP)

APPROVED REVISED THRESHOLDS FOR SERVICE-WIDE APPLICATION

The Approved Revised Thresholds and Composition of Tenders Boards are as follows:-

(a) Procurement Approval Thresholds for Bureau of Public Procurement, Tenders Boards and Accounting Officers (PSs and CEOs) for All Ministries, Departments and Agencies

Approving Authority/ "No Objection" to award	Goods	Works	Non-Consultant Services	Consultant Services
BPP issues "No Objection" to award/ FEC approves	N100 million and above	N1.0 billion and above	N100 million and above	N100 million and above
Ministerial Tenders Board	N5 million and above but less than N100 million	N10 million and above but less than N1.0 billion	N5 million and above but less than N100 million	N5 million and above but less than N100 million
Parastatal Tenders Board	N2.50 million and above but less than N50 million	N5 million and above but less than N250 million	N2.50 million and above but less than N50 million	N2.50 million and above but less than N50 million
Accounting Officer: Permanent Secretary	Less than N5 million	Less than N10 million	Less than N5 million	Less than N5 million
Accounting Officer: Director General/CEO	Less than N2.50 million	Less than N5 million	Less than N2.50 million	Less than N2.50 million

(b) Revised Special Financial limits and thresholds, Procurement Methods and Thresholds of Application and for expenditure related to the Nigerian National Petroleum Corporation:-

Approving Authority/ "No Objection" to award	Special Works (NNPC))
BPP issues "No Objection" to award/ FEC approves	N2.70 billion (US$20m) and above
Ministerial Tenders Board (NNPC Tenders Board)	N1.40 billion (US$10m) and above but less than N2.70 billion (US$20m) for NNPC Tenders Board
Group Headquarters/ Tenders Board	N540 million (US$4m) and above but less than N1.40 billion (US$10m) for GEC NNPC
Parastatal Tenders Board (Refinery & Petrochemicals/ Exploration & Production/Corporate Supply Chain Tenders Boards)	N270 million (US$2m) and above but less than N540 million (US$4m) for SBU B/GED/ (DEXCOM)

Parastatal Tenders Board (Minor Refinery & Petrochemicals/ Exploration & Production/Corporate Supply Chain Tenders Boards)	N70 million (US$0.5m) and above but less than N270 million (US$2m) for SBU MD/MT/ (MEXCOM)
Parastatal Tenders Board (Business Unit Refinery & Petrochemicals/Exploration & Production/Corporate Supply Chain Tenders Boards)	N13.50 million (US$0.10m) and above but less than N70 million (US$0.50m) for SBU ED/MT/ (DIVCOM)
Accounting Officer: Permanent Secretary (Group Managing Director at CHQ Level)	Less than N40 million (US$0.30m)
Accounting Officer: Director General/CEO (Managing Directors at SBU Level)	Less than N13.50 million (US$0.10m)

(c) Procurement Methods and Thresholds of Application

Procurement/ Selection Method and Prequalification	Goods	Works (N)	Non-Consultant Services (N)	Consultant Services (N)
International/ National Competitive Bidding	N100 million and above	N1 billion and above	N100 million and above	Not Applicable
National Competitive Bidding	N2.5 million and above but less than N100 million	N2.5 million and above but less than N1 billion	N2.5 million and above but less than N100 million	Not Applicable
Shopping (Market Survey)	Less than N2.5 million	Less than N2.5 million	Less than N2.5 million	Not Applicable
Single Source/ Direct Contracting (Minor value procurements)	Less than N0.25 million	Less than N0.25 million	Less than N0.25 million	Less than N0.25 million
Prequalification	N100 million and above	N300 million and above	N100 million and above	Not Applicable
Quality and Cost Based	Not Applicable	Not Applicable	Not Applicable	N25 million and above
Consultant Qualifications	Not Applicable	Not Applicable	Not Applicable	Less than N25 million
Least Cost	Not Applicable	Not Applicable	Not Applicable	Less than N25 million

(d) Composition of Tenders Boards

Ministry:		
	Chairman:-	Permanent Secretary
	Members:-	Heads of Departments
Parastatals:		
	Chairman:-	Chief Executive Officers
	Members:-	Heads of Departments

2. The Bureau of Public Procurement wishes to observe that by these new thresholds, greater procurement responsibilities have been placed on the

Ministries, Departments and Agencies while the Bureau would be paying greater attention during post-procurement reviews in compliance with Clause 16(13), Part IV (Fundamental Principles for Procurements) of the 2007 Public Procurement Act, which states that:-

"Copies of all procurement records shall be transmitted to the Bureau not later than 3 months after the end of the financial year and shall show:-

(a) information identifying the procuring entity and the contractors;

(b) the date of the Contract award;

(c) the value of the Contract, and,

(d) the detailed records of the procurement proceedings",

NOTE:

ONLY PROJECTS in excess of ₦300m for Works and ₦100m for Goods & Services qualify for Pre-qualification.

In other words Ministries/Department / Agencies (MDAs) should go straight to invite Bids for Tender for projects costing less than ₦100m for Goods (Supply Items) and ₦300m for works (Construction).