Transmission Company of Nigeria (TCN)

Performance Improvement Plan (PIP)

Volume 1: Background Information

November 2022

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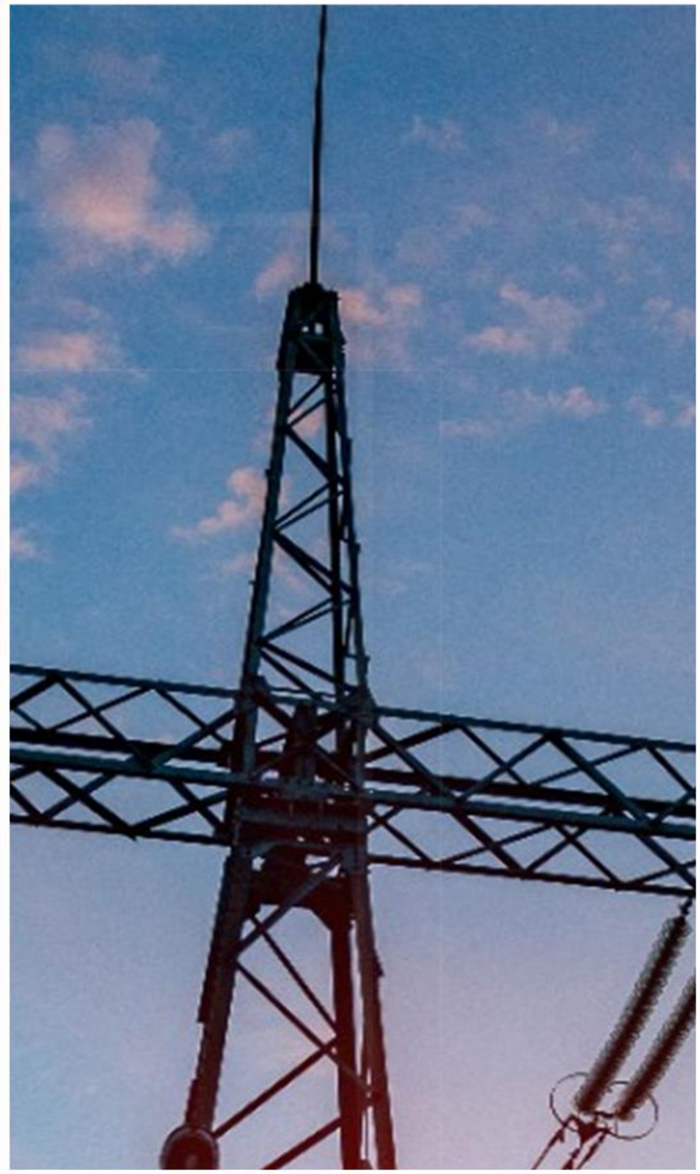
Abbreviations

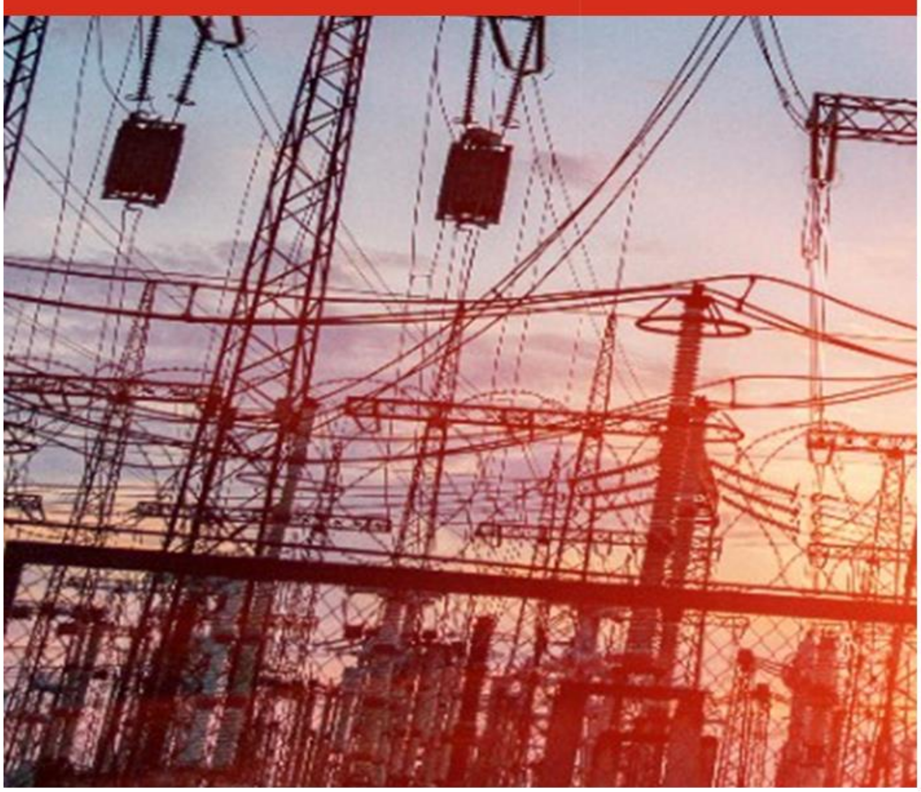
TCN	Transmission Company of Nigeria
DISCO	Distribution Companies
GENCO	Generation Companies
NERC	Nigeria Electricity Regulatory Commission
NESI	Nigerian Electricity Supply Industry
MYTO	Multi-Year Tariff Order
WAPP	West African Power Pool
NCC	National Control Center
PIP	Performance Improvement Plan
FMP	Federal Ministry of Power
PSRP	Power Sector Recovery Program
CAPEX	Capital Expenditure
OPEX	Operating Expenditure
KPI	Key Performance Indicators
NEPA	National Electric Power Authority
TSP	Transmission Service Provider
ISO	Independent System Operator
MO	Market Operator
PHCN	Power Holding Company of Nigeria
ECOWAS	Economic Community of West African States
EPSR	Electric Power Sector Reform Act
MVA	Megavolt Ampere
kVA	Kilo-Volt-Amperes

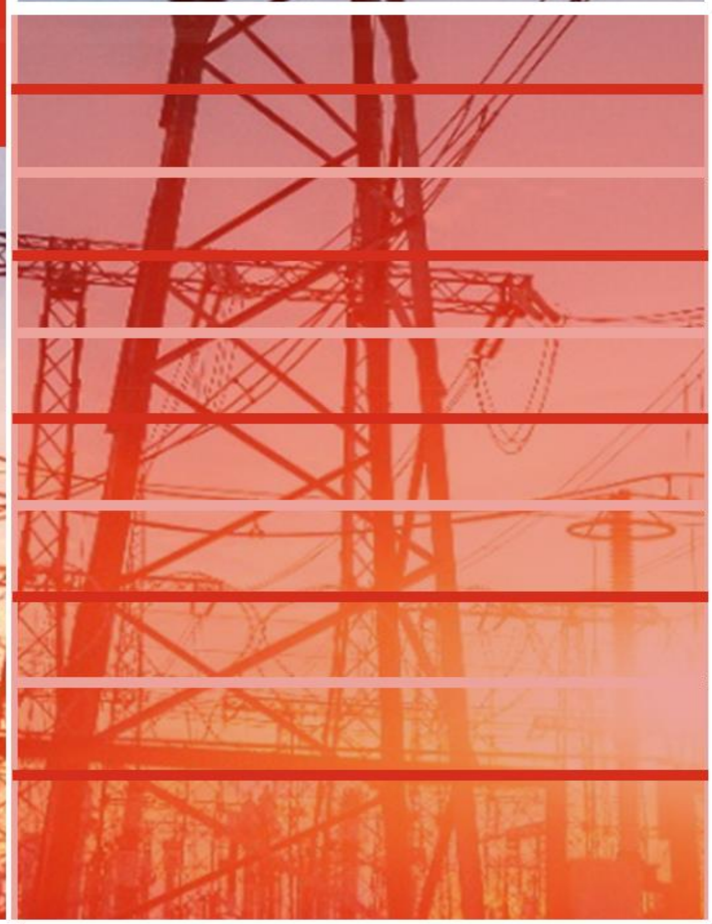
KV	Kilovolt
kW	kilowatt
Pf	Power Factor
NETAP	Nigeria Electricity Transmission Project
MW	Megawatts
MVA	Megavolt Ampere
GIS	Gas-insulated Substation
GW	Gigawatts
TREP	Transmission Rehabilitation and Expansion Program
SCADA	Supervisory Control and Data Acquisition
ERP	Enterprise Resource Programme
FGN	Federal Government of Nigeria
MRO	Minimum Remittance Order
AFD	Agence Française de Développement
AFDB	African Development Bank
DC	Double Circuit
HV	High Voltage
IDB	Islamic Development Bank
JICA	Japan International Cooperation Agency
SC	Single Circuit
WB	World Bank
PSMP	Power System Master Plan
NIPP	National Integrated Power Project

1

EXECUTIVE SUMMARY







1.1 Key Report Highlights

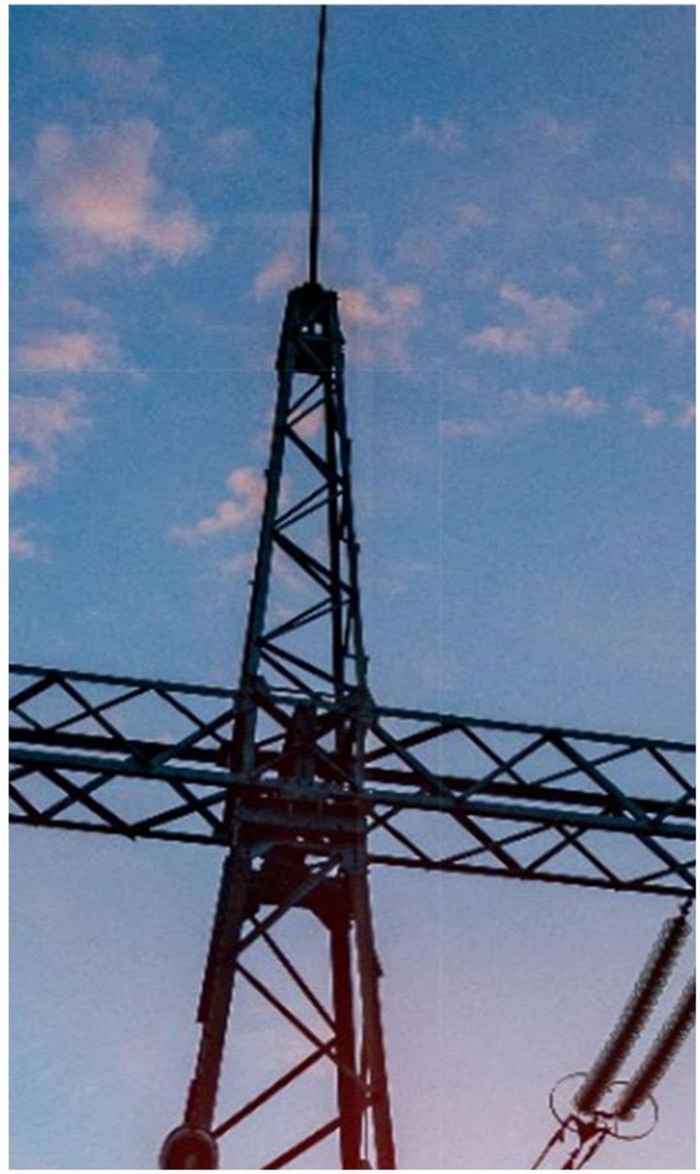
This report is the first Volume of TCN Performance Improvement Plan (PIP). The PIP is being prepared by the Transmission Company of Nigeria (TCN) for the Nigerian Electricity Regulatory Commission (NERC). The PIP is a prerequisite in filing for a Major Tariff review in line with the provisions of the Multi-Year Tariff Order (MYTO) methodology and other applicable procedures for electricity Tariff review in the Nigerian Electricity Supply Industry. This Volume discusses TCN's background, TCN's funding sources, TCN's strategic goals and state of TCN's infrastructure.

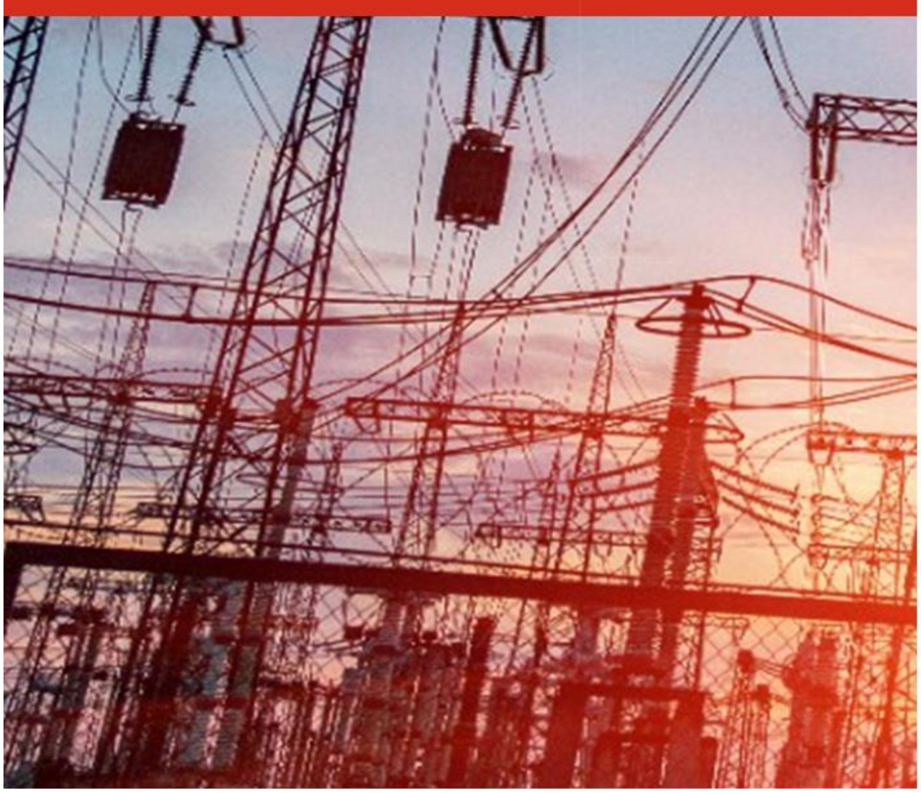
The PIP is being prepared to meet the Discos; in this regard, TCN has met with all the Discos several times to examine various needs of the Discos. One of the project streams discussed in this report was catalyzed from such meetings. TCN PIP Committee also engaged the 11 Discos in preparation for this report's production; the meetings' minute s are reproduced in this report.
This report presents ongoing TCN projects under various project streams by the Discos they will benefit. The needs of Discos were extracted from various interactions with them and populated in the report. More than half of the needs have been addressed or are being addressed. - If found beneficial and cost-effective, the other needs not yet addressed will form a substantial part of proposed network improvement investments. However, TCN will also propose investment in communication/visibility, protection, stability, and efficiency solutions for a safer, more efficient, and reliable grid.

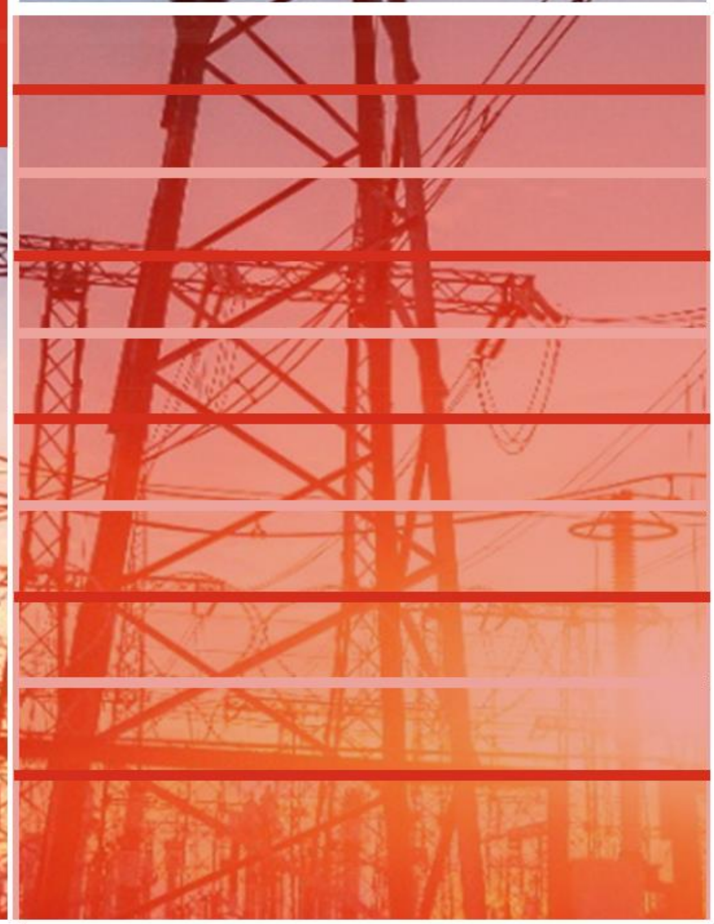
TCN will produce Volume 2 of this report based on feedback from NERC and Discos. Volume 2 will provide details of TCN investment plans based on issues identified in the final version of this Volume 1.

2

BACKGROUND/ OVERVIEW







2.1 Background/Introduction

2.1.1 Purpose of Report

This Performance Improvement Plan (PIP) is prepared by The Transmission Company of Nigeria (TCN) for the Nigerian Electricity Regulatory Commission (NERC). The PIP is a prerequisite in filing for a Major Tariff review in line with the provisions of the Multi-Year Tariff Order (MYTO) methodology and other applicable procedures for electricity Tariff review in the Nigerian Electricity Supply Industry.

The PIP is a 5-years forecast covering the year 2023 – 2027, justifying the investment of the TCN towards significant improvement in the performance of grid-interface connections, grid reliability, enhanced grid security, significant system losses reduction, efficient dispatch of generation and energy throughput, the safety of Transmission network and other infrastructure, grid visibility, system automation and other service improvement initiatives.

Once approved, the PIP would form the basis for the prioritization, implementation and monitoring of the Capital Expenditure (CAPEX) program, focusing on their impact on improved energy throughput, enhanced system reliability, system losses reduction and the achievement of their respective Key Performance Indicators (KPIs).

To ensure grid-interface connections, alignment of performance initiatives, and achieving the objectives of the Power Sector Recovery Program (PSRP), TCN complied with the directives of NERC to ensure proper alignment with the approved PIPs of the Discos.

Objective of the PIP

1. Ensure execution of targeted investments towards addressing the misalignment at transmission and distribution interface points.
2. Align TCN's investment with those of GenCos and DisCos to enable optimal utilization of generation and network capacity for improved service delivery.
3. To strengthen regulatory oversights on network investments to ensure value for money.
4. To guide system expansion and planning aimed at serving the existing and projected load growth over the next five years in line with the Grid Code.

NERC's Expectations

1. **Target Output:**
    - TCN is obligated to provide detailed justification for the identified projected including how the execution of such project will impact the underlisted output/outcomes over the 5-year planning horizon
2. **Programmes, projects and Activities:**
    - TCN is required to provide details of its proposed investment, programmes and activities for the next 5 years.
3. **Operations and Maintenance Expenses:**
    - This should indicate the number of personnel and material resources required.
4. **Projected Costs & Financing Plans:**
    - Proposed project cost accompanied by the financing plan and source of funds.
5. **Risk Factors and Mitigation Measures**

2.2 Transmission Company of Nigeria (TCN) Overview

2.2.1 About TCN

The Transmission Company of Nigeria (TCN) is one of the 18 successor companies of the former Power Holding Company of Nigeria (PHCN) established as part of the Power Sector unbundling in line with the Electric Power Sector Reforms Act (EPSRA) of 2005. TCN is a federally owned electric utility corporation in Nigeria established in 2005. The headquarters is located at the Federal Capital Territory in Abuja.

It is a member of the West African Power Pool, an agency committed to improving energy flow across ECOWAS member states through joint financing between member countries for better sustainability of regional power projects. In furtherance of this collective objective, the TCN provides bulk power supplies to countries like the Republic of Niger, the Republic of Benin and Togo.
TCN holds the Transmission Service Provider (TSP) licence and System Operations (ISO) license from the Nigeria Electricity Regulatory Commission (NERC).

As the Transmission Service Provider (TSP), it is mandated to carry out the Expansion, Operations and Maintenance of the Nigeria National Grid, and as the System Operator, is mandated to provide System and Market Operations services in the Nigerian Electricity Market (NEM) as well as System Planning, in line with provisions of the EPSRA, Grid Code, Market Rules and other extant regulations of the NESI

2.2.2 TCN's Mission and Vision Statement

TCN's vision and mission statement is guided by the company's seven core values. These values guide the company's every action. These core values are Integrity, Transparency, Sustainability, Professionalism, Customer Focus, Teamwork & Safety.

Vision

To be one of the leading electricity transmission companies in the world.

Mission

To transmit electricity in a most efficient and effective manner

2.3 TCN's Funding Structure

2.3.1 Introduction

TCN funds its operational/maintenance and capital expenses from different sources. The sources are:

- Concessionary loans from Multilateral agencies

- Internal Generated Revenue from NERC-approved tariff-based revenue collected from:
    - Distribution Companies (Discos),
    - International Customers and
    - Eligible Customers:
- Capex projects by NDPHC
- Capex projects FGNPC.

2.3.2 Multilateral Agencies Sources

Transmission projects are capital intensive and require reliable funding sources for their timely completion. TCN takes advantage of funds from Multilateral Agencies through loan supports backed by the Federal Government of Nigeria to finance some of its projects. These projects are executed by specialized units of the company called Project Management Units (PMUs)

The first Project Management Unit (PMU) in TCN was created in 2003 as a requirement for World Bank (WB) credit. The sole aim of the PMU is to ensure effective and efficient Management of projects following the Bank's procedures and world best practices. TCN currently has four PMUs, one for a set of projects funded by a financing source. These are shown in Table 2-1.

Table 2-1: Multilateral Funding Sources and Total Costs

S/N	Names of Multilateral Sources	Total Estimated Project Cost
1	World Bank – Project Management Unit (PMU)	• USD486M Nigeria Electricity Transmission Project
2	Agence Francaise de Development (AFD) - Project Management Unit (PMU)	• USD170 M Abuja Transmission Project • Northern Corridor Project - $200m
3	African Development Bank (AfDB) - Project Management Unit (PMU)	• USD210 M Nigeria Transmission Expansion Project
4	Japan International Corporation Agency (JICA) - Project Management Unit (PMU)	• USD235 M Lagos-Ogun Power Transmission Project

Some of the project sources by multilateral include:

2.3.2.(a) Nigeria Electricity Transmission Access Project (NETAP)-World Bank ($486 M).

This project focuses on upgrading old and deficient critical transmission substations and restructuring them to meet N – 1 redundancy criteria. The project will also resolve deficiencies in various control rooms by automating them in readiness for SCADA procurement. The project is at an advanced stage of implementation.

2.3.2.(b) Lagos/Ogun Transmission Project financed by the Agence Française de Développement (AFD)

This project will construct six substations and associated 330kV and 132kV lines in the industrial areas of Ogun State and Lagos State (4No. 330kV and 2No. 132kV substations).

2.3.2.(c) Northern Corridor Transmission Project financed by AFD and EU (for $274 million and €25 million).

This project will construct and fund new 330kV DC lines; Kainji-Birnin, Kebbi-Sokoto, Katsina-Daura-Gwiwa-Jogana-Kura and Sokotov - Kaura.Namoda - Katsina. The project will also re-construct one of the two Shiroro-Kaduna old and limited 330kV SC lines into a quad line and build four 330kV substations in Sokoto, Daura, Jogana, and Kaura-Namoda.

2.3.2.(d) Nigeria Transmission Expansion Project - AFDB ($410M)

The project will reconstruct the Alaoji-Owerri-Onitsha 330 SC and Ughelli-Benin 330kV lines into quad lines and construct a 330kV quad line between Kaduna (Mando) to Kano (Kumbotso). The project will also construct several 132kV lines in Borno, Adamawa and Yobe State plus 2no. 330kV substations at Millennium City-Kaduna and Zaria.

2.3.3 SLA Projects

SLA projects are projects to be funded by CBN through loans provided to the Discos. The loans are to be paid back by deduction from TCN Internal Generated Revenue Invoices.

2.3.4 Internal Generated Revenue

TCN generates money from the following services:

1) Wheeling charges from:
    a. Distribution Companies (Discos),
    b. Eligible Customers and
    c. International Customers
2) Services charges for services rendered by the System Operator and Market Operator.

Note: Many transmission projects are being funded through the IGR and managed by the Engineering department of the TCN. The IGR is also used to repay loans obtained from Multilateral agencies.

2.3.4.(a) Revenue from Distribution Companies (Discos)

TCN earns revenue from the Discos for the "Transmission Use of System", System Operations and Market Operations services. However, some Discos have not been remitting the whole portion of their charges; hence the revenue from the Discos is not predictable and abundant caution must be taken in using them to plan for project payments.

2.3.5 Federal Government Appropriation

A lot of capital projects in TCN are funded by appropriation funds from the Federal Government through yearly budgets. These projects are being managed by the TCN Engineering department. These appropriated funds can be considered as a form of donation to TCN.

2.3.6 Presidential Power Initiative (PPI) /FGN Power Co. Projects

The Nigerian Presidential Power Initiative (PPI) is a government-to-government agreement between Nigeria and Germany aimed to resolve some existing challenges in the Nigerian power sector and expand the capacity of the transmission and distribution network. The PPI project aims to upgrade the electricity network to achieve an operational capacity of 25,000 megawatts (MW) from the current average of around 4,500 MW through a series of projects spanning three phases. Some TCN brownfield and greenfield projects are included in this initiative.

2.3.7 NDPHC Projects

Niger Delta Power Holding Company is currently constructing some transmission projects. These projects include the construction of transmission substations and lines designed to evacuate power to the grid.

2.4 Project Completed Since 2015

The following projects, shown in Table 2-2, were achieved and completed in the year 2015 and above

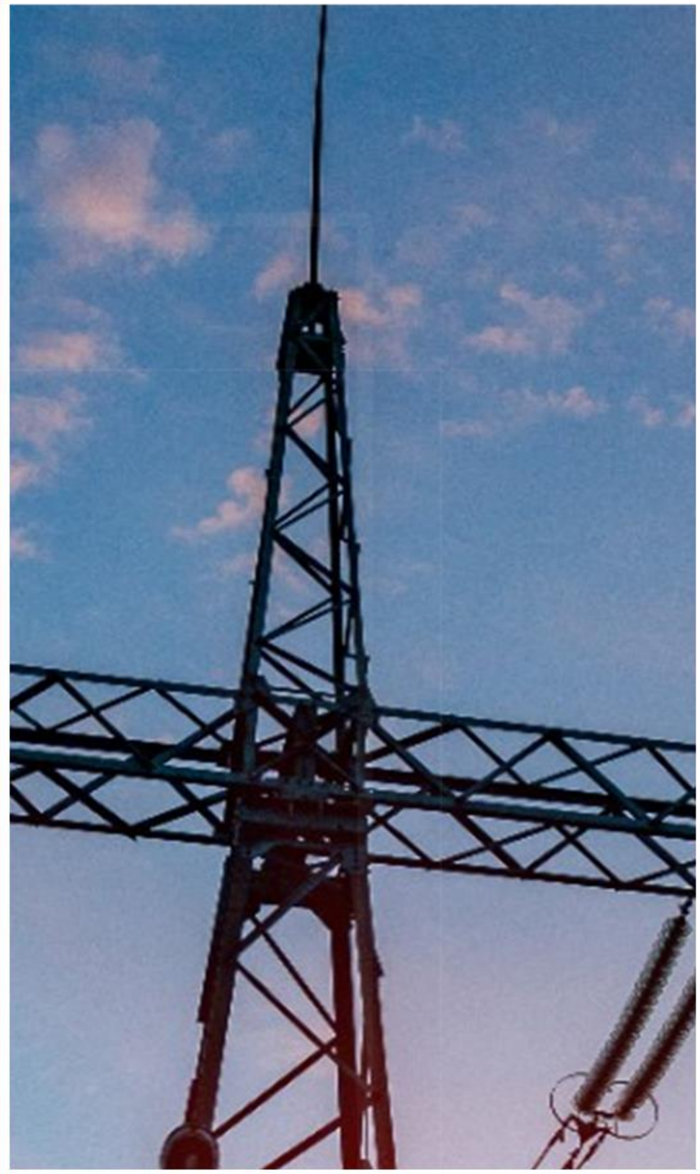
Table 2-2: Substations in Ibadan Disco Franchise Area

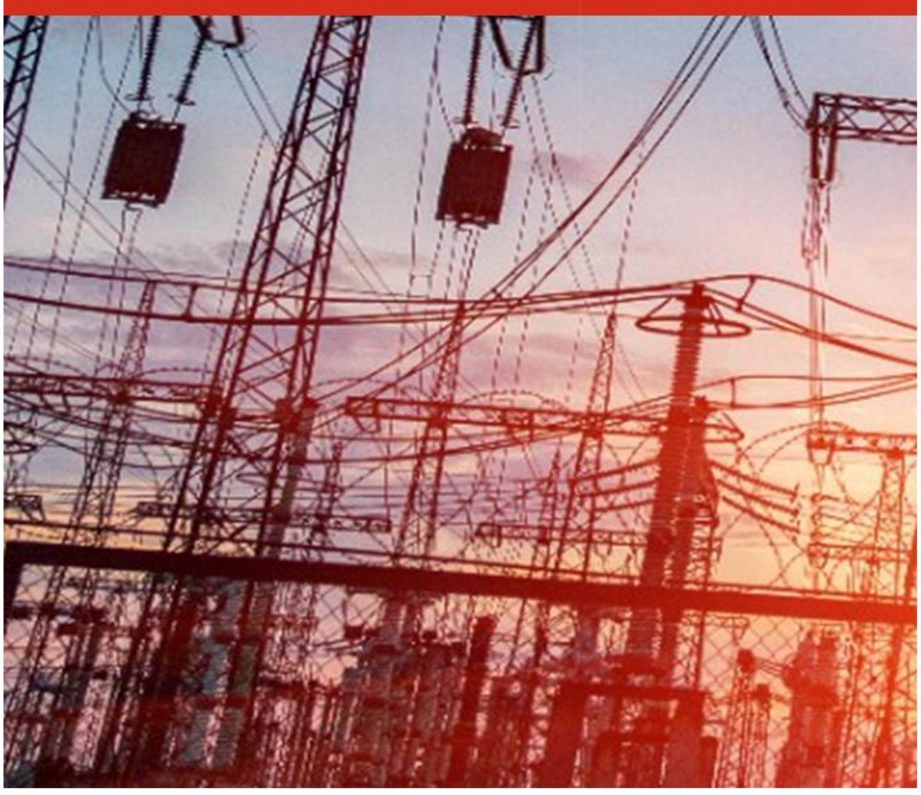
No	Project Name	State(s)	Completion Date
1	2x60MVA, 132/33kV substation at Agu-Awka	Anambra	Aug.,2021
2	Construction of Ikorodu – Shagamu 132kV double circuit transmission line	Lagos, Ogun	Aug.,2021
3	2x60MVA, 132/33kV substation at Gagarawa	Jigawa	Oct.,2020
4	2 x 60MVA, 132/33kV substation at Odogunyan	Ogun, Lagos	May, 2018
5	Katampe Capacitor Bank Projects	FCT	Dec.,2018
6	Rehabilitation of Afam TS with 1 x 150MVA 330/132/33kV transformer and construction of Afam IV to Afam I 132kV Transmission Line	Rivers	August, 2018
7	Damaturu 1x150MVA, 330/132kV Substation	Yobe	Dec., 2018
8	Grid Rehabilitation And Reinforcement, Katsina, Hadejia, Kontagora.	Katsina, Jigawa & Niger	Jun., 2018
9	1x150MVA, 330/132kv substation at Maiduguri + 60MVA 132/33KV S/S- Borno State	Borno	Dec., 2018
10	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 Kano State	Kano	Dec.,2018

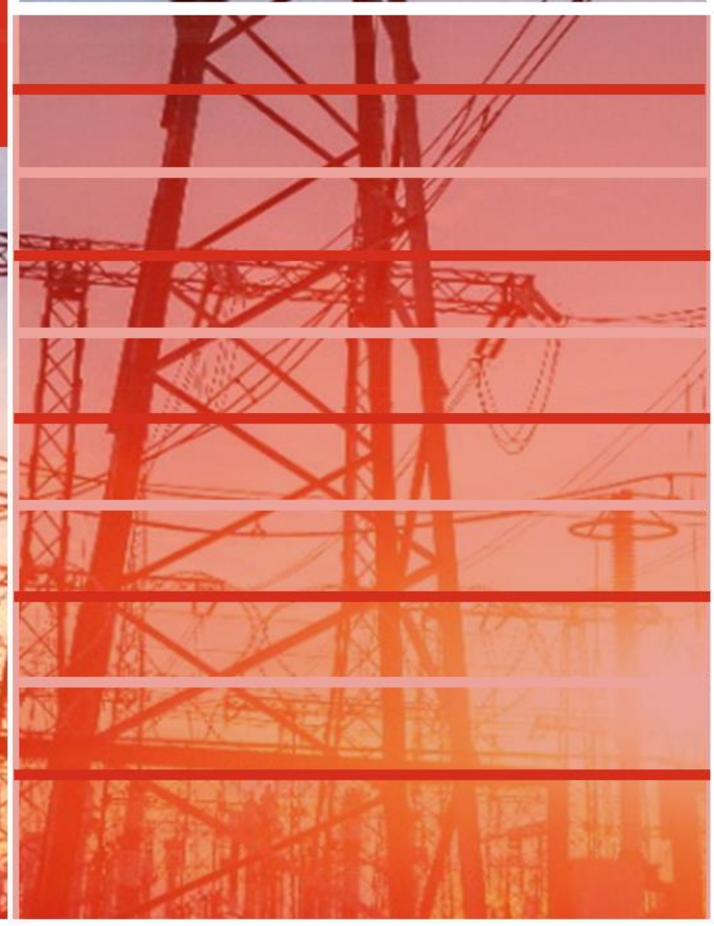
11	Yelwa - Yauri 2 x 30/40MVA S/S and 100KM of 33KV Line Kebbi State	Kebbi	Dec.,2018
12	1x60MVA, 132/33kV substation reinforcement at Ukpilla substation, Edo State	Edo	Dec., 2018
13	Construction of 1x28MVA Substation at Mayo Belwa(Mobitra)	Adamawa	Jun., 2017
14	Kukwaba 2x60MVA, 132/33kV substation	FCT	July., 2017
15	Daura 2 x 30/40MVA S/S and 2x 132kv line bay ext. at Katsina Katsina State	Katsina	Dec., 2017
16	Katsina- Daura 132kv DC line Katsina State	Katsina	Dec, 2017
17	Talata Mafara 2x30/40MVA 132/33kV substation	Zamfara	Dec., 2017
18	1 x 60MVA 132/33kV Substation each at Ughelli and Amukpe, Delta State	Delta	Dec., 2017
19	2 x 60MVA, 132/33kV substation at Ayobo with 132kV DC T/line Ikeja West - Ayobo.	Ogun, Lagos	Dec., 2017
20	2nd Benin-Onitsha 330kv SC line Edo-Delta-Anambra States	Edo, Delta & Anambra	Apr, 2016
21	Compensation requirement for completion of 2nd Benin-Onitsha 330kV S/C line	Edo, Delta & Anambra	Apr, 2016
22	Oshogbo- Ede 132KV DC Line	Osun	May, 2016

3

STRATEGIC GOALS







3.1 Baseline Study

3.1.1 Introduction of the Baseline Study

TCN engaged a firm to develop a strategic map for it. The engagement started with a baseline study. The baseline study assessed TCN's current operational, organizational, and financial state, identifying challenges and opportunities to inform the development of TCN's Strategic Plan. The Baseline Study used a combination of internal and external stakeholder interviews, desk research, and working sessions with TCN to assess the firm's current challenges and opportunities for improvement. The Baseline Study served as the foundation for understanding TCN's opportunities and gaps, which can be used to develop actionable recommendations and to inform TCN's Strategic Plan.

The Baseline Study used a three-step approach and an evidence-based framework to assess the six components of TCN's performance relative to one another. The three steps are discussed next:

3.1.1.(a) Research and Data Gathering

About twentyu TCN Staff members and five others employees of other agencies in the power sector were interviewed to get their perspective on the current state of TCN. Also, various documents relating to TCN were reviewed, including TCN licenses, audited financial statements, KPIs, the market rules, grid code, and external presentations

3.1.1.(b) Framework Development

Research findings were organized into a 6-component framework that considers both the internal- and external-facing factors driving TCN's success. This framework is illustrated in Figure 3-1. The external triangle depicts external-facing core functional areas, and the internal triangle depicts internal-facing core functional areas.

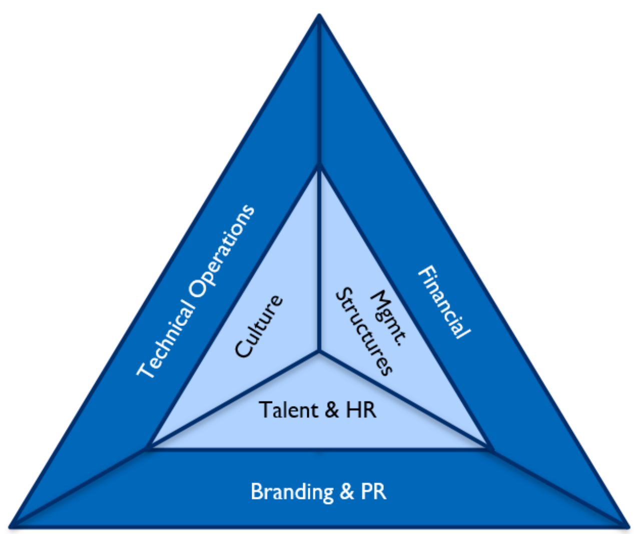


Figure 3-1: Six Components Strategic Framework

3.1.1.(c) *Synthesized Findings*

Findings were mapped to the six components and evaluated according to the simplified scale in Figure 3-2.

Figure 3-2:Evaluation scale of the six components

3.1.2 Findings of the Baseline Study

The Baseline Study Reported the following general points:

- TCN's strengths lie in its engineering expertise and its improving financial performance. ,However, it is challenged in specific organizational capacities which hold the firm back from its full potential in serving the Nigerian people.
- Historical de-prioritization of building internal capacity has created organizational challenges that, if left unchecked, will likely worsen. This may compromise the staff's ability to effectively perform their duties, reducing TCN's technical and financial performance.

Findings for the six components are presented in the following subsections.

3.1.2.(a) *Technical Operations*

TCN Technical Operations was found to be advanced based on the scale of evaluation, and the justification given is:

- TCN has made progress in upgrading and expanding its grid through initiatives like TREP and is working towards numerous improvements across maintenance, demand-planning, project prioritization, and SCADA that will help the firm realize its full technical potential.

3.1.2.(b) *Financial*

TCN Financial was found to be advanced based on the scale of evaluation and the justification is given as:

- Though TCN's potential for revenue is undermined by the poor performance of partners, the firm's financial health and long-term viability has been improving due to a concerted effort to diversify funding sources and cooperate more closely on development with DISCOS, along with significant advances in policy (e.g., Technical Committee on Payment, MYTO adjustment, MRO, Enforcement of the Payments Section of the Market Rules, Eligible Customers, International Customers).

3.1.2.(c) Branding and Public Relations

TCN Branding and Public Relations were found to be lagging based on the scale of evaluation, and the justification is given as follows:

- Public perception of TCN tends to be negative and does not accurately reflect the firm's contributions to the energy sector due to a general lack of awareness around the evolution of the energy sector (e.g., continued association with NEPA and PHCN), misinformation perpetrated by the media, and the bureaucratic and funding hurdles that limit TCN's response

3.1.2.(d) Culture

TCN Culture was found to be lagging based on the scale of evaluation and the justification is given as follows:

- Despite a shared understanding of TCN's overall mission, stakeholders struggled to articulate a distinct identity across the firm, observing challenges with morale, cohesion, and resistance to change.

3.1.2.(e) Management Structures

TCN Management Structures was found to be lagging based on the scale of evaluation and the justification is given as:

- Although TCN has some documentation covering functional areas like departments or processes such as performance management, many of these policies require further refinement, broader dissemination, and the addition of measurable standards to ensure efficacy, compliance, and continuity in the face of turnover.

3.1.2.(f) Talent and Human Resources

TCN Talent and Human Resources were found to be lagging based on the scale of evaluation, and the justification is given as follows:

- Due to a combination of attrition, irregular recruitment cycles, and short training programs, TCN struggles with knowledge loss, staffing misalignment, and skill gaps that undermine technical proficiency and business continuity.

3.2 Strategy Road Map

The Baseline Study identified multiple opportunities that could help TCN improve its organizational capacity, synchronize different company functions, and accelerate its technical and financial performance. The Baseline Study was used to produce a Strategic Road Map for TCN. The Strategic Road Map suggested that TCN should embark on an internal transformation, prioritizing its people, processes, and technology along with demand-based decision-making to unlock greater technical and financial success over the long term. The specific suggestions for the six components are summarized in the next subsections.

3.2.1 Technical Optimization: Drive Decisions around Demand

a) *Key Objectives*
Through continuous improvements across maintenance, demand-planning, and SCADA, TCN will be able to wheel more power, more efficiently and consistently.

b) *Current Capacity*
TCN has made progress in upgrading and expanding its grid, and could benefit from improvements across maintenance, proactive demand-based planning, project prioritization, and implementing SCADA. These improvements will help the firm realize its full technical potential.

c) *Organizational Gaps*
- Misalignment of project priority
- Short-sighted planning processes

d) *Initiative to Close Gaps*
- Formalize the project selection framework
- Reconcile the pipeline
- Standardize the maintenance plan
- Produce an Integrated Resource and Resilience Plan (IRRP)
- Finalize implementation of SCADA

3.2.2 Culture Change: Commit to a Culture of Excellence

a) *Key Objectives*
By engaging internally, and co-creating and documenting a cultural vision, TCN personnel will develop a better understanding of how their work advances the broader mission of the firm, fostering productivity, accountability, and buy-in towards shared goals.

b) *Current Capacity*
Despite a shared understanding of TCN's overall mission, stakeholders struggled to articulate a distinct identity across the firm, observing challenges with morale, cohesion, and resistance to change.

c) *Organizational Gaps*
- Lack of articulated cultural vision from leadership
- Ambiguous behavioural expectations

d) *Initiative to Close Gaps*
- Articulate and socialize a cultural vision
- Implement a code of conduct
- Facilitate connectivity and cohesion

3.2.3 Management Systems Augmentation: Solidify the Foundation

a) *Key Objectives*

By streamlining policies and functions, TCN can gain greater insight into its strengths and weaknesses as a firm, helping leadership to preemptively mitigate any barriers to advancement across core functional areas

b) *Current Capacity*

Although TCN has some documentation covering functional areas like departments, or processes such as performance management, many of these policies require further refinement, broader dissemination, and the addition of measurable standards to ensure efficacy, compliance, and continuity in the face of turnover.

c) *Organizational Gaps*

- Processes are not well documented and difficult to find
- Performance management is not structured and underutilizes KPIs
- The organization structure is not documented and readily available

d) *Initiative to Close Gaps*

- Finalize corporate structure and governance
- Refine standard operating procedures (SOPs)
- Enhance performance management
- Utilize KPIs to measure transformation
- Build a knowledge management database

3.2.4 Human Capital Optimization: Empower & Invest in People

a) *Key Objectives*

By improving TCN's human capital, it will have a workforce that is sufficiently prepared to operate and grow TCN's business.

b) *Current Capacity*

Due to a combination of attrition, government-imposed hiring rules, and insufficient training programs, TCN struggles with knowledge loss, staffing shortages, and skill gaps that undermine business continuity.

c) *Organizational Gaps*

- Total filled and vacant positions are unknown
- Roles and responsibilities are not defined, confusing the workforce
- Staff are not adequately trained to perform responsibilities
- No succession or recruitment plans in place

d) *Initiative to Close Gaps*

- Conduct a staffing audit
- Define and document roles and responsibilities
- Build internal capacity through training
- Create a recruitment plan

- Develop a succession plan

3.2.5 Branding and Public Relations: Communicate Proactively

a) *Key Objectives*

By proactively communicating TCN's objectives and intended changes, TCN will build trust among its staff and external customers and cultivate a positive public image.

b) *Current Capacity*

Public perception of TCN tends to be negative and does not accurately reflect the firm's contributions to the energy sector due to a general lack of awareness around the evolution of the energy sector, misinformation perpetrated by the media, and the bureaucratic and funding hurdles that limit TCN's response.

c) *Organizational Gaps*

- Reactive, rather than proactive, public response campaigns
- Historical de-prioritization of internal communications and public affairs

d) *Initiative to Close Gaps*

- Develop a public outreach campaign
- Increase TCN's brand visibility through physical signage

3.2.6 Digital Transformation: Embrace Innovation

a) *Key Objectives*

By leveraging modern technology, TCN will be able to streamline business operations and gain deeper, data-driven insights to form strategic decisions.

b) *Current Capacity*

TCN has stated ambitious goals to accelerate its technology modernization efforts by implementing enterprise software (e.g., ERP), but lacks the technological prerequisites to do so.

c) *Organizational Gaps*

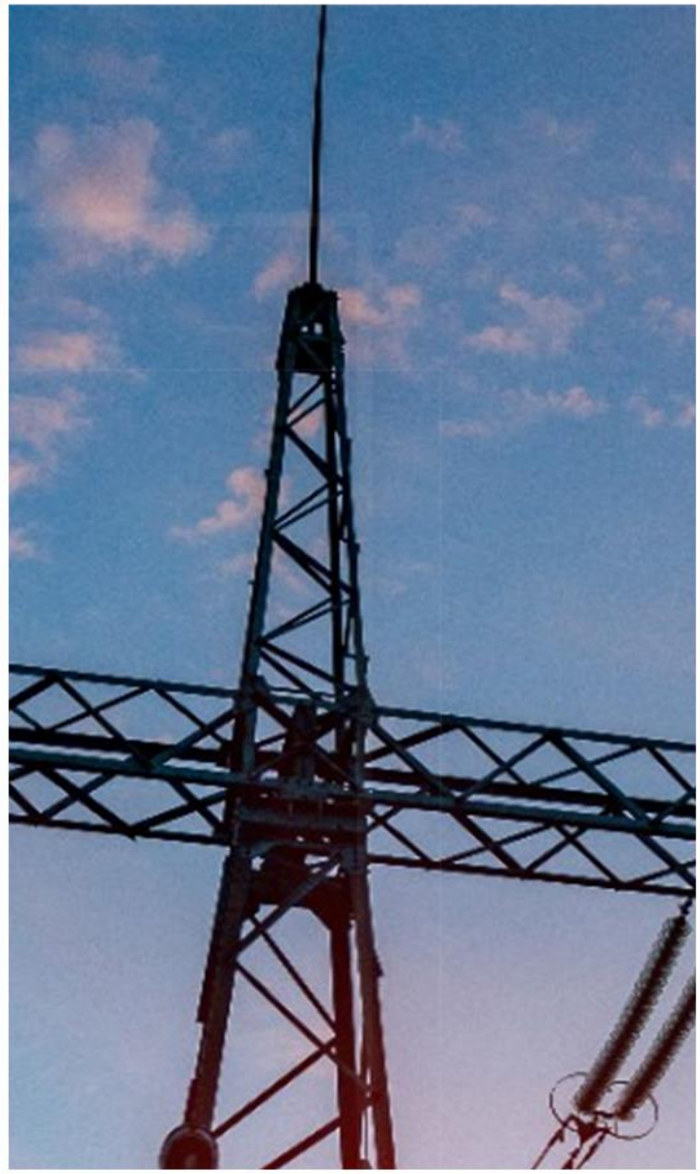
- Lack of holistic planning between current hardware and desired software
- Lack of available technology assets
- Workforce resistance to transitioning to a digital environment

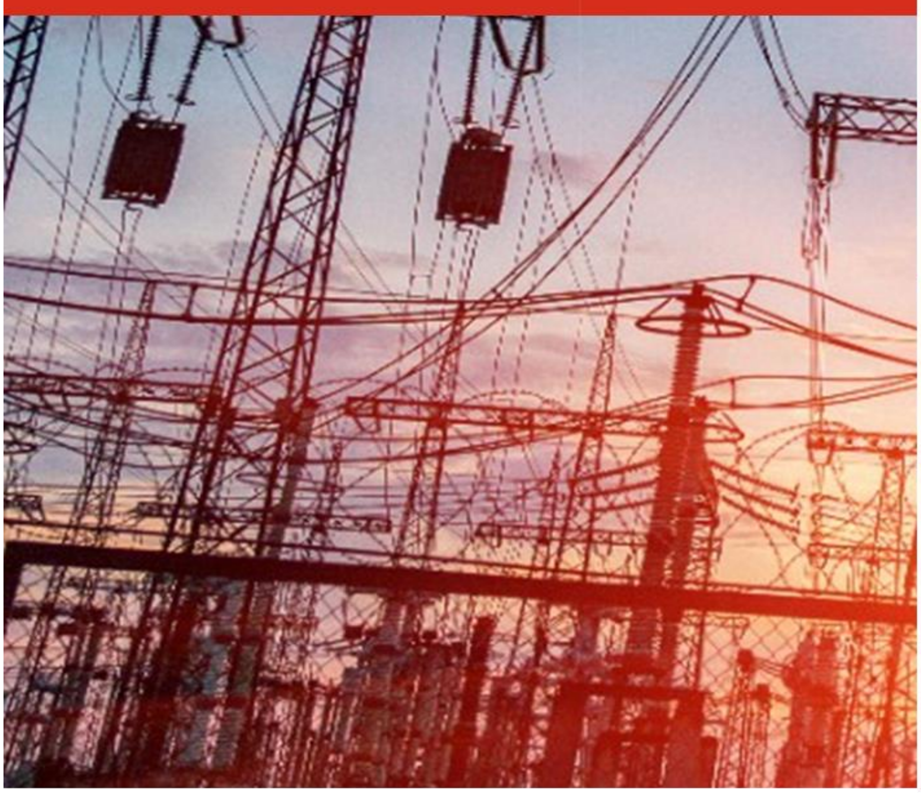
d) *Initiative to Close Gaps*

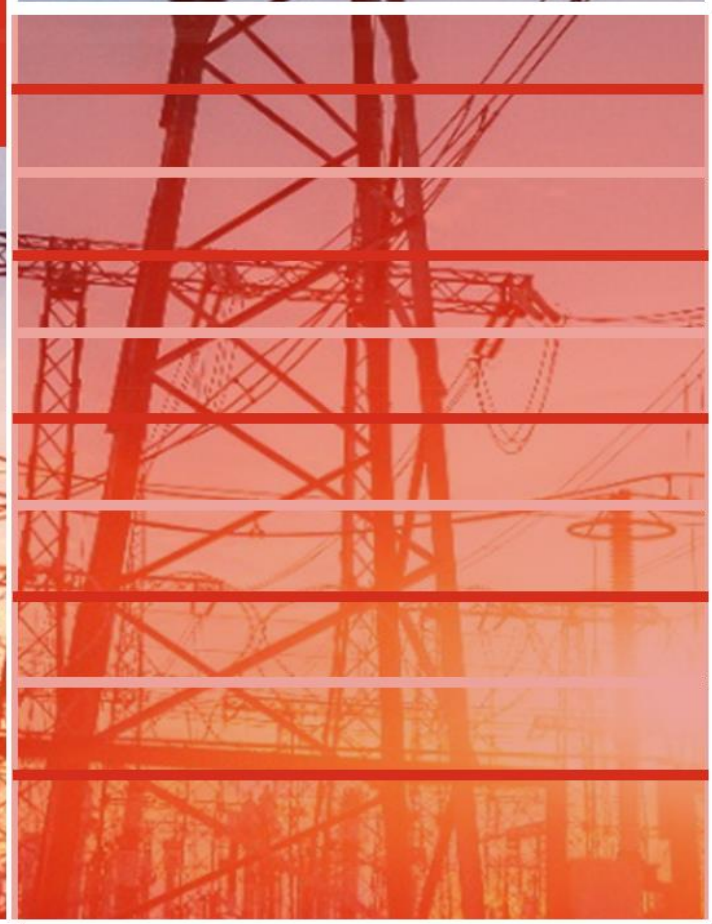
- Gauge interoperability of new and old technology
- Create a technological enabling environment

- Automate routine processes
- Complete an enterprise technology upgrade

4
STATE OF TCN'S INFRASTRUCTURE







4.1 Overview of TCN Network

TCN owns and manages the 330kV and 132kV kV transmission lines and substations infrastructure constituting the power transmission system. TCN interconnects 27 Generating Companies (GenCos) and load centres of 11 Distribution Companies (Discos) making up the Nigerian Electricity Grid. Power is taken from the transmission system through over 840 Transmission/Distribution Interface (33kV feeders radiating from 132/33kV transformers); three international connectors (to export power to utilities in Benin Republic, Togo Republic and Niger Republic); and 18 Eligible Customers on 132kV and 33kV network.

The 132 kV system, which includes 330/132 kV substations, 132 kV overhead lines, and 132 /33 kV substations, faces the most constraints, whereas the 330 kV system has relatively adequate levels of redundancy in most parts of the system and so can withstand a single fault without losing major load. This improvement was achieved following the commissioning in 2016 of the Enugu-Makurdi-Jos, South-to-North 330 kV link and the commissioning of the Ikot Ekpene substation and Afam-Calabar 330 kV link.

This is a very significant improvement from the transmission network inherited from the old NEPA, which was made up of one 330KV ring, the Oshogbo-Benin-Lagos 330KV ring, that linked the hydro-generators and load centres in the Northern Axis with gas-fired generators and load centers in the Southern Axis. However, TCN, with the support of the FGN, has improved significantly, with more than five 330 KV rings. In addition, more lines and substations have been constructed and commissioned.

The following 330 kV rings exist in the system, creating a robust and redundant grid backbone:

- Lagos (primary load): Oshogbo-Benin-Egbin-Ikeja West
- West (hydro): Oshogbo-Benin-Abuja-Shiroro-Jebba
- Southeast (gas): Onitsha-Alaoji-Afam-Ikot Ekpene-Enugu
- East: Shiroro-Abuja-Benin-Onitsha-Enugu-Makurdi-Jos-Kaduna

The backbone lines and numerous completed projects have increased TCN's wheeling capacity to about 8,100MW and power supply has improved tremendously nationwide at TCN/Disco interfaces as a result of these investment initiatives.

However, despite the existence of these robust 330 network, a critical part of the Northwestern axis of the Grid is infrastructure deficient at the 330kV level. Kano Region that serves the Kano Disco is supplied by a radial single circuit line radiating from Mando 330 kV substation in Kaduna. The Mando – Kumbotso 330kV line is a single circuit line limited to less than 400 MW. Any outage on the line causes the whole of Kano, Katsina and Jigawa States to be out of electricity. Similarly, the North-Eastern axis supplying part of Jos Disco and the whole of Yola Disco is served by a radial single circuit: a 330kV line radiating from Jos 330kV substation to Gombe. Any outage on the single line leaves the entire Northeast region without electricity supply.

Although remarkable progress has been made so far at the 330kV level, there are still considerable number of constraints at the level of 132kV lines and 132kV/33kV TCN interfaces with the Discos; these constraints can be categorized into three broad categories:

1. Discos do not have adequate evacuation capacity at locations where TSP has abundance transformation capacity.
2. Discos have abundance evacuation capacity at locations where TSP injects limited power because of line or equipment constraints or faults.
3. TSP and Discos have matching capacities at interfaces, but Discos do not want energy at these interfaces because the majority of the customers connected to them cannot pay.

The industry regulator, NERC, is tackling these challenges by requesting for Performance Improvement Plans (PIPs) to address the challenges facing the Discos and TCN. The Discos have submitted their PIPs in accordance with the NERC issued PIP guidelines. The PIPs are expected to serve as output-based plans specifying target outputs over the next five years, with a clear roadmap to achieve them along with resource mapping, cost and risk analysis. The PIPs are also tied to the allowed capital expenditure (CAPEX) allowances in the MYTO model.

TCN, in developing this PIP report, considers the identification of existing and potential constraints to meeting electricity demand arising from the transmission system infrastructure and proffering improvement projects as a significant priority. The TCN's PIP intends to align with each disco's PIP to adequately address the transmission – distribution interface issues.

4.2 Analysis of TCN's Bulk Power Delivery Infrastructure

4.2.1 Transmission Substations

The Transmission Company of Nigeria has a total of 196 substations: 43Nos 330KV and 153Nos 132kV substations. For ease of administration, the substations are grouped for administration and maintenance under the ten regions of TCN as depicted in Figure 4-1.

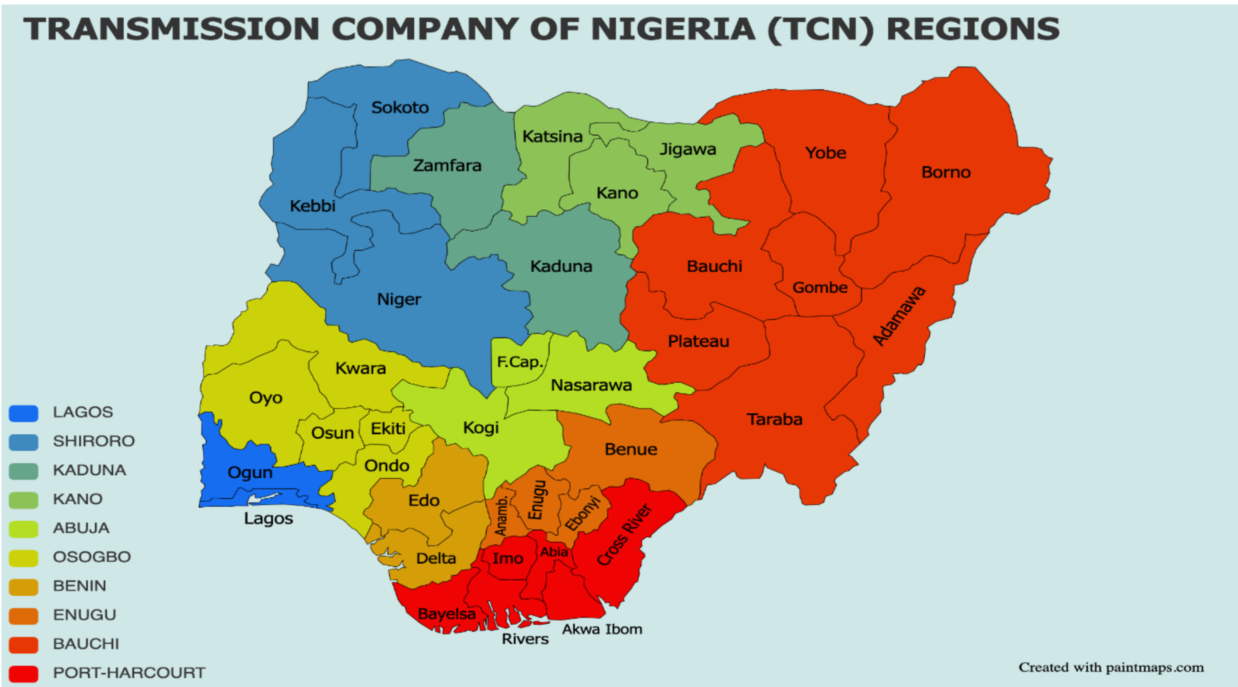


Figure 4-1: Map of Nigeria, with TCN region overlaid on it

The substations statistics by regions are given in Table 4-1:

Table 4-1: TCN Substations Regional Statistics

REGION	132KV Substation	330 KV Substation
ABUJA	16	6
BAUCHI	16	5
BENIN	11	5
ENUGU	17	5
KADUNA	6	1
KANO	14	1
LAGOS	29	8
OSOGBO	17	3
PORT-HARCOURT	17	5
SHIRORO	10	4
	153	43

The 330kV substations are listed by their TCN regions and the Discos they serve in Table 4-2. Table 4-2 also shows the age range of the substations.

Table 4-2: 330kV Substations by Region

No	Code	Region	STATION	Age Range	Type	Disco 1	Disco 2	Disco 3	Disco 4	Disco 5
1	330.ABU.AJA	ABUJA	AJAOKUTA	<40 & > 30 years	Substation	AEDC	BEDC			
2	330.ABU.GER	ABUJA	GEREGU	<10 years	Switching Station	AEDC	BEDC			
3	330.ABU.GWA	ABUJA	GWAGWALADA	<10 years	Substation	AEDC				
4	330.ABU.KAT	ABUJA	KATAMPE	<30 & > 20 years	Substation	AEDC				
5	330.ABU.LAF	ABUJA	LAFIA	<10 years	Substation	AEDC				
6	330.ABU.LOK	ABUJA	LOKOJA	<30 & > 20 years	Substation	AEDC	BEDC			
7	330.BAU.DAM	BAUCHI	DAMATURU	<10 years	Substation	YEDC				
8	330.BAU.GOM	BAUCHI	GOMBE	<40 & > 30 years	Substation	JEDC	YEDC			
9	330.BAU.JOS	BAUCHI	JOS	<40 & > 30 years	Substation	JEDC				
10	330.BAU.MOL	BAUCHI	MOLAI	<10 years	Substation	YEDC				
11	330.BAU.YOL	BAUCHI	YOLA	<40 & > 30 years	Substation	YEDC				
12	330.BEN.BEN	BENIN	BENIN	>50 years	Substation	BEDC	EKEDC	IKEDC	IBEDC	EEDC
13	330.BEN.UGH	BENIN	UGHELLI/DELTA	<40 & > 30 years	Substation	BEDC				
14	330.BEN.IHO	BENIN	IHOVBOR	<10 years	Substation	BEDC	IBEDC			
15	330.BEN.OMO	BENIN	OMOTOSHO	<10 years	Switching Station	BEDC	EKEDC	IKEDC		
16	330.BEN.SAP	BENIN	SAPELE	<40 & > 30 years	Switching Station	BEDC				
17	330.ENU.API	ENUGU	APIR	<10 years	Substation	JEDC				
18	330.ENU.ASA	ENUGU	ASABA	<20 & > 10 years	Substation	BEDC	EEDC			
19	330.ENU.NEW	ENUGU	NEW HAVEN	<40 & > 30 years	Substation	EEDC				
20	330.ENU.ONI	ENUGU	ONITSHA	<40 & > 30 years	Substation	EEDC	BEDC			
21	330.ENU.UGW	ENUGU	UGWUAJI	<10 years	Substation	EEDC	JEDC			
22	330.KAD.MAN	KADUNA	MANDO T. S	>50 years	Substation	KAEDCO				
23	330.KAN.KUM	KANO	KUMBOTSO	<50 & > 40 years	Substation	KEDCO				
24	330.LAG.AJA	LAGOS	AJA	<40 & > 30 years	Substation	EKEDC				
25	330.LAG.AKA	LAGOS	AKANGBA	<50 & > 40 years	Substation	EKEDC	IKEDC			
26	330.LAG.ALA	LAGOS	ALAGBON	<30 & > 20 years	Substation	EKEDC				
27	330.LAG.EGB	LAGOS	EGBIN	<30 & > 20 years	Substation	IKEDC				
28	330.LAG.IKE	LAGOS	IKEJA WEST	<50 & > 40 years	Substation	EKEDC	IKEDC			
29	330.LAG.LEK	LAGOS	LEKKI	<20 & > 10 years	Substation	EKEDC				
30	330.LAG.OKE	LAGOS	OKE-ARO	<20 & > 10 years	Substation	IKEDC				
31	330.LAG.OLO	LAGOS	OLORUNSOGO	<10 years	Switching Station	IBEDC	IKEDC	EKEDC		
32	330.OSH.AYE	OSHOGBO	AYEDE	>50 years	Substation	IBEDC				
33	330.OSH.GAN	OSHOGBO	GANMO	<20 & > 10 years	Substation	IBEDC				
34	330.OSH.OSO	OSHOGBO	OSOGBO	>50 years	Substation	IBEDC				
35	330.POR.ADI	PORT HARCOURT	ADIABOR	<10 years	Substation	PHEDC				
36	330.POR.AFA	PORT HARCOURT	AFAM	<30 & > 20 years	Substation	PHEDC				
37	330.POR.ALA	PORT HARCOURT	ALAOJI	<30 & > 20 years	Substation	PHEDC	EEDC			
38	330.POR.IKO	PORT HARCOURT	IKOT-EKPENE	<10 years	Substation	PHEDC				
39	330.POR.ODU	PORT HARCOURT	ODUKPANI	<10 years	Substation	PHEDC				
40	330.SHI.JEB	SHIRORO	JEBBA	<50 & > 40 years	Substation	AEDC	IBEDC			
41	330.SHI.SHI	SHIRORO	SHIRORO	>50 years	Substation	AEDC	KAEDCO			
42	330.SHI.KAI	SHIRORO	KAINJI	>50 years	Substation	AEDC	KAEDCO			
43	330.SHI.BIR	SHIRORO	BIRNIN KEBBI	<40 & > 30 years	Substation	KAEDCO				

The 132kV substations are listed by their TCN regions and the Discos they serve in Table 4-3.

Table 4-3: 132kV Substations by Region

No	Code	REGION	STATION	Disco 1	Disco 2
1	132.ABU.AJA	ABUJA	Ajaokuta 132kV	AEDC	
2	132.ABU.AKW	ABUJA	Akwanga 132kV	AEDC	

3	132.ABU.APO	ABUJA	Apo 132kV	AEDC	
4	132.ABU.CEN	ABUJA	Central Area 132kV	AEDC	
5	132.ABU.GWA	ABUJA	Gwagwalada 132kV	AEDC	
6	132.ABU.KAR	ABUJA	Karu 132kV	AEDC	
7	132.ABU.KAT	ABUJA	Katampe2 132kV	AEDC	
8	132.ABU.KAT	ABUJA	Katampe3 132kV	AEDC	
9	132.ABU.KEF	ABUJA	Keffi 132kV	AEDC	
10	132.ABU.KUB	ABUJA	Kubwa 132kV	AEDC	
11	132.ABU.KUK	ABUJA	Kukwaba 132kV	AEDC	
12	132.ABU.LAF	ABUJA	Lafia 132kV	AEDC	
13	132.ABU.LOK	ABUJA	Lokoja 132kV	AEDC	
14	132.ABU.OKE	ABUJA	Okene 132kV	AEDC	
15	132.ABU.OKP	ABUJA	Okpella 132kV	AEDC	BEDC
16	132.ABU.SUL	ABUJA	Suleja 132kV	AEDC	
17	*132.BAU.ASH*	*BAUCHI*	*Ashaka 132kV*	*JEDC*	
18	*132.BAU.BAU*	*BAUCHI*	*Bauchi 132kV*	*JEDC*	
19	*132.BAU.BIU*	*BAUCHI*	*Biu 132kV*	*YEDC*	
20	*132.BAU.DAM*	*BAUCHI*	*Damaturu 132kV*	*YEDC*	
21	*132.BAU.DAM*	*BAUCHI*	*Damboa 132kV*	*YEDC*	
22	*132.BAU.GOM*	*BAUCHI*	*Gombe 132kV*	*JEDC*	
23	*132.BAU.JAL*	*BAUCHI*	*Jalingo 132kV*	*YEDC*	
24	*132.BAU.JOS*	*BAUCHI*	*Jos 132kV*	*JEDC*	
25	*132.BAU.KAF*	*BAUCHI*	*Kafanchan 132kV*	*KAEDCO*	
26	*132.BAU.MAI*	*BAUCHI*	*Maiduguri 132kV*	*YEDC*	
27	*132.BAU.MAK*	*BAUCHI*	*Makeri 132kV*	*JEDC*	
28	*132.BAU.MAY*	*BAUCHI*	*Mayo-Belwa 132kV*	*YEDC*	
29	*132.BAU.MOL*	*BAUCHI*	*Molai 132kV*	*YEDC*	
30	*132.BAU.POT*	*BAUCHI*	*Potiskum 132kV*	*YEDC*	
31	*132.BAU.SAV*	*BAUCHI*	*Savannah 132kV*	*YEDC*	
32	*132.BAU.YOL*	*BAUCHI*	*Yola 132kV*	*IBEDC*	
33	132.BEN.AFI	BENIN	Afiesere 132kV	BEDC	
34	132.BEN.AMU	BENIN	Amukpe 132kV	BEDC	
35	132.BEN.BEN	BENIN	Benin 132kV	BEDC	
36	132.BEN.DEL	BENIN	Delta 132kV	BEDC	
37	132.BEN.EFF	BENIN	Effurun 132kV	BEDC	
38	132.BEN.ETS	BENIN	Etsako 132kV	BEDC	
39	132.BEN.IHO	BENIN	Ihovbor 132kV	BEDC	
40	132.BEN.IRR	BENIN	Irrua 132kV	BEDC	
41	132.BEN.OGH	BENIN	Oghara 132kV	BEDC	
42	132.BEN.OKA	BENIN	Okada 132kV	BEDC	
43	132.BEN.OND	BENIN	Ondo 132kV	BEDC	
44	*132.ENU.ABA*	*ENUGU*	*Abakaliki 132kV*	*EEDC*	

45	132.ENU.AGB	ENUGU	Agbor 132kV	BEDC	
46	132.ENU.AGU	ENUGU	Agu Awka 132kV	EEDC	
47	132.ENU.API	ENUGU	Apir 132kV	JEDC	
48	132.ENU.ASA	ENUGU	Asaba 132kV	BEDC	
49	132.ENU.GCM	ENUGU	GCM 132kV	EEDC	
50	132.ENU.NEW	ENUGU	New-Haven 132kV	EEDC	
51	132.ENU.NIB	ENUGU	Nibo Awka 132kV	EEDC	
52	132.ENU.NKA	ENUGU	Nkalagu 132kV	EEDC	
53	132.ENU.OJI	ENUGU	Oji River 132kV	EEDC	
54	132.ENU.ONI	ENUGU	Onitsha 132kV	EEDC	
55	132.ENU.OTU	ENUGU	Otukpo 132kV	JEDC	
56	132.ENU.TAK	ENUGU	Takum 132kV	YEDC	
57	132.ENU.UGW	ENUGU	Ugwuaji 132kV	EEDC	
58	132.ENU.UNN	ENUGU	UNN Nsukka 132kV	EEDC	
59	132.ENU.WUK	ENUGU	Wukari 132kV	YEDC	
60	132.ENU.YAN	ENUGU	Yandev 132kV	JEDC	
61	132.KAD.FUN	KADUNA	Funtua 132kV	KEDCO	
62	132.KAD.GUS	KADUNA	Gusau 132kV	KAEDCO	
63	132.KAD.KAD	KADUNA	Kaduna Town 132kV	KAEDCO	
64	132.KAD.MAN	KADUNA	Mando 132kV	KAEDCO	
65	132.KAD.TAL	KADUNA	Talata-Mafara 132kV	KAEDCO	
66	132.KAD.ZAR	KADUNA	Zaria 132kV	KAEDCO	
67	132.KAN.AZA	KANO	Azare 132kV	KEDCO	
68	132.KAN.BIC	KANO	Bichi 132kV	KEDCO	
69	132.KAN.DAK	KANO	Dakata 132kV	KEDCO	
70	132.KAN.DAN	KANO	Dan-Agundi 132kV	KEDCO	
71	132.KAN.DAU	KANO	Daura 132kV	KEDCO	
72	132.KAN.DUT	KANO	Dutse 132kV	KEDCO	
73	132.KAN.GAG	KANO	Gagarawa 132kV	KEDCO	
74	132.KAN.HAD	KANO	Hadejia 132kV	KEDCO	
75	132.KAN.KAN	KANO	Kankia 132kV	KEDCO	
76	132.KAN.KAT	KANO	Katsina 132kV	KEDCO	
77	132.KAN.KUM	KANO	Kumbotso 132kV	KEDCO	
78	132.KAN.KWA	KANO	Kwanar-Dangora 132kV	KEDCO	
79	132.KAN.TAM	KANO	Tamburawa 132kV	KEDCO	
80	132.KAN.WUD	KANO	Wudil 132kV	KEDCO	
81	132.LAG.ABE	LAGOS	Abeokuta 132kV	IBEDC	
82	132.LAG.AGB	LAGOS	Agbara 132kV	EKEDC	
83	132.LAG.AJA	LAGOS	Aja 132kV	EKEDC	
84	132.LAG.AKA	LAGOS	Akangba 132kV	EKEDC	
85	132.LAG.AKO	LAGOS	Akoka 132kV	EKEDC	
86	132.LAG.ALA	LAGOS	Alagbon 132kV	EKEDC	

87	132.LAG.ALA	LAGOS	Alausa 132kV	IKEDC	
88	132.LAG.ALI	LAGOS	Alimosho 132kV	IKEDC	
89	132.LAG.AMU	LAGOS	Amuwo-Odofin 132kV	EKEDC	IKEDC
90	132.LAG.APA	LAGOS	Apapa-Road 132kV	EKEDC	
91	132.LAG.AYO	LAGOS	Ayobo 132kV	IKEDC	
92	132.LAG.EGB	LAGOS	Egbin 132KV	IKEDC	
93	132.LAG.EJI	LAGOS	Ejigbo 132kV	IKEDC	
94	132.LAG.IJO	LAGOS	Ijora 132kV	EKEDC	
95	132.LAG.IKO	LAGOS	Ikorodu 132kV	IKEDC	
96	132.LAG.ILA	LAGOS	Ilashe-Island 132kV	EKEDC	
97	132.LAG.ILU	LAGOS	Ilupeju 132kV	IKEDC	
98	132.LAG.ISO	LAGOS	Isolo 132kV	EKEDC	IKEDC
99	132.LAG.ITI	LAGOS	Itire 132kV	EKEDC	IKEDC
100	132.LAG.LEK	LAGOS	Lekki 132kV	EKEDC	
101	132.LAG.MAR	LAGOS	Maryland 132kV	IKEDC	
102	132.LAG.NEW	LAGOS	New Abeokuta 132kV	IBEDC	
103	132.LAG.ODO	LAGOS	Odogunyan 132kV	IKEDC	
104	132.LAG.OGB	LAGOS	Ogba 132kV	IKEDC	
105	132.LAG.OJO	LAGOS	Ojo 132kV	EKEDC	
106	132.LAG.OKE	LAGOS	Oke-Aro 132kV	IBEDC	IKEDC
107	132.LAG.OTT	LAGOS	Otta 132kV	IBEDC	IKEDC
108	132.LAG.OWO	LAGOS	Oworonshoki 132kV	IKEDC	
109	132.LAG.PAP	LAGOS	Papalanto 132kV	IBEDC	
110	*132.OSO.ADO*	*OSOGBO*	*Ado Ekiti 132kV*	*BEDC*	
111	*132.OSO.AKU*	*OSOGBO*	*Akure 132kV*	*BEDC*	
112	*132.OSO.AYE*	*OSOGBO*	*Ayede 132kV*	*IBEDC*	
113	*132.OSO.GAN*	*OSOGBO*	*Ganmo 132kV*	*IBEDC*	
114	*132.OSO.IBA*	*OSOGBO*	*Ibadan-North 132kV*	*IBEDC*	
115	*132.OSO.IJE*	*OSOGBO*	*Ijebu-Ode 132kV*	*IBEDC*	
116	*132.OSO.ILE*	*OSOGBO*	*Ile-Ife 132kV*	*IBEDC*	
117	*132.OSO.ILE*	*OSOGBO*	*Ilesha 132kV*	*IBEDC*	
118	*132.OSO.ILO*	*OSOGBO*	*Ilorin 132kV*	*IBEDC*	
119	*132.OSO.ISE*	*OSOGBO*	*Iseyin 132kV*	*IBEDC*	
120	*132.OSO.IWO*	*OSOGBO*	*Iwo 132kV*	*IBEDC*	
121	*132.OSO.JER*	*OSOGBO*	*Jericho 132kV*	*IBEDC*	
122	*132.OSO.MCP*	*OSOGBO*	*Mcpherson 132kV*	*IBEDC*	
123	*132.OSO.OFF*	*OSOGBO*	*Offa 132kV*	*IBEDC*	
124	*132.OSO.OMU*	*OSOGBO*	*Omu-Aran 132kV*	*IBEDC*	
125	*132.OSO.OSH*	*OSOGBO*	*Oshogbo 132kV*	*IBEDC*	
126	*132.OSO.SHA*	*OSOGBO*	*Shagamu 132kV*	*IBEDC*	
127	132.POR.ABA	PORT-HARCOURT	Aba Town 132kV	EEDC	

128	132.POR.AFA	PORT-HARCOURT	Afam 132kV	PHEDC	
129	132.POR.AHO	PORT-HARCOURT	Ahoada 132kV	PHEDC	
130	132.POR.CAL	PORT-HARCOURT	Calabar 132kV	PHEDC	
131	132.POR.EKE	PORT-HARCOURT	Eket 132kV	PHEDC	
132	132.POR.EKI	PORT-HARCOURT	Ekim 132kV	PHEDC	
133	132.POR.ELE	PORT-HARCOURT	Elelenwon 132kV	PHEDC	
134	132.POR.GBA	PORT-HARCOURT	Gbarain 132kV	PHEDC	
135	132.POR.ITU	PORT-HARCOURT	Itu 132kV	PHEDC	
136	132.POR.ODU	PORT-HARCOURT	Odukpani PS 132kV	PHEDC	
137	132.POR.OWE	PORT-HARCOURT	Owerri 132kV	EEDC	
138	132.POR.PH	PORT-HARCOURT	PH Main 132kV	PHEDC	
139	132.POR.PH	PORT-HARCOURT	PH Town 132kV	PHEDC	
140	132.POR.RUM	PORT-HARCOURT	Rumuosi 132kV	PHEDC	
141	132.POR.UMU	PORT-HARCOURT	Umuahia 132kV	PHEDC	
142	132.POR.UYO	PORT-HARCOURT	Uyo 132kV	PHEDC	
143	132.POR.YEN	PORT-HARCOURT	Yenagoa 132kV	PHEDC	
144	*132.SHI.BID*	*SHIRORO*	*Bida 132kV*	*AEDC*	
145	*132.SHI.BIR*	*SHIRORO*	*Birnin-Kebbi 132kV*	*KAEDCO*	
146	*132.SHI.JEB*	*SHIRORO*	*Jebba 132kV*	*AEDC*	
147	*132.SHI.KAI*	*SHIRORO*	*Kainji 132kV*	*AEDC*	
148	*132.SHI.KON*	*SHIRORO*	*Kontagora 132kV*	*AEDC*	
149	*132.SHI.MIN*	*SHIRORO*	*Minna 132kV*	*AEDC*	
150	*132.SHI.SHI*	*SHIRORO*	*Shiroro II TS 132kV*	*AEDC*	
151	*132.SHI.SOK*	*SHIRORO*	*Sokoto 132kV*	*KAEDCO*	
152	*132.SHI.TEG*	*SHIRORO*	*Tegina 132kV*	*AEDC*	
153	*132.SHI.YAU*	*SHIRORO*	*Yauri 132kV*	*KAEDCO*	

A lot of the stations are old and due to old age have deficient components like:

A. Deficient and sub-optimal isolators
B. Leaking Circuit Breakers
C. Unmotorable Switches
D. Analog Relay Panels that cannot communicate to the control infrastructure
E. Analog Control Panels
F. Missing Communication Equipment.

4.2.1.(a) Upgrade of substations

In line with the TCN company's strategic corporate vision on Technical Optimization, it was decided that necessary upgrades should be carried out on deficient 330kV and 132KV stations and increase the capacities of the ones where demands from the stations have outgrown the stations capacity. Therefore, the following activities are being carried out at some 330kV and 132kV substations.

A. Panels need to be digitized and modernized from the current analogue from
B. Relays and their panels need to be digitized
C. Communication interfaces need to be digitized.
D. Switch Gears need to be changed
E. Create redundancies in the substations.

Most of the refurbishment is being carried out with loans from the World Bank Project and the World Bank PIP support loan.

4.2.2 Transformers in Substations

Transformers are the work horses of transmission substations; this section analyses the transformers in the various TCN substations. TCN has a total of 442 Transformers, of which 338 are 132kV/33kV transformers, and 84 are 330kV/132kV Transformers.

4.2.2.(a) 330kV Transformers Statistics

The 86 Nos 330kV Transformers have a combined capacity of 13,088 MVA. 14 are out of service, representing 2,094 MVA not available. Therefore, the effective availability of the 330KV Transformers is 10,994 MVA. This effective capacity is distributed as shown Table 4-4.

Table 4-4: Distribution of 330kV Capacity By Region

Region	Capacity
ABUJA	1062
BAUCHI	750
BENIN	450
ENUGU	1290
KADUNA	690
KANO	600
LAGOS	3270
OSOGBO	990

PORT HARCOURT	1032
SHIRORO	860
TOTAL	10994

4.2.2.(b) 132kV Transformers Statistics

The 359 Nos 132kV Transformers have a combined capacity of 17,608 MVA. 22Nos of the 132kV Transformers are out of service, representing 948 MVA unavailable. 35 Nos Transformers are available but not serving any need. These 35 132kV Transformers fall into the following categories: On Soak, Their Station is out of Service (Maiduguri and Molai 132kV), or Isolated. The capacity of these 35 Nos Transformers is 1,300 MVA, representing idle capacity, the Discos are not taking.

The effective availability of the 132KV Transformers is 15,360 MVA. This effective capacity is distributed as shown in Table 4-5.

Table 4-5: Distribution of 132kV Capacity by Region

Region	Capacity
ABUJA	1,908
BAUCHI	960
BENIN	940
ENUGU	1,375
KADUNA	820
KANO	1,100
LAGOS	4,150
OSOGBO	1,536
PORT HARCOURT	1,732
SHIRORO	840
TOTAL	15,360

A substantial amount of the transformers are old and inefficient. Therefore, TCN is replacing and upgrading this category of transformers under the World Bank NETAP project.

4.2.3 Indoor and outdoor switchgear

4.2.3.(a) Indoor switchgears

- Instrument transformers are parts of the 330kV Gas Insulated Substation at Ajah, Lekki and Alagbon substations and are in good working conditions.

- Instrument transformers are parts of the 132kV Gas Insulated Substation Ajah, Lekki and Alagbon, Itire, Amuwo, Akoka and Apapa Road substations and are in good working conditions.

- Instrument transformers are parts of the 33kV Metal Clads Switchgears in various locations and are in good working conditions except for the few substations that are undergoing rehabilitation/replacement in Lagos (Itire, Amuwo, Akoko, Apapa and Central business area Abuja).

4.2.3.(b) Outdoor switchgears

- 98% of outdoor instrument transformers (Current transformer and Voltage Transformer) are okay at 330kV level, except for some very old ones that require replacement, and the replacement is ongoing at Shiroro and Jebba substations.

- 97% of outdoor instrument transformers (Current transformer and Voltage Transformer) are okay at 132kV level in various substations.

- 92% of outdoor instrument transformers (Current transformer and Voltage Transformer) are okay at 33kV level in various substations. However, due to frequent load variations and fault surges on the 33kV feeder bays, some of the 33kV CT & VT are subjected to insulation failure and saturation, which causes it to go bad. Replacement of the CT & VT is done on a regular basis.

4.3 Communication and SCADA/Related Infrastructure

TCN has an existing SCADA and Telecommunication System that was installed in May 2009. However, the System does not cover the entire grid, so a substantial amount of Transmission and Generation Stations are not covered by the SCADA and Telecommunication systems. Also, major software and hardware subsystems in the system are now obsolete.

4.3.1 Overview of the SCADA System

The current SCADA System is a Siemens Spectrum System (a proprietary system) and it communicates with the Siemens SINAUT RTUs programmed with IEC 870 - 5 - 101 Protocol at the substations. There are four (4) interconnected (via high-speed data links) Master Stations located at the four (4) Control Centers, and they are National Control Centre ("NCC") at Osogbo, Backup National Control Centre ("BCC") at Shiroro and two (2) Regional Control Centers (Ikeja West and Benin). Each Master Station has a number of RTUs connected to it and under normal conditions, the control room staff at each control centre through its Master Station can monitor and control the substations connected to that Master Station. NCC can take over the functions of all the regional control centres. Shiroro, which is the National Backup Control Center ("BCC"), is able to take over all the NCC functions.
The current system is not being used as configured due to different issues explained below:

Two types of computer models are used in implementing these server functions, they are SUN Blade 150 and Sun Fire V240. These servers are running under the SUN's Solaris Operating System.

The power system applications are installed in the SCADA System but are not operational.

4.3.2 Coverage of the Current SCADA System

Table 4-6 shows the coverage of the current SCADA system. Eight out of the twenty-seven generators in the grid are integrated into the current SCADA system. Of the eight, only five are visible to the National Control Centre (NCC) due to various telecommunication and SCADA challenges. Likewise, only 19 out of the 43 330kV Substations in the grid are integrated into the current SCADA system, with only 15 visible out of the 19. For the 132kV substations, only 102 stations are integrated, with just 30 visible to the (NCC).

Table 4-6: Coverage of Current SCADA

STATIONS/ SUBSTATIONS	TOTAL	SCADA INTEGRATED	% INTEGRATION	VISIBLE TO NCC	% VISIBILITY
Power Stations	27	8	30%	5	19%
330kV Substations	43	19	44%	15	35%
132kV Substations	152	102	67%	30	20%
TOTAL	222	129	58%	50	23%

4.3.3 Limitation of the Present Scada System

The current SCADA System is greatly limited due to the following reasons:

i) The System was installed over 15 years ago and has reached its end of life.

ii) Lack of spare parts to replace faulty parts

iii) The telecommunication links between the Substations/ Power Stations to the Master Station are either faulty or frequently break down. This has reduced the visibility of the network from the Master Station

iv) Insufficient coverage of the grid telecoms facility; many stations do not have communication links to them

v) The present SCADA System is limited in terms of Database size and cannot accommodate elements from new Substations and Power Station and currently does not have visibility of the entire network.

i. Limited integration and adaptation of new (SAS) Substations

ii. Defective Switchyard Elements

iii. Inadequate Manpower

iv. Inadequate Human Capacity

4.3.4 Grid Telecommunication Network Background

The TCN's Grid Telecommunication Network (GTN) is comprised of: Fiber Optics, Power Line Carrier ("PLC") and Radio. Synchronous Digital Hierarchy ("SDH") and Plesiochronous_Digital_Hierarchy ("PDH") systems are used in the fiber optics system. PLC network covers the entire grid system from 330KV to 132KV levels and comprises of multi-vendor equipment from ABB, Siemens AG, SELTA (Italy), and CCC/Himark (China).

4.3.5 Overview of Fiber Optic Network

This technology has found immense attraction in the electric power industry telecommunication service delivery because of its numerous advantages over other communication media; consequently, NEPA/PHCN/TCN has over the years tried to leverage this service in delivering voice and data services. The system is installed in most 330KV and 132KV substations, being utilized adequately for SCADA signal routing and monitoring in the Master station at NCC, the Backup master station at Shiroro and other two Regional Control Centres (RCCs) at Benin and Ikeja West.

4.3.5.(a) Limitations of the Optic Fibre Network

i The early usage started with the PDH and later the SDH Terminal equipment was rolled out by Siemens AG. Lately, there are different equipment vendors — such as FOX of ABB, SELTA, CCC of China, Himark of China, etc. However, the deployment of Fibre Optic Technologies (FOTs) in the industry has not been comprehensive throughout the grid network and the problem of standardization has been an issue. Most installations (from different vendors) have been fragmented in such a way that it is possible to optimize the usage. The roll out from NIPP and TCN cannot optimally operate together in such a seamless manner to deliver voice and data without interface /connectivity issues arising. There is therefore the ultimate need to embark on defragmentation of the SDH equipment from multi-vendors for optimal use.

ii Lack of training on the maintenance of optic fibre cable and equipment, and frequent vandalism of both the cable and the sky wire.

4.3.6 Overview of Power Line Carrier System

The Power Line Carrier Communication (PLCc) system in TCN follows the grid transmission network, traversing the entire 330KV up to the 132KV transmission route throughout the country and connecting even the neighbouring countries involved in the WAPP agreement.

The legacy PLC system was mainly analogue BBC/ABB PLC of ETB type installed in the early 1980s, and due to obsolesce and lack of funding, the system could not serve effectively and was replaced with ETI and ESB2000i.

4.3.6.(a) Limitations of the Powerline Carrier System

Presently most of the PLC equipment are made of analogue ETLs, SELTA and Himark with the deployment of some PowerLink PLC type from Siemens AG during the World Bank (WB) sponsored SCADA/Telecoms rehabilitation project in 2004. Most of the PLCs) in use are analogue and there is therefore absolute need to upgrade them into digital platform to access the benefits there.

4.3.7 Overview of Radio System

The type of radio used for the SCADA/Telecommunication rehabilitation work by Siemens AG of Germany was the MDS Microwave radio which was rolled out in 2006 during the World

Bank sponsored SCADA/Telecoms Rehabilitation Project. The radio was deployed to handle the various short distance 132KV substation's RTUs clusters in mainly Lagos and Kano areas.

4.3.7.(a) Limitations of the Radio Systems

The deployment was poorly handled, and the benefits were not derived before it finally ceased functioning. Most radios were sent out for repairs, but no success has been recorded. The problem seriously affects SCADA rehabilitation at the 132KV level, where most of these radios were deployed to transport data.

4.3.8 Maintenance of SCADA and Telecommunications

Schedule of maintenance is as follows;

i. Routine maintenance of all SCADA front end equipment
ii. Restoration of defective SCADA RTUs and associated equipment
iii. Database maintenance at the Master Station (MS)

4.3.9 The New SCADA-EMS Projects and other Projects to Fill the Existing Gaps

In other to overcome the shortfall in the provisioning of SCADA-EMS and Telecommunication systems in TCN, TCN has carefully planned and is currently embarking on a new Project being funded by the World Bank NETAP to upgrade, replace, refurbish the existing SCADA-EMS and Telecoms network.

4.3.9.(a) Scope of the New World Bank Sponsored SCADA – EMS and Telecoms Project

TCN obtained a loan through the Federal Government from the World Bank under the Nigerian Electricity Transmission Project (NETAP) for the Rehabilitation of TCN SCADA System and Procurement of a Supervision Consultant for the Project. A Supervision Consultant has been procured with CESI of Italy being the preferred Consultant.

The scope of the Consultancy for the supervision of the SCADA Project is divided into 3 parts namely:

I. Review and Validation of the RFP prepared by the earlier Consultants EDF and assistance in the bidding stage of the Project.
II. Supervision of works related to the SCADA-EMS/Telecoms Project, including testing and commissioning of all works.
III. Supervision during the warranty phase of the Project.

The Contract was awarded in September, 2021 to CESI, Italy and the Consultant has since commenced work on the bidding phase.

The SCADA Project would include survey, investigation, data acquisition, design, manufacture, supply, procurement, transportation to sites, installation, testing and commissioning of all necessary works for the turnkey implementation of the “Rehabilitation of SCADA/EMS Control Centre Systems in Nigeria” Project.

The detailed scope is as follows:

- SCADA & EMS System.
  - Procurement of Control Centre Equipment for two National Control Centres at Gwagwalada and Osogbo, one backup Supplementary National Control Centre at Shiroro, three Regional Control Centres at Benin, Ikeja West and Shiroro
  - Procurement of Remote Consoles at the 6 Regional Operational Centres; Abuja, Bauchi, Enugu, Kaduna, Osogbo and Port-Harcourt
  - The general architecture of the new SCADA system would have a robust Data Storage/Centre that would house all TCN Market Operations and ICT applications going forward. In addition, measures would be put in place to ensure that a "disaster recovery" solution is implemented, in terms of architecture, hardware infrastructure and software needed to synchronize data of the different areas and allow operations in emergency conditions, even for prolonged periods.
- Automation Equipment and Plant Interfacing Works.
  - Interconnection of all Power Stations and Transmission Substations using communication links to the Control Centres
- Remote Terminal Units./Automation Equipment
  - Provision of Automation Equipment in about 85 Transmission Substations where equipment are non-existent, deficient or obsolete
- Telecommunication Network

  The Grid Telecommunication Network (GTN) has been one of the greatest challenges in managing the Grid. Problems in the GTN range from obsolete equipment to proliferation of equipment i.e multi-vendor equipment which do not seamlessly communicate with one another. It is envisaged that this Project will address these problems by ensuring that a vendor specific Telecommunication Network Management System will monitor and manage the Multi-Protocol Label Switching –

Transport Profile (MPLS-TP) and Power Line Carrier Communication (IP based PLCC) Systems.

The GTN provided in this project includes:

- Procurement of Telecoms Network Management System at the Control Centre for monitoring and management of the MPLS-TP and PLCC equipment
- Procurement of a Radio Management System at 3No. Control Centres for monitoring and management of the Microwave Radios
- Procurement of PLCC (IP based Power Line Carrier Communication System)
- Procurement of about 2723km of OPGW on critical links
- Auditing and repairs of existing 2000km of OPGW in the GTN
- 48 V DC System & UPS System
- Routing principle adopted in the Communications aspect of the new SCADA Scheme
- The Backbone will be made up of OPGW that has 1+1 redundancy on the line, and backed up by PLCC. The Fibre core will be routed in 2-pair cores, another pair for the redundancy, and a separate pair for the inter-control centre protocol.
- The PLCC back up itself has 1+1 redundancy on the line being phase to phase set up on all the lines. On very few critical nodes where phase to phase isn't possible, or where PLCC won't be installed, a Microwave radio necessarily becomes the back up.
- Redundancy is a key policy in the design of our new Backbone

- Capacity Building

There will be adequate training of staff on the use of the system.

The new SCADA system will ensure visibility of all the existing 330kV, 132kV and Power Generation Stations with allowances for future stations.

The SCADA – EMS and Telecoms upgrade contract was awarded to Nari Relay. The contract was signed on August 25th, 2022 and is expected to be implemented for 24 months.

4.3.10 <u>Other Efforts by TCN towards the realization of a robust SCADA System</u>

While the procurement of the new SCADA-EMS and Telecoms project is ongoing, certain stop-gap measures have been taken towards the improvement of the visibility of the Grid at NCC in order to ensure the stability of the Grid. These measures include:

i Deployment of Web-based Solution for the acquisition of Data for SCADA - Internet of Things (IoT) technology

Web-based Solutions have been deployed using GPRS and Cloud Technology to improve the visibility of the Transmission Network. This a simple solution that requires minimal cost and time to implement and is currently being deployed by internal TCN engineers.

Though this solution does not have the full complement of a complete SCADA- EMS System, it has increased the visibility of the Grid. From 8 legacy Power Stations that were visible at the NCC, all the Generators have been made visible. In addition, more 330kV and 132kV Transmission substations are being added to the network by the team of in-house TCN engineers. The visibility of the Grid enables the Grid Controllers to make more informed decisions in the management of the Grid, thereby increasing the stability of the Grid.

ii Ongoing installation of OPGW Fibre Optic links on four (4) critical transmission line routes to resolve some of the shortfalls in the provisioning of telecommunication infrastructure.

iii Procurement of Automation Equipment and Telecommunications equipment under the NETAP Rehabilitation Projects and other donor funded Projects

4.4 Network Security: Availability and Reliability

Network security can be referred to as the level of reliability the system is expected to provide in terms of supply continuity either globally across the entire system or to a specific node on the system. Security of the system can be threatened either by loss of major load or loss of Generator Unit significant enough to cause system Disturbance resulting in loss of supply to all or part(s) of the system. The Grid Code has defined the supply Reliability Criteria for the critical segments of the system to be N-1 secured. The Reliability Criteria is embedded in the Planning Criteria for the development of the system.

Availability is related to Reliability. Availability means the availability of crucial power transmission components like lines, transformers and switch gears. When critical components are not available, the system becomes less reliable. An unreliable system cannot be counted to deliver energy to consumers when expected. Lack of reliability can also initiate stability issues that lead to grid collapses.

4.4.1 Availability and Reliability

Components of the grid, like lines and transformers, are routinely taken out for maintenance and are taken out by unplanned events. While often forced outages are not severe in consequences, some outages have been known to trigger reliability and stability issues. Moreover, the loss of components also makes the grid lose part of its resilience. Some of the issues causing network availability and reliability issues are discussed next.

4.4.1.(a) Forced Generation Outage

A forced generation outage is the sudden loss of a generating unit. On the aggregate, forced outages of generators in the grid are very high. Forced generation outages result in grid instability by drastically reducing the supply of electricity and causing sharp frequency dips that might cause system collapse. Some generation forced outages are suspected to have caused system collapses.

Forced generation outages are caused by sudden loss of gas, a loss of transformer units, high vibration, and a high exhaust temperature spread, stemming mostly from a lack of maintenance. Generators should be incentivized to procure reliable and adequate gas supply; and also maintain their systems.

4.4.1.(b) *Gas Availability*

Of the 27 Generators in the power grid, 24 are operated by gas; making gas the most dominant prime mover of the turbines. Therefore, any disruption in gas supply creates availability, reliability and stability challenges for grid operations.
Thermal generators in the Nigerian power sector regularly face gas constraints due to the following main reasons:

- Insufficient gas volume: mainly due to lack of payment
- Low pressure for the gas to be utilized
- Pipeline Vandalism: In the past, pipeline vandalism has initiated grid collapses. Pipeline vandalism has greatly reduced but still a potent threat to grid stability. Pipelines are still susceptible to sabotage because the network is mostly composed of surface pipelines which are generally accessible due to not being buried.

As a result of these gas constraints, many generators cannot operate at their full capacity The level of gas available to generators is often unpredictable since most generators do not have signed and enforced Gas Supply Agreements and gas is mostly provided on a best endeavour basis. This unpredictability makes daily operational planning difficult and often renders operations ineffective.

4.4.1.(c) *Forced Transmission Outage*

Forced Transmission Outage refers to a situation where a transmission line or substation component suddenly goes out of operation, creating power flow imbalance and load/generation imbalance. An initial Forced Transmission Outage can initiate others and cause the grid to collapse. Some causes of Forced Transmission Outages are:

- Lack of Vegetation Management, causing short circuit faults on the line.
- Protective devices not properly calibrated and attuned to prevailing conditions.
- Protective Relays inadvertently responding to power swings. Power swings (i.e., rapid and non-standard changes in turbine rotating angles) are caused by line switching, sudden connection and disconnection of generator turbines, large loads, and system faults. Protective relays can sometimes initiate unnecessary protective actions by mistakenly sensing power swings as faults in their protection zones. Unnecessary protective actions, the tripping of transmission lines in their zones of protection, can lead to a system collapse due to further aggravating the initial disturbance.

4.4.1.(d) *Transmission Lines Constraint Challenge*

TCN faces many challenges at the 132kV level mainly due to old and undersized 132kV conductors that limit power delivery to Discos. These constraints have reduced availability at TCN/Disco interface.

4.4.2 The solution to improve availability and reliability

TCN aims to operate the grid based on the N-1 philosophy, so in this regard, TCN is actively ensuring that critical components have pairs or alternate paths to relieve them in case of failure.

4.4.2.(a) Procurement of Redundant Transformers

Some critical substations are being augmented with additional transformers to create N-1 redundancy for improved availability and reliability of supply.

4.4.2.(b) Upgrade of Existing Lines and Paralleling Single Circuit Lines

TCN plans to upgrade undersized and old 132kV and 330kV lines and create alternate lines for lines like Kaduna Kano lines that does not have redundancy.

4.4.2.(c) Tracing Clearing

TCN plans to continue to undertake aggressive trace clearing of vegetation that causes fault on critical lines.

4.4.2.(d) Procurement of Drones

Drones will be procured for inspection of transmission lines to timely detect issues that need to be fixed before they escalate into larger problems

4.4.2.(e) Procurement of Helicopters

Helicopters will be procured for patrol and fixing of issues on transmission lines. The use of helicopters saves time in addressing issues and increases reliability and availability.

4.4.2.(f) Procurement of Critical Spare Parts

Procurement of Critical spares for prompt network maintenance will increase availability and decrease outage time

4.4.2.(g) Deployment of Asset Performance Management System

Deployment of Asset Performance Management System for Realtime monitoring of assets condition in near real-time. The monitoring of assets helps to detect issues expediently, and the issues are resolved quickly before they cause bigger issues.

4.4.3 Reliability Criteria

In preparing this PIP, N-1 Reliability Criteria has been considered by running contingency analysis to determine the critical lines in the system whose interruption could result in system disturbance. The results of the contingency analysis for each year of the five years PIP are highlighted in the following tables 12 – 17.

4.4.3.(a) Year One Contingency Result

Table 4-7: Result of N-1 Contingency for year one

S/N	Transmission Line	Condition	Remarks
1	Kainji – Birnin Kebbi 330kV Line	Blown Up	Critical
2	Shiroro – Kaduna 330kV Line 1	Iteration Limit Exceeded	Alert state
3	Shiroro – Kaduna 330kV Line 2	Iteration Limit Exceeded	Alert state
4	Kaduna – Kano 330kV Line	Blown Up	Critical
5	Jos – Gombe Line	Blown Up	Critical

4.4.3.(b) Year Two Contingency Result

Table 4-8: Result of N-1 Contingency for year two

S/N	Transmission Line	Condition	Remarks
1	Benin - Egbin 330kV Line	Iteration Limit Exceeded	Implementation of Ogijo substation under the JICA project is important
2	Omotosho – Ikeja West 330kV Line	Iteration Limit Exceeded	Implementation of Ogijo substation under the JICA project is important
3	Osogbo – Akure 330kV Line	Iteration Limit Exceeded	Completion of new Ihovbor – Akure 2x330kV line
4	Zungeru TS – Jebba 2x330kV Lines	Iteration Limit Exceeded	Existing Jebba – Shiroro DC line is bear lion
5	Zungeru GS – Zungeru 2x330kV	Iteration Limit Exceeded	Make the line 4x330kV or 2x330kV Quad
6	Zungeru TS – Millenium	Iteration Limit Exceeded	Reactor is necessary at triple point
7	Ihovbor – Akure 330kV Line	Iteration Limit Exceeded	Fast track completion of new Ihvobor – Akure 2x330kV lines
8	Kaduna – Kano 330kV Line	Blown Up	Implement, New Kano, Zaria and Katsina 330kV substations and associated line
9	Jos – Gombe 330kV Line	Blown Up	Additional 330kV line is important for N-1
10	Jos – Lafia 2x330kV Lines	Iteration Limit Exceeded	Fast track transposition of the line
11	Alaoji – Onitsha 330kV Line	Iteration Limit Exceeded	Upgrade line
12	Makurdi – Ugwuaji 2x330kV Lines	Iteration Limit Exceeded	Alert state
13	Makurdi – Lafia 2x330kV Lines	Iteration Limit Exceeded	Alert state
14	Ikot Ekpene – Ugwuaji 4x330kV Lines	Iteration Limit Exceeded	Alert state
15	Ajaokuta – Lokoja 2x330kV Lines	Iteration Limit Exceeded	Alert state
16	Lokoja – Gwagwalada 2x330kV Lines	Iteration Limit Exceeded	Alert state
17	Katamape – Gwagwalada 330kV Line	Iteration Limit Exceeded	Alert state

4.4.3.(c) Year Three Contingency Result

Due to the reinforcements carried out in the 3rd year, the contingency analysis results did not return any critical lines of note.

4.4.3.(d) Year Four Contingency Result

Table 4-9: Result of N-1 Contingency for year four

S/N	Transmission Line	Condition	Remarks
1	Kaduna – Zaria 330kV Line	Iteration Limit Exceeded	Alert state
2	Kaduna – Millenium 330kV Line	Iteration Limit Exceeded	Alert state

4.4.3.(e) Year Five Contingency Result

Table 4-10: Result of N-1 Contingency for year five

S/N	Transmission Line	Condition	Remarks
1	Kaduna – New Kano 2x330kV Line	Iteration Limit Exceeded	Alert state
2	Kaduna – Zaria 330kV Line	Iteration Limit Exceeded	Alert state

4.5 Grid Stability

The TCN grid is operated through manual dispatch and instructions; this mode of operation as opposed to an automated mode of operation creates stability problem for the system. The lack of an automated system hinders TCN's ability to:

1) Monitor generating unit output levels or terminal voltages in real time.
2) Instantaneously share output adjustments among generators to restore frequency deviations; and
3) Optimally dispatch generators while respecting system constraints and cost.

Exacerbating the stability issues is the lack of synchronized reserves from generating units to adequately address or mitigate any power system disruption. In addition, gas supply constraints and forced outages from the transmission and Discos end also create reliability problems for the grid. Furthermore, some protective devices on the grid are not properly attuned to prevailing conditions and inadvertently take out large portions of the grid, initiating system collapses.

Extreme stability issues propagated by the factors highlighted in the preceding have caused the Nigerian grid a total of 220 system collapses from January 2010 to October 2022. Out of the 220 system collapses, 156 are complete and 64 are partial, as shown in Table 4-11. However, Figure 4-2 shows that there has been drastic reduction in the number of grid collapses. The reductions are due to the use of free governor control in some generators, deployment of under-frequency relays and improved operational system planning. Adequate and consistent automation of the system via robust deployment of an adequate SCADA/EMS/Telecommunications system will resolve most of the issues that initiate grid collapses.

Table 4-11: Grid Collapse statistics

YEAR	TOTAL COLLAPSE	PARTIAL COLLAPSE	TOTAL NUMBER
2010	22	20	42
2011	13	6	19
2012	16	8	24
2013	22	2	24
2014	9	4	13
2015	6	4	10
2016	22	6	28
2017	15	9	24
2018	12	1	13
2019	9	1	10
2020	4	0	4
2021	2	2	4
2022	4	2	6
Total	156	64	221

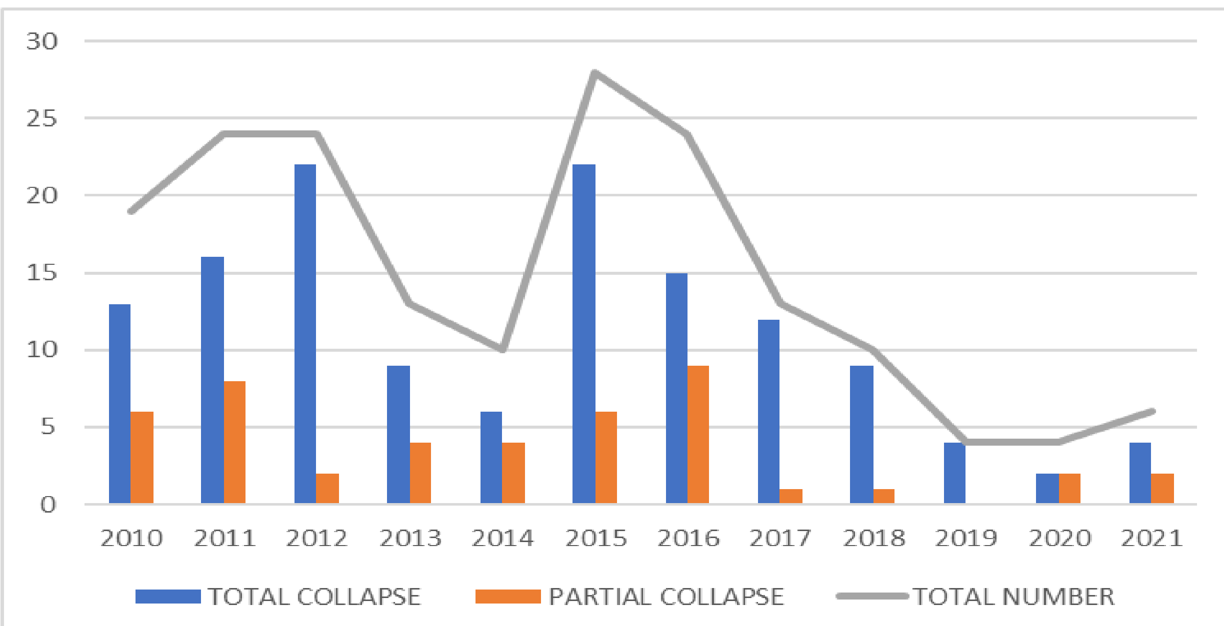


Figure 4-2: Partial and Total Grid Collapses since the Year 2010

4.5.1 Major Causes of Collapses and Mitigation

There are a lot of events that can initiate a grid collapse and these events might not be avoidable. Remedial actions or mechanisms are needed to prevent the grid from collapsing once such events are triggered. The grid currently lack some of the mechanisms.

4.5.1.(a) Absence of Operational Reserves

The frequent grid collapses caused by frequency deviations have been attributed to the lack of adequate (operating) reserves. Operating reserves are essential to counteract the effects of load forecast errors, generation and transmission forced outages, and other contingencies on frequency stability.

Generators have no incentive to offer other classes of reserves, such as secondary, tertiary, and emergency reserves, because any amount of operating capacity left to provide reserves will not earn revenue in the Nigerian energy and capacity market; a major loss of revenue for GENCOs. A recent attempt was made to procure secondary reserves from generators. However, it has become clear that without a functional SCADA/EMS with complementary telecommunication from generators to the Control Centers it will be impossible to properly deploy secondary reserves. TCN is currently working on procuring a functional SCADA/EMS/ Telecommunications System.

4.5.1.(b) *Lack of Adequate Turbine Governor Control*

Section 12.6.2 of the Grid Code makes it compulsory for all generators to be fitted with a turbine governor control system which must operate on power related speed 'droop' characteristics of between four percent and six percent. As a result, all generators are required to provide primary reserves. Furthermore, primary reserves are not considered as ancillary services as stated in section 15.8.2 of the Grid Code. Since primary reserves are not considered ancillary services, they are supposed to be offered for free.

Ideally, when there is frequency deviation, a generator's response to frequency deviations is relative to their size and total generation in the system.
Every generator moves up or down instantaneously to stabilize the frequency before contracted secondary reserves take over. This is beneficial for all generators because it will help in the overall stabilization of the grid and also prevent damage to the generators themselves due to erratic frequency deviations.

This requirement of the Grid Code to provide free turbine governor services for frequency stabilization has not been complied with by all generators. It is also challenging to know when generators are complying without a monitoring system like the SCADA/EMS.

Note: TCN plans to use IoT devices it is deploying to monitor the response of all generators to frequency deviations.

4.5.2 The solution to improve Stability

TCN is currently procuring the SCADA/EMS that will enable the automatic deployment of reserves needed for grid stability. In addition, TCN will attempt to use its IoT devices to monitor the compliance of the generators on the use of their governor to control slight deviations in grid frequency. However, TCN will need NERC to allow the procurement of the reserves to be initiated again once the SCADA/EMS is finished.

4.6 Power Quality

Power quality is the ability of the grid to produce power at specified frequency ranges, voltage limits and voltage waveform integrity. While low power quality might not be an issue for most residential and commercial customers, a substantial amount of heavy power users in the manufacturing industries require higher power quality. As a result, manufacturers that operate sensitive equipment susceptible to damage from power quality issues refrain from connecting to the grid. Manufacturers with sensitive equipment often self-generate to ensure power quality and consist of a substantial amount of suppressed load within the Nigerian power system.

4.6.1 Frequency Limits Deviations

The frequency of the grid, a lot of the time, deviates widely from its statutory limit. The Grid Code recommends a nominal frequency of 50 Hz, with a band range of 49.75 Hz to 50.25 Hz. Under system stress conditions, the frequency is allowed to oscillate between 48.75 Hz to 51.25 Hz. The Grid Code requires the frequency to oscillate within this band 97 percent of the time during normal conditions.
The non-compliance of the frequency with the Grid Code requirements can be seen in the plot of the daily frequency range for October 2022 Figure 4-3. For all days in October 2022, the frequency value deviated from its lower and upper statutory limits. This illustrates inadequate control due to lack of reserves to control the frequency values.

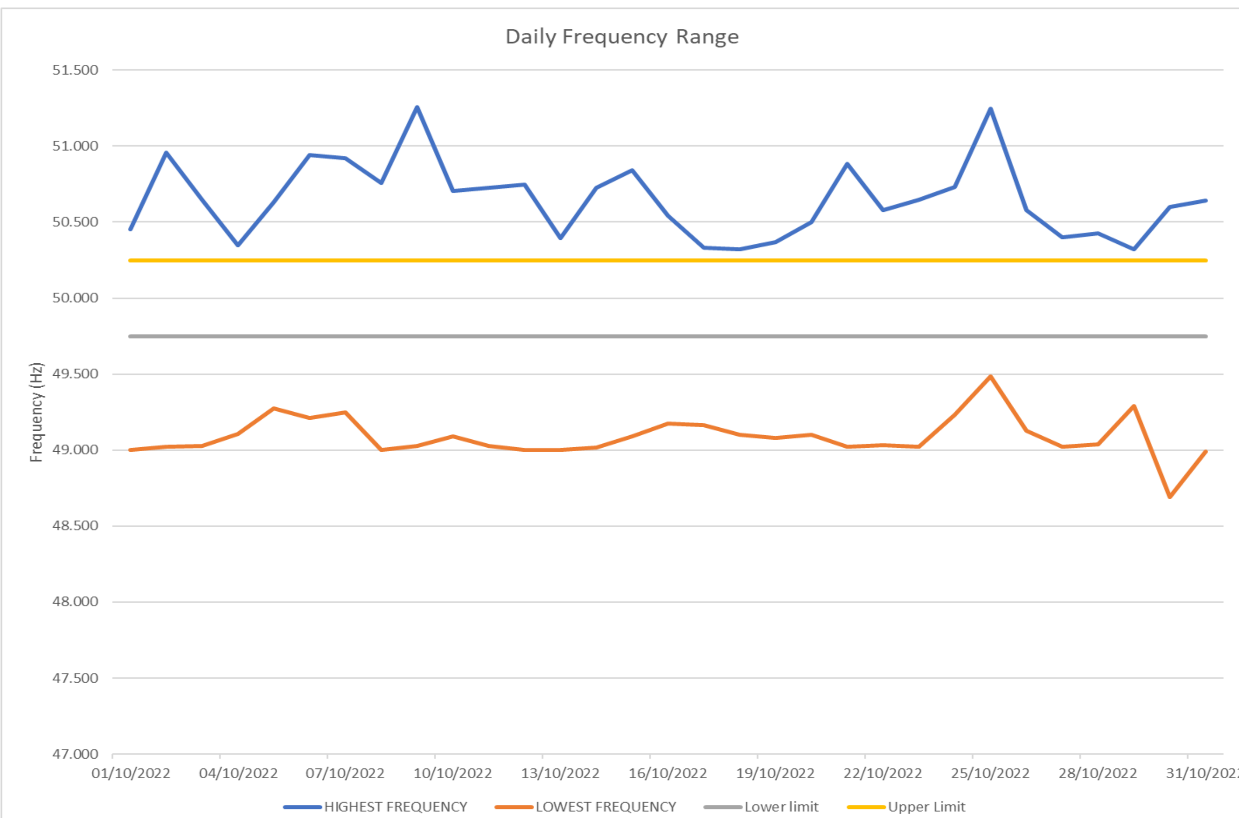


Figure 4-3: Daily highest and lowest frequency plot for October 2022

The frequency of grid supply is a very critical parameter for some classes of industrial consumers who use sensitive types of machinery and equipment. Wide frequency deviations from narrow tolerance limits could damage sensitive industrial machinery and equipment connected to the grid at the 132kV and 330kV levels.

According to the NERC Quarterly Report of Quarter 4, 2021:

> *"As at June 2021, industrial customers accounted for 12% of annual energy sales by DisCos. However, they have the highest tariff rates and have the lowest commercial losses of all consumer classes. These make them the ideal customers for DisCos but the inability to guarantee power supply at the right quality continuously means that many industrial customers avoid using the grid power supply for production purposes even when available; this is due to the potential impact of poor quality of power supply on their critical machinery."*

The Grid Code expects that frequency should be controlled by the use of primary, secondary, tertiary and emergency reserves.

Primary reserves are an automatic increase or decrease in power output of a generating unit in response to a decrease or increase in system frequency through the control action of the turbine governor. The Grid Code mandates that all generators connected to the grid have turbine governor control actions capability. In other words, all generators must participate in the instantaneous stabilizing of the grid frequency, especially since all generators have governor controls.

Secondary reserves are an automatic increase or decrease in power output of a generator which is fully available in 30 seconds to take over from primary reserves. The primary and secondary reserves form a class of reserves called spinning reserves in the previous version of the Grid Code. They are called spinning reserves because they are provided by generators who are synchronized to the grid and generating. The generators providing these services are operating below their business as usual output in order to create room for the up and down frequency tracking movements.

Tertiary reserves are not automatic and are based on instructions from the System Operator and are required to replace depleted secondary reserves.

Emergency reserves are used during abnormal operating conditions of the grid and are used to stabilize the grid.

Slow reserves are the component of the reserves that are not synchronized to the transmission system but are required to be completely synchronized to the grid within a particular time. Slow reserves are used to restore the other reserves collectively known as quick reserve. They are also used to correct deviations resulting from inaccurate operational planning descriptions or unexpected generator trips. The reserves and their specific requirements are summarized in Table 4-12 below.

Table 4-12: Reserve Types according to the Grid Code

Reserve Type	Activation Time (Fully Active)	Sustained Time (Sustained for)	Adjustability	Controller / Communication
Primary	10 seconds	1 hour	Continuously adjustable	Local Frequency Controller
Secondary	30 seconds	1 hour		Communication interface for integration into automatic generation control/secondary controller of the System Operator
Tertiary	10 minutes	4 hours	Continuously adjustable	Communication interface for the System Operator instructions or dedicated telephone line for the System Operator instructions ensuring that the required activation time can be met
Emergency	10 minutes	4 hours	Continuously adjustable or discrete steps	
Slow	Mutually agreed (>1 hour)	Mutually agreed (>4 hours)		

4.6.2 Lack of Operating Reserve Policy

Grid Code section 15.6 mandates a consultative process for developing an Operating Reserve Policy to be approved by NERC. The policy is to allocate reserves among generators taking into consideration factors such as the cost of providing the operating reserves and the risk of the generator reliability that is providing the service. The Grid Code stipulates that the policy should specify the following requirements for the System Operator with regards to primary reserves:

1. Ensure primary reserves are available to maintain system frequency within acceptable limits;
2. Keep the frequency above 48.75 Hz following all credible single contingency losses; and
3. Ensure the same volume of negative primary reserve is available.

The System Operator and the grid users are meant to continually maintain the policy and attune it to new realities. An amended version, taking into consideration the frequency stabilization performance of the previous year, is required to be submitted to NERC annually. Although frequency performance indices have improved a lot in recent years, there is currently no Operating Reserve Policy in place to guide the amount and procurement of operating reserves required in grid stabilization.

4.6.3 Solutions to Frequency Issues

The following solutions will be worked upon to resolve the frequency issues.

a) *Operational Reserve Policy*

As specified in Section 15.6.1 of the Grid Code, TCN will develop, in consultation with the Users, the Operating Reserve Policy for approval by NERC. The Policy shall allocate the permissible mix of Quick Reserve and Slow Reserve, the Procedure for applying Operating Reserve in practice, and the limitations, if any, upon the amount of Interruptible Load which may be included.

b) Procurement of Reserves

While it is mandatory that all generators must provide primary frequency control through unhindered governor control; secondary reserve and tertiary reserve must be procured and paid for. However, the deployment of secondary and tertiary reserves is only possible with the automation and monitoring provided by the SCADA/EMS system.
Once the SCADA/EMS system is installed TCN will engage with NERC on the procurement of Reserves from Eligible Generators.

4.6.4 Voltage Quality Issues

While Frequency is a (mostly) uniform variable that is constant across the grid, voltage is a localized phenomenon and varies by location. Voltages are expected to be restricted to certain level in order not to cause adverse effects for end users. It is also expected that momentary spikes, dips and flickers and brownouts avoided. The Grid Code requires the System Operator to maintain the Voltage Limits shown in Table 4-13 for 330kV and 132kV at the different busbars in the system.

Table 4-14: Statutory Voltage Levels

Voltage Level	Minimum Voltage (kV) (pu)	Maximum Voltage (kV) (pu)
330 kV	280.5 (0.85)	346.5 (1.05)
132 kV	112.2 (0.85)	145.2 (1.10)

Wide voltage deviations can cause loss of industrial machineries and equipment's; therefore, some customers with sensitive machineries will rather self-generate than connect to the grid. Furthermore, large voltage deviations put the system at risk of forced outages which can trigger partial or total voltage collapse.

Using October 2022 as a reference point, Figure 4-4 shows the highest and lowest daily voltage for October 2022. Every day in the month, a bus had a voltage above the recommended highest limit, while there was no occurrence of voltage below the recommended lowest limit.

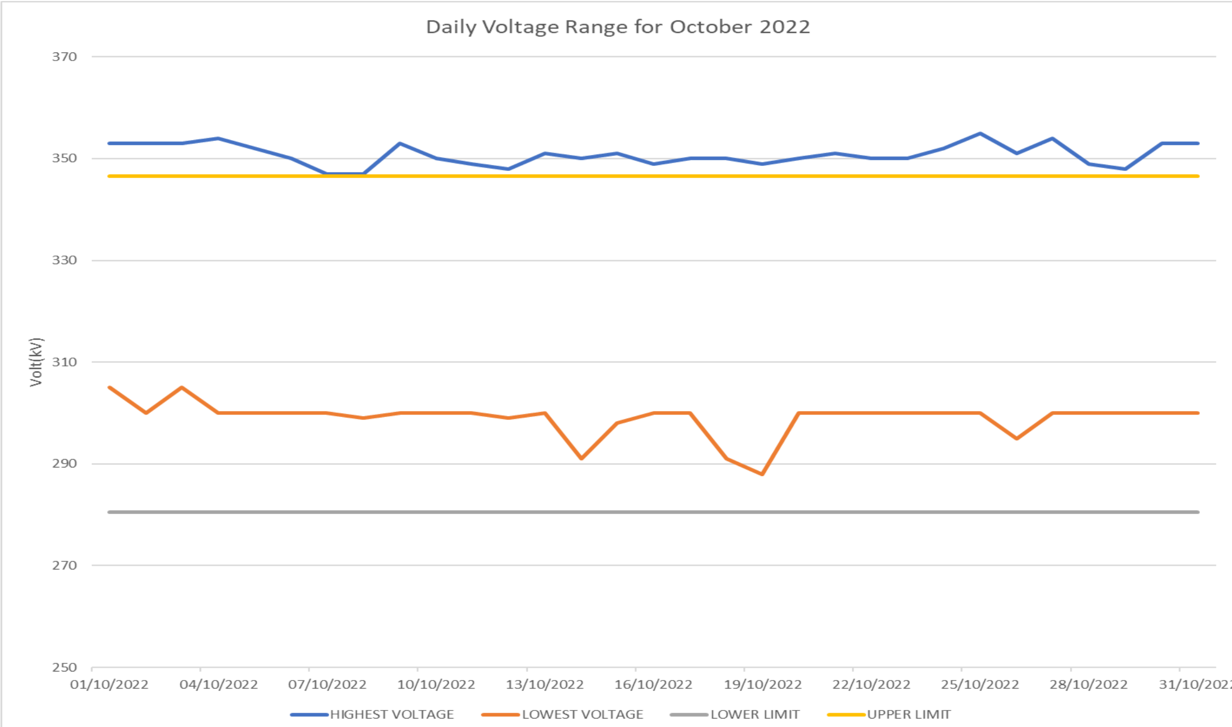


Figure 4-4: Highest and lowest voltage for days in October 2022

Voltages at substations tend to go above their upper limits when lines are lightly loaded and there are no reactors or similar type compensators to adjust the voltage. Similarly, voltages tend to go below their lower limit when lines are heavily loaded and there are no capacitors or similar type compensators to adjust the voltage. Reactors and capacitors act to adjust voltage by absorbing reactive power or producing reactive power.

4.6.4.(a) Voltage Improvement Equipment in the System

Voltage regulation is the process of controlling voltage at buses to meet statutory requirement. Voltage regulation is a critical requirement for efficient system operations and stability. Depending on the network configuration at any given time, voltage control equipment may be required to facilitate voltage regulation for stable operation. Accordingly, Voltage control equipment are installed at different locations on the system for this purpose.

TCN deploys a lot of Reactors (Inductors) to moderate high voltage at various substations. The various reactors are listed in Table 4-15

Table 4-15: List of Reactors in TCN

SN	STATIONS	REACTOR (MVAR)
1	OSOGBO 330kV T/S	75MX
2	KUMBOTSO 330kV T/S	75MX
3	BENIN 330kV T/S	75MX
4	JOS 330kV T/S	2X75MX
5	GOMBE 330kV T/S	2X50MX

6	DAMATURU 330kV T/S	75MX
7	YOLA 330kV T/S	75MX
8	MOLAI 330kV T/S	75MX
9	MANDO 330kV T/S	2X75MX
10	ALAOJI 330 kV T/S	75MX
11	ADIABOR 330 kV T/S	75MX
12	JEBBA 330kV T/S	75MX
13	BIRNIN KEBBI 330kV T/S	75MX
14	KATAMPE 330kV T/S	75MX
15	LOKOJA 330kV T/S	75MX
16	ONITSHA 330kV T/S	75 MX
17	API 330kV T/S	2X75 MX
18	IKEJA WEST T/S	2X75MX
19	KADUNA 330kV T/S	75MX
20	LAFIA 330 kV T/S	75MX
21	GWAGWALADA 330 kV T/S	75MX
22	AJAOKUTA 330 kV T/S	75MX
23	SAKETE 330 kV T/S	75MX

There are 56 Capacitor Banks at various substations in the system. Of the 56, only the 2Nos 50MVAR Capacitor are operational in Kumbotso 330 kV substations are operational, the rest are either faulty or not commissioned since they have been installed.

It is also to be noted that due to dynamics of the system in terms of operations and development, different nodes of the system have varying requirements for voltage improvement equipment based on the current configuration of the system. Some substations nodes were identified from studies to have voltage equipment limitations for efficient voltage management for the different scenarios of the five-year PIP. From operational records, some stations need reactors due to the fact that they constantly experience voltage above the statutory limit of 347.5 KV. Table 4-16 shows the substations needing reactors.

Table 4-16: Stations in need of Reactors

No	Station in Need of Reactor
1	IKOT EKPENE T/S
2	NEW HAVEN T/S
3	ONITSHA T.S
4	ALAOJI T.S
5	UGWUAJI T/S
6	GWAGWALADA T/S
7	BENIN T/S
8	GANMO T/S
9	LAFIA T/S
10	DELTA T/S.

From studies, the following stations in Table 4-17 need Capacitor Banks.

Table 4-17: Stations in need of Capacitor

S/N	Station	Capacitor Size
1	Birnin Kebbi 330/132/33kV	50
2	Iseyin 132/33kV	25
3	Ijebu-Ode 132/33kV	25
4	Millenium Clty 330/132/33kV	2 X 50
5	Funtua 132/33kV Substation	2 X10

Some substations experience voltage above the upper statutory limit of 347.5kV and below the lower limit of 280.5kV. These stations need static var compensator (SVC)/ Static Synchronous Compensator (STATCOM). These stations are listed in Table 4-18 .

Table 4-18: Stations in need of Dynamic Compensators

S/N	Stations
1	GOMBE T/S
2	BIRNIN KEBBI T/S
3	KANO T/S
4	YOLA T/S
5	ALAGBON
6	KATAMPE T/S

4.6.5 Solutions to Voltage Issues

The following solutions will be implemented by TCN to address voltage limits violations.

4.6.5.(a) Operational Studies

Many of the Capacitors in the grid are not deployed due to operational issues encountered in deployment of capacitors. These issues can be overcome by extensive operational to calibrate the settings of the capacitors to the local conditions they are going to operate in.

4.6.5.(b) Medium and Long Term Planning

There is a long timeline for design, procurement, and installation of voltage compensation devices like capacitors and reactors. Their procurements are considered in Transmission System Expansion plans. Long-term simulation studies identify voltage violations and determine voltage support service requirements, like capacitors and reactors. TCN will continue to engage in medium-term and long-term planning to help identify locations with voltages lower or higher than statutory voltages. After identification, appropriate compensation techniques will be designed and procured to alleviate the problems.

4.6.5.(c) Incentivize Generators to control voltage at their nodes

Generators are critical in voltage control, especially in their immediate locality. In real time, generators can be used to regulate voltage by producing or absorbing reactive power into the system. It is important to note that voltage support provided by a generator hinders the

effective real power it produces. As a result of this opportunity cost, NERC should incentivize generators to help in voltage stabilization.
In addition, Section 16.7.1 of the Grid Code stipulates that the System Operator may establish contracts for voltage control with some users in order to operate the system efficiently and securely at all times.
TCN will develop adequate regulatory and system policies for NERC's approval to incentivize the procurement of voltage support services from generators, especially in the long-term planning cycle.

4.6.5.(d) Repair and Commissioning of Capacitor Banks

Using the results of operational studies, faulty capacitors will be repaired and commissioned. While the undeployed ones will also be commissioned in order to maintain voltages at various nodes at required levels.

4.6.5.(e) Procurement of New Capacitor Banks if the need arises.

After the faulty capacitors are repaired and the undeployed ones are commissioned, studies will be done to see if there is need for more.

4.6.5.(f) Procurement of Reactor

Operational reports have shown that reactors are needed in substations listed in Table 4-16. Studies will be done to confirm the actual need of these suggested reactors.

4.6.5.(g) Procurement of Dynamic Compensators

It is to be noted that some parts of the Grid especially in the far north-eastern region of the country are very sensitive in terms of voltage variation. Optimal solution to addressing this voltage sensitivity would best be achieved by having a dynamic reactive power response. A power plant in the axis could help significantly in facilitating more power offtake in the future. However, given the forecast demand of Yola Disco over the next five years, the existing voltage improvement equipment will suffice for the period.

4.6.5.(h) The magnitude of improvement needed for optimal performance

Based on the current configuration of the system and the upcoming yearly improvement in line with this PIP, the needed voltage improvement equipment over the next five (5) years are listed in table 9 below.

Table 4-19: Prioritized voltage improvement compensation devices

S/N	Substation	Proposed Voltage Improvement Equipment	Proposed year of implementation for optimal performance
1.	Ugwuaji 330/132/33kV	75MX Reactor	To be implemented in year 1
2.	Ikot Ekpene 330/132/33kV	75MX Reactor	To be implemented in year 1
3	Funtua 132/33kV Substation	2 X 10MVAr Capacitor	To be implemented in year 1
4.	Iseyin 132/33kV	25MVAr Capacitor	To be implemented in year 4

5.	Ijebu-Ode 132/33kV	25MVAr Capacitor	To be implemented in year 4
6.	Birnin Kebbi 330/132/33kV	50MVAr Capacitor	To be implemented in year 5
7.	Millenium City 330/132/33kV	2 X 50MVAr Capacitor	To be implemented in year 5

4.6.6 Distortion of Power Quality by Large Consumers

The TCN grid consists of large power consumers connected directly at the 132kV level and 33kv level. Some of these customers are known to inject large harmonics into the grids and distort voltage quality. These consumers often fail to provide power conditioners, such as harmonic filters, capacitors, and reactors, at their point of interconnection with the grid to mitigate power quality issues, causing power quality issues such as voltage and frequency deviations outside statutory limits and harmonics.

4.6.6.(a) Power Quality by Large Consumers will be monitored

TCN will start monitoring waveforms from certain class of large users. If it is found that any large user is distorting the waveforms, TCN will work with the user to mitigate the distortion by the procurement of power conditioners like harmonic filters and capacitors.

4.7 Transfer Capability Performance

The Transfer Capability of the grid was evaluated to determine the actual wheeling capability of the system based on current capacity of the existing transmission infrastructure (lines and substations). The wheeling capacity study was done to identify the maximum load the transmission infrastructure can deliver in its current configuration.

4.7.1 Methodology

A Power flow study was conducted to determine the wheeling capacity by considering the Base Case which is the existing network model representing present conditions. In achieving the objectives, the following steps were implemented;

i. The existing model was updated using verified field inputs from all Regions to establish the Base case as at September 2022.
ii. In the study, all contracted generation was deployed to full contracted capacity
iii. All 330kV lines were checked for loading greater than 50% to maintain N-1 security for double circuit lines and to maintain system stability for single circuit lines.
iv. Load and Generation levels were gradually increased to maximally utilize the transmission infrastructure capacity to deliver power at the TCN-Disco interfaces without violation of statutory limits of power supply quality.
v. PSS (E) Ver. 35.3 Simulation software was used for the Load flow studies in this exercise.

4.7.2 Result of the Wheeling Capacity Study

The study in line with the above methodology revealed a wheeling capacity of the system in its current state as about 8,500MW. However, it is to be noted that the wheeling capacity study was based on unrestricted power flow to all locations irrespective of the Discos preferences but to check the transfer capability across the entire system.
Based on 8,500MW Wheeling capacity, capability to deliver power to each of the Discos is shown in Table 4-20.

Table 4-20: Power Delivered to offtakers at transfer capacity limit of 8,500 MW.

Disco	Loading Level (MW)
Abuja	990.69
Benin	919.51
Eko	809.63
Enugu	746.99
Ibadan	958.45
Ikeja	1,051.47
Jos	311.04
Kaduna	478.21
Kano	325.83
PortHarcourt	857.73
Yola	288.61
NIGELEC/WAPP	491.20
Total Delivered	8,229.38
Total Generation	8,549.22
System loss	319.84

The generation capacity delivered by the Gencos is shown in Table 4-21

Table 4-21: Generation Capacity at Grid Transfer Limit

No	Genco	Generation (MW)
1	EgbinPower	1,052.48
2	ParasEnergy	60.45
3	OlorunsogoGas-	259.87
4	OlorunsogoNIPP–	450.65
5	KainjiHydro	551.12
6	JebbaHydro	485.38
7	ShiroroHydro	500.00
8	DeltaGas	440.13
9	SapeleNIPP	186.74
10	SapeleSteam	227.25

11	OmotoshoGas-	222.29
12	OmotoshoNIPP–	120.41
13	IhovborNIPP	246.70
14	AzuraPower	435.00
15	DadinKowa	36.09
16	Okpai	446.11
17	AfamVI	536.13
18	AfamV	155.35
19	Omoku	96.24
20	IbomPower	92.07
21	RiversIPP	80.00
22	TransAmadi-	80.00
23	Alaoji	484.89
24	Calabar	500.00
25	GeruguGas	320.80
26	GereguNIPP	390.53
	Total Generation	8,456.68

4.7.3 Review of the current state of infrastructure: Existing network

Under the 8,549.22 MW scenario, power was supplied to the Discos in the quantities highlighted above without violations both in terms of voltage and thermal limits. Power supply beyond the 8,5429.22MW is constraint by the limitation of some critical 132kV lines supplying major load centers and substation in addition to operational considerations. Based on the simulated wheeling capacity of 8500 MW, some lines and transformers have been identified as being critically loaded close to their limits. The critical lines and transformers are identified and tabulated in Table 4-22 and Table 4-23.

Table 4-22: Limitation of Transmission Lines

S/N	Critical Transmission lines	Loading (%)
1	Egbin - Ikorodu 132kV double circuit transmission line	96.2
2	Ikeja West – Alimosho 132kV double circuit transmission line	85.6
3	Ayede – Ibadan North 132kV SC transmission line	89.5
4	Osogbo – Ilesha T 132kV single circuit transmission line	101.4
5	Delta – Effurun 132kV single circuit transmission line	86.1
6	Kano – Dan Agundi 132kV single circuit transmission line	97.0

7	Awka – Onitsha 132kV single circuit transmission line	89.4
8	Ajaokuta – Okene 132kV single circuit	98.2
9	Katampe – Kubwa 132kV single circuit transmission line	81.6
10	Apo – Karu 132kV single circuit transmission line	127

Table 4-23: Limitation of Transformers

S/N	RATING (MVA)	SUBSTATION	NOMENCLATURE	Loading (%)
1	150	330/132kV Egbin	IBTR1	105.0
2	150	330/132kV Egbin	IBTR2	105.0
3	60	132/33kV Lekki	TR1	90.0
4	60	132/33kV Lekki	TR2	94.0
5	30	132/33kV Maryland	T3	97.0
6	60	132/33kV Oworonsoki	T1	92.0
7	60	132/33kV Oke-Aro	TR1	96.0
8	60	132/33kV Ganmo	T1	94.0
9	60	132/33kV Effurun	TR3	94.0
10	40	132/33kV Amukpe	T1	95.0
11	150	330/132/33kV Jos	T2A	91.0
12	150	330/132kV New Haven	T3	95.0
13	150	330/132kV New Haven	T4	95.0
14	60	132/33kV Asaba	T2	91.0
15	150	330/132kV Onitsha	T2A	90.0
16	60	132/33kV Calabar	T133	90.0
17	150	330/132kV Katampe	TR1	97.0
18	150	330/132kV Katampe	TR2	97.0
19	150	330/132kV Katampe	TR3	97.0
20	60	132/33kV Suleja	T4	90.0
21	60	132/33kV Gwagwalada	TR2	95.1

4.7.4 Detailed outline of new and ongoing programs towards mitigating the current equipment limitation and infrastructural gaps

The proposed and ongoing projects identified to address the above listed limitations are listed in Table 4-24 and Table 4-25 below respectively.

Table 4-24: New and Ongoing programs to address identified line limitations

S/N	Critical Transmission lines	Loading (%)	Proposed/Ongoing Solution

1	Egbin - Ikorodu 132kV double circuit transmission line	96.2	Proposed for Reconductoring with higher capacity conductor in the short term and initiate the feasibility of 132kV connection from proposed Ogijo 330/132kV substation to existing Ikorodu 132kV substation.
2	Ikeja West – Alimosho 132kV double circuit transmission line	85.6	Completion of Ongoing Reconductoring project under the World Bank
3	Ayede – Ibadan North 132kV SC transmission line	89.5	Proposed for reconductoring of Ayede-Ibadan North- Iseyin and Osogbo-Iwo 132kV lines.
4	Akure – Osogbo 132kV SC transmission line		Completion of ongoing 330/132kV Akure substation with associated lines. This will take care of this heavily loaded line
5	Osogbo – Ilesha T 132kV single circuit transmission line	101.4	Implementation of Reconductoring project captured in World Bank Package
6	Delta – Effurun 132kV single circuit transmission line	86.1	Implementation of Reconductoring project captured in SLA projects. The line has been reconductored to Bear Conductor.
7	Kano – Dan Agundi 132kV single circuit transmission line	97.0	Implementation of the proposed Reconductoring project
8	Awka – Onitsha 132kV single circuit transmission line	89.4	Proposed for reconductoring
9	Ajaokuta – Okene 132kV single circuit	98.2	Implementation of Reconductoring project captured in WB Package
10	Katampe – Kubwa 132kV single circuit transmission line	81.6	Proposed turn in and out 2nd Katampe – Suleja 132kV line into Kubwa SS and proposed for reconductoring in the long term
11	Apo – Karu 132kV single circuit transmission line	127	Completion of Lafia – Akwanga 132kV double circuit line. This will ensure the deloading of Apo – Karu 132kV line by connecting Akwanga and Keffi substations from Lafia 330/132/33kV substation

Table 4-25: New and ongoing programs to address critical transformers

S/N	RATING (MVA)	SUBSTATION	NOMENCLATURE	Loading (%)	Proposed/Ongoing Solution

1	150	330/132kV Egbin	IBTR1	105.0	• Reinforcement with at least 150MVA transformer for the short term and • implementation of Proposed Ogijo 330/132kV substation captured in JICA funded projects.
2	150	330/132kV Egbin	IBTR2	105.0	
3	60	132/33kV Lekki	TR1	90.0	implementation of 2x100MVA transformer under NETAP should be expedited
4	60	132/33kV Lekki	TR2	94.0	
5	30	132/33kV Maryland	T3	97.0	Upgrading of the 2x30MVA to 2x100MVA under NETAP should be expedited.
6	30	132/33kV Oworonsoki	T1	92.0	Captured in SLA – upgrading to 60MVA
7	60	132/33kV Oke-Aro	TR1	96.0	Captured in SLA-addition of 100MVA
8	60	132/33kV Ganmo	T1	94.0	Proposed Reinforcement - addition of 100MVA
9	60	132/33kV Effurun	TR3	94.0	Replacement of failed 60MVA with 100MVA captured under NETAP
10	40	132/33kV Amukpe	T1	95.0	Proposed for Reinforcement
11	150	330/132/33kV Jos	T1A	91.0	2nd 150MVA the work is ongoing
12	150	330/132kV New Haven	T3	95.0	Reinforcement with 150MVA 330/132kV and 2X60MVA 132/33kV transformer
13			T4	95.0	
14	60	132/33kV Asaba	T2	91.0	Upgrading of 2x60MVA with 2x 100MVA as Captured in SLA
15	150	330/132kV Onitsha	T2A	90.0	Proposed replacement of the 90MVA with 300MVA and reconfigure the outgoing 132kV feeders.
16	60	132/33kV Calabar	T133	90.0	Proposed for Reinforcement
17	150	330/132kV Katampe	TR1	97.0	Completion of New Apo SS will provide relied for transformer in Katampe
18	150		TR2	97.0	
19	150		TR3	97.0	
20	60	132/33kV Suleja	T4	90.0	The 33kV outgoing feeders can be rearrange to distribute the load with

					the second 60MVA on soak.
21	60	132/33kV Gwagwalada	TR2	95.1	Urgent need for replacement of the faulty 60MVA

4.7.5 Magnitude of Improvement needed for optimal performance

In order to determine the magnitude of improvement required for optimal performance, the Disco five (5) year projections for the PIP was used to prioritise the projects to be delivered yearly to meet the Disco load projections.

Table 4-26 shows the load projection by Discos for the Five years under review.

Table 4-26: Disco five-year load projections

DISCO	Current Energy Delivered	PIP Year 1	PIP Year 2	PIP Year 3	PIP Year 4	Pip Year 5
Abuja	471.23	565.62	660.0	754.38	848.77	943.15
Benin	162.44	205.98	249.52	293.06	336.60	380.14
Eko	440.07	541.80	643.54	745.27	847.01	948.74
Enugu	259.02	337.92	416.83	495.73	574.63	653.54
Ibadan	451.00	547.00	643.00	739.00	835.00	931.00
Ikeja	485.05	605.07	725.09	845.11	965.14	1085.16
Jos	142.69	183.97	225.25	266.53	307.81	349.09
Kaduna	224.66	385.16	545.66	706.16	866.67	1027.17
Kano	219.18	550.00	559.00	568.00	577.00	586.00
PH	226.48	269.73	312.97	356.21	399.45	442.69
Yola	40.07	116.00	129.00	144.00	159.00	174.00
Grand Total	3121.89	4308.25	5109.84	5913.45	6717.08	7520.68

Table 4-27 shows the projects prioritized on yearly basis to meet the projected Disco demand for the five years.

Table 4-27: Prioritized project per year

PROJECTS PROPOSED FOR COMPLETION IN YEAR 1			
S/N	Critical Transmission lines/Transformers	Loading (%)	Proposed/Ongoing Solution
1.	Kano – Dan Agundi 132kV single circuit transmission line	104.8	Fast track reconductoring project captured in SLA projects. Implementing this project in year 1 will improve the supply capability to Dan Agundi S/S to double the current capacity of 70MW.
2.	150MVA 330/132/33kV T2A at Kano 330/132/33kV SS	89.4	Fast track the ongoing 300MVA NETAP project in Kano330/132/33kV transformer proposed for Kano SS. Implementing this project in year 1 will improve the transformation capacity at Kumbotso by an additional 240MW.
3	Kaduna – Kano 330kV SC line		Construction of 2nd Kano – Kaduna 330kV DC transmission line
4.	Kainji – Birnin Kebbi 330kV SC		Construction of 2nd kainji – B/Kebbi 330kV DC line
5.	Lekki 60MVA transformers TR1 & TR2	89.4	Fast track the NETAP 1X300MVA, 2X100MVA in Lekki to relief the existing 2 x 60MVA and provide additional capacity upstream in anticipation of the demand growth.
6.	150MVA 330/132/33kV at Birnin Kebbi 330/132/33kV SS		Fast track the additional 2X150MVA 33/132/33kV and 1X60MVA transformer proposed for Birnin Kebbi SS captured in NETAP project, which was implemented in year 1
7.	Jos – Gombe 330kV SC line		Construction of 2nd Jos – Gombe 330kV DC line for network security and improve power supply to meet the forecast demand of Jos and Yola Discos in year 3 and beyond.
8.	Ajah 60MVA transformer TR2	80.1	Completion of ongoing 1X100MVA and 2X60MVA transformers in SLA projects. 1X100MVA implemented in year 1
9.	Oke Aro 60MVA transformer T5 & T6	85.3	Fast track completion of 1X100MVA implemented in year 1 from SLA projects
10.	2nd 60MVA at Gwagwalada SS	83	Replacement of faulty 60MVA at Gwagwalada SS
PROJECTS PROPOSED FOR COMPLETION IN YEAR 2			
S/N	Critical Transmission lines/Transformers	Loading (%)	Proposed/Ongoing Solution
1.	Egbin 150MVA IBTR1 & IBTR2	81	Additional 150MVA 330/132/33kV transformer proposed and implemented in year 2.

2.	Katsina - Kankia 132kV SC line	100	Fast track the reconductoring of the line to be implemented in year 3. Captured in SLA projects.
3.	Kano - Kankia 132kV line	90	Recommended for reconductoring to be implemented in year 2.
4.	Zaria - Funtua - Gusau	99.2	Fast track the reconductoring of the line implemented in year 2 to be used in year 3. Captured in SLA projects
5.	Katampe - Kubwa	86	Proposed Turn in Turn out of Katampe - Kubwa second 132kV line implemented in year 2
PROJECTS PROPOSED FOR COMPLETION IN YEAR 3			
S/N	Critical Transmission lines/Transformers	Loading (%)	Proposed/Ongoing Solution
1.	Kano - Kaduna 330kV SC line	54	1. Fast track Mando - New Kano 330kV DC line currently ongoing and implemented in year 3 thus supply to KEDCO attained the forecasted 568MW due to the implementation of this project. Captured in AfDB projects. 2. Completion of New Kano - Katsina 330kV DC line implemented in year 3 for system security
2.	Kaduna - Zaria 132kV SC line	93	1. Turn in Turn out of Old Kano - Kaduna 330kV line at Zaria and Upgrade of Zaria 132kV SS to 2X150MVA 330/132/33kV SS to attain the KAEDCO forecasted load of 706.16MW in year 4. Captured in IDB 2. Completion of Zungeru - Millennium City 330kV DC and Millennium city 2X150MVA, 2X100MVA S/S 3. Complete and upgrade the connection of GEZ 2X60MVA substation from 33kV to 132kV voltage level
3.	Jos-Gombe 330kV SC line		Implemented in year 3 for network security
4.	150MVA 330/132/33kV Transformer T5 at Mando 330kV SS	83	Additional 150MVA recommended for Kaduna SS implemented in year 3
5.	Ihovbor - Akure - Osogbo line		Fast track the completion of the ongoing second Ihovbor - Akure - Osogbo line for network security implemented in year 3.

6.	30MVA transformers at Maryland	97	Fast track replacement of 2X30MVA with 2X100MVA in Maryland captured in NETAP project. Implemented in year 3 to be used in year 4
7.	Omotosho-Epe-Lekki DC 330kV		Fast track completion of the Omotosho - Epe - Lekki 330kV DC. Captured in FGN project implemented in year 3 to be used in year 4.
8.	Katampe 330kV 3 X 150MVA 330/132kV Substation		1. Completion of ongoing New Apo2X150MVA 2X60MVA SS 2. Completion of ongoing New Apo - Lafia 330kV DC 3. Completion of ongoing New Apo - Old Apo 132kV SC line 4. Completion of ongoing New Apo - Kuje 132kV line 5. Completion of ongoing New Apo - Lokogoma Wumba 132kV DC line 6. Completion of ongoing Dawaki 132/33kV SS - Gwarimpa 7. Completion of ongoing Kuje - West Main SC line which are all AFD projects.
9.	Ayede - Ibadan North 132kV line	95.7	Fast track reconductoring of the line to be implemented in year 3 for use in year 4.
10.	Osogbo - Ilesha - Ife 132kV SC line	87.9	Proposed for reconductoring implemented in year 3 Captured in World Bank Package.
PROJECTS PROPOSED FOR COMPLETION IN YEAR 4			
S/N	Critical Transmission lines/Transformers	Loading (%)	Proposed/Ongoing Solution
1.	Kumbotso - Hadeija 132kV line	---	Recommended for reconductoring in year 3 and implemented in year 4 captured in NETAP projects
2.	Kumbotso - Dakata 132kV line	90.0	Recommended for reconductoring in year 3 and implemented in year 4 captured in IDB projects.
3.	Zaria - Funtua - Gusau 132kV SC line	99.2	Recommended for reconductoring to be implemented in year 4
4.	Kumbosto 150MVA Transformer	91.0	Additional 150MVA proposed in Kano SS to be implemented in year 4.
5.	Egbin - Ikorodu 132kV DC	105	Reconductoring of the line implemented in year 4.
6.	Mando - Kaduna Town line 1	104.8	Proposed for reconductoring to be implemented in year 4 and used for year 5.

7.	Mando - Kaduna Town line 2	89.4	Proposed for reconductoring to be implemented in year 4 and used for year 5.
8.	Apo - Karu 132kV SC line	91.8	Proposed Lafia - Akwanga line to be implemented in year 4.
9.	Ganmo 30MVA transformer	95.0	Upgrade of 30MVA to 100MVA currently ongoing in NETAP project implemented in year 4.
10.	Jebba 30MVA transformer	90.0	Additional 60MVA proposed for Jebba SS captured in the Siemens PPI projects implemented in year 4.
11.	Kaduna Mando 150MVA T5	82.7	Proposed Upgrade of the 150MVA to 300MVA implemented in year 4.
12.	Apir 40MVA transformer MOB	80.0	Fast track completion of ongoing additional 60MVA to Apir SS
13.	Sagamu Transformer T1	81.0	Proposed additional 60MVA implemented in year 4
14.	Alagbon 300MVA Transformer	83.0	Fast track ongoing additional 300MVA and 2X100MVA project expected to be completed in 2023 but implemented in year 4. Captured in NETAP
15.	Dogongari 2X40MVA	89.0	Upgrade 2X40MVA to 2X60MVA transformer at Dogon-gari to be implemented in year 4
PROJECTS PROPOSED FOR COMPLETION IN YEAR 5			
S/N	Critical Transmission lines/Transformers	Loading (%)	Proposed/Ongoing Solution
1.	Kaduna - Mando 60MVA Transformer T2	98	Upgrade to 100MVA implemented in year 5
2.	Kaduna Town 60MVA transformer T1A	87	Upgrade 15MVA to 100MVA implemented in year 5
3.	Zaria 60MVA transformer	86	Upgrade to 100MVA implemented in year 5.

4.8 Connection of new Users of the Transmission System

The Grid Code Section 11 and 12 stipulates the procedures and requirements for new connection to the grid. These connections shall be managed based on system impact studies which will determine availability of network capacity at the proposed connection point.

- Report on the availability of capacity on the network at the connection point to connect new users' power
- Management of constraints and Congestion at such connection points and plans to improve evacuation of power at connection points
- Plan and readiness to integrate renewable energy resources into the transmission network and detailed report on system studies obligation to ensure system stability.

4.8.1 Availability of Capacity on the Network to Connect New Users at the Connection Point

The current average daily load consumption on the network is about 4700MW. The highest peak attained on the network is about 5800MW. Therefore, with simulated wheeling capacity of the network, it is safe to say that there is room for connection of new users. In term of new Gencos connection, it is also feasible subject to specific connection points on the system. Based on ongoing developments, new Gencos as well as addition of new Units in existing Gencos are expected within the five years PIP duration and plans for their evacuation have been covered in the plan.

4.8.2 Management of Constraints and Congestion at Connection Points

Constraints and congestion at certain parts of the system were visibly seen from the wheeling capacity studies as well as from the yearly studies of the Discos five years demand projections. Most of the constraints identified are in the 132kV system, where many; critical 132kV lines and transformers were loaded close to their limits. Transformers limitations were also observed at some 330kV substations such as Katampe, Onitsha, Egbin and New Haven. Table 4-22 and Table 4-23 of this report outlined the identified constraints and the congestion areas with recommended mitigations also recommended in Table 4-24 and Table 4-25.
Congestion is also envisaged in evacuation of additional generation capacity expected to be commissioned within the five years of this PIP. There are also existing power plants in the system that suffers congestion challenges with respect to their evacuation. Plans have been outlined in the PIP as indicated in table 10 below to ensure effective evacuation of the generation capacity to avoid stranded power from the power plants. Some of the projects are currently ongoing and need to be expedited while others are new ones need to be initiated to guarantee such evacuation.

Table 4-28: Proposed generation within the PIP period and evacuation plan

S/N	Generator	Installed Capacity (MW)	Proposed connection point	Year of proposed implementation	Proposed solution to manage congestion
1.	Zungeru Hydro	375	Jebba - Shiroro 330kV Line	Implemented in year 1	Connection to Shiroro - Jebba 330kV line at a switching station called Triple Point
2.	Pacific	400	Omotosho - Epe 330kV Line	Implemented in year 3	Fast track the Omotosho - Epe - Lekki

					330kV DC line to improve generation available to Lagos.
3.	NNPC Maiduguri	50	Maiduguri Substation	Implemented in year 3	
	Azura and Ihovbor Power plants	450 and 500	Ihovbor Substation	Implemented in year 1	Turn-in Turn-out of Benin – Ajaokuta 330kV SC transmission line
4	Afam Fast Power	240	Afam 132kV SS	Implemented in year 1	Installation of additional 150MVA, 330/132kV Inter-bus transformer at the Afam 132kV SS and completion of Afam – Ikot Ekpene 330kV DC line
5	Rivers IPP Unit 2	180	Rivers IPP 132kV SS	Implemented in year 1	Upgrading of Rivers IPP 132kV SS with 2X150MVA, 330/132kV Inter-bus transformers and Turning-in and Turning-out of Afam – Onne 330kV DC at the SS.
6	Oloronshogo Gas and Oloronshogo NIPP	335 and 750	Olorunsogo 330/132kV Substation	To be implemented in year 3 or soon thereafter.	Fast tracked implementation of Arigbajo substation and associated transmission lines under JICA project
7	Omotosho Gas and Omotosho NIPP	335 and 500	Omotosho Substation 330/132kV	To be implemented in year 3 or soon thereafter.	Implementation of Ogijo Substation and associated transmission lines under JICA project

4.8.3 Plan and Readiness to Integrate Renewable Resources into the Transmission System

Integration of Renewable Energy to the Grid and in the energy mix of the country is in the front burner today. This is in line with the global trend as part of the effort to tackle the challenges of climate change. The Federal Government of Nigeria has made commitments in different fronts to promote RE integration with set targets and timelines. Interestingly, significant private sector investments are attracted in the RE sector including Utility-scale IPPs. So far, investment of about 5,000MW in RE power generation is different levels under preparation across the country.

With regards to the readiness of the transmission system to integrate the RE, a number of Provisional Approvals have been granted to some of the investors based on shallow evacuation studies that confirms availability of transmission capacity to evacuate the proposed capacity; however, Grid Connection Agreements are yet to be executed. It is to be noted that no single RE IPP is ready for connection to the Grid as at today, however, TCN advocates for gradual integration of the RE starting from low to high penetration with conscious consideration to operational security of the Grid. As per low penetration, it can be said that the transmission system can accommodate the RE in terms of network capacity to flow the electrons. At this stage, operational concerns of the RE due to its variability nature shall be treated on case-by-case basis but as the penetration level increases, comprehensive operational requirement shall be developed and deployed by the System Operator.

Therefore, to facilitate the Grid readiness for high penetration of the RE plants, comprehensive RE Integration and Flexibility studies is being conducted to establish a clear outlook of the phases of integration in terms of capacity scenarios, timing, operational requirements as well as tools/procedures and energy solutions necessary for stable operation of the Grid. This is to ensure that the impact of the variable nature of the RE on the Grid operations are clearly identified and the requirements for stable operations are also outlined for the gradual integration.

Table 4-29: Pipeline renewable power capacities

S/N	Solar Power Projects	Capacity (MW)
1	14 Front Runner PV Power Plants	1,275
2	NNREC	2,000
3.	Others	Bulk Power

4.9 Transmission Loss Factor (TLF) Performance

4.9.1 Transmission Efficiency and Transmission Loss Factor

Losses are inherent in any transmission system. Transmission Loss is measured as the difference between the energy sent out by all generators and the energy received by all loads (11 Discos, Eligible Customers, and the International Customers). The Transmission Efficiency (TE) is obtained by dividing the Energy Received by the Energy Sent Out. The transmission Loss Factor (TLF) is 1 – the Transmission Efficiency. A low TLF is desirable because it corresponds to a high TE. Figure 4-5 shows the plot of total energy generated and total energy load from January 2016 to September 2022, with the corresponding TLF.

The TLF is regulated by NERC as a performance incentive for the TCN. TCN earns the equivalent generation cost for having a monthly TLF below NERC specified TLF and losses the equivalent generation costs for a monthly TLF above the NERC specified TLF. The regulated

TLF was 8.05% for a while, but it has been scheduled to be reduced over a five-period starting from 2022 as shown in Table 4-30.

Table 4-30: Yearly Regulated Loss

Year	2022	2023	2024	2025	2026
Regulated Loss	7.50%	7.25%	7.00%	6.75%	6.50%

Based on the 2021 Generation Cost, an extra 1% in TLF above the regulated value costs TCN about 8 billion Naira annually. TCN also has the opportunity to earn this amount if it decreases the TLF by 1%.

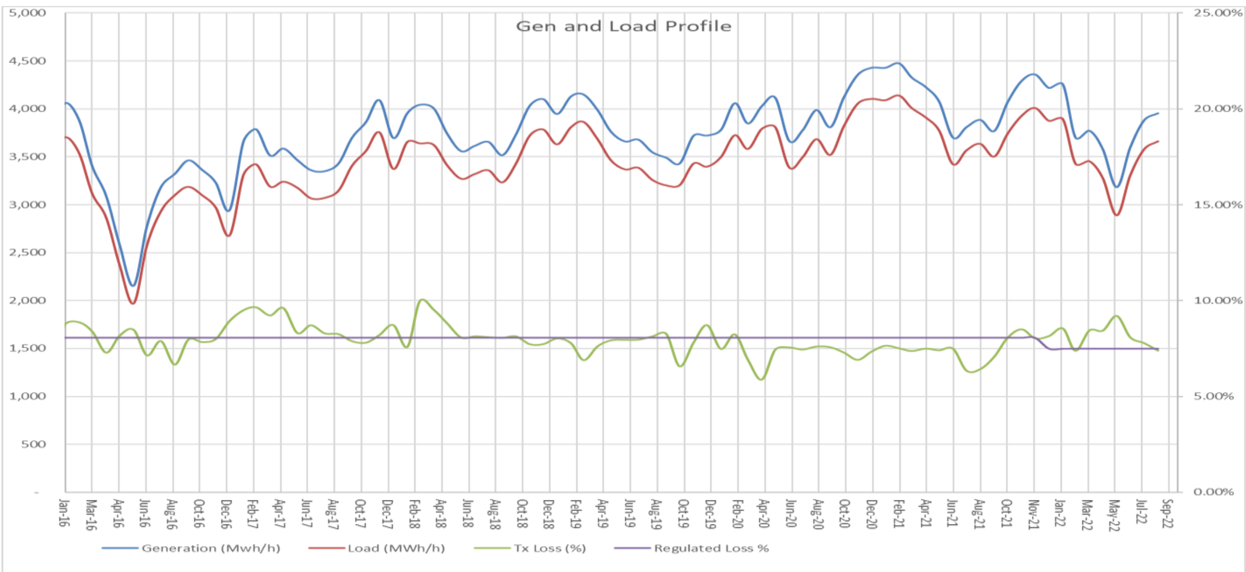


Figure 4-5: Plot of Generation, Load and Corresponding Loss Factor

4.9.2 <u>Causes of Transmission Losses</u>

Transmission Losses are caused by several factors. Lines, transformers, and other power equipment are the primary sources of losses in a transmission system. While these losses are inevitable, they must be controlled within acceptable limits.

4.9.2.(a) *<u>Excessive Line Losses</u>*

Lines will produce more losses than expected if they are old and poorly maintained. Undersized conductors also produce more losses than conductors of appropriate size.

4.9.2.(b) *<u>Excessive SwitchGear and Transformer Losses</u>*

Defective Switchgear and transformers will contribute more losses than non-defective ones.

4.9.2.(c) *<u>Lack of Capacitors and Inductor Banks</u>*

Many places do not have localized reactive power sources, so they depend on the lines to transmit reactive power to them. This transportation causes unnecessary line losses.

4.9.2.(d) Transformers on Soak

There are some transformers on soak due to Discos not radiating feeders from the substations they are in.

4.9.3 Reduction of Transmission Losses

Transmission loss will embark on reducing transmission losses and avoid penalties that come with not meeting regulatory benchmarks by doing the following:

- Replacing old and inefficient transformers with new ones
- Reconductoring of some lines with high capacity/low loss conductors
- Placement of capacitors and reactors at needed locations

4.10 Protection System/Coordination

4.10.1 Relays in the System

TCN has protection relays from diverse manufacturers with the following technologies:

- Electromechanical Relay (~30%)
- Static relay (~25%)
- Digital/ Numerical relay (~45)

4.10.2 Reliability of Protection Relay

The reliability of the various categories of relays are given next.

- Electromechanical Relay: 50% response reliability due to ageing and non-replaceable spare parts and System Automation Connectivity is practically difficult to achieve.
- Static relay: 65% response reliability due to ageing and non-replaceable spare parts System Automation is difficult because it is not programmable, and need an external module to interface with the Numerical relay before it can be programmed.
- Digital/ Numerical relay: It is an Intelligent Electronic Devices (IED), 100% reliable, effective communication and connectivity with substation Automation System.

4.10.3 Replacement of Old Protection Relays and Instrument Transformers

TCN has embarked on an exercise to replace static and electromechanical relays with digital/numerical relays to ensure more reliability, fast response to fault, and adaptation to automation connectivity with the SCADA system. This is being under the auspices of the replacement exercise of old substation protection facilities funded by World Bank NETAP loan and TCN IGR. Procurement of protection relays (Overcurrent, Differential and Distance) is ongoing to provide replacement spares.

In the last year, the following has been with replacement has been done.

- 16 Nos of Distance relays deployed for replacement on 330kV and 132kV lines
- 12 Nos of Differential relays have been replaced with new ones
- 30 Nos of Over current relays replaced
- 66 Nos of 330kV Current transformers replaced
- 40 Nos of 132kV Current transformers replaced
- 180 Nos of 33kV current transformers for transformer secondary and feeder bays replaced.
- 108 Nos of 33kV voltage transformers replaced.
- 52 Nos of 132kV Capacitive voltage transformers replaced
- 30 Nos of 330 kV Capacitive voltage transformers replaced
- Various sizes of control cables replaced

4.10.4 Protection coordination between TCN / GENCO

The coordination level with Generation stations is majorly at 330kV and partly at 132kV.

- 100% 330kV connected through line protection and Back Up protection.
- 100% 132kV connected through line protection and Back Up protection.

4.10.4.(a) The coordination Level @ 330KV

At 330kV, the coordination is about 85% due to internal problems within Generation stations.

- Negative sequence
- Overcurrent (Overload)
- Over frequency/Under frequency

4.10.4.(b) The coordination Level @ 132KV

At 132kV, the coordination is about 85% due to internal problems within Generation stations.

- Negative sequence
- Overcurrent (Overload)
- Over frequency/Under frequency

4.10.5 Protection coordination between TCN / Disco

At 33kV, the coordination is about 65% due to internal problems within Distribution substations.

- Overcurrent /Earth fault relay

4.11 TCN Infrastructural Vision

The TCN Strategic Road Map (Supporting Document 2) was introduced in Chapter 3 . The Strategic goals were broken down into six broad categories; one deals with bulk power supply infrastructural vision. This sub-vision is titled:

> *"Technical Optimization: Drive Decisions Around Demand - Use a demand-based framework to focus on maintenance and expansion projects that will improve grid visibility and reliability, minimize losses and target high demand-growth areas."*

Generally, TCN will ensure that decision-making processes are objective, grounded in data, and financially sound.

Table 4-31 shows the initiatives grouped under Technical Optimization and Table 4-32 shows actions to be undertaken under the initiatives.

Table 4-31: Initiatives under Technical Optimization

	INITIATIVES	JUSTIFICATION
1.1	*Formalize the project selection framework* – develop a formulaic process that balances consumer demands with financial viability to determine if and where, and when TCN will invest in maintenance or expansion	Aligning investment choices with TCN's broader goals – both for the Nigerian people, and as a business – will help the firm fortify against political influences and better maximize its overall returns
1.2	*Reconcile the pipeline* – prioritize and sequence TCN's portfolio of investments, including stranded, planned, and future projects/assets	By critically assessing ongoing and future projects, TCN will be better prepared to allocate limited resources and anticipate impending needs
1.3	*Standardize the maintenance plan* – structure schedules for routine maintenance and inventory assessments based on demand criteria (*Initiative 1.1*) and severity	Proactively restoring infrastructure will enable TCN to mitigate the need for more intensive reconstruction, thereby cutting costs and preventing unexpected outages
1.4	*Produce an Integrated Resource and Resilience Plan (IRRP)* – develop a cross-industry strategy for cohesive expansion	Taking into consideration the needs and parameters of the NESI will help TCN better align with partners and strengthen connectivity across the value chain
1.5	*Finalize the implementation of SCADA* – building on initiatives completed in Years 1 and 2 (e.g., *Initiatives 6.1, 6.3,* and *6.4*), fully	With enhanced insight into grid performance, TCN will be better prepared to manage supply and demand, as well as

	acquire and incorporate the system into TCN's grid	lobby for things like a more cost-reflective tariff

Table 4-32: Initiatives and Actions under Technical Optimization

Initiatives	Actions	Rationale
1.1 *Formalize the project selection framework*	1.1.1 Consider targets and goals for expansion (both domestic and international); map out customer needs, accordingly	*Having a framework in place will promote systematic, evidence-based decision-making *Aligning investment choices with TCN's broader goals – both for the Nigerian people, and as a business – will help the firm fortify against political influences and better maximize its overall returns
	1.1.2 Develop and adopt a Transmission Planning Criteria with sets of acceptance criteria around project viability, including willingness to pay, population size and demand growth, equity of access, depreciation of assets, and cost and revenue generation implications	
	1.1.3 Outline the step-by-step process of securing project approvals, including data points, stakeholders involved, timelines, and budgetary considerations and thresholds	
1.2. Reconcile the pipeline projects with a view to re-prioritizing their implementation to achieve resource optimization.	1.2.1 Compile a complete list of the pipeline (stranded, planned, and future projects)	*Leveraging demand-based metrics will encourage TCN to prioritize the most commercially viable projects *By critically assessing ongoing and future obligations, TCN will be better prepared to allocate limited resources and anticipate impending needs
	1.2.2 Identify the costs of completion associated with the pipeline (including risks and barriers)	
	1.2.3 Leveraging the framework developed in *Initiative 1.1*, prioritize the pipeline, ranking in order from most important to least important to complete	
	1.2.4 Assign each project in the pipeline a status and timeframe and begin reallocating the budget to account for those with the highest priority and most immediate time to completion	
1.3 *Standardize the maintenance plan*	1.3.1 Compile records of historical maintenance needs over the past 10 years (including timeframe and resources required, such as costs, personnel, equipment, etc.)	*A proactive, data-driven maintenance plan in coordination with adequate supply of spare parts can mitigate against unexpected outages *Proactively restoring infrastructure will enable TCN to mitigate the need for more intensive
	1.3.2 Cross-compare maintenance records with the complete pipeline from *Action 1.2.1* to forecast future maintenance needs; consider existing maintenance resources and fill gaps	
	1.3.3 Devise a new schedule for routine maintenance and inventory assessments that allows	

	for consistent and continuous verification of equipment status	reconstruction, thereby cutting costs and preventing against unexpected outages
1.4 *Produce an Integrated Resource and Resilience Plan (IRRP)*	1.4.1 Leverage the Market Rules, Grid Code, and internationally recognized guidelines to inform the development of a preliminary IRP and for medium- and long-term planning, taking into consideration ongoing and future grid expansion	*Cross-collaboration with value chain partners will facilitate a more cohesive and connected industry moving forwards
	1.4.2 Coordinate with GENCOs and DISCOs to align on expectations and evolving needs	*Taking into consideration the needs and parameters of the NESI will help TCN better align with partners and strengthen connectivity across the value chain
	1.4.3 Regularly convene key stakeholders as an industry body to address roadblocks and constraints	
1.5 *Finalize the implementation of SCADA*	1.5.1 Develop procedures and manuals to be programmed into the SCADA system as control actions	*Modernizing the grid will allow TCN to make more effective and informed investment decisions
	1.5.2 Finalize the procurement process and begin incorporating the new hardware and software technology into the grid; ensure interoperability with existing digital systems (per *Initiative 6.1* and in accordance with *Initiatives 6.3* and *6.4*)	*With enhanced insight into grid performance, TCN will be better prepared to manage supply and demand, as well as lobby for things like a more cost-reflective tariff
	1.5.3 Host extensive hands-on trainings to brief personnel on SCADA system requirements	

4.12 Nigeria Grid Expansion and Maintenance Plan

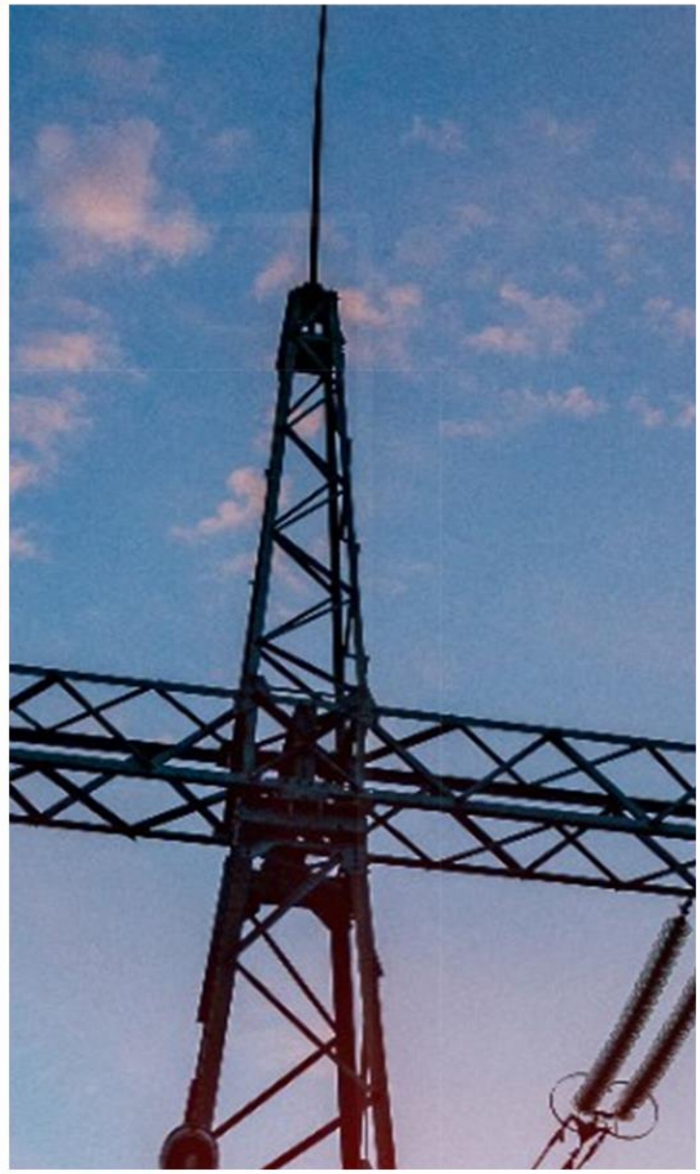
Despite the achievements in the last decades, as discussed in Section 4.1, more still needs to be done. Ageing transformers, breakers, transmission lines and other substations need to be replaced or rehabilitated. New lines and substations need to be built to accommodate future growth. TCN developed a long term, Least Cost Expansion Master Plan in which critical constraints were identified involving overloaded transmission lines and substations under N-0 and N-1 conditions. Pockets of compensation requirements are also part of the issues identified. Resolving these constraints are considered as priorities to guarantee system reliability and stability and is being implemented as part of an initiative called the Nigeria Electricity Grid Maintenance, Expansion and Rehabilitation Program (NEGMERP): which aims to support the rehabilitation and upgrade of Nigeria's electricity transmission substations and lines to increase power transmission and allow distribution companies improve supply to consumers.

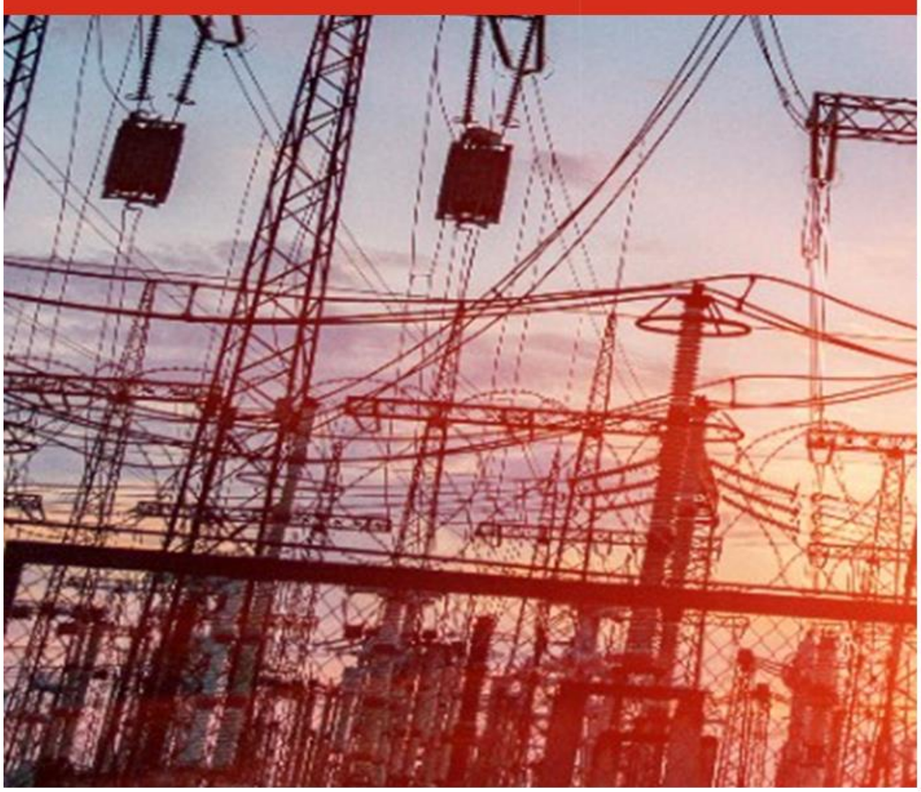
The NEGMERP is funded by:

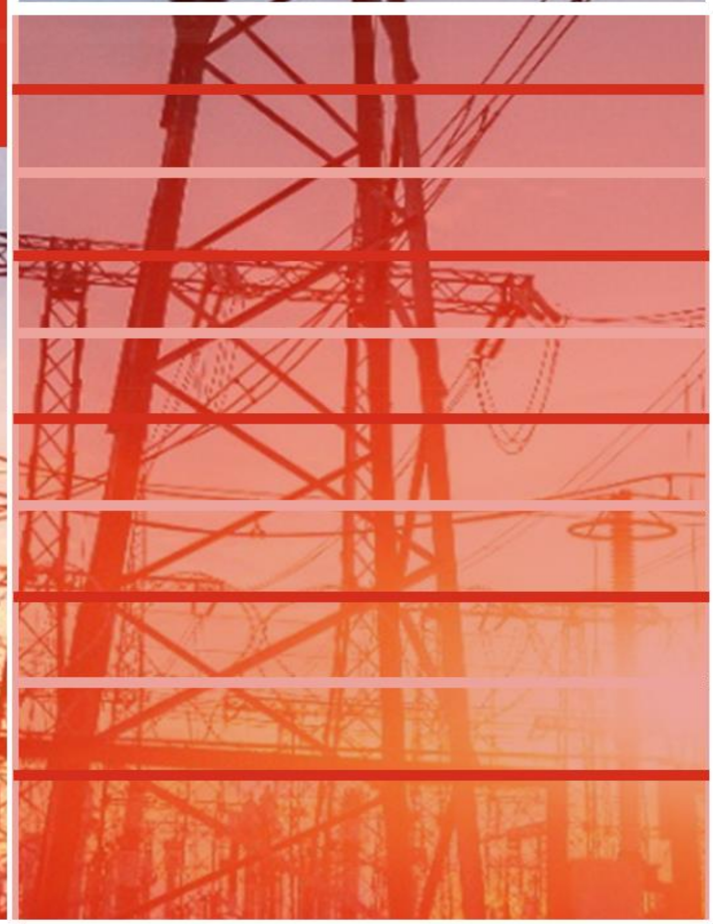
1. Internally Generated Revenue from services rendered to Generation Companies, Distribution Companies, International Distribution Companies and Directly Connected Customers
2. Federal Government budgetary appropriation for capital projects.
3. The company also receives grants and loans from multilateral development agencies such as:
    a. World Bank (WB), African Development Bank (AFDB),
    b. Japan International Cooperation Agency (JICA),
    c. Agence Francais de Development (AFD)
    d. African Development Bank (AfDB)
    e. and the European Union (EU) among others.

These sources are discussed in Section 2.3.

5
ENGAGEMENT AND CONSULTATIONS WITH DISCOS







5.1 Introduction

In it is guideline to TCN, NERC provided specific guidelines for the preparation of PIP by the TCN for the alignment of the transmission and distribution networks plans amongst other performance improvement objectives. The alignment principles in the guidelines are:

I. NERC expects TCN to give due regards to the load demand/energy offtake growth and PIPs of the Discos.
II. TCN's PIP shall be evaluated on the robustness of the consultation process leading to the preparation of the PIP. Apart from reading and understanding the PIPs of the DisCos, TCN is expected to duly consult with DisCos and GenCos in order to avoid misalignments between transmission infrastructure development in the gas supply and transportation infrastructure.
III. One of the stated objectives of the PIP is to: align TCN's investment with those of GenCos and DisCos to enable optimal utilization of generation and network capacity for improved service delivery

Starting from 2020, TCN has actively and constructively engaged the Discos on their needs. A lot of the meetings were held at the instance of the regulator NERC. At such engagements the Discos discussed extensively the areas they seek improvement from TCN. Also, the Discos, in some their reports, have outlined some of the areas in their franchise zone that they required urgent transmission interventions. In addition, the PIP committee of TCN has met with all the Discos, the highlights of the meetings are discussed in the next sub-sections. Chapter 7 summarizes the need of each of the Discos.

5.2 Meeting with the Discos

TCN PIP team held a consultative meeting with all the Discos in the year 2021 and year 2022.

5.2.1 Meeting Objectives

The objectives of the meeting were:

- Discussion of Disco intake statistics at the TCN/Disco interface.
- Discussion of TCN ongoing and planned projects in Disco franchise areas
- Discussed whether the above TCN projects cover the five years expansion and maintenance plans of Disco as expressed in the Disco's NERC approved Performance Improvement Plan (PIP)
- Get feedbacks on the needs of Disco
- Ensure that the TCN meets the capacity requirements of Abuja Disco at all TCN/Abuja Disco interface

5.2.2 Key Take Outs from Consultative Meeting

The key takes outs of the meeting are:

- Most of the 151 Nos 132kV/33kV substations are underutilized due to either 132kV line constraints or Discos downstream constraints.
- The TCN team asserted that most of the substations are under-utilized based on their historical average loading records hence, concerned that some of the transformer replacement desired by some Discos are not justifiable. The Discos replied that some of the transformers tend to be overloaded during peak periods. TCN noted that a few cases exist, but overall, a lot of the substations' transformers are not overloaded. TCN and Discos agreed to use historical data to establish the need for more transformation capacity.
- TCN and some Discos discussed and agreed that transformational capacities of transformers are not necessarily the problems in most substations; but problems can come from switchgear components and other accessories; or in some cases, limitation of the lines feeding the transformers.
- TCN has a lot of substations where the Discos have not built proper 33kV/11kV injection substations under and Discos' customers only take power through 33kV line.
- New TCN substations were approved for construction over 10 years ago and the constructions have started. Some of the substations are almost finished, but the Discos are not building 33kV lines or 33kV/11kV injection substations to take power out of the constructed substations.
- TCN has a lot of ongoing projects (funded by its IGR, FGN Appropriation, World Bank, JICA, AFD and AfDB). These ongoing transmission projects once completed will be mostly sufficient to meet the PIP needs of the Discos.
- TCN asserted that most of the requests of Discos are either in ongoing TCN's project in the Discos franchise area or are not needed
- TCN also advised the Discos to reconfigure some of their feeders within the same station connected to overloaded transformer to lightly loaded ones to relieve such a transformer during intermittent overloaded conditions.
- TCN asserted that in some cases that Discos can move feeders from one TCN substation that is overloaded to a nearby TCN substation that is underloaded. Like in the case of Itire TS and Isolo TS in Eko Disco.
- Some Disco did not disaggregate their five years projection for ease of analysis of needs.
- A lot of 132kV lines serving the Discos are severely undersized and carrying suboptimal power level not enough to serve the Discos.
- The Discos need to do vegetation management in some places so as to increase the uptime of feeders and improve utilization.
- Some Discos complained of TCN building substations in places where they are not needed.

5.3 Abuja Electricity Distribution Company

5.3.1 Introduction

The Committee on TCN Performance Improvement Plan (PIP) met with Abuja Electricity Distribution Company on Thursday, February 24th, 2022. The list of the attendees is given in Table 5-1.

Table 5-1: List of Attendees of Meeting with AEDC on PIP

S/NO	NAME	ORGANIZATION	E-MAIL
1	Engr Kabiru M Adamu	TCN	Kabirua2002@yahoo.com
2	Engr. Abutu E.	TCN	Abutuson45@gmail.com
3	Engr. B. Abdulmumin	TCN	Faabideen@gmail.com
4	Engr. Seun Amoda	TCN	Oamoda@gmail.com
5	Rufai Taofeeq Kola	AEDC	Taofeeq.Rufai@abujaelectricity.com
6	Alex Onah	AEDC	Alexander.onah@abujaelectricity.com
7	Mukhtar Ado	AEDC	Mukhtar.ado@abujaelectricity.com
8	Olumuyiwa A. Awoniyi	AEDC	Olumuyiwa.awoniyi@abujaelectricity.com
9	Lami A. Maji	AEDC	Lami.maji@abujaelectricity.com
10	Oluwafemi Zaccheaus	AEDC	Oluwafemi.Zaccheaus@abujaelectricity.com

TCN gave a presentation that highlighted the following:

5.3.2 TCN Substations in Abuja Discos and the utilizations of the substations.

That there are 16 TCN substations in Abuja Disco franchise areas where Abuja Disco gets power from TCN network, and the substations are listed in Table 5-2.

Table 5-2: Substations in Abuja Franchise Area

REGION	DISCO	STATION	Capacity (MVA)	330 KV 1	330 KV 2	330 KV 3
ABUJA	Abuja	Ajaokuta 132kV	90	Ajaokuta 330kV	Benin 330kV	
ABUJA	Abuja	Akwanga 132kV	60	Katampe 330kV	Gwagwalada 330kV	
ABUJA	Abuja	Apo 132kV	245	Katampe 330kV	Gwagwalada 330kV	
SHIRORO	Abuja	Bida 132kV	90	Katampe 330kV	Shiroro 330kV	
ABUJA	Abuja	Central Area	180	Katampe 330kV	Shiroro 330kV	Gwagwalada 330kV
ABUJA	Abuja	Gwagwalada	60	Gwagwalada 330kV		
ABUJA	Abuja	Karu 132kV	120	Katampe 330kV	Gwagwalada 330kV	
ABUJA	Abuja	Katampe2	120	Katampe 330kV	Shiroro 330kV	Gwagwalada 330kV
ABUJA	Abuja	Katampe3	100	Katampe 330kV	Shiroro 330kV	Gwagwalada 330kV
ABUJA	Abuja	Keffi 132kV	90	Katampe 330kV	Gwagwalada 330kV	
SHIRORO	Abuja	Kontagora	60	Shiroro 330kV		
ABUJA	Abuja	Kubwa 132kV	120	Katampe 330kV	Shiroro 330kV	
ABUJA	Abuja	Kukwaba 132kV	120	Katampe 330kV	Gwagwalada 330kV	
ABUJA	Abuja	Lokoja 132kV	60	Lokoja 330kV		
SHIRORO	Abuja	Minna 132kV	180	Katampe 330kV	Shiroro 330kV	
ABUJA	Abuja	Okene 132kV	90	Ajaokuta 330kV	Benin 330kV	
SHIRORO	Abuja	Shiroro II TS	30	Shiroro 330kV	Katampe 330kV	
ABUJA	Abuja	Suleja 132kV	203	Katampe 330kV	Shiroro 330kV	
SHIRORO	Abuja	Tegina 132kV	30	Shiroro 330kV		
			2,048			

Table 5-3 and Table 5-4 show the utilization factors of the 16 substations in Abuja Discos. TCN asserted to Abuja Disco that the 16 substations are grossly underutilized as shown in Table 5-3 and Table 5-4.

Table 5-3: Utilization Factors of Substations in Abuja Disco Franchise Area

STATION	Capacity (MVA)	Jan-21	Feb-21	Mar-21	Apr-21	May-21	Jun-21	Jul-21	Aug-21	Max % Utilization
Ajaokuta 132kV	90	8.59	9.21	9.10	9.34	8.31	8.89	8.42	8.13	12.98%
Akwanga 132kV	60	11.85	13.60	11.42	11.96	9.91	6.72	8.31	11.42	28.34%
Apo 132kV	245	90.60	97.70	99.43	96.81	85.70	75.56	81.19	82.28	50.73%
Bida 132kV	90	10.59	11.07	11.26	11.13	9.66	8.22	10.84	9.78	15.63%
Central Area	180	47.32	51.28	51.84	49.82	45.16	43.18	41.55	44.60	36.00%
Gwagwalada	60	10.45	11.46	12.65	12.08	11.63	10.42	12.68	11.84	26.43%
Karu 132kV	120	35.51	43.10	36.39	38.76	32.50	22.59	30.69	36.95	44.90%
Katampe2 132kV	120	39.86	43.18	46.08	46.40	42.86	39.79	38.30	40.13	48.33%
Katampe3 132kV	100	19.94	20.46	21.30	21.71	20.98	16.81	17.51	18.91	27.13%
Keffi 132kV	90	14.59	15.06	11.63	12.75	10.76	7.61	11.27	12.34	20.92%
Kontagora 132kV	60	6.27	6.39	6.40	6.49	5.96	4.96	5.36	4.67	13.53%
Kubwa 132kV	120	35.88	37.26	41.95	41.76	38.59	30.99	32.95	34.37	43.69%
Kukwaba 132kV	120	33.34	36.65	36.07	37.13	31.04	27.44	28.43	30.91	38.68%
Lokoja 132kV	60	11.75	11.64	13.02	11.93	11.16	10.62	10.46	9.74	27.13%
Minna 132kV	180	27.00	26.84	28.89	29.29	24.43	22.45	21.58	20.35	20.34%
Okene 132kV	90	21.42	19.74	19.72	20.50	19.56	17.21	19.12	15.42	29.75%
Shiroro II TS	30	2.04	2.07	1.55	1.33	1.75	1.30	1.13	1.06	8.63%
Suleja 132kV	203	32.67	35.60	32.98	32.41	30.00	24.38	29.78	32.33	21.98%
Tegina 132kV	30	6.87	7.78	7.36	7.57	6.46	4.36	4.65	4.09	32.43%
	2,048	466.56	500.10	499.04	499.19	446.43	383.50	414.24	429.31	30.53%

Table 5-4: Utilization Factors of Substations in Abuja Disco Franchise Area

STATION	Max Jan-21	Max Feb-21	Max Mar-21	Max Apr-21	Max of Max	% Utilization
Ajaokuta 132kV	22.3	22.4	22.9	24.1	24.1	322.43%
Akwanga 132kV	34.4	20.9	24.1	20.2	34.4	359.56%
Apo 132kV	122.1	157.5	142.9	195	195.0	251.78%
Bida 132kV	25.8	42.3	26.3	27.1	42.3	475.23%
Central Area 132kV	80.8	85.1	83.5	80.7	85.1	213.51%
Gwagwalada 132kV	29.8	31.89	33.8	32.9	33.8	349.62%
Karu 132kV	76.3	69.7	134.9	79.4	134.9	435.09%
Katampe2 132kV	80	60.5	66.3	68.5	80.0	215.54%
Katampe3 132kV	28	30.4	32.1	33.1	33.1	190.62%
Keffi 132kV	38.9	40.7	34.3	37	40.7	398.87%
Kontagora 132kV	17.5	17	18.8	18.1	18.8	361.93%
Kubwa 132kV	48.3	63.8	78.05	74.7	78.1	233.60%
Kukwaba 132kV	52.2	94.8	60.7	64.4	94.8	319.14%
Lokoja 132kV	37.3	41.82	45.06	50.4	50.4	528.05%
Minna 132kV	68.1	74.8	88.9	74.8	88.9	379.36%
Okene 132kV	50.5	48	46.5	49.3	50.5	307.86%
Shiroro II TS 132kV	11.6	10.9	10.8	11.5	11.6	1087.95%
Suleja 132kV	63.3	71.69	67.88	68.23	71.7	276.48%
Tegina 132kV	31.4	13.6	14.35	13.1	31.4	518.42%
	918.60	997.8	1032.14	1022.53	1199.54	300.37%

5.3.3 Abuja Disco PIP

The approved NERC's Abuja PIP energy trajectory is shown in Table 5-5.

Table 5-5: Abuja PIP energy growth submission

Disco	Current Energy Delivered (MWh/h)	PIP Year 1 Target (MWh/h)	PIP Year 2 Target (MWh/h)	PIP Year 3 Target (MWh/h)	PIP Year 4 Target (MWh/h)	PIP Year 5 Target (MWh/h)	Service Improvement Target (MWh/h)
Abuja	471.23	565.62	660.00	754.38	848.77	943.15	471.92

Abuja Disco has not broken down its future load requirement by substations and feeders. However, Abuja Disco promised they will work on breaking it down.

5.3.4 Discussions

- The TCN team asserted that most of the substations are under-utilized based on their historical average loading records hence, concerned that some of the transformer replacement desired by Abuja Disco may not be justifiable. Abuja Disco replied that some of the transformers tend to be overloaded during peak periods. TCN noted that a few cases exist, but overall a lot of the substations' transformers are not overloaded. Both TCN and Abuja Disco agreed to use historical data to establish the need for more transformation capacity.

- TCN was interested in knowing the plan of Abuja Disco for the substations been proposed to be built at the World Trade Center and Ministry of Defense which are about 1km from each other. TCN was interested in knowing whether Abuja Disco has done load studies on the area. Abuja Disco said they have not done any studies but they are optimistic the demand in that area will grow and agreed to carry out the necessary studies.
- TCN and the AEDC discussed and agreed that transformational capacities of transformers are not necessarily the problems in most substations; but problems can come from switchgear components and other accessories; or in some cases, limitation of the lines feeding the transformers.
- TCN asserted that the ongoing transmission projects in Abuja Disco franchise area once completed will suffice to meet the five years plan of the Disco.
- TCN also advised Abuja Disco to reconfigure some of their feeders within the same station connected to overloaded transformer to lightly loaded ones to relieve such a transformer during intermittent overloaded conditions.
- TCN asserted that in some cases Abuja Discos can move feeders from one TCN substation that is overloaded to a nearby TCN substation that is underloaded.
- Abuja Disco agreed to work on its detailed expansion plans.
- Abuja Disco assured TCN of it cooperation particularly with the Planning Department to ensure alignment of development plans.

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5.4 Benin Electricity Distribution Company

5.4.1 Introduction

The Committee on TCN Performance Improvement Plan (PIP) met with Benin Electricity Distribution Company on on Thursday, February 10th, 2022 (via "Google Meet"). The list of the attendees is given in Table 5-6.

Table 5-6: List of Attendees of Meeting with Benin Disco on PIP

S/NO	NAME	ORGANIZATION	E-MAIL
1	Engr. Kabiru Adamu	TCN	kabirua2002@yahoo.com
2	Engr. Adesanya A. B	TCN	abaadesanya@yahoo.co.uk
3	Engr. Abutu E.	TCN	abutuson45@gmail.com
4	Engr. Hampashi Eric	TCN	erichampashi@yahoo.com
5	Engr. B. Abdulmumin	TCN	faabideen@gmail.com
6	Engr. Seun Amoda	TCN	oamoda@gmail.com
7	Mr. Abu Ejoor	BEDC	abuejoor@bedcpower.com
8	Engr. Ashok	BEDC	ashokacharya@bedcpower.com

TCN gave a presentation that highlighted the following:

5.4.2 TCN Substations in Benin Disco and the utilizations of the substations.

That there are 17 TCN substations in Benin Disco franchise area where Benin Disco gets power from TCN network and the substations are listed in Table 5-7.

Benin Disco noted the following corrections Table 5-7.:

- That Asaba should be 120MVA not 180MVA.

Table 5-7: Substations in Benin Disco Franchise Area

REGION	DISCO	STATION	Capacity (MVA)	330 KV 1	330 KV 2	330 KV 3
OSOGBO	Benin	Ado Ekiti 132kV	126	Osogbo 330kV		
BENIN	Benin	Afiesere 132kV	30	Delta 330KV	Benin 330kV	
ENUGU	Benin	Agbor 132kV	120	Asaba 330kV		
BENIN	Benin	Akure 132kV	210	Osogbo 330kV		
BENIN	Benin	Amukpe 132kV	90	Delta 330KV	Benin 330kV	
ENUGU	Benin	Asaba 132kV	180	Asaba 330kV		
BENIN	Benin	Benin 132kV	240	Benin 330kV	Ajaokuta 330kV	Delta 330KV
BENIN	Benin	Delta 132kV	120	Delta 330KV	Benin 330kV	
BENIN	Benin	Effurun 132kV	120	Delta 330KV	Benin 330kV	
BENIN	Benin	Etsako 132kV	40	Asaba 330kV		
BENIN	Benin	Ihovbor 132kV	120	Ihovbor 330kV		
BENIN	Benin	Irrua 132kV	90	Benin 330kV	Ajaokuta 330kV	
BENIN	Benin	Oghara 132kV	30	Benin 330kV	Delta 330KV	
BENIN	Benin	Okada 132kV	40	Ihovbor 330kV		
ABUJA	Benin	Okpella 132kV	30	Ajaokuta 330kV	Benin 330kV	
OSOGBO	Benin	Omu-Aran 132kV	30	Ganmo 330kV	Osogbo 330kV	
BENIN	Benin	Ondo 132kV	60	Osogbo 330kV		
			1676			

Table 5-8 and Table 5-9 show the utilization factors of the 17 substations in Benin Disco. TCN asserted to Benin Disco that the 17 substations are grossly underutilized as shown in Table 5-8 and Table 5-9

Table 5-8: Utilization Factors of Substations in Benin Disco Franchise Area

STATION	Capacity (MVA)	Jan-21	Feb-21	Mar-21	Apr-21	May-21	Jun-21	Jul-21	Aug-21	%
Ado Ekiti 132kV	126	17.17	15.92	16.17	15.62	14.02	14.20	14.34	12.31	17.04%
Afiesere 132kV	30	-	-	-	0.00	-	-	-	0.00	0.02%
Agbor 132kV	120	7.41	7.57	6.64	6.87	7.18	6.96	6.96	6.58	7.88%
Akure 132kV	210	29.19	29.85	27.80	27.38	29.43	27.22	27.30	24.90	17.77%
Amukpe 132kV	90	15.93	13.05	13.42	12.26	15.91	15.55	16.52	12.88	22.95%
Asaba 132kV	180	40.59	45.21	44.14	43.72	37.89	38.67	39.94	36.95	31.40%
Benin 132kV	240	68.19	65.20	72.31	64.39	65.93	63.83	67.07	71.09	37.66%
Delta 132kV	120	26.02	22.61	21.95	20.91	21.97	21.57	23.66	21.48	27.10%
Effurun 132kV	120	33.43	35.40	39.33	35.28	37.46	33.88	35.75	31.76	40.97%
Etsako 132kV	40	12.51	13.28	11.36	11.16	11.88	10.11	10.58	10.57	41.50%
Ihovbor 132kV	120	33.27	33.41	28.56	31.73	33.17	28.21	29.60	28.68	34.81%
Irrua 132kV	90	12.06	10.52	9.68	9.58	9.90	7.08	8.14	6.66	16.74%
Oghara 132kV	30	3.97	3.63	3.65	3.68	3.25	3.15	3.71	2.94	16.55%
Okada 132kV	40	6.50	4.76	3.24	2.83	3.71	2.36	3.14	2.26	20.31%
Okpella 132kV	30	5.43	5.25	5.46	5.51	4.96	4.50	5.11	3.80	22.95%
Omu-Aran 132kV	30	4.32	4.63	3.94	2.96	2.62	2.23	2.97	2.16	19.30%
Ondo 132kV	60	9.08	9.08	7.32	7.06	9.04	7.89	8.63	7.43	18.93%
	1676	325.06	319.38	314.97	300.94	308.32	287.41	303.42	282.45	24.24%

Table 5-9: Utilization Factors of Substations in Benin Disco Franchise Area

STATION	Max Jan-21	Max Feb-21	Max Mar-21	Max of Max	% Utilization
Ado Ekiti 132kV	29.4	25.6	25.5	29.4	29.17%
Afiesere 132kV	0	0	0	0	0.00%
Agbor 132kV	20.8	21.3	20	21.3	22.19%
Akure 132kV	47.2	40.7	43.4	47.2	28.10%
Amukpe 132kV	36.1	40	41.2	41.2	57.22%
Asaba 132kV	66.8	67.5	181.1	181.1	125.76%
Benin 132kV	113.3	110.1	111.15	113.3	59.01%
Delta 132kV	140.7	75.9	73.2	140.7	146.56%
Effurun 132kV	64.1	70.6	68.6	70.6	73.54%
Etsako 132kV	26.4	25.4	26.5	26.5	82.81%
Ihovbor 132kV	59.4	140.7	71.6	140.7	146.56%
Irrua 132kV	30.1	30.7	32.7	32.7	45.42%
Oghara 132kV	11.6	11.3	11.4	11.6	48.33%
Okada 132kV	13.6	13.4	13.3	13.6	42.50%
Okpella 132kV	14.9	17.3	17.8	17.8	74.17%
Omu-Aran 132kV	14	14.5	14.7	14.7	61.25%
Ondo 132kV	21	23	22.5	23	47.92%
	709.4	728	774.65	925.4	69.02%

- Benin Disco asserted that Benin, Asaba, Ihovbor and Effurun are overloaded. TCN agreed that they might be overloaded at certain period, but on the average they are not fully utilized on the average.
- Benin Disco complained that a lot of its 33kV feeders are pegged by TCN relays, making it impossible to add extra load to them when they lose other feeders that are on the same transformers with them.

5.4.3 Benin Disco PIP

The approved NERC's Benin Disco PIP energy trajectory is shown in Table 5-10

Table 5-10: Benin Disco PIP energy growth submission

Disco	Current Energy Delivered (MWh/h)	PIP Year 1 Target (MWh/h)	PIP Year 2 Target (MWh/h)	PIP Year 3 Target (MWh/h)	PIP Year 4 Target (MWh/h)	PIP Year 5 Target (MWh/h)	Service Improvement Target (MWh/h)
Benin	162.44	205.98	249.52	293.06	336.60	380.14	217.69

As requested by the TCN committee, Benin Disco broke down the energy growth by Substations as shown in Table 5-11. However, TCN pointed out to Benin Disco that the broken down projections do not tally with what the Disco submitted to NERC. And also the baseline used does not correspond to actual Data. Benin Disco agreed to look at the data again and resend.

Table 5-11: Benin PIP energy growth submission broken down by feeders

					YEAR -1 : 7.5%			YEAR -2 : 5.5%			YEAR -3 : 5.5%			YEAR -4 : 5.5%			YEAR -5 : 7.5%		
STATION	ASSOCIATED 33KV FEEDER	baseline Min Load (MW)	Baseline Av. Load (MW)	Baseline Max Load (MW)	PIP Year 1 Average (MW)	PIP Year 1 Off-Peak (MW)	PIP Year 1 Peak (MW)	PIP Year 2 Average (MW)	PIP Year 2 Off-Peak (MW)	PIP Year 2 Peak (MW)	PIP Year 3 Average (MW)	PIP Year 3 Off-Peak (MW)	PIP Year 3 Peak (MW)	PIP Year 4 Average (MW)	PIP Year 4 Off-Peak (MW)	PIP Year 4 Peak (MW)	PIP Year 5 Average (MW)	PIP Year 5 Off-Peak (MW)	PIP Year 5 Peak (MW)
Okpella 132kV	33KV AUCHI FDR	2.00	4.13	6.80	2.15	4.43	7.31	2.27	4.68	7.71	2.39	4.94	8.14	2.52	5.21	8.58	2.71	5.60	9.23
Okpella 132kV	CEMENT FACTORY FDR	1.80	2.21	3.00	1.94	2.37	3.23	2.04	2.50	3.40	2.15	2.64	3.59	2.27	2.79	3.79	2.44	3.00	4.07
Okpella 132kV	OKPELLA TOWN FDR	6.80	8.09	10.00	7.31	8.70	10.75	7.71	9.18	11.34	8.14	9.68	11.97	8.58	10.21	12.62	9.23	10.98	13.57
Benin 132kV	SW/STATION	7.00	13.39	19.80	7.53	14.39	21.29	7.94	15.18	22.46	8.38	16.02	23.69	8.84	16.90	24.99	9.50	18.16	26.87
Benin 132kV	GUINNESS	3.90	4.30	4.60	4.19	4.62	4.95	4.42	4.87	5.22	4.67	5.14	5.50	4.92	5.42	5.81	5.29	5.83	6.24
Benin 132kV	XING 1	21.00	23.61	26.20	22.58	25.38	28.17	23.82	26.77	29.71	25.13	28.25	31.35	26.51	29.80	33.07	28.50	32.04	35.55
Benin 132kV	XING 2	23.20	26.08	28.90	24.94	28.04	31.07	26.31	29.58	32.78	27.76	31.21	34.58	29.29	32.93	36.48	31.48	35.39	39.22
Benin 132kV	NEKPENEKPEN	13.35	14.99	16.80	14.35	16.12	18.06	15.14	17.00	19.05	15.97	17.94	20.10	16.85	18.92	21.21	18.12	20.34	22.80
Benin 132kV	KOKO	14.70	16.68	19.50	15.80	17.93	20.96	16.67	18.92	22.12	17.59	19.96	23.33	18.56	21.06	24.62	19.95	22.64	26.46
Benin 132kV	GRA	18.55	20.46	22.80	19.94	21.99	24.51	21.04	23.20	25.86	22.20	24.48	27.28	23.42	25.82	28.78	25.17	27.76	30.94
Benin 132kV	ETETE	18.30	20.08	20.95	19.67	21.59	22.52	20.75	22.77	23.76	21.90	24.02	25.07	23.10	25.35	26.45	24.83	27.25	28.43
Etsako 132kV	AGBEDE	13.20	14.26	15.30	14.19	15.33	16.45	14.97	16.17	17.35	15.79	17.06	18.31	16.66	18.00	19.31	17.91	19.35	20.76
Etsako 132kV	AGOR	11.50	13.83	16.20	12.36	14.87	17.42	13.04	15.69	18.37	13.76	16.55	19.38	14.52	17.46	20.45	15.61	18.77	21.98
Irrua 132kV	AGENEBODE	0.20	2.24	4.90	0.22	2.41	5.27	0.23	2.54	5.56	0.24	2.68	5.86	0.25	2.83	6.19	0.27	3.04	6.65
Irrua 132kV	EHOR	10.90	13.40	16.10	11.72	14.41	17.31	12.36	15.20	18.26	13.04	16.03	19.26	13.76	16.91	20.32	14.79	18.18	21.85
Irrua 132kV	UZEBBA	6.90	8.26	9.90	7.42	8.88	10.64	7.83	9.37	11.23	8.26	9.88	11.85	8.71	10.42	12.50	9.36	11.21	13.43
Irrua 132kV	AGBOR	2.90	4.68	6.20	3.12	5.03	6.67	3.29	5.31	7.03	3.47	5.60	7.42	3.66	5.91	7.83	3.94	6.36	8.41
Irrua 132kV	UBIAJA	6.70	8.39	10.80	7.20	9.02	11.61	7.60	9.52	12.25	8.02	10.04	12.92	8.46	10.59	13.63	9.09	11.39	14.66
Oghara 132kV	OGHARA TOWN	9.30	10.80	12.10	10.00	11.61	13.01	10.55	12.25	13.72	11.13	12.92	14.48	11.74	13.63	15.27	12.62	14.66	16.42
Oghara 132kV	TEACHING HOSPITAL	0.30	1.05	3.20	0.32	1.13	3.44	0.34	1.19	3.63	0.36	1.26	3.83	0.38	1.33	4.04	0.41	1.42	4.34
Ihovbor 132kV	EGBA	21.20	22.21	23.30	22.79	23.87	25.05	24.04	25.19	26.43	25.37	26.57	27.88	26.76	28.03	29.41	28.77	30.14	31.62
Ihovbor 132kV	OLUKU	14.60	16.34	18.00	15.70	17.57	19.35	16.56	18.53	20.41	17.47	19.55	21.54	18.43	20.63	22.72	19.81	22.18	24.43
Ihovbor 132kV	IHOVBOR	15.90	18.39	21.20	17.09	19.77	22.79	18.03	20.86	24.04	19.02	22.01	25.37	20.07	23.22	26.76	21.58	24.96	28.77
Ihovbor 132kV	UNIBEN	13.40	17.90	19.90	14.41	19.24	21.39	15.20	20.30	22.57	16.03	21.42	23.81	16.91	22.60	25.12	18.18	24.29	27.00
Okada 132kV	OKADA	2.30	3.13	6.00	2.47	3.37	6.45	2.61	3.55	6.80	2.75	3.75	7.18	2.90	3.96	7.57	3.12	4.25	8.14
Okada 132kV	EXPRESS	3.80	5.11	6.90	4.09	5.49	7.42	4.31	5.79	7.83	4.55	6.11	8.26	4.80	6.45	8.71	5.16	6.93	9.36
Afiesere 132kV	AFIESERE TOWN	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Delta 132kV	AGBARHO/EKU	17.90	19.25	21.40	19.24	20.69	23.01	20.30	21.83	24.27	21.42	23.03	25.61	22.60	24.30	27.01	24.29	26.12	29.04
Delta 132kV	OTOVWODO/PATANI	20.40	21.33	23.10	21.93	22.92	24.83	23.14	24.19	26.20	24.41	25.52	27.64	25.75	26.92	29.16	27.68	28.94	31.35
Delta 132kV	UGHELLI/SHELL	6.80	8.86	10.50	7.31	9.52	11.29	7.71	10.05	11.91	8.14	10.60	12.56	8.58	11.18	13.25	9.23	12.02	14.25
Delta 132kV	BETA.GLASS	3.10	3.60	3.90	3.33	3.87	4.19	3.52	4.08	4.42	3.71	4.31	4.67	3.91	4.54	4.92	4.21	4.89	5.29
Delta 132kV	ALADJA	22.50	23.90	25.90	24.19	25.69	27.84	25.52	27.11	29.37	26.92	28.60	30.99	28.40	30.17	32.69	30.53	32.43	35.15
Delta 132kV	ISOKO/KWALE	11.10	15.59	17.60	11.93	16.76	18.92	12.59	17.68	19.96	13.28	18.66	21.06	14.01	19.68	22.22	15.06	21.16	23.88
Akure 132kV	OWENA 33kV	7.00	9.44	11.00	7.53	10.15	11.83	7.94	10.71	12.48	8.38	11.30	13.16	8.84	11.92	13.89	9.50	12.81	14.93
Akure 132kV	AKURE MAIN 33KV	10.00	11.83	14.60	10.75	12.71	15.70	11.34	13.41	16.56	11.97	14.15	17.47	12.62	14.93	18.43	13.57	16.05	19.81
Akure 132kV	IJU 33kV	8.00	9.00	12.00	8.60	9.68	12.90	9.07	10.21	13.61	9.57	10.77	14.36	10.10	11.36	15.15	10.86	12.21	16.28
Akure 132kV	OWO 33kV	10.00	11.17	13.00	10.75	12.00	13.98	11.34	12.66	14.74	11.97	13.36	15.55	12.62	14.10	16.41	13.57	15.15	17.64
Akure 132kV	ELIZADE 33KV	1.40	1.79	3.20	1.51	1.93	3.44	1.59	2.03	3.63	1.68	2.14	3.83	1.77	2.26	4.04	1.90	2.43	4.34
Akure 132kV	FUTA	1.00	2.07	4.00	1.08	2.23	4.30	1.13	2.35	4.54	1.20	2.48	4.79	1.26	2.62	5.05	1.36	2.81	5.43
Akure 132kV	IGBARA-OKE 33KV	7.00	8.17	10.00	7.53	8.78	10.75	7.94	9.26	11.34	8.38	9.77	11.97	8.84	10.31	12.62	9.50	11.08	13.57
Akure 132kV	OBA-ILE 33kV	12.50	13.54	14.50	13.44	14.56	15.59	14.18	15.36	16.44	14.96	16.20	17.35	15.78	17.09	18.30	16.96	18.38	19.68
Ondo 132kV	OKITIPUPA 33kV	6.00	9.25	12.00	6.45	9.94	12.90	6.80	10.49	13.61	7.18	11.07	14.36	7.57	11.68	15.15	8.14	12.55	16.28
Ondo 132kV	ONDO TOWNSHIP 33KV	14.50	16.92	18.00	15.59	18.19	19.35	16.44	19.19	20.41	17.35	20.24	21.54	18.30	21.35	22.72	19.68	22.96	24.43
Amukpe 132kV	ADEJE	2.10	3.52	5.40	2.26	3.78	5.81	2.38	3.99	6.12	2.51	4.21	6.46	2.65	4.44	6.82	2.85	4.77	7.33
Amukpe 132kV	INDUSTRIAL	8.80	10.77	13.20	9.46	11.57	14.19	9.98	12.21	14.97	10.53	12.88	15.79	11.11	13.59	16.66	11.94	14.61	17.91
Amukpe 132kV	ABRAKA	12.50	13.06	13.70	13.44	14.04	14.73	14.18	14.82	15.54	14.96	15.63	16.39	15.78	16.49	17.29	16.96	17.73	18.59
Amukpe 132kV	MOSOGAR	11.90	14.01	15.80	12.79	15.06	16.99	13.50	15.89	17.92	14.24	16.76	18.90	15.02	17.68	19.94	16.15	19.01	21.44
Amukpe 132kV	SAPELE	12.40	13.85	15.00	13.33	14.89	16.13	14.06	15.70	17.01	14.84	16.57	17.95	15.65	17.48	18.93	16.83	18.79	20.35
Effurun 132kV	EFFURUN	11.30	12.58	14.20	12.15	13.53	15.27	12.82	14.27	16.10	13.52	15.06	16.99	14.26	15.88	17.92	15.33	17.08	19.27
Effurun 132kV	ENERHEN	13.80	14.86	17.20	14.84	15.97	18.49	15.65	16.85	19.51	16.51	17.78	20.58	17.42	18.76	21.71	18.73	20.16	23.34
Effurun 132kV	PTI	0.70	1.64	3.60	0.75	1.76	3.87	0.79	1.86	4.08	0.84	1.96	4.31	0.88	2.07	4.54	0.95	2.23	4.89
Effurun 132kV	SAPELE	8.40	10.59	12.40	9.03	11.39	13.33	9.53	12.01	14.06	10.05	12.67	14.84	10.60	13.37	15.65	11.40	14.37	16.83
Effurun 132kV	REFINERY 1	11.00	14.95	16.50	11.83	16.07	17.74	12.48	16.96	18.71	13.16	17.89	19.74	13.89	18.87	20.83	14.93	20.29	22.39
Effurun 132kV	REFINERY 2	15.20	17.73	19.60	16.34	19.06	21.07	17.24	20.11	22.23	18.19	21.22	23.45	19.19	22.38	24.74	20.63	24.06	26.60
Effurun 132kV	WARRI	13.30	14.67	16.60	14.30	15.77	17.85	15.08	16.63	18.83	15.91	17.55	19.86	16.79	18.51	20.95	18.05	19.90	22.53
Agbor 132kV	FEEDER 6	16.40	18.67	20.80	17.63	20.07	22.36	18.60	21.17	23.59	19.62	22.33	24.89	20.70	23.56	26.26	22.25	25.33	28.23
Asaba 132kV	GSM	14.40	18.06	19.60	15.48	19.41	21.07	16.33	20.48	22.23	17.23	21.61	23.45	18.18	22.80	24.74	19.54	24.50	26.60
Asaba 132kV	ISSELE-UKU	10.50	11.54	12.90	11.29	12.41	13.87	11.91	13.09	14.63	12.56	13.81	15.43	13.25	14.57	16.28	14.25	15.66	17.51
Asaba 132kV	OGWASHI-UKU	7.20	8.79	11.30	7.74	9.45	12.15	8.17	9.97	12.82	8.61	10.52	13.52	9.09	11.10	14.26	9.77	11.93	15.33
Asaba 132kV	HEAD BRIDGE	14.40	17.24	19.00	15.48	18.53	20.43	16.33	19.55	21.55	17.23	20.62	22.73	18.18	21.76	23.98	19.54	23.39	25.78
Asaba 132kV	TOWNSHIP	16.40	19.61	22.30	17.63	21.08	23.97	18.60	22.24	25.29	19.62	23.46	26.68	20.70	24.75	28.15	22.25	26.61	30.26
Asaba 132kV	EASTERN METAL	10.50	15.11	17.70	11.29	16.24	19.03	11.91	17.13	20.07	12.56	18.08	21.18	13.25	19.07	22.34	14.25	20.50	24.02
Omu-Aran 132kV	OTUN	7.00	**9.00**	**10.00**	7.53	9.68	10.75	7.94	10.21	11.34	8.38	10.77	11.97	8.84	11.36	12.62	9.50	12.21	13.57
Ado Ekiti 132kV	IKERE EKITI 33kV	8.30	9.91	12.00	8.92	10.65	12.90	9.41	11.24	13.61	9.93	11.86	14.36	10.48	12.51	15.15	11.26	13.45	16.28
Ado Ekiti 132kV	ADO TOWNSHIP 33kV	10.00	12.46	14.70	10.75	13.39	15.80	11.34	14.13	16.67	11.97	14.91	17.59	12.62	15.73	18.56	13.57	16.91	19.95
Ado Ekiti 132kV	ABUAD	0.20	1.67	4.00	0.22	1.80	4.30	0.23	1.90	4.54	0.24	2.00	4.79	0.25	2.11	5.05	0.27	2.27	5.43
Ado Ekiti 132kV	IWOROKO 33kV	8.50	9.28	10.20	9.14	9.98	10.97	9.64	10.53	11.57	10.17	11.11	12.20	10.73	11.72	12.88	11.53	12.60	13.84
Ado Ekiti 132kV	ILAWE 33kV	5.20	7.90	10.10	5.59	8.49	10.86	5.90	8.96	11.45	6.22	9.45	12.08	6.56	9.97	12.75	7.06	10.72	13.71
OKENE 132KV	**OSOSO**	5.00	6.00	10.00	5.38	6.45	10.75	5.67	6.80	11.34	5.98	7.18	11.97	6.31	7.57	12.62	6.78	8.14	13.57
OKENE 132KV	**IKARE**	6.00	8.00	10.00	6.45	8.60	10.75	6.80	9.07	11.34	7.18	9.57	11.97	7.57	10.10	12.62	8.14	10.86	13.57

5.4.4 Discussions

- Benin Disco said they will look at their disaggregated five years projection and make it more realistic.
- Benin Disco will make its other requests known.

5.5 Eko Electricity Distribution Company

5.5.1 Introduction

The Committee on TCN Performance Improvement Plan (PIP) met with Eko Electricity Distribution Company on Monday, November 29th , 2021 . The list of the attendees is given in Table 5-12.

Table 5-12: List of Attendees of Meeting with Eko Disco on PIP

S/NO	NAME	ORGANIZATION	E-MAIL
1	Engr. Adesanya A. B	TCN	abaadesanya@yahoo.co.uk
2	Engr. Abutu E.	TCN	abutuson45@gmail.com
3	Engr. Hampashi Eric	TCN	erichampashi@yahoo.com
4	Engr. B. Abdulmumin	TCN	faabideen@gmail.com
5	Engr. A. G. Adamu	TCN	engrbaffa@yahoo.com
6	Engr. Usaini Lawan	TCN	usainilawan@gmail.com
7	Engr. Dahiru A. D.	TCN	istahir@yahoo.com
8	Engr. G. O Nwokoye	TCN	nwokoyego@gmail.com
9	Engr. Seun Amoda	TCN	oamoda@gmail.com
10	Engr. Francis Agoha	Eko Disco	francis.agoha@ekedp.com
11	Engr. Saadu Kamaldeen	Eko Disco	kamaldeen.saadu@ekedp.com
12	Engr. Henry Ukon	Eko Disco	henry.ukon@ekedp.com
13	Engr.Okusaga I. Kasim	Eko Disco	idowu.okusaga@ekedp.com
14	Engr. Nosa Igbinedion	Eko Disco	nosa.igbinedion@ekedp.com
15	Engr. Michael Uvere	Eko Disco	michael.uvere@ekedp.com

TCN gave a presentation that highlighted the following:

5.5.2 TCN Substations in Eko Disco and the utilizations of the substations.

That there are 14 TCN substations in Eko Disco franchise area where Eko Disco gets power from TCN network and the substations are listed in Table 5-13.

Table 5-13: Substations in Eko Disco Franchise Area

REGION	DISCO	STATION	Capacity (MVA)	330 KV 1	330 KV 2	330 KV 3
LAGOS	Eko	Agbara 132kV	150	Akangba 330kV	Ikeja West 330KV	
LAGOS	Eko	Aja 132kV	280	Ajah 330kV		
LAGOS	Eko	Akangba 132kV	360	Akangba 330kV	Alagbon 330kV	Ajah 330kV
LAGOS	Eko	Akoka 132kV	85	Alagbon 330kV	Akangba 330kV	Ikeja West 330KV
LAGOS	Eko	Alagbon 132kV	340	Alagbon 330kV	Akangba 330kV	Ikeja West 330KV
LAGOS	Eko	Amuwo-Odofin	100	Akangba 330kV	Ikeja West 330KV	
LAGOS	Eko	Apapa-Road	60	Akangba 330kV	Ikeja West 330KV	
LAGOS	Eko	Ejigbo 132kV	40	Ikeja West 330KV		
LAGOS	Eko	Ijora 132kV	135	Akangba 330kV	Alagbon 330kV	Ikeja West 330KV
LAGOS	Eko	Ilashe-Island	30	Akangba 330kV	Ikeja West 330KV	
LAGOS	Eko	Isolo 132kV	45	Ikeja West 330KV		
LAGOS	Eko	Itire 132kV	30	Ikeja West 330KV		
LAGOS	Eko	Lekki 132kV	120	Lekki 330kV		
LAGOS	Eko	Ojo 132kV	120	Akangba 330kV	Ikeja West 330KV	
			1895			

Table 5-14 and Table 5-15 show the utilization factors of the 14 substations in Eko Disco. TCN asserted to Eko Disco that the 14 substations are grossly underutilized as shown in Table 5-14 and Table 5-15.

Table 5-14: Utilization Factors of Substations in Eko Disco Franchise Area

STATION	Jan-21	Feb-21	Mar-21	Apr-21	May-21	Jun-21	Jul-21	Aug-21	%
Agbara 132kV	32	27	25	23	26	28	33	33	22.09%
Aja 132kV	77	73	60	64	61	51	56	67	27.58%
Akangba 132kV	59	62	58	51	48	49	53	51	17.31%
Akoka 132kV	23	22	20	19	19	16	15	17	27.44%
Alagbon 132kV	84	86	77	71	71	67	64	71	25.36%
Amuwo-Odofin	32	34	29	27	25	23	28	28	33.64%
Apapa-Road	23	24	23	22	19	19	18	18	40.12%
Ejigbo 132kV	0	0	0	0	0	0	0	0	0.00%
Ijora 132kV	33	33	31	26	28	25	27	29	24.57%
Ilashe-Island	0	0	0	0	0	0	0	0	0.00%
Isolo 132kV	12	12	12	10	11	10	10	11	27.48%
Itire 132kV	7	7	6	4	5	5	5	5	23.50%
Lekki 132kV	60	61	53	57	55	45	45	50	50.58%
Ojo 132kV	34	35	31	30	35	31	31	34	29.56%
	475	478	426	404	402	368	385	414	25.21%

Table 5-15: Utilization Factors of Substations in Eko Disco Franchise Area

STATION	Max Jan -21	Max Feb-21	Max Mar-21	Max of Max	% Utilization
Agbara 132kV	58	60	60	60	40%
Aja 132kV	126	115	120	126	45%
Akangba 132kV	88	87	89	89	25%
Akoka 132kV	31	33	34	34	40%
Alagbon 132kV	121	132	136	136	40%
Amuwo-Odofin	47	49	47	49	49%
Apapa-Road	38	37	38	38	63%
Ejigbo 132kV	0	0	0	0	0%
Ijora 132kV	55	59	55	59	44%
Ilashe-Island	0	0	0	0	0%
Isolo 132kV	24	18	18	24	53%
Itire 132kV	10	10	10	10	32%
Lekki 132kV	85	85	86	86	72%
Ojo 132kV	59	56	55	59	49%
	742	742	748	770	41%

- Eko Disco claimed that some of the stations are grossly underutilized because TCN has not provided adequate accessories to connect to the transformers. A case of Ogba TS was mentioned. Eko Disco said they have made a request of TCN to expand the bay.
- TCN also told Eko Disco to carry out vegetation management in some places so as to increase the uptime of feeders and improve utilization.

5.5.3 Eko Disco PIP

The approved NERC's Eko Disco PIP energy trajectory is shown in Table 5-16.

Table 5-16: Eko Disco PIP energy growth submission

Disco	Current Energy Delivered (MWh/h)	PIP Year 1 Target (MWh/h)	PIP Year 2 Target (MWh/h)	PIP Year 3 Target (MWh/h)	PIP Year 4 Target (MWh/h)	PIP Year 5 Target (MWh/h)	Service Improvement Target (MWh/h)
Eko	440.07	541.80	643.54	745.27	847.01	948.74	508.68

As requested by the TCN committee, Eko Disco broke down the energy growth by Substations as shown in Table 5-17 and Table 5-18. However, TCN pointed out to Eko Disco that the broken down projections do not tally with what the Disco submitted to NERC.

Eko Disco responded by saying estimation and projection are dynamic and change to reflect new realities.

Table 5-17: Eko PIP energy growth submission broken down by substation

STATION	PIP Year 1 Average (MW)	PIP Year 1 Off-Peak (MW)	PIP Year 1 Peak (MW)	PIP Year 2 Average (MW)	PIP Year 2 Off-Peak (MW)	PIP Year 2 Peak (MW)	PIP Year 3 Average (MW)	PIP Year 3 Off-Peak (MW)	PIP Year 3 Peak (MW)	PIP Year 4 Average (MW)	PIP Year 4 Off-Peak (MW)	PIP Year 4 Peak (MW)	PIP Year 5 Average (MW)	PIP Year 5 Off-Peak (MW)	PIP Year 5 Peak (MW)
Aja 132kV	97	141	146	100	145	150	100	146	151	101	148	153	94	118	123
Akoka 132kV	19	27	42	19	28	43	19	28	44	20	29	44	20	29	45
Alagbon 132kV	108	194	227	112	200	233	113	202	236	114	204	238	115	206	240
Amuwo-Odofin 132kV	35	54	54	36	56	56	37	56	56	37	57	57	37	57	57
Apapa-Road 132kV	24	37	38	25	38	39	25	38	40	25	39	40	25	39	40
Lekki 132kV	84	117	119	87	120	123	88	121	124	89	122	125	90	123	126
Akangba 132kV	64	117	127	66	121	130	67	122	132	67	123	133	68	124	134
Ijora 132kV	33	69	90	34	71	93	35	71	94	35	72	95	35	73	96
Ilashe-Island 132kV	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Isolo 132kV	11	17	18	11	17	19	11	17	19	11	17	10	6	9	10
Itire 132kV	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Ojo 132kV	38	62	65	39	64	67	39	64	67	40	65	68	40	66	69
Agbara 132kV	49	72	89	51	74	92	51	75	93	52	75	94	52	76	95
Grand Total	**562**	**906**	**1,015**	**579**	**933**	**1,045**	**585**	**943**	**1,055**	**590**	**952**	**1,056**	**582**	**922**	**1,035**

Table 5-18: Eko PIP energy growth submission broken down by feeders

					YEAR -1 : 7.5%			YEAR -2 : 5.5%			YEAR -3 : 5.5%			YEAR -4 : 5.5%			YEAR -5 : 7.5%		
STATION	ASSOCIATED 33KV FEEDER	baseline Min Load (MW)	Baseline Av. Load (MW)	Baseline Max Load (MW)	PIP Year 1 Average (MW)	PIP Year 1 Off-Peak (MW)	PIP Year 1 Peak (MW)	PIP Year 2 Average (MW)	PIP Year 2 Off-Peak (MW)	PIP Year 2 Peak (MW)	PIP Year 3 Average (MW)	PIP Year 3 Off-Peak (MW)	PIP Year 3 Peak (MW)	PIP Year 4 Average (MW)	PIP Year 4 Off-Peak (MW)	PIP Year 4 Peak (MW)	PIP Year 5 Average (MW)	PIP Year 5 Off-Peak (MW)	PIP Year 5 Peak (MW)
Okpella 132kV	33KV AUCHI FDR	2.00	4.13	6.80	2.15	4.43	7.31	2.27	4.68	7.71	2.39	4.94	8.14	2.52	5.21	8.58	2.71	5.60	9.23
Okpella 132kV	CEMENT FACTORY FDR	1.80	2.21	3.00	1.94	2.37	3.23	2.04	2.50	3.40	2.15	2.64	3.59	2.27	2.79	3.79	2.44	3.00	4.07
Okpella 132kV	OKPELLA TOWN FDR	6.80	8.09	10.00	7.31	8.70	10.75	7.71	9.18	11.34	8.14	9.68	11.97	8.58	10.21	12.62	9.23	10.98	13.57
Benin 132kV	SW/STATION	7.00	13.39	19.80	7.53	14.39	21.29	7.94	15.18	22.46	8.38	16.02	23.69	8.84	16.90	24.99	9.50	18.16	26.87
Benin 132kV	GUINNESS	3.90	4.30	4.60	4.19	4.62	4.95	4.42	4.87	5.22	4.67	5.14	5.50	4.92	5.42	5.81	5.29	5.83	6.24
Benin 132kV	XING 1	21.00	23.61	26.20	22.58	25.38	28.17	23.82	26.77	29.71	25.13	28.25	31.35	26.51	29.80	33.07	28.50	32.04	35.55
Benin 132kV	XING 2	23.20	26.08	28.90	24.94	28.04	31.07	26.31	29.58	32.78	27.76	31.21	34.58	29.29	32.93	36.48	31.48	35.39	39.22
Benin 132kV	NEKPENEKPEN	13.35	14.99	16.80	14.35	16.12	18.06	15.14	17.00	19.05	15.97	17.94	20.10	16.85	18.92	21.21	18.12	20.34	22.80
Benin 132kV	KOKO	14.70	16.68	19.50	15.80	17.93	20.96	16.67	18.92	22.12	17.59	19.96	23.33	18.56	21.06	24.62	19.95	22.64	26.46
Benin 132kV	GRA	18.55	20.46	22.80	19.94	21.99	24.51	21.04	23.20	25.86	22.20	24.48	27.28	23.42	25.82	28.78	25.17	27.76	30.94
Benin 132kV	ETETE	18.30	20.08	20.95	19.67	21.59	22.52	20.75	22.77	23.76	21.90	24.02	25.07	23.10	25.35	26.45	24.83	27.25	28.43
Etsako 132kV	AGBEDE	13.20	14.26	15.30	14.19	15.33	16.45	14.97	16.17	17.35	15.79	17.06	18.31	16.66	18.00	19.31	17.91	19.35	20.76
Etsako 132kV	AGOR	11.50	13.83	16.20	12.36	14.87	17.42	13.04	15.69	18.37	13.76	16.55	19.38	14.52	17.46	20.45	15.61	18.77	21.98
Irrua 132kV	AGENEBODE	0.20	2.24	4.90	0.22	2.41	5.27	0.23	2.54	5.56	0.24	2.68	5.86	0.25	2.83	6.19	0.27	3.04	6.65
Irrua 132kV	EHOR	10.90	13.40	16.10	11.72	14.41	17.31	12.36	15.20	18.26	13.04	16.03	19.26	13.76	16.91	20.32	14.79	18.18	21.85
Irrua 132kV	UZEBBA	6.90	8.26	9.90	7.42	8.88	10.64	7.83	9.37	11.23	8.26	9.88	11.85	8.71	10.42	12.50	9.36	11.21	13.43
Irrua 132kV	AGBOR	2.90	4.68	6.20	3.12	5.03	6.67	3.29	5.31	7.03	3.47	5.60	7.42	3.66	5.91	7.83	3.94	6.36	8.41
Irrua 132kV	UBIAJA	6.70	8.39	10.80	7.20	9.02	11.61	7.60	9.52	12.25	8.02	10.04	12.92	8.46	10.59	13.63	9.09	11.39	14.66
Oghara 132kV	OGHARA TOWN	9.30	10.80	12.10	10.00	11.61	13.01	10.55	12.25	13.72	11.13	12.92	14.48	11.74	13.63	15.27	12.62	14.66	16.42
Oghara 132kV	TEACHING HOSPITAL	0.30	1.05	3.20	0.32	1.13	3.44	0.34	1.19	3.63	0.36	1.26	3.83	0.38	1.33	4.04	0.41	1.42	4.34
Ihovbor 132kV	EGBA	21.20	22.21	23.30	22.79	23.87	25.05	24.04	25.19	26.43	25.37	26.57	27.88	26.76	28.03	29.41	28.77	30.14	31.62
Ihovbor 132kV	OLUKU	14.60	16.34	18.00	15.70	17.57	19.35	16.56	18.53	20.41	17.47	19.55	21.54	18.43	20.63	22.72	19.81	22.18	24.43
Ihovbor 132kV	IHOVBOR	15.90	18.39	21.20	17.09	19.77	22.79	18.03	20.86	24.04	19.02	22.01	25.37	20.07	23.22	26.76	21.58	24.96	28.77
Ihovbor 132kV	UNIBEN	13.40	17.90	19.90	14.41	19.24	21.39	15.20	20.30	22.57	16.03	21.42	23.81	16.91	22.60	25.12	18.18	24.29	27.00
Okada 132kV	OKADA	2.30	3.13	6.00	2.47	3.37	6.45	2.61	3.55	6.80	2.75	3.75	7.18	2.90	3.96	7.57	3.12	4.25	8.14
Okada 132kV	EXPRESS	3.80	5.11	6.90	4.09	5.49	7.42	4.31	5.79	7.83	4.55	6.11	8.26	4.80	6.45	8.71	5.16	6.93	9.36
Afiesere 132kV	AFIESERE TOWN	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Delta 132kV	AGBARHO/EKU	17.90	19.25	21.40	19.24	20.69	23.01	20.30	21.83	24.27	21.42	23.03	25.61	22.60	24.30	27.01	24.29	26.12	29.04
Delta 132kV	OTOVWODO/PATANI	20.40	21.33	23.10	21.93	22.92	24.83	23.14	24.19	26.20	24.41	25.52	27.64	25.75	26.92	29.16	27.68	28.94	31.35
Delta 132kV	UGHELLI/SHELL	6.80	8.86	10.50	7.31	9.52	11.29	7.71	10.05	11.91	8.14	10.60	12.56	8.58	11.18	13.25	9.23	12.02	14.25
Delta 132kV	BETA.GLASS	3.10	3.60	3.90	3.33	3.87	4.19	3.52	4.08	4.42	3.71	4.31	4.67	3.91	4.54	4.92	4.21	4.89	5.29
Delta 132kV	ALADJA	22.50	23.90	25.90	24.19	25.69	27.84	25.52	27.11	29.37	26.92	28.60	30.99	28.40	30.17	32.69	30.53	32.43	35.15
Delta 132kV	ISOKO/KWALE	11.10	15.59	17.60	11.93	16.76	18.92	12.59	17.68	19.96	13.28	18.66	21.06	14.01	19.68	22.22	15.06	21.16	23.88
Akure 132kV	OWENA 33kV	7.00	9.44	11.00	7.53	10.15	11.83	7.94	10.71	12.48	8.38	11.30	13.16	8.84	11.92	13.89	9.50	12.81	14.93
Akure 132kV	AKURE MAIN 33KV	10.00	11.83	14.60	10.75	12.71	15.70	11.34	13.41	16.56	11.97	14.15	17.47	12.62	14.93	18.43	13.57	16.05	19.81
Akure 132kV	IJU 33kV	8.00	9.00	12.00	8.60	9.68	12.90	9.07	10.21	13.61	9.57	10.77	14.36	10.10	11.36	15.15	10.86	12.21	16.28
Akure 132kV	OWO 33kV	10.00	11.17	13.00	10.75	12.00	13.98	11.34	12.66	14.74	11.97	13.36	15.55	12.62	14.10	16.41	13.57	15.15	17.64
Akure 132kV	ELIZADE 33KV	1.40	1.79	3.20	1.51	1.93	3.44	1.59	2.03	3.63	1.68	2.14	3.83	1.77	2.26	4.04	1.90	2.43	4.34
Akure 132kV	FUTA	1.00	2.07	4.00	1.08	2.23	4.30	1.13	2.35	4.54	1.20	2.48	4.79	1.26	2.62	5.05	1.36	2.81	5.43
Akure 132kV	IGBARA-OKE 33KV	7.00	8.17	10.00	7.53	8.78	10.75	7.94	9.26	11.34	8.38	9.77	11.97	8.84	10.31	12.62	9.50	11.08	13.57
Akure 132kV	OBA-ILE 33kV	12.50	13.54	14.50	13.44	14.56	15.59	14.18	15.36	16.44	14.96	16.20	17.35	15.78	17.09	18.30	16.96	18.38	19.68
Ondo 132kV	OKITIPUPA 33kV	6.00	9.25	12.00	6.45	9.94	12.90	6.80	10.49	13.61	7.18	11.07	14.36	7.57	11.68	15.15	8.14	12.55	16.28
Ondo 132kV	ONDO TOWNSHIP 33KV	14.50	16.92	18.00	15.59	18.19	19.35	16.44	19.19	20.41	17.35	20.24	21.54	18.30	21.35	22.72	19.68	22.96	24.43
Amukpe 132kV	ADEJE	2.10	3.52	5.40	2.26	3.78	5.81	2.38	3.99	6.12	2.51	4.21	6.46	2.65	4.44	6.82	2.85	4.77	7.33
Amukpe 132kV	INDUSTRIAL	8.80	10.77	13.20	9.46	11.57	14.19	9.98	12.21	14.97	10.53	12.88	15.79	11.11	13.59	16.66	11.94	14.61	17.91
Amukpe 132kV	ABRAKA	12.50	13.06	13.70	13.44	14.04	14.73	14.18	14.82	15.54	14.96	15.63	16.39	15.78	16.49	17.29	16.96	17.73	18.59
Amukpe 132kV	MOSOGAR	11.90	14.01	15.80	12.79	15.06	16.99	13.50	15.89	17.92	14.24	16.76	18.90	15.02	17.68	19.94	16.15	19.01	21.44
Amukpe 132kV	SAPELE	12.40	13.85	15.00	13.33	14.89	16.13	14.06	15.70	17.01	14.84	16.57	17.95	15.65	17.48	18.93	16.83	18.79	20.35
Effurun 132kV	EFFURUN	11.30	12.58	14.20	12.15	13.53	15.27	12.82	14.27	16.10	13.52	15.06	16.99	14.26	15.88	17.92	15.33	17.08	19.27
Effurun 132kV	ENERHEN	13.80	14.86	17.20	14.84	15.97	18.49	15.65	16.85	19.51	16.51	17.78	20.58	17.42	18.76	21.71	18.73	20.16	23.34
Effurun 132kV	PTI	0.70	1.64	3.60	0.75	1.76	3.87	0.79	1.86	4.08	0.84	1.96	4.31	0.88	2.07	4.54	0.95	2.23	4.89
Effurun 132kV	SAPELE	8.40	10.59	12.40	9.03	11.39	13.33	9.53	12.01	14.06	10.05	12.67	14.84	10.60	13.37	15.65	11.40	14.37	16.83
Effurun 132kV	REFINERY 1	11.00	14.95	16.50	11.83	16.07	17.74	12.48	16.96	18.71	13.16	17.89	19.74	13.89	18.87	20.83	14.93	20.29	22.39
Effurun 132kV	REFINERY 2	15.20	17.73	19.60	16.34	19.06	21.07	17.24	20.11	22.23	18.19	21.22	23.45	19.19	22.38	24.74	20.63	24.06	26.60
Effurun 132kV	WARRI	13.30	14.67	16.60	14.30	15.77	17.85	15.08	16.63	18.83	15.91	17.55	19.86	16.79	18.51	20.95	18.05	19.90	22.53
Agbor 132kV	FEEDER 6	16.40	18.67	20.80	17.63	20.07	22.36	18.60	21.17	23.59	19.62	22.33	24.89	20.70	23.56	26.26	22.25	25.33	28.23
Asaba 132kV	GSM	14.40	18.06	19.60	15.48	19.41	21.07	16.33	20.48	22.23	17.23	21.61	23.45	18.18	22.80	24.74	19.54	24.50	26.60
Asaba 132kV	ISSELE-UKU	10.50	11.54	12.90	11.29	12.41	13.87	11.91	13.09	14.63	12.56	13.81	15.43	13.25	14.57	16.28	14.25	15.66	17.51
Asaba 132kV	OGWASHI-UKU	7.20	8.79	11.30	7.74	9.45	12.15	8.17	9.97	12.82	8.61	10.52	13.52	9.09	11.10	14.26	9.77	11.93	15.33
Asaba 132kV	HEAD BRIDGE	14.40	17.24	19.00	15.48	18.53	20.43	16.33	19.55	21.55	17.23	20.62	22.73	18.18	21.76	23.98	19.54	23.39	25.78
Asaba 132kV	TOWNSHIP	16.40	19.61	22.30	17.63	21.08	23.97	18.60	22.24	25.29	19.62	23.46	26.68	20.70	24.75	28.15	22.25	26.61	30.26
Asaba 132kV	EASTERN METAL	10.50	15.11	17.70	11.29	16.24	19.03	11.91	17.13	20.07	12.56	18.08	21.18	13.25	19.07	22.34	14.25	20.50	24.02
Omu-Aran 132kV	OTUN	7.00	**9.00**	**10.00**	7.53	9.68	10.75	7.94	10.21	11.34	8.38	10.77	11.97	8.84	11.36	12.62	9.50	12.21	13.57
Ado Ekiti 132kV	IKERE EKITI 33kV	8.30	9.91	12.00	8.92	10.65	12.90	9.41	11.24	13.61	9.93	11.86	14.36	10.48	12.51	15.15	11.26	13.45	16.28
Ado Ekiti 132kV	ADO TOWNSHIP 33kV	10.00	12.46	14.70	10.75	13.39	15.80	11.34	14.13	16.67	11.97	14.91	17.59	12.62	15.73	18.56	13.57	16.91	19.95
Ado Ekiti 132kV	ABUAD	0.20	1.67	4.00	0.22	1.80	4.30	0.23	1.90	4.54	0.24	2.00	4.79	0.25	2.11	5.05	0.27	2.27	5.43
Ado Ekiti 132kV	IWOROKO 33kV	8.50	9.28	10.20	9.14	9.98	10.97	9.64	10.53	11.57	10.17	11.11	12.20	10.73	11.72	12.88	11.53	12.60	13.84
Ado Ekiti 132kV	ILAWE 33kV	5.20	7.90	10.10	5.59	8.49	10.86	5.90	8.96	11.45	6.22	9.45	12.08	6.56	9.97	12.75	7.06	10.72	13.71
OKENE 132KV	**OSOSO**	5.00	6.00	10.00	5.38	6.45	10.75	5.67	6.80	11.34	5.98	7.18	11.97	6.31	7.57	12.62	6.78	8.14	13.57
OKENE 132KV	**IKARE**	6.00	8.00	10.00	6.45	8.60	10.75	6.80	9.07	11.34	7.18	9.57	11.97	7.57	10.10	12.62	8.14	10.86	13.57

5.5.4 Discussions

- TCN asserted that all its ongoing projects in Eko Disco franchise area suffices to meet the five years plan of Eko Disco.
- TCN asserted that most of the requests of Eko Disco are either in ongoing TCN's project in Eko Disco franchise or are not needed
- TCN and Eko both discussed and agreed that transformational capacities are not necessarily the problem; but a lot of problems are from switchgear components and other accessories.
- TCN also advised that Eko Disco should reconfigure some of their feeders within the same station connected to overloaded transformer to a lightly loaded transformer.
- TCN asserted that in some cases Eko Discos can move feeders from one TCN substation that is overloaded to a nearby TCN substation that is underloaded. Like in the case of Itire and Isolo.

5.6 Enugu Electricity Distribution Company

5.6.1 Introduction

The Committee on TCN Performance Improvement Plan (PIP) met with Enugu Electricity Distribution Company on Thursday, February 10th, 2022 (via google meet). The list of the attendees is given in Table 5-19.

Table 5-19: List of Attendees of Meeting with Enugu Disco on PIP

S/NO	NAME	ORGANIZATION	E-MAIL
1	Engr. Adesanya A. B	TCN	Abaadesanya@yahoo.co.uk
2	Engr. Abutu E.	TCN	Abutuson45@gmail.com
3	Engr. Hampashi Eric	TCN	Erichampashi@yahoo.com
4	Engr. B. Abdulmumin	TCN	Faabideen@gmail.com
5	Engr. A. G. Adamu	TCN	Engrbaffa@yahoo.com
6	Engr. Seun Amoda	TCN	oamoda@gmail.com
7	Engr. Praveen Chorghade	Enugu Disco	pchorghade@enugudisco.com
8	Uche Onuka Okala	Enugu Disco	ouche@enugudisco.com

TCN gave a presentation that highlighted the following:

5.6.2 TCN Substations in Enugu Discos and the utilizations of the substations.

That there are 14 TCN substations in Enugu Disco franchise area where Enugu Disco gets power from TCN network, and the substations are listed in

.

Table 5-20: Substations in Enugu Disco Franchise Area

REGION	DISCO	STATION	Capacity (MVA)	330 KV 1	330 KV 2	330 KV 3
PORT-	Enugu	Aba Town 132kV	187.5	Alaoji 330kV	Adiabor 330kV	
ENUGU	Enugu	Abakaliki 132kV	90	New-Haven 330kV		
ENUGU	Enugu	Agu Awka 132kV	40	New-Haven 330kV	Onitsha 330kV	
ENUGU	Enugu	GCM 132kV	60	Onitsha 330kV		
PORT-	Enugu	Itu 132kV	60	Alaoji 330kV	Adiabor 330kV	
ENUGU	Enugu	New-Haven	360	New-Haven 330kV	Onitsha 330kV	Makurdi 330kV
ENUGU	Enugu	Nibo Awka	90	New-Haven 330kV	Onitsha 330kV	
ENUGU	Enugu	Nkalagu 132kV	30	New-Haven 330kV		
ENUGU	Enugu	Oji River 132kV	30	New-Haven 330kV	Onitsha 330kV	
ENUGU	Enugu	Onitsha 132kV	200	Onitsha 330kV	New-Haven 330kV	
PORT-	Enugu	Owerri 132kV	160	Alaoji 330kV		
ENUGU	Enugu	Ugwuaji 132kV	60	Ugwuaji 330kV		
PORT-	Enugu	Umuahia 132kV	120	Alaoji 330kV		
ENUGU	Enugu	UNN Nsukka	30	New-Haven 330kV	Onitsha 330kV	
			1517.5			

Table 5-21 and Table 5-22 show the utilization factors of the 14 substations in Enugu Discos. TCN asserted to Enugu Disco that the 14 substations are grossly underutilized as shown in Table 5-21 and Table 5-22.

Table 5-21: Utilization Factors of Substations in Enugu Disco Franchise Area

STATION	Capacity (MVA)	Jan-21	Feb-21	Mar-21	Apr-21	May-21	Jun-21	Jul-21	Aug-21	%
Aba Town 132kV	187.5	47.67	49.53	42.89	41.58	39.16	39.38	39.59	35.59	33.02%
Abakaliki 132kV	90	20.56	21.57	18.20	16.16	14.74	13.20	15.34	14.75	29.96%
Agu Awka 132kV	40	14.49	14.64	14.24	12.83	13.05	10.66	12.31	12.39	45.75%
GCM 132kV	60	14.70	16.68	16.90	16.25	15.71	15.22	15.33	15.47	35.21%
Itu 132kV	60	2.75	2.42	0.73	1.42	0.84	0.85	1.10	0.95	5.72%
New-Haven 132kV	360	65.02	68.48	66.96	62.77	60.31	54.45	54.71	55.35	23.78%
Nibo Awka 132kV	90	15.70	19.46	17.04	14.06	15.33	12.57	13.61	14.15	27.03%
Nkalagu 132kV	30	2.55	2.39	1.15	1.14	1.26	0.78	1.33	1.00	10.62%
Oji River 132kV	30	6.63	5.04	4.53	3.90	2.50	3.18	4.09	3.43	27.64%
Onitsha 132kV	200	72.52	69.29	63.39	57.82	58.71	57.44	61.98	57.17	45.33%
Owerri 132kV	160	54.86	57.00	49.20	45.79	43.46	43.78	49.05	48.08	44.53%
Ugwuaji 132kV	60	3.57	2.77	2.50	2.88	2.91	2.78	3.10	4.17	8.68%
Umuahia 132kV	120	27.43	25.86	20.45	20.05	19.46	18.17	19.66	19.20	28.57%
UNN Nsukka	30	11.13	11.05	10.48	9.30	9.20	9.41	10.89	10.05	46.36%
	1517.5	359.56	366.19	328.66	305.95	296.66	281.87	302.09	291.73	30.16%

Table 5-22: Utilization Factors of Substations in Enugu Disco Franchise Area

STATION	Max Jan-21	Max Feb-21	Max Mar-21	Max of Max	% Utilization
Aba Town 132kV	88.6	88.7	92.2	92	61.47%
Abakaliki 132kV	45	45.33	46.75	47	64.93%
Agu Awka 132kV	35.5	95.7	40.1	96	299.06%
GCM 132kV	27.2	26.1	27.1	27	56.67%
Itu 132kV	8.8	7.9	4.2	9	18.33%
New-Haven 132kV	107.15	115.15	137.55	138	47.76%
Nibo Awka 132kV	48.5	37.7	57.3	57	79.58%
Nkalagu 132kV	9.5	8.8	4.6	10	39.58%
Oji River 132kV	25	12.5	25.3	25	105.42%
Onitsha 132kV	117.2	116.4	111.4	117	73.25%
Owerri 132kV	105.1	107.6	102.3	108	84.06%
Ugwuaji 132kV	12.01	8.01	8.71	12	25.02%
Umuahia 132kV	55.31	51.31	48.31	55	57.61%
UNN Nsukka 132kV	19.25	18	17.94	19	80.21%
	704	739	724	812	66.86%

5.6.3 ENUGU PIP

The approved NERC's Enugu PIP energy trajectory is shown in Table 5-23.

Table 5-23: Enugu PIP energy growth submission

Disco	Current Energy Delivered (MWh/h)	PIP Year 1 Target (MWh/h)	PIP Year 2 Target (MWh/h)	PIP Year 3 Target (MWh/h)	PIP Year 4 Target (MWh/h)	PIP Year 5 Target (MWh/h)	Service Improvement Target (MWh/h)
Enugu	259.02	337.92	416.83	495.73	574.63	653.54	394.52

Enugu Disco did not disaggregate the forecast by substations.

5.6.4 Discussions

- Enugu said that they will add their requests and issues pending to this minute once they get it.

5.7 Ibadan Electricity Distribution Company

5.7.1 Introduction

The Committee on TCN Performance Improvement Plan (PIP) met with Ibadan Electricity Distribution Company on Tuesday, February 15th, 2022 (via "Google Meet"). The list of the attendees is given in Table 5-24.

Table 5-24: List of Attendees of Meeting with Ibadan Disco on PIP

S/NO	NAME	ORGANIZATION	E-MAIL
1	Engr. Kabiru Adamu	TCN	kabirua2002@yahoo.com
2	Engr. Adesanya A. B	TCN	Abaadesanya@yahoo.co.uk
3	Engr. Abutu E.	TCN	Abutuson45@gmail.com
4	Engr. Hampashi Eric	TCN	Erichampashi@yahoo.com
5	Engr. B. Abdulmumin	TCN	Faabideen@gmail.com
6	Engr. Seun Amoda	TCN	oamoda@gmail.com
7	Mr. Olawale Aro	Ibadan Disco	olawale.aro@ibedc.com
8	Engr. Akin Abiodun	Ibadan Disco	Akin.Abiodun@ibedc.com
9	Engr. Bimbo Dada	Ibadan Disco	

TCN gave a presentation that highlighted the following:

5.7.2 TCN Substations in Ibadan Disco and the utilizations of the substations.

That there are 23 TCN substations in Ibadan Disco franchise area where Ibadan Disco gets power from TCN network and the substations are listed in Table 5-25. Ibadan Disco agreed that the table is correct.

Table 5-25: Substations in Ibadan Disco Franchise Area

REGION	DISCO	STATION	Capacity (MVA)	330 KV 1	330 KV 2	330 KV 3
LAGOS	Ibadan	Abeokuta 132kV	210	Ikeja West 330KV	Akangba 330kV	
LAGOS	Ibadan	Agbara 132kV	60	Akangba 330kV	Ikeja West 330KV	
OSOGBO	Ibadan	Ayede 132kV	220	Ayede 330kV	Osogbo 330kV	Egbin 330kV
OSOGBO	Ibadan	Ganmo 132kV	120	Ganmo 330kV	Osogbo 330kV	
OSOGBO	Ibadan	Ibadan-North	120	Ayede 330kV	Osogbo 330kV	
OSOGBO	Ibadan	Ijebu-Ode 132kV	60	Ayede 330kV	Egbin 330kV	Ikeja West 330KV
OSOGBO	Ibadan	Ile-Ife 132kV	60	Osogbo 330kV		
OSOGBO	Ibadan	Ilesha 132kV	80	Osogbo 330kV		
OSOGBO	Ibadan	Ilorin 132kV	151	Ganmo 330kV	Osogbo 330kV	
OSOGBO	Ibadan	Iseyin 132kV	45	Ayede 330kV	Osogbo 330kV	
OSOGBO	Ibadan	Iwo 132kV	40	Ayede 330kV	Osogbo 330kV	
SHIRORO	Ibadan	Jebba 132kV	30	Jebba 330kV		
OSOGBO	Ibadan	Jericho 132kV	85	Ayede 330kV		
SHIRORO	Ibadan	Kainji 132kV	80	Kainji 330kV		
OSOGBO	Ibadan	Mcpherson 132kV	40	Ayede 330kV	Egbin 330kV	Ikeja West 330KV
LAGOS	Ibadan	New Abeokuta	60	Ikeja West 330KV	Akangba 330kV	
OSOGBO	Ibadan	Offa 132kV	40	Ganmo 330kV	Osogbo 330kV	
LAGOS	Ibadan	Oke-Aro 132kV	60	Oke-Aro 330kV	Ikeja West 330KV	Egbin 330kV
OSOGBO	Ibadan	Omu-Aran 132kV	60	Ganmo 330kV	Osogbo 330kV	
OSOGBO	Ibadan	Oshogbo 132kV	120	Osogbo 330kV	Ayede 330kV	Ganmo 330kV
LAGOS	Ibadan	Otta 132kV	200	Ikeja West 330KV	Akangba 330kV	
LAGOS	Ibadan	Papalanto 132kV	150	Ikeja West 330KV	Akangba 330kV	
OSOGBO	Ibadan	Shagamu 132kV	60	Ayede 330kV	Egbin 330kV	Ikeja West 330KV
			2151			

Table 5-26 and Table 5-27 show the utilization factors of the 23 substations in Ibadan Discos. TCN asserted to Ibadan Disco that some of the 23 substations are grossly underutilized while some are overloaded as shown in Table 5-26 and Table 5-27.

Table 5-26: Utilization Factors of Substations in Ibadan Disco Franchise Area

STATION	Capacity (MVA)	Jan-21	Feb-21	Mar-21	Apr-21	May-21	Jun-21	Jul-21	Aug-21	%
Abeokuta 132kV	210	28.57	26.93	27.70	25.91	26.11	21.36	28.40	30.35	18.07%
Agbara 132kV	60	5.81	4.98	4.12	4.55	5.56	4.64	6.70	6.39	13.96%
Ayede 132kV	220	70.17	68.87	60.16	54.78	47.41	37.43	48.19	53.39	39.87%
Ganmo 132kV	120	38.18	38.45	36.27	33.64	33.14	28.81	34.91	32.59	40.05%
Ibadan-North	120	44.85	43.58	35.24	36.17	31.63	22.12	32.35	32.31	46.72%
Ijebu-Ode 132kV	60	20.95	20.19	18.26	16.55	15.17	13.12	15.58	17.65	43.64%
Ile-Ife 132kV	60	20.66	21.55	20.00	17.17	18.95	18.00	19.04	17.10	44.89%
Ilesha 132kV	80	16.80	16.77	14.60	13.27	14.56	13.14	13.93	13.17	26.25%
Ilorin 132kV	151	32.29	34.50	26.79	24.75	23.92	18.51	21.41	21.00	28.56%
Iseyin 132kV	45	13.54	14.19	13.32	12.33	13.54	11.80	12.96	10.32	39.42%
Iwo 132kV	40	7.54	6.92	5.60	6.66	5.43	5.30	5.42	5.23	23.55%
Jebba 132kV	30	10.16	10.29	12.05	10.45	9.27	7.10	8.95	9.22	50.23%
Jericho 132kV	85	28.48	26.39	22.44	21.36	19.66	13.83	19.69	19.36	41.88%
Kainji 132kV	80	10.64	10.97	12.08	12.27	9.30	8.74	8.41	8.06	19.17%
Mcpherson	40	0.95	0.97	0.79	0.92	1.01	0.93	1.05	0.85	3.29%
New Abeokuta	60	7.69	6.68	5.76	5.58	4.90	4.95	6.88	6.56	16.03%
Offa 132kV	40	8.87	8.51	8.50	8.40	7.95	6.89	8.32	8.61	27.73%
Oke-Aro 132kV	60	16.70	18.63	16.19	15.31	16.52	13.46	12.58	13.75	38.81%
Omu-Aran 132kV	60	9.98	10.35	9.02	7.20	6.88	6.19	7.14	7.63	21.57%
Oshogbo 132kV	120	59.33	57.38	53.70	57.15	56.08	52.69	56.81	52.24	61.80%
Otta 132kV	200	42.38	43.97	40.55	39.73	34.74	31.26	34.68	38.59	27.48%
Papalanto 132kV	150	16.44	14.63	13.42	12.95	10.31	9.67	10.50	15.78	13.70%
Shagamu 132kV	60	21.77	24.10	19.36	17.33	17.02	12.71	16.12	18.01	50.21%
	2151	532.75	529.78	475.93	454.44	429.09	362.65	430.03	438.19	30.96%

Table 5-27: Utilization Factors of Substations in Ibadan Disco Franchise Area

STATION	Max Jan-21	Max Feb-21	Max Mar-21	Max of Max	% Utilization
Abeokuta 132kV	53.81	49.41	57.51	57.51	34.2%
Agbara 132kV	13.70	12.20	12.60	13.70	28.5%
Ayede 132kV	99.00	100.00	93.00	100.00	56.8%
Ganmo 132kV	68.30	62.30	65.10	68.30	71.1%
Ibadan-North	75.90	75.30	73.10	75.90	79.1%
Ijebu-Ode 132kV	36.00	36.50	36.50	36.50	76.0%
Ile-Ife 132kV	32.70	36.80	50.70	50.70	105.6%
Ilesha 132kV	33.10	44.40	32.00	44.40	69.4%
Ilorin 132kV	60.90	59.80	66.50	66.50	55.0%
Iseyin 132kV	21.10	20.90	22.20	22.20	61.7%
Iwo 132kV	17.50	17.90	17.20	17.90	55.9%
Jebba 132kV	20.40	21.80	22.50	22.50	93.8%
Jericho 132kV	49.90	60.80	47.50	60.80	89.4%
Kainji 132kV	16.67	16.00	16.77	16.77	26.2%
Mcpherson	2.10	9.10	1.30	9.10	28.4%
New Abeokuta	17.10	16.60	16.60	17.10	35.6%
Offa 132kV	14.50	15.20	25.60	25.60	80.0%
Oke-Aro 132kV	31.00	29.00	29.00	31.00	64.6%
Omu-Aran 132kV	19.20	20.40	20.30	20.40	42.5%
Oshogbo 132kV	85.80	88.40	88.40	88.40	92.1%
Otta 132kV	71.01	67.52	72.00	72.00	45.0%
Papalanto 132kV	34.61	35.50	32.80	35.50	29.6%
Shagamu 132kV	36.20	38.20	36.10	38.20	79.6%
	910.50	934.03	935.28	990.98	57.6%

5.7.3 Ibadan Disco PIP

The approved NERC's Ibadan PIP energy trajectory is shown in Table 5-28.

Table 5-28: Ibadan PIP energy growth submission

Disco	Current Energy Delivered (MWh/h)	PIP Year 1 Target (MWh/h)	PIP Year 2 Target (MWh/h)	PIP Year 3 Target (MWh/h)	PIP Year 4 Target (MWh/h)	PIP Year 5 Target (MWh/h)	Service Improvement Target (MWh/h)
Ibadan	1,872.37	2,015.02	2,157.67	2,300.32	2,442.97	2,585.62	713.24

As requested by the TCN committee, Ibadan Disco broke down the energy growth by Substations. However, TCN pointed out to Ibadan Disco that the broken down projections do not tally with what the Disco submitted to NERC.

Ibadan Disco responded by saying estimation and projection are dynamic and change to reflect new realities, and that the NERC projection is not correct. They agreed to forward the correct projection data to TCN as soon as possible.

5.7.4 Discussions

- Ibadan Disco claimed that some of the stations are grossly overloaded. The cases of Ibadan North, Ilorin, Shagamu, and Ile-Ife were sited, and that these stations need addition capacity.
- Ibadan pointed out that they did not request for Transformers Spares: Power Transformers (2x150MVA + 2X100MVA +2x60MVA) Mobitra; 1x 60MVA
- Ibadan complained about undersized line conductors.
- Ibadan displayed her projections using the TCN template and pointed out that in Ayede 132kV,
  - Oluyole trips always
  - Eleyele is overloaded
- In Ibadan North 132kV
  - Adogba is restricted from taking load.
  - Ibadan North is limited to 102.
- In Jericho 132kV
  - Agodi line 1 is overloaded
- TCN also told Ibadan Disco to carry out vegetation management in some places so as to increase the uptime of feeders and improve utilization.

5.8 Ikeja Electricity Distribution Company

5.8.1 Introduction

The Committee on TCN Performance Improvement Plan (PIP) met with Ikeja Electricity Distribution Company on Monday, November 29th , 2021 in Abuja. The list of the attendees is given in Table 5-29.

Table 5-29: List of Attendees of Meeting with Ikeja Disco on PIP

S/NO	NAME	ORGANIZATION	E-MAIL
1	Engr. Adesanya A. B	TCN	Abaadesanya@yahoo.co.uk
2	Engr. Abutu E.	TCN	Abutuson45@gmail.com
3	Engr. Hampashi Eric	TCN	Erichampashi@yahoo.com
4	Engr. B. Abdulmumin	TCN	Faabideen@gmail.com
5	Engr. A. G. Adamu	TCN	Engrbaffa@yahoo.com
6	Engr. Usaini Lawan	TCN	Usainilawan@gmail.com
7	Engr. Dahiru A. D.	TCN	Istahir@yahoo.com
8	Engr. G. O Nwokoye	TCN	Nwokoyego@gmail.com
9	Engr. Seun Amoda	TCN	Oamoda@gmail.com
10	Engr.Olatayo Olalere	Ikeja Electric (IE)	Oolalere@ikejaelectric.com
11	Oladele Daramola	Ikeja Electric (IE)	Odaramola@ikejaelectric.com

TCN gave a presentation that highlighted the following:

5.8.2 TCN Substations in Ikeja Disco and the utilizations of the substations.

That there are 16 TCN substations in Ikeja Disco franchise area where Ikeja Disco gets power from TCN network, and the substations are listed in Table 5-30.

Ikeja Disco noted the following corrections to Table 44:

- That Isolo, Itire and Amuwo TCN Substations are shared with Eko Disco while Otta and Oke-Aro substations are shared with Ibadan Disco.
- Odogunyan TS is 120 MVA
- That the 100 MVA transformer in Ogba TS is not shown in TCN data.
- That Landcraft and Ohmic Steel take energy from the Ikorodu to Maryland line
- That Topic Steel take energy from the Ikorodu to Sagamu line.

Table 5-30: Substations in Ikeja Disco Franchise Area

REGION	DISCO	STATION	Capacity (MVA)	330 KV 1	330 KV 2	330 KV 3
LAGOS	Ikeja	Alausa 132kV	135	Ikeja West 330KV	Akangba 330kV	
LAGOS	Ikeja	Alimosho 132kV	230	Ikeja West 330KV	Akangba 330kV	
LAGOS	Ikeja	Amuwo-Odofin 132kV	60	Akangba 330kV	Ikeja West 330KV	
LAGOS	Ikeja	Ayobo 132kV	120	Ikeja West 330KV	Akangba 330kV	
LAGOS	Ikeja	Egbin 132kV	30	Egbin 330kV	Ikeja West 330KV	
LAGOS	Ikeja	Ejigbo 132kV	260	Ikeja West 330KV	Akangba 330kV	
LAGOS	Ikeja	Ikorodu 132kV	280	Ikeja West 330KV	Egbin 330kV	
LAGOS	Ikeja	Ilupeju 132kV	60	Ikeja West 330KV	Akangba 330kV	
LAGOS	Ikeja	Isolo 132kV	105	Ikeja West 330KV	Akangba 330kV	
LAGOS	Ikeja	Itire 132kV	70	Ikeja West 330KV	Akangba 330kV	
LAGOS	Ikeja	Maryland 132kV	180	Ikeja West 330KV	Akangba 330kV	
LAGOS	Ikeja	Odogunyan 132kV	240	Ikeja West 330KV	Akangba 330kV	
LAGOS	Ikeja	Ogba 132kV	165	Ikeja West 330KV	Akangba 330kV	
LAGOS	Ikeja	Oke-Aro 132kV	120	Oke-Aro 330kV	Ikeja West 330KV	Egbin 330kV
LAGOS	Ikeja	Otta 132kV	60	Ikeja West 330KV	Akangba 330kV	
LAGOS	Ikeja	Oworonshoki 132kV	150	Ikeja West 330KV	Alagbon 330kV	
			2265			

Table 5-31 and Table 5-32 show the utilization factors of the 16 substations in Ikeja Discos. TCN asserted to Ikeja Disco that the 16 substations are grossly underutilized as shown in Table 5-31 and Table 5-32.

Table 5-31: Utilization Factors of Substations in Ikeja Disco Franchise Area

STATION	Capacity (MVA)	Jan-21	Feb-21	Mar-21	Apr-21	May-21	Jun-21	Jul-21	Aug-21	Max % Utilization
Alausa 132kV	135	55	56	53	53	52	48	46	47	42%
Alimosho 132kV	230	49	50	45	47	48	43	42	44	22%
Amuwo-Odofin 132kV	60	14	12	14	14	13	14	15	15	26%
Ayobo 132kV	120	31	32	30	30	29	29	29	31	27%
Egbin 132kV	30		7	5	0	0	0	0	0	25%
Ejigbo 132kV	260	65	67	58	53	59	60	60	66	26%
Ikorodu 132kV	280	73	69	66	65	71	67	65	60	26%
Ilupeju 132kV	60	27	28	23	19	21	21	22	23	46%
Isolo 132kV	105	23	24	24	22	19	17	18	16	23%
Itire 132kV	70	26	28	27	22	21	21	22	25	40%
Maryland 132kV	180	40	39	34	32	31	29	30	33	22%
Odogunyan 132kV	240	20	21	21	21	19	18	19	15	9%
Ogba 132kV	165	56	59	57	55	55	50	48	51	36%
Oke-Aro 132kV	120	34	35	32	36	33	30	30	30	30%
Otta 132kV	60	10	11	8	6	10	9	9	9	18%
Oworonshoki 132kV	150	41	41	34	34	35	33	35	36	28%
	2265	566	579	532	510	518	489	492	502	26%

Table 5-32: Utilization Factors of Substations in Ikeja Disco Franchise Area

STATION	Max Jan-21	Max Feb-21	Max Mar-21	Max of Max	% Utilization
Alausa 132kV	70	75	78	78	72%
Alimosho 132kV	74	72	73	74	40%
Amuwo-Odofin 132kV	28	31	31	31	65%
Ayobo 132kV	48	54	55	55	57%
Egbin 132kV		17	19	19	77%
Ejigbo 132kV	96	94	95	96	46%
Ikorodu 132kV	105	109	104	109	49%
Ilupeju 132kV	44	48	46	48	101%
Isolo 132kV	42	35	42	42	50%
Itire 132kV	38	38	39	39	70%
Maryland 132kV	66	51	52	66	46%
Odogunyan 132kV	35	35	36	36	18%
Ogba 132kV	84	89	90	90	68%
Oke-Aro 132kV	52	50	58	58	60%
Otta 132kV	22	20	22	22	46%
Oworonshoki 132kV	68	65	59	68	56%
	870	882	897	929	51%

- Ikeja Disco claimed that some of the stations are grossly underutilized because TCN has not provided adequate accessories to connect to the transformers. A case of Ogba TS was mentioned. Ikeja Disco said they have made a request of TCN to expand the bay.
- TCN also told Ikeja Disco carryout vegetation management in some places so as to increase the uptime of feeders and improve utilization.

5.8.3 Ikeja Disco PIP

The approved NERC's Ikeja PIP energy trajectory is shown in Table 5-33.

Table 5-33: Ikeja PIP energy growth submission

Disco	Current Energy Delivered (MWh/h)	PIP Year 1 Target (MWh/h)	PIP Year 2 Target (MWh/h)	PIP Year 3 Target (MWh/h)	PIP Year 4 Target (MWh/h)	PIP Year 5 Target (MWh/h)	Service Improvement Target (MWh/h)
Ikeja	485.05	605.07	725.09	845.11	965.14	1,085.16	600.11

As requested by the TCN committee, Ikeja Disco broke down the energy growth by Substations as shown in Table 5-34. However, TCN pointed out to Ikeja Disco that the broken-down projections do not tally with what the Disco submitted to NERC.
Ikeja Disco responded by saying estimation and projection are dynamic and change to reflect new realities.

Table 5-34: Ikeja PIP energy growth submission broken down by substation

STATION	PIP Year 1 Average	PIP Year 1 Peak (MW)	PIP Year 2 Average	PIP Year 2 Peak (MW)	PIP Year 3 Average	PIP Year 3 Peak (MW)	PIP Year 4 Average	PIP Year 4 Peak (MW)	PIP Year 5 Average	PIP Year 5 Peak (MW)
Amuwo-Odofin 132kV	18	43	22	52	26	62	32	75	38	90
Oworonshoki 132kV	50	88	60	128	72	153	86	184	103	221
Ilupeju 132kV	35	68	43	87	51	104	61	125	73	150
Isolo 132kV	35	72	42	100	50	120	60	143	72	172
Itire 132kV	33	63	39	77	47	93	57	112	68	134
Alausa 132kV	55	111	66	145	79	173	94	208	113	250
Alimosho 132kV	75	120	90	144	108	173	130	208	156	249
Ayobo 132kV	47	79	56	138	67	165	81	198	97	238
Ejigbo 132kV	107	181	128	247	154	296	185	355	222	426
Ogba 132kV	69	142	83	205	100	246	120	295	144	354
Oke-Aro 132kV	50	83	60	129	72	154	86	185	104	222
Otta 132kV	14	28	16	39	20	47	24	56	28	67
Ikorodu 132kV	105	196	126	255	151	306	181	367	218	441
Egbin 132KV	0	0	0	0	0	0	0	0	0	0
Maryland 132kV	40	88	47	109	57	131	68	157	82	189
Odogunyan 132kV	35	62	42	107	50	128	60	154	72	185
Grand Total	767	1426	920	1961	1104	2354	1325	2825	1590	3389

5.8.4 Ikeja's need from TCN

Ikeja Disco presented the following needs, in Table 5-35, from TCN:

Table 5-35: Ikeja Discos need from TCN

REGION	Disco	AREA CONTROL	STATION	TRANSFORMER	Requirements from TCN
LAGOS	Ikeja	IKEJA WEST	Alimosho 132kV	T2	TCN to upgrade 100MVA to 150MVA
LAGOS	Ikeja	IKEJA WEST	Ejigbo 132kV	T1	TCN to upgrade 100MVA to 150MVA
LAGOS	Ikeja	IKEJA WEST	Ejigbo 132kV	T2	TCN to upgrade 100MVA to 150MVA
LAGOS	Ikeja	EGBIN	Ikorodu 132kV	TR3	TCN to upgrade 100MVA to 150MVA
LAGOS	Ikeja	AKANGBA	Ilupeju 132kV	T1	TCN to upgrade 2*15MVA to 60MVA
LAGOS	Ikeja	AKANGBA	Ilupeju 132kV	T4	TCN to upgrade 30MVA to 100MVA
LAGOS	Ikeja	AKANGBA	Itire 132kV	T1	TCN to upgrade 30MVA to 100MVA
LAGOS	Ikeja	IKEJA WEST	Alausa 132kV	T2	TCN to upgrade 30MVA to 100MVA
LAGOS	Ikeja	IKEJA WEST	Alimosho 132kV	T1	TCN to upgrade 30MVA to 100MVA
LAGOS	Ikeja	EGBIN	Maryland 132kV	T1	TCN to upgrade 30MVA to 100MVA
LAGOS	Ikeja	EGBIN	Egbin 132KV	TR1	TCN to upgrade 30MVA to 60MVA
LAGOS	Ikeja	IKEJA WEST	Alausa 132kV	T1	TCN to upgrade 45MVA to 100MVA
LAGOS	Ikeja	IKEJA WEST	Ogba 132kV	MOBITRA	TCN to upgrade 45mvA to 60MVA
LAGOS	Ikeja	IKEJA WEST	Alausa 132kV	T3	TCN to upgrade 60MVA to 100MVA
LAGOS	Ikeja	IKEJA WEST	Ayobo 132kV	T1	TCN to upgrade 60MVA to 100MVA
LAGOS	Ikeja	OLORUNSOGO	Otta 132kV	T2	TCN to upgrade 60MVA to 100MVA
LAGOS	Ikeja	EGBIN	Ikorodu 132kV	TR2	TCN to upgrade 60MVA to 100MVA
LAGOS	Ikeja	EGBIN	Maryland 132kV	T3	TCN to upgrade 60MVA to 100MVA
LAGOS	Ikeja	EGBIN	Odogunyan 132kV	TR2	TCN to upgrade 60MVA to 100MVA

5.8.5 Discussions

- TCN asserted that all its ongoing projects in Ikeja Disco franchise area suffices to meet the five years plan of Ikeja Disco.
- TCN asserted that most of the requests of Ikeja Disco are either in ongoing TCN's project in Ikeja Disco franchise or are not needed
- TCN and Ikeja both discussed and agreed that transformational capacities are not necessarily the problem; but a lot of problems are from switchgear components and other accessories.
- TCN also advised that Ikeja Disco should reconfigure some of their feeders within the same station connected to overloaded transformer to a lightly loaded transformer.
- TCN asserted that in some cases Ikeja Discos can move feeders from one TCN substation that is overloaded to a nearby TCN substation that is underloaded. Like in the case of Itire and Isolo.

5.9 Jos Electricity Distribution Company

5.9.1 Introduction

The Committee on TCN Performance Improvement Plan (PIP) met with Jos Electricity Distribution Company on Thursday, February 15th, 2022 (via "Google Meet"). The list of the attendees is given in Table 5-36.

Table 5-36: List of Attendees of Meeting with Jos Disco on PIP

S/NO	NAME	ORGANIZATION	E-MAIL
1	Engr. Kabiru Adamu	TCN	kabirua2002@yahoo.com
2	Engr. Adesanya A. B	TCN	abaadesanya@yahoo.co.uk
3	Engr. Abutu E.	TCN	abutuson45@gmail.com
4	Engr. Hampashi Eric	TCN	erichampashi@yahoo.com
5	Engr. B. Abdulmumin	TCN	faabideen@gmail.com
6	Engr. Seun Amoda	TCN	oamoda@gmail.com
7	Engr. Hamisu Jigawa	Jos Disco	jigaway2k@gmail.com
8	Engr. Hamisu Usman	Jos Disco	husman8@gmail.com
9	Engr. Alhassan Shuaib	Jos Disco	asd_shuaib@yahoo.com

TCN gave a presentation that highlighted the following:

5.9.2 TCN Substations in Jos Disco and the utilizations of the substations.

That there are 9 TCN substations in Jos Disco franchise areas where Jos Disco gets power from TCN network, and the substations are listed in Table 5-37.

Jos Disco noted the following corrections to the table:

- That some transformer capacities are not up to what is on the plate name

Table 5-37: Substations in Jos Disco Franchise Area

REGION	DISCO	STATION	Capacity (MVA)	330 KV 1	330 KV 2	330 KV 3
ENUGU	Jos	Apir 132kV	100	Makurdi	New Haven 330kV	
BAUCHI	Jos	Ashaka 132kV	20	Gombe	Jos 330kV	Yola 330kV
KADUNA	Jos	Azare 132kV	30	Kumbotso		
BAUCHI	Jos	Bauchi 132kV	100	Gombe	Jos 330kV	Yola 330kV
BAUCHI	Jos	Gombe 132kV	135	Gombe	Jos 330kV	Yola 330kV
BAUCHI	Jos	Jos 132kV	120	Jos 330kV	Gombe 330kV	Yola 330kV
BAUCHI	Jos	Makeri 132kV	120	Jos 330kV	Gombe 330kV	Yola 330kV
ENUGU	Jos	Otukpo 132kV	77.5	Makurdi	New Haven 330kV	
ENUGU	Jos	Yandev 132kV	105	Makurdi	New Haven 330kV	
			807.5			

Table 5-38 and Table 5-39 show the utilization factors of the 9 substations in Jos Discos. TCN asserted to Jos Disco that the 9 substations are grossly underutilized as shown in Table 5-38 and Table 5-39.

Table 5-38: Utilization Factors of Substations in Jos Disco Franchise Area

STATION	Capacity (MVA)	Jan-21	Feb-21	Mar-21	Apr-21	May-21	Jun-21	Jul-21	Aug-21	%
Apir 132kV	100	23.70	22.63	26.70	22.49	26.17	22.00	19.63	20.28	33.38%
Ashaka 132kV	20	7.83	8.60	7.26	5.78	8.10	7.70	7.16	8.38	53.78%
Azare 132kV	30	4.61	4.30	4.70	4.44	4.66	4.42	4.30	4.39	19.59%
Bauchi 132kV	100	16.81	16.57	18.40	19.19	21.85	17.58	20.21	22.66	28.33%
Gombe 132kV	135	21.66	20.62	23.30	24.55	25.43	25.57	23.79	23.18	23.67%
Jos 132kV	120	29.21	28.64	27.71	26.64	28.06	26.80	30.59	27.38	31.86%
Makeri 132kV	120	22.65	22.91	23.21	22.77	23.23	22.68	22.68	24.85	25.88%
Otukpo 132kV	77.5	12.26	10.98	10.13	9.03	9.20	8.06	8.98	8.41	19.78%
Yandev 132kV	105	19.05	18.57	19.22	18.41	16.66	15.06	17.26	13.58	22.88%
	807.5	157.80	153.84	160.65	153.30	163.36	149.86	154.60	153.10	25.29%

Table 5-39: Utilization Factors of Substations in Jos Disco Franchise Area

STATION	Max Jan -21	Max Feb-21	Max Mar-21	Max of Max	% Utilization
Apir 132kV	45.3	45.5	48.5	48.5	60.63%
Ashaka 132kV	12.5	12.2	12.4	12.5	78.13%
Azare 132kV	14.5	14	13.9	14.5	60.42%
Bauchi 132kV	43.7	38.2	45.5	45.5	56.88%
Gombe 132kV	56.76	53	53.12	56.76	52.56%
Jos 132kV	72.2	71.6	73.5	73.5	76.56%
Makeri 132kV	49.21	49.6	51.6	51.6	53.75%
Otukpo 132kV	29.3	25.6	26.2	29.3	47.26%
Yandev 132kV	32.2	35	35.2	35.2	41.90%
	355.67	344.7	359.92	367.36	56.87%

5.9.3 Jos Disco PIP

The NERC's approved PIP energy trajectory for Jos is shown in Table 5-40.

Table 5-40: Jos PIP energy growth submission

Disco	Current Energy Delivered (MWh/h)	PIP Year 1 Target (MWh/h)	PIP Year 2 Target (MWh/h)	PIP Year 3 Target (MWh/h)	PIP Year 4 Target (MWh/h)	PIP Year 5 Target (MWh/h)	Service Improvement Target (MWh/h)
Jos	142.69	183.97	225.25	266.53	307.81	349.09	206.39

As requested by the TCN committee, Jos Disco broke down the energy growth by Substations as shown in Table 5-41. However, TCN pointed out to Jos Disco that the broken-down projections do not tally with what the Disco submitted to NERC. And also, the baseline used does not correspond to actual Data. Jos Disco agreed to look at the data again and resend.

Table 5-41: Jos PIP energy growth submission broken down by feeders

STATION	ASSOCIATED 33KV FEEDER	PIP Year 1 Average (MW)	PIP Year 1 Off-Peak (MW)	PIP Year 1 Peak (MW)	PIP Year 2 Average (MW)	PIP Year 2 Off-Peak (MW)	PIP Year 2 Peak (MW)	PIP Year 3 Average (MW)	PIP Year 3 Off-Peak (MW)	PIP Year 3 Peak (MW)	PIP Year 4 Average (MW)	PIP Year 4 Off-Peak (MW)	PIP Year 4 Peak (MW)	PIP Year 5 Average (MW)	PIP Year 5 Off-Peak (MW)	PIP Year 5 Peak (MW)
Ashaka 132kV	ASHAKA	10.4	8.4	12.2	11.3	9.4	12.2	11.78	9.86	12.24	11.90	9.96	12.36	12.01	10.06	12.49
Gombe 132kV	KUMO	4.8	2.4	9.0	6.9	3.6	9.0	7.95	4.73	9.01	8.03	4.78	9.10	8.11	4.83	9.19
Gombe 132kV	DARAZO	2.9	1.0	4.9	3.9	1.9	4.9	4.39	2.40	4.90	4.43	2.42	4.95	4.48	2.45	5.00
Gombe 132kV	FMC	0.5	0.2	0.6	0.5	0.3	0.6	0.59	0.45	0.63	0.59	0.45	0.64	0.60	0.45	0.64
Gombe 132kV	MALLAM SIDI	0.8	0.4	**3.4**	2.1	0.6	3.4	2.74	0.83	3.40	2.77	0.84	3.43	2.80	0.85	3.47
Gombe 132kV	W/WORKS	2.0	1.0	3.0	2.5	1.5	3.0	2.79	1.52	3.05	2.82	1.54	3.08	2.85	1.55	3.11
Gombe 132kV	GOMBE	6.7	2.9	10.9	8.8	4.8	**12.5**	10.66	6.33	12.50	10.77	6.39	12.63	10.87	6.46	12.75
Gombe 132kV	SHONGO	4.5	2.8	**7.0**	5.7	3.6	7.0	6.36	4.18	7.00	6.43	4.22	7.07	6.49	4.27	7.14
Gombe 132kV	DOMA	11.6	6.6	**19.4**	15.5	9.1	**20.4**	17.95	11.80	20.40	18.13	11.92	20.60	18.31	12.04	20.81
Bauchi 132kV	GRA/PALACE	4.8	1.8	9.7	7.2	3.3	**21**	14.11	4.75	21.00	14.25	4.80	21.21	14.39	4.85	21.42
Bauchi 132kV	WATER WORKS	9.3	5.8	**17.9**	13.6	7.5	**19.6**	16.59	10.07	19.60	16.76	10.17	19.80	16.93	10.27	19.99
Bauchi 132kV	YANKARI	1.3	0.2	4.1	2.7	0.8	4.1	3.40	1.24	4.10	3.44	1.25	4.14	3.47	1.27	4.18
Bauchi 132kV	NABORDO	4.1	2.8	6.9	5.5	3.5	**9.5**	7.51	3.98	9.50	7.58	4.02	9.60	7.66	4.06	9.69
Bauchi 132kV	NINGI	2.1	1.1	5.1	3.6	1.6	5.1	4.37	2.11	5.12	4.41	2.13	5.18	4.46	2.15	5.23
Bauchi 132kV	DASS	2.2	0.7	6.2	4.2	1.4	**6.5**	5.36	2.33	6.50	5.41	2.35	6.57	5.46	2.37	6.63
Bauchi 132kV	DABO FARM	4.4	0.9	10.1	7.3	2.7	10.1	8.70	4.46	10.14	8.79	4.51	10.24	8.88	4.55	10.34
Jos 132kV	RUKUBA	4.5	3.0	**9.7**	7.1	3.7	**13.9**	10.51	4.93	13.90	10.61	4.98	14.04	10.72	5.03	14.18
Jos 132kV	TORO	5.1	3.4	8.0	6.5	4.2	8.0	7.23	4.85	7.95	7.30	4.90	8.03	7.37	4.95	8.11
Jos 132kV	JUTH	10.5	4.3	**23.1**	16.8	7.4	23.1	19.95	11.60	23.10	20.15	11.72	23.33	20.35	11.84	23.56
Jos 132kV	ZARIA ROAD	3.6	1.4	7.3	5.5	2.5	7.3	6.41	3.49	7.34	6.47	3.52	7.41	6.54	3.56	7.49
Jos 132kV	NNPC	2.4	1.6	4.5	3.4	2.0	4.5	3.99	2.22	4.53	4.03	2.24	4.58	4.07	2.26	4.62
Jos 132kV	ANGLO/JOS	10.3	5.0	**22.0**	16.1	7.6	**22.3**	19.22	11.39	22.30	19.42	11.50	22.52	19.61	11.62	22.75
Jos 132kV	DOGON DUTSE	8.6	2.9	**18.5**	13.6	5.8	**20**	16.78	9.15	20.00	16.94	9.25	20.20	17.11	9.34	20.40
Makeri 132kV	GOVT. HOUSE	4.7	2.8	8.9	6.8	3.7	8.9	7.86	4.77	8.92	7.94	4.82	9.01	8.02	4.86	9.10
Makeri 132kV	MAKERI	5.6	3.3	10.4	8.0	4.5	**12**	10.01	5.74	12.00	10.11	5.80	12.12	10.21	5.86	12.24
Makeri 132kV	NEW ANGLO JOS	6.1	3.2	**11.1**	8.6	4.7	11.1	9.84	6.13	11.08	9.94	6.19	11.19	10.04	6.26	11.30
Makeri 132kV	BUKURU	10.4	5.4	**19.9**	15.1	7.9	19.9	17.50	11.03	19.85	17.67	11.15	20.05	17.85	11.26	20.25
Makeri 132kV	DOROWA	7.7	3.7	**14.0**	10.8	5.7	14.0	12.39	7.75	13.95	12.51	7.83	14.09	12.64	7.91	14.23
Makeri 132kV	SPARE	0.0	0.0	0.0	0.0	0.0	0.0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Apir 132kV	NNPC	12.7	9.3	**22.3**	17.5	11.0	**24.3**	20.89	13.74	24.30	21.10	13.87	24.54	21.31	14.01	24.79
Apir 132kV	BARRACKS ROAD	12.3	8.0	17.2	14.7	10.2	17.2	15.96	11.95	17.17	16.12	12.07	17.34	16.28	12.19	17.51
Apir 132kV	NORTH BANK	8.6	6.0	15.6	12.1	7.3	**18.3**	15.21	9.22	18.30	15.36	9.31	18.48	15.51	9.40	18.67
Otukpo 132kV	ANKPA	7.4	4.8	11.8	9.6	6.1	11.8	10.68	7.34	11.77	10.78	7.42	11.89	10.89	7.49	12.01
Otukpo 132kV	ASA	3.0	0.7	5.0	4.0	1.9	5.0	4.51	2.43	5.01	4.55	2.46	5.06	4.60	2.48	5.11
Otukpo 132kV	OJU	3.5	2.7	4.6	4.1	3.1	4.6	4.35	3.08	4.63	4.39	3.11	4.68	4.43	3.14	4.72
Otukpo 132kV	TARAKU	4.0	2.3	7.1	5.5	3.1	7.1	6.31	3.84	7.08	6.37	3.87	7.15	6.43	3.91	7.22
Yandev 132kV	BCC II	0.7	0.4	1.5	1.1	0.5	1.5	1.27	0.31	1.46	1.28	0.31	1.48	1.29	0.31	1.49
Yandev 132kV	BCC I	2.2	1.2	3.9	3.0	1.7	3.9	3.45	1.87	3.88	3.49	1.88	3.92	3.52	1.90	3.96
Yandev 132kV	MAKURDI	1.8	1.5	3.2	2.5	1.7	3.2	2.86	1.58	3.20	2.88	1.60	3.23	2.91	1.61	3.26
Yandev 132kV	WUKARI	6.7	5.1	9.9	8.3	5.9	9.9	9.07	6.60	9.85	9.16	6.67	9.95	9.25	6.74	10.05
Yandev 132kV	YANDEV	9.5	7.7	12.7	11.1	8.6	12.7	11.87	9.32	12.68	11.99	9.41	12.81	12.11	9.51	12.93
Yandev 132kV	KATSINA-ALA	7.8	5.4	11.2	9.5	6.6	11.2	10.36	7.56	11.21	10.46	7.63	11.32	10.56	7.71	11.44
Azare 132kV	MISAU	3.7	2.9	5.0	4.3	3.3	5.0	4.65	3.31	4.97	4.70	3.35	5.02	4.74	3.38	5.07
Azare 132kV	AZARE	6.5	4.0	9.5	8.0	5.2	**11**	9.49	6.11	11.00	9.58	6.17	11.11	9.68	6.23	11.22
Azare 132kV	JAMA'ARE	2.6	1.8	3.7	3.1	2.2	3.7	3.41	2.17	3.67	3.44	2.19	3.71	3.48	2.21	3.74

5.9.4 Discussions

- Jos Disco said they will look at their disaggregated five years projection and make it more realistic.
- Jos Disco meeting was adjourned till next week Wednesday.
- Jos Disco should make the load projection template sent to her by TCN ready before the next agreed meeting date Wednesday (23rd of February 2022).
- Jos will make its other requests known.

5.10 Kaduna Electricity Distribution Company

5.10.1 Introduction

The Committee on TCN Performance Improvement Plan (PIP) met with Kaduna Electricity Distribution Company on Thursday, February 15th, 2022 (via "Google Meet"). The list of the attendees is given in Table 5-42.

Table 5-42: List of Attendees of Meeting with Kaduna Disco on PIP

S/NO	NAME	ORGANIZATION	E-MAIL
1	Engr. Kabiru Adamu	TCN	kabirua2002@yahoo.com
2	Engr. Adesanya A. B	TCN	Abaadesanya@yahoo.co.uk
3	Engr. Abutu E.	TCN	Abutuson45@gmail.com
4	Engr. Hampashi Eric	TCN	Erichampashi@yahoo.com
5	Engr. B. Abdulmumin	TCN	Faabideen@gmail.com
6	Engr. Seun Amoda	TCN	Oamoda@gmail.com
7	Engr. Lawal Lawal	Kaduna Disco	Lawal.Lawal@KadunaElectric.com
8	Engr. Bello Musa	Kaduna Disco	bello.musa@kadunaelectric.com,
9	Engr. Masoud Salisu	Kaduna Disco	masoud.salisu@kadunaelectric.com
10	Mohammed Manga	Kaduna Disco	mohammed.manga@kadunaelectric.com
11	Mahmud Suleiman	Kaduna Disco	mahmud.suleiman@kadunaelectric.com

TCN gave a presentation that highlighted the following:

5.10.2 TCN Substations in Kaduna Disco and the utilizations of the substations.

That there are 10 TCN substations in Kaduna Disco franchise area where Kaduna Disco gets power from TCN network and the substations are listed in Table 5-43. Kaduna Disco noted the following corrections to the table:

Table 5-43: Substations in Kaduna Disco Franchise Area

REGION	DISCO	STATION	Capacity (MVA)	330 KV 1	330 KV 2	330 KV 3
SHIRORO	Kaduna	Birnin-Kebbi 132kV	150	Birnin Kebbi 330kV	Mando 330kV	Kumbotso 330KV
KADUNA	Kaduna	Gusau 132kV	60	Birnin Kebbi 330kV	Mando 330kV	Kumbotso 330KV
KADUNA	Kaduna	Kaduna Town 132kV	240	Mando 330kV	Birnin Kebbi 330kV	Kumbotso 330KV
BAUCHI	Kaduna	Kafanchan 132kV	40	Jos 330kV	Gombe 330kV	
KADUNA	Kaduna	Mando 132kV	240	Mando 330kV	Birnin Kebbi 330kV	Kumbotso 330KV
SHIRORO	Kaduna	Sokoto 132kV	90	Birnin Kebbi 330kV	Mando 330kV	Kumbotso 330KV
KADUNA	Kaduna	Talata-Mafara 132kV	30	Birnin Kebbi 330kV	Mando 330kV	Kumbotso 330KV
SHIRORO	Kaduna	Tegina 132kV	30	Shiroro 330KV		
SHIRORO	Kaduna	Yauri 132kV	30	Shiroro 330KV		
KADUNA	Kaduna	Zaria 132kV	200	Mando 330kV	Birnin Kebbi 330kV	Kumbotso 330KV
			1110			

Table 5-44 and Table 5-45 show the utilization factors of the 10 substations in Kaduna Discos. TCN asserted to Kaduna Disco that the 10 substations are grossly underutilized as shown in Table 51 and Table 52.

Table 5-44: Utilization Factors of Substations in Kaduna Disco Franchise Area

STATION	Capacity (MVA)	Jan-21	Feb-21	Mar-21	Apr-21	May-21	Jun-21	Jul-21	Aug-21	%
Birnin-Kebbi	150	36.78	35.74	41.29	45.98	44.34	36.68	36.20	33.63	38.32%
Gusau 132kV	60	13.21	15.17	15.03	18.20	18.05	14.04	14.21	13.86	37.91%
Kaduna Town	240	53.57	57.70	61.26	61.88	48.47	55.04	55.63	58.01	32.23%
Kafanchan	40	4.40	2.71	1.91	4.62	5.56	6.68	5.95	6.96	21.75%
Mando 132kV	240	62.86	61.86	68.87	71.02	67.85	65.62	64.27	64.08	36.99%
Sokoto 132kV	90	24.39	26.73	25.89	29.44	35.73	31.53	32.49	37.28	51.78%
Talata-Mafara	30	5.90	6.74	6.20	7.72	6.44	4.30	4.91	4.11	32.18%
Tegina 132kV	30	3.21	2.67	2.50	2.75	2.50	1.81	2.00	1.33	13.39%
Yauri 132kV	30	9.46	9.62	10.23	12.04	8.80	6.94	7.85	8.43	50.17%
Zaria 132kV	200	26.73	29.11	29.22	24.81	25.81	26.27	26.53	28.67	18.26%
	1110	240.52	248.06	262.38	278.46	263.55	248.91	250.04	256.37	31.36%

Table 5-45: Utilization Factors of Substations in Kaduna Disco Franchise Area

STATION	Max Jan-21	Max Feb-21	Max Mar-21	Max of Max	% Utilization
Birnin-Kebbi	63.6	63.5	72.7	72.7	60.58%
Gusau 132kV	39.6	75.5	36.8	75.5	157.29%
Kaduna Town	92	108	99.5	108	56.25%
Kafanchan	20.6	5.7	5.6	20.6	64.38%
Mando 132kV	113.6	116.6	163	163	84.90%
Sokoto 132kV	52.408	55.405	52.6	55.405	76.95%
Talata-Mafara	16.3	15.8	17.2	17.2	71.67%
Tegina 132kV	5.4	28	8	28	116.67%
Yauri 132kV	18.6	24.1	21.7	24.1	100.42%
Zaria 132kV	61.51	60.51	58	61.51	38.44%
	483.62	553.12	535.10	626.02	70.50%

5.10.3 Kaduna Disco PIP

The approved NERC's Kaduna PIP energy trajectory is shown in Table 5-46.

Table 5-46: Kaduna PIP energy growth submission

Disco	Current Energy Delivered (MWh/h)	PIP Year 1 Target (MWh/h)	PIP Year 2 Target (MWh/h)	PIP Year 3 Target (MWh/h)	PIP Year 4 Target (MWh/h)	PIP Year 5 Target (MWh/h)	Service Improvement Target (MWh/h)
Kaduna	224.66	385.16	545.66	706.16	866.67	1,027.17	802.51

TCN is still expecting Kaduna Disco to break down its 5 years energy forecast by feeders according to the template sent to it.

5.10.4 Discussions

- Kaduna Disco said they will send their disaggregated five years projection
- The TCN and Kaduna system development teams agreed to meet on next week Thursday (24th of February 2022).
- Kaduna will make its other requests known.

5.11 Kano Electricity Distribution Company

5.11.1 Introduction

The Committee on TCN Performance Improvement Plan (PIP) met with Kano Electricity

The Committee on TCN Performance Improvement Plan (PIP) met with Kaduna Electricity Distribution Company on Thursday, February 17th, 2022 (via "Google Meet"). The list of the attendees is given in Table 5-47.

Table 5-47: List of Attendees of Meeting with Kano Disco on PIP

S/NO	NAME	ORGANIZATION	E-MAIL
1	Engr. Kabiru Adamu	TCN	kabirua2002@yahoo.com
2	Engr. Adesanya A. B	TCN	abaadesanya@yahoo.co.uk
3	Engr. Abutu E.	TCN	abutuson45@gmail.com
4	Engr. Hampashi Eric	TCN	erichampashi@yahoo.com
5	Engr. B. Abdulmumin	TCN	faabideen@gmail.com
6	Engr. Seun Amoda	TCN	oamoda@gmail.com
7	Engr. David Omoloye	Kano Disco	david.omoloye@kedco.ng
8	Engr. Inuwa Daneji	Kano Disco	inuwa.daneji@kedco.ng
9	Engr. Nura Wada Nas	Kano Disco	wada.nura@kedco.ng

TCN gave a presentation that highlighted the following:

5.11.2 TCN Substations in Kano Disco and the utilizations of the substations.

That there are 13 TCN substations in Kano Disco franchise area where Kano Disco gets power from TCN network and the substations are listed in Table 5-48.

Table 5-48: List of Attendees of Meeting with Kano Disco on PIP

REGION	DISCO	STATION	Capacity (MVA)	330 KV 1	330 KV 2	330 KV 3
KANO	Kano	Dakata 132kV	150	Kumbotso 330KV		
KANO	Kano	Dan-Agundi 132kV	180	Kumbotso 330KV		
KANO	Kano	Daura 132kV	30	Kumbotso 330KV		
KANO	Kano	Dutse 132kV	60	Kumbotso 330KV		
KADUNA	Kano	Funtua 132kV	90	Kumbotso 330KV		
KANO	Kano	Gagarawa 132kV	120	Kumbotso 330KV		
KANO	Kano	Hadejia 132kV	67.5	Kumbotso 330KV		
KANO	Kano	Kankia 132kV	30	Kumbotso 330KV		
KANO	Kano	Katsina 132kV	150	Kumbotso 330KV		
KANO	Kano	Kumbotso 132kV	180	Kumbotso 330KV		
KANO	Kano	Kwanar-Dangora	30	Kumbotso 330KV	Mando 330kV	Birnin Kebbi 330kV
KANO	Kano	Tamburawa 132kV	60	Kumbotso 330KV	Mando 330kV	Birnin Kebbi 330kV
KANO	Kano	Wudil 132kV	30	Kumbotso 330KV		
			1177.5			

Table 5-49 and Table 5-50 show the utilization factors of the 13 substations in Kano Discos. TCN asserted to Kano Disco that the 13 substations are grossly underutilized as shown in Table 5-49 and Table 5-50.

Table 5-49: Utilization Factors of Substations in Kano Disco Franchise Area

STATION	Capacity (MVA)	Jan-21	Feb-21	Mar-21	Apr-21	May-21	Jun-21	Jul-21	Aug-21	%
Dakata 132kV	150	43.07	46.20	49.29	47.28	45.26	40.27	35.09	39.65	41.08%
Dan-Agundi	180	46.64	44.77	48.50	39.04	48.35	41.86	33.91	47.67	33.68%
Daura 132kV	30	8.21	8.93	8.25	8.21	8.78	6.33	5.54	6.13	37.21%
Dutse 132kV	60	7.99	8.45	8.48	9.08	8.73	7.41	5.17	6.52	18.92%
Funtua 132kV	90	11.49	11.10	11.87	11.19	11.18	9.30	9.04	9.49	16.49%
Gagarawa	120	0.35	0.60	0.44	0.37	0.42	0.61	0.59	0.56	0.63%
Hadejia 132kV	67.5	5.72	5.57	6.77	7.09	7.81	6.09	4.78	5.66	14.46%
Kankia 132kV	30	12.71	11.65	11.15	9.65	8.57	8.29	5.64	4.58	52.97%
Katsina 132kV	150	23.00	23.06	23.29	23.83	27.21	22.40	21.46	21.77	22.67%
Kumbotso	180	39.93	40.79	41.97	39.23	38.50	37.70	32.46	36.87	29.15%
Kwanar-	30	7.98	7.91	7.20	5.42	4.91	3.40	3.45	3.22	33.24%
Tamburawa	60	16.68	25.95	25.29	23.83	21.40	20.13	18.85	22.25	54.07%
Wudil 132kV	30	4.57	4.39	4.91	4.97	8.26	6.57	6.10	7.79	34.40%
	1177.5	228.35	239.37	247.42	229.19	239.37	210.35	182.06	212.15	26.27%

Table 5-50: Utilization Factors of Substations in Kano Disco Franchise Area

STATION	Max Jan-21	Max Feb-21	Max Mar-21	Max of Max	% Utilization
Dakata 132kV	69.3	71.5	70.8	71.5	59.58%
Dan-Agundi	79.7	79.2		79.7	55.35%
Daura 132kV	16.3	16.9	17.1	17.1	71.25%
Dutse 132kV	16.7	18.8	23.4	23.4	48.75%
Funtua 132kV	27.2	27.8	28.9	28.9	40.14%
Gagarawa	0.8	2.5	1.1	2.5	2.60%
Hadejia 132kV	11.4	13	15.3	15.3	28.33%
Kankia 132kV	22.81	22.91	22.11	22.91	95.46%
Katsina 132kV	57.4	58.2	41.4	58.2	48.50%
Kumbotso	62.3	68	61.7	68	47.22%
Kwanar-	20	21.8	21.8	21.8	90.83%
Tamburawa	30.8	56.3	41.6	56.3	117.29%
Wudil 132kV	9.9	10.1	11.2	11.2	46.67%
	424.61	467.01	356.41	476.81	50.62%

Kano Disco asserted capacity are being given to places where they are not needed.

5.11.3 Kano Disco PIP

The approved NERC's Kano PIP energy trajectory is shown in Table 5-51.

Table 5-51: Kano PIP energy growth submission

Disco	Current Energy Delivered (MWh/h)	PIP Year 1 Target (MWh/h)	PIP Year 2 Target (MWh/h)	PIP Year 3 Target (MWh/h)	PIP Year 4 Target (MWh/h)	PIP Year 5 Target (MWh/h)	Service Improvement Target (MWh/h)
Kano	219.18	279.45	339.73	400.00	460.27	520.55	301.37

As requested by the TCN committee, Kano Disco broke down the energy growth by Substations as shown in Table 5-52. However, TCN pointed out to Kano Disco that the broken down projections do not tally with what the Disco submitted to NERC. And also the baseline used does not correspond to actual Data. Kano Disco agreed to look at the data again and resend.

Table 5-52: Kano PIP energy growth submission broken down by feeders

STATION	TRANSFORMER NAME	RATING	FEEDER BAND	ASSOCIATED 33KV FEEDER	PIP Year 1 Average (MW)	PIP Year 1 Off-Peak	PIP Year 1 Peak (MW)	PIP Year 2 Average (MW)	PIP Year 2 Off-Peak	PIP Year 2 Peak (MW)	PIP Year 3 Average (MW)	PIP Year 3 Off-Peak	PIP Year 3 Peak (MW)	PIP Year 4 Average (MW)	PIP Year 4 Off-Peak	PIP Year 4 Peak (MW)	PIP Year 5 Average (MW)	PIP Year 5 Off-Peak	PIP Year 5 Peak (MW)
Funtua 132kV	TR3	30.00	E	DANDUME	3.00	2.50	4.00	3.15	2.63	4.20	3.31	2.76	4.41	3.47	2.89	4.63	3.65	3.04	4.86
Funtua 132kV	TR3	30.00	D	MALUMFASHI	5.00	4.00	8.00	5.25	4.20	8.40	5.51	4.41	8.82	5.79	4.63	9.26	6.08	4.86	9.72
Funtua 132kV	TR3	30.00	A	KATSINA ROAD	4.00	3.00	8.00	4.20	3.15	8.40	4.41	3.31	8.82	4.63	3.47	9.26	4.86	3.65	9.72
Funtua 132kV	TR4	60.00	A	TEXTILE	6.00	5.00	8.00	6.30	5.25	8.40	6.62	5.51	8.82	6.95	5.79	9.26	7.29	6.08	9.72
Funtua 132kV	TR4	60.00	B	MAMMAM NASIR	3.00	2.80	3.80	3.15	2.94	3.99	3.31	3.09	4.19	3.47	3.24	4.40	3.65	3.40	4.62
Dakata 132kV	TR1	60.00	A	SMALL SCALE	8.00	6.00	12.50	8.40	6.30	13.13	8.82	6.62	13.78	9.26	6.95	14.47	9.72	7.29	15.19
Dakata 132kV	TR1	60.00	A	IDH	16.00	14.00	23.00	16.80	14.70	24.15	17.64	15.44	25.36	18.52	16.21	26.63	19.45	17.02	27.96
Dakata 132kV	TR2	60.00	A	FLOUR MILLS	18.00	14.00	24.00	18.90	14.70	25.20	19.85	15.44	26.46	20.84	16.21	27.78	21.88	17.02	29.17
Dakata 132kV	TR2	60.00	A	GASKIYA	10.00	8.00	18.00	10.50	8.40	18.90	11.03	8.82	19.85	11.58	9.26	20.84	12.16	9.72	21.88
Dakata 132kV	TR1	60.00	A	MTN	14.00	12.00	20.00	14.70	12.60	21.00	15.44	13.23	22.05	16.21	13.89	23.15	17.02	14.59	24.31
Dakata 132kV	TR3	30.00	A	NNPC	10.00	8.00	15.00	10.50	8.40	15.75	11.03	8.82	16.54	11.58	9.26	17.36	12.16	9.72	18.23
Dan-Agundi 132kV	TR1	60.00	A	KURNA	18.00	14.00	23.00	18.90	14.70	24.15	19.85	15.44	25.36	20.84	16.21	26.63	21.88	17.02	27.96
Dan-Agundi 132kV	TR2	60.00	A	CBN	8.00	6.00	12.50	8.40	6.30	13.13	8.82	6.62	13.78	9.26	6.95	14.47	9.72	7.29	15.19
Dan-Agundi 132kV	TR2	60.00	A	CLUB	12.00	8.00	18.00	12.60	8.40	18.90	13.23	8.82	19.85	13.89	9.26	20.84	14.59	9.72	21.88
Dan-Agundi 132kV	TR2	60.00	A	DAN'AGUNDI 1	9.00	7.00	12.50	9.45	7.35	13.13	9.92	7.72	13.78	10.42	8.10	14.47	10.94	8.51	15.19
Dan-Agundi 132kV	TR2	60.00	A	ZARIA ROAD	20.00	18.00	29.00	21.00	18.90	30.45	22.05	19.85	31.97	23.15	20.84	33.57	24.31	21.88	35.25
Dan-Agundi 132kV	TR3	60.00	A	BUK	18.00	16.00	24.00	18.90	16.80	25.20	19.85	17.64	26.46	20.84	18.52	27.78	21.88	19.45	29.17
Dan-Agundi 132kV	TR3	60.00	B	DAN'AGUNDI 2	8.00	6.00	10.00	8.40	6.30	10.50	8.82	6.62	11.03	9.26	6.95	11.58	9.72	7.29	12.16
Daura 132kV	TR2	30/40	C	MASHI	3.50	2.50	4.50	3.68	2.63	4.73	3.86	2.76	4.96	4.05	2.89	5.21	4.25	3.04	5.47
Daura 132kV	TR2	30/40	A	DAURA	6.00	5.00	8.00	6.30	5.25	8.40	6.62	5.51	8.82	6.95	5.79	9.26	7.29	6.08	9.72
Daura 132kV	TR2	30/40	E	MAI'ADU'A	3.50	3.00	4.70	3.68	3.15	4.94	3.86	3.31	5.18	4.05	3.47	5.44	4.25	3.65	5.71
Daura 132kV	TR2	30/40	C	KAZAURE	3.00	2.50	3.80	3.15	2.63	3.99	3.31	2.76	4.19	3.47	2.89	4.40	3.65	3.04	4.62
Dutse 132kV	TR1	30/40	D	SUMAILA	3.00	2.50	5.00	3.15	2.63	5.25	3.31	2.76	5.51	3.47	2.89	5.79	3.65	3.04	6.08
Dutse 132kV	TR1	30/40	A	DUTSE	6.00	5.00	8.00	6.30	5.25	8.40	6.62	5.51	8.82	6.95	5.79	9.26	7.29	6.08	9.72
Dutse 132kV	TR2	30/40	B	BIRNIN KUDU	6.00	5.00	8.00	6.30	5.10	8.40	6.62	5.05	8.82	6.95	5.32	9.26	7.29	5.43	9.72
Dutse 132kV	TR2	30/40	D	JAHUN	3.50	3.00	5.70	3.68	3.15	5.99	3.86	3.31	6.28	4.05	3.47	6.60	4.25	3.65	6.93
Hadejia 132kV	TR3	60.00	D	BIRNIWA	2.00	1.50	3.70	2.10	1.58	3.89	2.21	1.65	4.08	2.32	1.74	4.28	2.43	1.82	4.50
Hadejia 132kV	TR3	60.00	D	GUMEL	1.50	1.20	2.50	1.58	1.26	2.63	1.65	1.32	2.76	1.74	1.39	2.89	1.82	1.46	3.04
Hadejia 132kV	TR3	60.00	A	KAFIN HAUSA	3.50	3.00	4.50	3.68	3.15	4.73	3.86	3.31	4.96	4.05	3.47	5.21	4.25	3.65	5.47
Hadejia 132kV	TR3	60.00	A	UNIVERSITY	0.20	0.10	0.60	0.21	0.11	0.63	0.22	0.11	0.66	0.23	0.12	0.69	0.24	0.12	0.73
Hadejia 132kV	TR1	7.50	A	HADEJIA	5.00	4.00	7.00	5.25	4.20	7.35	5.51	4.41	7.72	5.79	4.63	8.10	6.08	4.86	8.51
Kankia 132kV	TR2	30.00	A	AMPRI GLOBAL	0.20	0.10	0.60	0.21	0.11	0.63	0.22	0.11	0.66	0.23	0.12	0.69	0.24	0.12	0.73
Kankia 132kV	TR2	30.00	E	DANBATTA	4.50	3.50	6.00	4.73	3.68	6.30	4.96	3.86	6.62	5.21	4.05	6.95	5.47	4.25	7.29
Kankia 132kV	TR2	30.00	C	DUTSENMA	8.00	6.00	12.00	8.40	6.30	12.60	8.82	6.62	13.23	9.26	6.95	13.89	9.72	7.29	14.59
Kankia 132kV	TR2	30.00	D	MUSAWA	8.00	6.00	12.50	8.40	6.30	13.13	8.82	6.62	13.78	9.26	6.95	14.47	9.72	7.29	15.19
Katsina 132kV	TR1	60.00	A	AJIWA	4.50	3.70	7.00	4.73	3.89	7.35	4.96	4.08	7.72	5.21	4.28	8.10	5.47	4.50	8.51
Katsina 132kV	TR1	60.00	A	POWER HOUSE	14.00	12.00	20.00	14.70	12.60	21.00	15.44	13.23	22.05	16.21	13.89	23.15	17.02	14.59	24.31
Katsina 132kV	TR1	60.00	D	POLY	3.00	2.50	5.00	3.15	2.63	5.25	3.31	2.76	5.51	3.47	2.89	5.79	3.65	3.04	6.08
Katsina 132kV	TR2	30.00	D	KAITA	4.00	3.50	6.00	4.20	3.68	6.30	4.41	3.86	6.62	4.63	4.05	6.95	4.86	4.25	7.29
Katsina 132kV	TR3	30.00	A	DANA SRM	O/S	O/S	O/S												
Katsina 132kV	TR3	30.00	A	KOFAR GUGA	10.00	8.00	12.50	10.50	8.40	13.13	11.03	8.82	13.78	11.58	9.26	14.47	12.16	9.72	15.19
Katsina 132kV	TR4	30.00		WIND FARM	0.20	0.10	0.80	0.21	0.11	0.84	0.22	0.11	0.88	0.23	0.12	0.93	0.24	0.12	0.97
Kumbotso 132kV	TR4	60.00	A	DANGOTE	15.00	12.00	20.00	15.75	12.60	21.00	16.54	13.23	22.05	17.36	13.89	23.15	18.23	14.59	24.31
Kumbotso 132kV	TR4	60.00	A	SPANISH 2	18.00	16.00	23.50	18.90	16.80	24.68	19.85	17.64	25.91	20.84	18.52	27.20	21.88	19.45	28.56
Kumbotso 132kV	TR1	60.00	A	SPANISH 1	0.10	0.10	0.10	0.11	0.11	0.11	0.11	0.11	0.11	0.12	0.12	0.12	0.12	0.12	0.12
Kumbotso 132kV	TR1	60.00	A	ATM	6.00	5.00	8.50	6.30	5.25	8.93	6.62	5.51	9.37	6.95	5.79	9.84	7.29	6.08	10.33
Kumbotso 132kV	TR1	60.00	A	ANGELS	15.00	12.00	17.00	15.75	12.60	17.85	16.54	13.23	18.74	17.36	13.89	19.68	18.23	14.59	20.66
Kumbotso 132kV	TR1	60.00	D	BAGAUDA	8.00	6.00	13.00	8.40	6.30	13.65	8.82	6.62	14.33	9.26	6.95	15.05	9.72	7.29	15.80
Kumbotso 132kV	TR2	30/40		ON SOAK				0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Kwanar-Dangora	TR1	30/40	D	LAW SCHOOL	5.00	4.00	13.30	5.25	4.20	13.97	5.51	4.41	14.66	5.79	4.63	15.40	6.08	4.86	16.17
Kwanar-Dangora	TR1	30/40	E	KARAYE	3.50	3.00	5.50	3.68	3.15	5.78	3.86	3.31	6.06	4.05	3.47	6.37	4.25	3.65	6.69
Kwanar-Dangora	TR1	30/40	E	FALGORE	4.50	3.50	5.70	4.73	3.68	5.99	4.96	3.86	6.28	5.21	4.05	6.60	5.47	4.25	6.93
Tamburawa 132kV	TR1	30/40	A	COCA - COLA	15.00	10.00	18.00	15.75	10.50	18.90	16.54	11.03	19.85	17.36	11.58	20.84	18.23	12.16	21.88
Tamburawa 132kV	TR2	30/40	E	KWANKWASO	4.00	2.50	6.50	4.20	2.63	6.83	4.41	2.76	7.17	4.63	2.89	7.52	4.86	3.04	7.90
Tamburawa 132kV	TR2	30/40	A	TAMBURAWA	5.00	4.00	7.00	5.25	4.20	7.35	5.51	4.41	7.72	5.79	4.63	8.10	6.08	4.86	8.51
Tamburawa 132kV	TR2	30/40	A	CHALLAWA	5.00	4.00	6.50	5.25	4.20	6.83	5.51	4.41	7.17	5.79	4.63	7.52	6.08	4.86	7.90
Tamburawa 132kV	TR2	30/40		FEEDER 3	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Tamburawa 132kV	TR2	30/40	A	RIJIYAR ZAKI	14.00	12.00	17.00	14.70	12.60	17.85	15.44	13.23	18.74	16.21	13.89	19.68	17.02	14.59	20.66
Wudil 132kV	TR1	30/40	E	GARKO	3.00	2.50	3.50	3.15	2.63	3.68	3.31	2.76	3.86	3.47	2.89	4.05	3.65	3.04	4.25
Wudil 132kV	TR1	30/40	C	GANO	10.00	8.00	14.00	10.50	8.40	14.70	11.03	8.82	15.44	11.58	9.26	16.21	12.16	9.72	17.02
Wudil 132kV	TR1	30/40	A	WUDIL	3.00	2.50	3.50	3.15	2.63	3.68	3.31	2.76	3.86	3.47	2.89	4.05	3.65	3.04	4.25
Gagarawa 132kV	T1	60.00	NA	ON SOAK				0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Gagarawa 132kV	T2	60.00	A	RICE MILL	0.40	0.20	0.80	0.42	0.21	0.84	0.44	0.22	0.88	0.46	0.23	0.93	0.49	0.24	0.97
Gagarawa 132kV	T2	60.00	B	GAGARAWA	3.00	2.50	3.50	3.15	2.63	3.68	3.31	2.76	3.86	3.47	2.89	4.05	3.65	3.04	4.25

5.11.4 Discussions

- TCN team noted that feeders are not fully utilized.
- TCN also noted that some feeders are not classified in Kano Disco.
- Kano Disco agreed to complete the classification of the feeders.
- Kano Disco said they will look at their disaggregated five years projection and make it more realistic.
- Kano Disco complained of capacity wrongly placed.
- Kano Disco complained of transformers being pegged.
- Kano Disco pleaded that TCN should reconductor Kumbotso-Dan Agudi line and Kumbotso-Dakata line

5.12 Port Harcourt Electricity Distribution Company

5.12.1 Introduction

The Committee on TCN Performance Improvement Plan (PIP) met with Port-Harcourt Electricity Distribution Company on Thursday, February 17th, 2022 (via google meet). The list of the attendees is given in Table 5-53.

Table 5-53: List of Attendees of Meeting with Ibadan Disco on PIP

S/NO	NAME	ORGANIZATION	E-MAIL
1	Engr. Kabiru Adamu	TCN	kabirua2002@yahoo.com
2	Engr. Adesanya A. B	TCN	abaadesanya@yahoo.co.uk
3	Engr. Hampashi Eric	TCN	erichampashi@yahoo.com
4	Engr. B. Abdulmumin	TCN	faabideen@gmail.com
5	Engr. Seun Amoda	TCN	oamoda@gmail.com
7	Chukwudi Adeshina	TCN	chukwudi.adeshina@phed.com.ng
8	Aderonke Dahunsi	TCN	aderonke.dahunsi@phed.com.ng

TCN gave a presentation that highlighted the following:

5.12.2 TCN Substations in Port Harcourt Disco and the utilizations of the substations.

That there are 14 TCN substations in Port-Harcourt Disco franchise area where Port-Harcourt Disco gets power from TCN network and the substations are listed in Table 5-54.

Table 5-54: Substations in Port-Harcourt Disco Franchise Area

REGION	DISCO	STATION	Capacity (MVA)	330 KV 1	330 KV 2	330 KV 3
PORT-HARCOURT	Port-Harcourt	Afam 132kV	30	Afam 330kV	Alaoji 330kV	
PORT-HARCOURT	Port-Harcourt	Ahoada 132kV	60	Alaoji 330kV		
PORT-HARCOURT	Port-Harcourt	Calabar 132kV	180	Adiabor 330kV	Alaoji 330kV	
PORT-HARCOURT	Port-Harcourt	Eket 132kV	105	Adiabor 330kV	Alaoji 330kV	
PORT-HARCOURT	Port-Harcourt	Ekim 132kV	60	Adiabor 330kV	Alaoji 330kV	
PORT-HARCOURT	Port-Harcourt	Elelenwon 132kV	60	Afam 330kV	Alaoji 330kV	
PORT-HARCOURT	Port-Harcourt	Gbarain 132kV	60	Alaoji 330kV		
PORT-HARCOURT	Port-Harcourt	Itu 132kV	60	Alaoji 330kV	Adiabor 330kV	
PORT-HARCOURT	Port-Harcourt	Odukpani PS 132kV	60	Odukpani 330kV		
PORT-HARCOURT	Port-Harcourt	PH Main 132kV	180	Afam 330kV	Alaoji 330kV	
PORT-HARCOURT	Port-Harcourt	PH Town 132kV	135	Afam 330kV	Alaoji 330kV	
PORT-HARCOURT	Port-Harcourt	Rumuosi 132kV	40	Afam 330kV	Alaoji 330kV	
PORT-HARCOURT	Port-Harcourt	Uyo 132kV	180	Adiabor 330kV	Alaoji 330kV	
PORT-HARCOURT	Port-Harcourt	Yenagoa 132kV	120	Alaoji 330kV		
			1330			

Table 5-55 and Table 5-56 show the utilization factors of the 14 substations in Port-Harcourt Discos. TCN asserted to Port-Harcourt Disco that the 14 substations are grossly underutilized as shown in Table 5-55 and Table 5-56.

Table 5-55: Utilization Factors of Substations in Port-Harcourt Disco Franchise Area

STATION	Capacity (MVA)	Jan-21	Feb-21	Mar-21	Apr-21	May-21	Jun-21	Jul-21	Aug-21	%
Afam 132kV	30	9.04	3.37	7.89	6.84	3.29	2.15	-	0.69	37.66%
Ahoada 132kV	60	6.68	5.69	4.95	5.50	5.46	5.43	5.57	4.24	13.92%
Calabar 132kV	180	26.97	31.20	28.63	25.20	24.93	23.83	24.06	26.15	21.67%
Eket 132kV	105	5.57	6.38	6.04	6.91	6.66	6.68	6.25	7.00	8.34%
Ekim 132kV	60	1.69	1.73	1.30	1.67	1.59	1.28	1.35	1.74	3.63%
Elelenwon 132kV	60	0.08	24.59	12.19	17.51	17.19	19.51	21.10	22.03	51.23%
Gbarain 132kV	60	-	-	0.36	0.13	-	-	-	-	0.75%
Itu 132kV	60	9.76	9.63	7.68	7.38	6.77	5.76	7.11	6.18	20.33%
Odukpani PS 132kV	60	0.00	0.05	0.00	0.00	0.01	0.00	-	-	0.10%
PH Main 132kV	180	74.21	68.24	72.90	68.61	66.82	59.36	65.19	65.98	51.53%
PH Town 132kV	135	34.43	36.14	33.66	35.84	34.30	31.47	31.87	33.45	33.46%
Rumuosi 132kV	40	22.02	22.47	30.90	29.26	28.50	25.31	28.35	30.92	96.63%
Uyo 132kV	180	22.89	26.52	22.91	22.49	22.92	19.62	22.19	21.63	18.41%
Yenagoa 132kV	120	10.22	11.75	10.42	12.40	10.27	9.47	12.81	12.32	13.35%
	1330	223.55	247.77	239.82	239.75	228.72	209.87	225.87	232.35	23.29%

Table 5-56: Utilization Factors of Substations in Port-Harcourt Disco Franchise Area

STATION	Max Jan-21	Max Feb-21	Max Mar-21	Max of Max	% Utilization
Afam 132kV	16.83	16.9	19.5	19.5	81.25%
Ahoada 132kV	27.8	22.31	22.02	27.8	57.92%
Calabar 132kV	74.3	69.72	64.01	74.3	51.60%
Eket 132kV	22.01	29.01	26	29.01	34.54%
Ekim 132kV	10	9.5	8.2	10	20.83%
Elelenwon 132kV	4.44	56.7	42.6	56.7	118.13%
Gbarain 132kV	0	0	1.5	1.5	3.13%
Itu 132kV	20.9	22	20.7	22	45.83%
Odukpani PS 132kV	0.01	4.8	0.01	4.8	10.00%
PH Main 132kV	124.25	123.35	115.95	124.25	86.28%
PH Town 132kV	74.6	74.8	84	84	77.78%
Rumuosi 132kV	47.9	48.3	61.6	61.6	192.50%
Uyo 132kV	57	58	51.5	58	40.28%
Yenagoa 132kV	47.1	51.1	52.6	52.6	54.79%
	527.14	586.49	570.19	626.06	58.84%

Port-Harcourt Disco asserted that Rumuosi is too overloaded.

5.12.3 Port Harcourt Disco PIP

The approved NERC's Port-Harcourt PIP energy trajectory is shown in Table 5-57.

Table 5-57: Port-Harcourt PIP energy growth submission

Disco	Current Energy Delivered (MWh/h)	PIP Year 1 Target (MWh/h)	PIP Year 2 Target (MWh/h)	PIP Year 3 Target (MWh/h)	PIP Year 4 Target (MWh/h)	PIP Year 5 Target (MWh/h)	Service Improvement Target (MWh/h)
Port Harcourt	226.48	269.73	312.97	356.21	399.45	442.69	216.21

As requested by the TCN committee, Port-Harcourt Disco broke down the energy growth by Substations as shown in Table 5-58.

Table 5-58: Port-Harcourt PIP energy growth submission broken down by feeders

STATION	TRANSFORMER NAME	RATING	FEEDER BAND	ASSOCIATED 33KV FEEDER	ASSOCIATED 33KV FEEDER	PIP Year 1 Average (MW)	PIP Year 1 Off-Peak	PIP Year 1 Peak (MW)	PIP Year 2 Average (MW)	PIP Year 2 Off-Peak	PIP Year 2 Peak (MW)	PIP Year 3 Average (MW)	PIP Year 3 Off-Peak	PIP Year 3 Peak (MW)	PIP Year 4 Average (MW)	PIP Year 4 Off-Peak	PIP Year 4 Peak (MW)	PIP Year 5 Average (MW)	PIP Year 5 Off-Peak	PIP Year 5 Peak (MW)
Calabar 132kV	T1	60.00	A	EPZ 1	BAO YAO	7.4	5.0	13.4	6.87	4.28	10.40	7.02	4.35	13.55	7.17	4.43	13.70	7.32	4.50	13.85
Calabar 132kV	T1	60.00	A	EPZ 2	EPZ2	5.5	5.4	6.9	8.96	8.25	10.60	9.11	8.33	7.05	9.26	8.40	7.20	9.41	8.47	7.35
Calabar 132kV	T1	60.00	B	FLOUR	STATE	4.4	5.6	7.0	7.13	6.60	8.70	7.28	6.68	7.15	7.43	6.75	7.30	7.58	6.82	7.45
Calabar 132kV	T1	60.00	B	ODUKPA	AKAMKP	1.0	5.6	7.0	4.26	3.38	3.40	4.41	3.46	7.15	4.56	3.53	7.30	4.71	3.60	7.45
Calabar 132kV	T3	60.00	A	AMIKA	AMIKA	5.1	8.2	12.3	16.68	18.53	19.00	16.83	18.61	12.45	16.98	18.68	12.60	17.13	18.75	12.75
Calabar 132kV	T3	60.00	A	P/STN	DIAMON	3.9	4.2	4.9	4.09	4.30	5.20	4.24	4.38	5.05	4.39	4.45	5.20	4.54	4.52	5.35
Calabar 132kV	T3	60.00	A	WATER	WATER	0.7	0.3	1.7	2.17	2.03	2.50	2.32	2.11	1.85	2.47	2.18	2.00	2.62	2.25	2.15
Calabar 132kV	T4	60.00	B	FLOUR	FLOUR	3.7	6.1	7.3	8.48	8.90	10.80	8.63	8.98	7.45	8.78	9.05	7.60	8.93	9.12	7.75
Calabar 132kV	T4	60.00	A	NIGER	NIGER	3.0	2.9	3.4	3.40	3.32	3.60	3.55	3.39	3.55	3.70	3.47	3.70	3.85	3.54	3.85
Calabar 132kV	T4	60.00	A	UNICEM	EPZ1	0.1	0.1	0.1	0.08	0.10	0.10	0.23	0.18	0.25	0.38	0.25	0.40	0.53	0.32	0.55
Calabar 132kV	T4	60.00	A		OLAM	1.2	3.4	4.0	1.75	3.50	6.35	1.90	3.58	4.15	2.05	3.65	4.30	2.20	3.72	4.45
Eket 132kV	T1B	45.00	A	ABAK	EKET	5.3	8.5	9.0	5.11	8.00	10.00	5.26	8.08	9.15	5.41	8.15	9.30	5.56	8.22	9.45
Eket 132kV	T1B	45.00	E	EKET	ETINAN	1.4	1.3	1.5	2.97	3.08	6.25	3.12	3.16	1.65	3.27	3.23	1.80	3.42	3.30	1.95
Eket 132kV	T2B	60.00	A	EKET	EKPENUK	3.9	4.5	4.6	4.01	4.46	5.50	4.16	4.53	4.75	4.31	4.61	4.90	4.46	4.68	5.05
Eket 132kV	T2B	60.00	D	MBO	MBO	2.2	3.0	3.1	1.60	0.00	5.00	1.75	0.08	3.25	1.90	0.15	3.40	2.05	0.22	3.55
Eket 132kV	T2B	60.00	D	ONNA	IBENO	4.7	4.4	5.2	1.50	1.50	1.50	1.65	1.58	5.35	1.80	1.65	5.50	1.95	1.72	5.65
Ekim 132kV	TR1	60.00	A	FEEDER 1	INDUSTRI	0.1	0.1	0.1	3.00	3.04	3.80	3.15	3.12	0.25	3.30	3.19	0.40	3.45	3.26	0.55
Ekim 132kV	TR1	60.00	B	FEEDER	IKOT	2.4	2.3	2.4	3.24	3.31	3.90	3.39	3.38	2.55	3.54	3.46	2.70	3.69	3.53	2.85
Ekim 132kV	TR1	60.00	C	FEEDER	EKIM	2.4	2.3	2.3	2.87	2.55	4.10	3.02	2.63	2.45	3.17	2.70	2.60	3.32	2.77	2.75
Itu 132kV	T1A	60.00	D	ITAM	ITAM	1.9	4.5	5.6	11.21	11.44	14.40	11.36	11.52	5.75	11.51	11.59	5.90	11.66	11.66	6.05
Itu 132kV	T1A	60.00	D	ITU(OKU	OKU	2.1	3.6	3.7	18.30	16.30	29.80	18.45	16.38	3.85	18.60	16.45	4.00	18.75	16.52	4.15
Odukpani PS 132kV	T2	60.00	D	FEEDER 4		0.0	0.0	0.0	0.00											
Uyo 132kV	T1	60.00	A	FOUR	FOUR	8.2	8.7	13.2	11.13	9.83	14.00	11.28	9.91	13.35	11.43	9.98	13.50	11.58	10.05	13.65
Uyo 132kV	T1	60.00	A	UYO	IBESIKPO	2.7	3.0	3.7	14.27	13.17	18.50	14.42	13.24	3.85	14.57	13.32	4.00	14.72	13.39	4.15
Uyo 132kV	T1	60.00	A	UYO	CHAMPIO	1.0	1.0	1.0	2.40	3.00	3.00	2.55	3.08	1.15	2.70	3.15	1.30	2.85	3.22	1.45
Uyo 132kV	T2	60.00	A	FIVE STAR	LA	1.3	1.2	1.5	1.50	1.83	2.00	1.65	1.91	1.65	1.80	1.98	1.80	1.95	2.05	1.95
Uyo 132kV	T2	60.00	E	IKOT	OBOT	4.0	4.1	11.3	6.71	6.92	8.00	6.86	6.99	11.45	7.01	7.07	11.60	7.16	7.14	11.75
Uyo 132kV	T2	60.00	B	UYO	ORON	2.1	3.6	4.4	7.31	6.75	10.00	7.46	6.83	4.55	7.61	6.90	4.70	7.76	6.97	4.85
Uyo 132kV	T3	60.00	D	ABAK	ABAK	2.3	3.9	6.1	5.10	4.88	10.50	5.25	4.95	6.25	5.40	5.03	6.40	5.55	5.10	6.55
Uyo 132kV	T3	60.00	A	IKOT	IKOT	3.7	4.7	7.7	4.63	4.67	9.00	4.78	4.74	7.85	4.93	4.82	8.00	5.08	4.89	8.15
Uyo 132kV	T3	60.00		FEEDER 7	AFAHA	0.5	1.8	3.7	5.30	7.00	13.00	5.45	7.08	3.85	5.60	7.15	4.00	5.75	7.22	4.15
Afam 132kV	T1	30.00	E	NDOKI 1	NDOKI	0.6	1.7	1.7	3.45	3.10	5.00	3.60	3.18	1.85	3.75	3.25	2.00	3.90	3.32	2.15
Afam 132kV	T1	30.00	D	NDOKI	KOMKOM	3.6	10.4	10.7	4.56	4.57	6.00	4.71	4.64	10.85	4.86	4.72	11.00	5.01	4.79	11.15
Ahoada 132kV	T1	30/40	E	ABONIM	ABONEM	0.2	0.2	0.8	0.97	0.82	1.50	1.12	0.89	0.95	1.27	0.97	1.10	1.42	1.04	1.25
Ahoada 132kV	T1	30/40	E	ABONIM	BUGUMA	0.4	1.0	1.0	2.05	1.55	2.60	2.20	1.63	1.15	2.35	1.70	1.30	2.50	1.77	1.45
Ahoada 132kV	T1	30/40	D	CHOBA(E	EMOHUA	0.7	3.7	3.8	8.50	9.07	10.80	8.65	9.14	3.95	8.80	9.22	4.10	8.95	9.29	4.25
Ahoada 132kV	T2	30/40	E	AHAODA	AHOADA	2.5	2.0	2.1	5.42	4.10	7.50	5.57	4.18	2.25	5.72	4.25	2.40	5.87	4.32	2.55
Ahoada 132kV	T2	30/40	E	ISIOKPO	ISIOKPO	0.0	0.0	0.0	0.00	0.00										
Elelenwon 132kV	T01	60.00	D	BORI	BORI	0.7	4.6	8.5	7.35	7.36	8.80	7.50	7.43	8.65	7.65	7.51	8.80	7.80	7.58	8.95
Elelenwon 132kV	T01	60.00	B	BRISTEL/	RSTV	6.6	6.5	7.2	6.53	6.80	9.40	6.68	6.88	7.35	6.83	6.95	7.50	6.98	7.02	7.65
Elelenwon 132kV	T01	60.00	B	IGBO	IGBO	0.5	5.3	5.7	9.38	9.62	12.55	9.53	9.69	5.85	9.68	9.77	6.00	9.83	9.84	6.15
Elelenwon 132kV	T01	60.00	D	ONNE	ONNE	2.5	10.3	11.6	7.20	7.00	9.10	7.35	7.08	11.75	7.50	7.15	11.90	7.65	7.22	12.05
Elelenwon 132kV	T01	60.00	A	OYIGBO	OYIGBO	4.3	4.6	4.8	7.73	8.10	9.60	7.88	8.18	4.95	8.03	8.25	5.10	8.18	8.32	5.25
Elelenwon 132kV	T01	60.00	B	TIMBER	TIMBER	4.9	4.6	5.5	5.59	4.92	7.00	5.74	4.99	5.65	5.89	5.07	5.80	6.04	5.14	5.95
PH Main 132kV	T1A	60.00	A	ABULOM	ABULOM	7.7	7.9	8.4	7.01	6.58	7.55	7.16	6.65	8.55	7.31	6.73	8.70	7.46	6.80	8.85
PH Main 132kV	T1A	60.00	A	RSPUB 1	RSPUB 1	8.4	8.3	8.5	8.83	8.02	13.30	8.98	8.09	8.65	9.13	8.17	8.80	9.28	8.24	8.95
PH Main 132kV	T1A	60.00	B	UNIPORT	RUMUOD	8.1	17.9	20.1	17.44	16.68	20.75	17.59	16.75	20.25	17.74	16.83	20.40	17.89	16.90	20.55
PH Main 132kV	T2A	60.00	A	RAINBO	RAINBO	10.7	10.3	11.3	11.40	9.55	14.80	11.55	9.63	11.45	11.70	9.70	11.60	11.85	9.77	11.75
PH Main 132kV	T2A	60.00	A	REFINERY	REFINERY	12.0	11.6	13.2	11.25	10.78	13.00	11.40	10.86	13.35	11.55	10.93	13.50	11.70	11.00	13.65
PH Main 132kV	T2A	60.00	A	RSPUB 2	TRANS	14.1	12.5	16.3	14.75	14.95	17.20	14.90	15.03	16.45	15.05	15.10	16.60	15.20	15.17	16.75
PH Main 132kV	T3A	60.00	B	FEEDER	AIRPORT	7.6	15.1	16.1	15.42	15.70	19.00	15.57	15.78	16.25	15.72	15.85	16.40	15.87	15.92	16.55
PH Main 132kV	T3A	60.00	B	FEEDER	AKANI	8.4	8.5	8.3	10.63	8.65	14.05	10.78	8.73	8.45	10.93	8.80	8.60	11.08	8.87	8.75
PH Main 132kV	T3A	60.00	B	FEEDER	RUMUOL	13.3	13.2	13.8	12.39	10.98	15.05	12.54	11.05	13.95	12.69	11.13	14.10	12.84	11.20	14.25
PH Main 132kV	T3A	60.00	A	REFINERY	REFINERY	5.2	5.1	5.5	7.47	7.19	9.20	7.62	7.27	5.65	7.77	7.34	5.80	7.92	7.41	5.95
PH Town 132kV	T1A	60.00	A	BOROKIRI	BOROKIRI	4.4	6.9	8.3	7.14	6.84	9.25	7.29	6.92	8.45	7.44	6.99	8.60	7.59	7.06	8.75
PH Town 132kV	T1A	60.00	B	RUMUOL	RUMUOL	3.9	3.9	8.3	10.85	11.09	13.05	11.00	11.17	8.45	11.15	11.24	8.60	11.30	11.31	8.75
PH Town 132kV	T1A	60.00	A	SILVER	SILVER	8.5	9.3	9.5	8.89	9.20	11.00	9.04	9.28	9.65	9.19	9.35	9.80	9.34	9.42	9.95
PH Town 132kV	T1A	60.00	A	U.T.C.	UTC	6.3	6.1	6.8	6.16	6.18	11.05	6.31	6.25	6.95	6.46	6.33	7.10	6.61	6.40	7.25
PH Town 132kV	T1A	60.00		K24	T1B	11.2	9.1	13.9	11.33	12.15	12.90	11.48	12.23	14.05	11.63	12.30	14.20	11.78	12.37	14.35
PH Town 132kV	T2A	30.00	A	UST	UST	9.6	12.3	15.2	11.71	11.14	15.05	11.86	11.22	15.35	12.01	11.29	15.50	12.16	11.36	15.65
PH Town 132kV	T2B	45.00	A	SECRETA	SECRETA	9.6	10.9	11.8	9.13	9.22	11.85	9.28	9.29	11.95	9.43	9.37	12.10	9.58	9.44	12.25
Rumuosi 132kV	T1	40.00	A	AIRPORT	GREATER	4.6	3.5	6.3	15.42	15.70	19.00	15.57	15.78	6.45	15.72	15.85	6.60	15.87	15.92	6.75
Rumuosi 132kV	T2	60.00	A	NTA	NTA	2.5	11.6	14.5	11.09	11.13	15.60	11.24	11.20	14.65	11.39	11.28	14.80	11.54	11.35	14.95
Rumuosi 132kV	T1	40.00	A	RUKPOK	RUKPOK	3.9	6.2	7.1	13.02	8.81	17.20	13.17	8.88	7.25	13.32	8.96	7.40	13.47	9.03	7.55
Rumuosi 132kV	T2	60.00	B	UPTH	UPTH	3.5	11.3	11.7	12.91	12.41	15.70	13.06	12.48	11.85	13.21	12.56	12.00	13.36	12.63	12.15
Rumuosi 132kV	T2	60.00	A	RUMUPE	RUMUEPI	12.1	10.2	13.3	11.80	8.50	15.30	11.95	8.58	13.45	12.10	8.65	13.60	12.25	8.72	13.75
Yenagoa 132kV	T1A	90/95	A	GOVT	GOVT	1.3	0.9	4.3	1.43	1.87	2.00	1.58	1.94	4.45	1.73	2.02	4.60	1.88	2.09	4.75
Yenagoa 132kV	T1A	90/95	D	IMIRINGI	IMIRINGI	0.7	1.2	1.8	13.40	15.25	16.50	13.55	15.33	1.95	13.70	15.40	2.10	13.85	15.47	2.25
Yenagoa 132kV	T1A	90/95	D	OPOLO	OPOLO	0.9	1.7	4.3	11.85	11.23	15.10	12.00	11.31	4.45	12.15	11.38	4.60	12.30	11.45	4.75
Yenagoa 132kV	T2	30/40	A	AMASOM	AMASOM	0.4	0.5	0.6	2.17	2.28	2.50	2.32	2.36	0.75	2.47	2.43	0.90	2.62	2.50	1.05
Yenagoa 132kV	T2	30/40	D	IMIRINGI	AGUDAM	1.9	3.9	8.6	8.48	2.33	15.30	8.63	2.41	8.75	8.78	2.48	8.90	8.93	2.55	9.05
Yenagoa 132kV	T2	30/40	D	TUNGBO	TUNGBO	0.6	1.5	2.7	5.55	5.32	6.70	5.70	5.39	2.85	5.85	5.47	3.00	6.00	5.54	3.15
GBARAIN	T1	60.00	D		GBARAIN	1.8	3.5	6.9	2.10	4.70	9.00	2.25	4.78	7.05	2.40	4.85	7.20	2.55	4.92	7.35
Abakaliki 132KV	T2	30.00	D		YAHE	4.0	6.2	14.7	3.90	5.35	16.90	4.05	5.42	14.85	4.20	5.50	15.00	4.35	5.57	15.15
Abakaliki 132KV	T1	60.00	D		ITIGIDI	3.7	6.0	14.5	2.80	4.47	13.00	2.95	4.54	14.65	3.10	4.62	14.80	3.25	4.69	14.95
FIPL GT			A		NLNG	0.6	0.9	1.1	0.80	0.90	1.90	0.95	0.98	1.25	1.10	1.05	1.40	1.25	1.12	1.55
FIPL GT			A		ORDINAN	4.4	8.3	12.2	6.40	10.28	14.20	6.55	10.36	12.35	6.70	10.43	12.50	6.85	10.50	12.65
Yandev 132kV	T2	60.00	D		KASTINA															
INDORAMA GT			A		EPCL	0.2	0.2	0.2	0.20	0.20	0.20	0.35	0.28	0.35	0.50	0.35	0.50	0.65	0.42	0.65

5.12.4 Discussions

- Port-Harcourt Disco complained that Rumuosi will be overloaded until PPI/FGNPowerCo complete its rehabilitation project at Rumuosi.
- TCN team urged Port-Harcourt to look for temporary solution pending the completion of the PPI PROJECTS.
- Port-Harcourt Disco proposed additional 60 MVA for Rumuosi.
- Port-Harcourt Disco noted that Itu transmission station does not need more MVA and it is wondering why TCN is adding new capacity under MVA.
- Port-Harcourt Disco wants to know how soon the Ikom and Ogoja transmission line issues will be resolved.
- Port-Harcourt will make its other requests known.

5.13 Yola Electricity Distribution Company

5.13.1 Introduction

The Committee on TCN Performance Improvement Plan (PIP) met with Yola Electricity Distribution Company on Thursday, February 17th, 2022 (via google meet). The list of the attendees is given in Table 5-59.

Table 5-59: List of Attendees of Meeting with Yola Disco Disco on PIP

S/NO	NAME	ORGANIZATION	E-MAIL
1	Engr. Kabiru Adamu	TCN	kabirua2002@yahoo.com
2	Engr. Adesanya A. B	TCN	abaadesanya@yahoo.co.uk
3	Engr. Hampashi Eric	TCN	erichampashi@yahoo.com
4	Engr. B. Abdulmumin	TCN	faabideen@gmail.com
5	Engr. Seun Amoda	TCN	oamoda@gmail.com
6	Sadiq Mohammed	Yola Disco	sadiq.mohammed@yedc.com.ng
7	Kabir Muhammad	Yola Disco	kabir.muhammad@yedc.com.ng

TCN gave a presentation that highlighted the following:

5.13.2 TCN Substations in Yola Disco and the utilizations of the substations.

That there are 11 TCN substations in Yola Disco franchise area where Yola Disco gets power from TCN network and the substations are listed in

REGION	DISCO	STATION	Capacity (MVA)	330 KV 1	330 KV 2	330 KV 3
BAUCHI	Yola	Biu 132kV	30	Gombe 330kV	Molai 330kV	Jos 330kV
BAUCHI	Yola	Damaturu 132kV	60	Damaturu 330kV		
BAUCHI	Yola	Damboa 132kV	40	Gombe 330kV	Molai 330kV	Jos 330kV
KADUNA	Yola	Hadejia 132kV	60	Kumbotso 330KV		
BAUCHI	Yola	Jalingo 132kV	60	Yola 330kV	Gombe 330kV	Jos 330kV
BAUCHI	Yola	Maiduguri 132kV	105	Molai 330kV	Gombe 330kV	Jos 330kV
BAUCHI	Yola	Mayo-Belwa 132kV	40	Yola 330kV	Gombe 330kV	Jos 330kV
BAUCHI	Yola	Molai 132kV	120	Molai 330kV		
BAUCHI	Yola	Potiskum 132kV	60	Gombe 330kV	Molai 330kV	Jos 330kV
BAUCHI	Yola	Savannah 132kV	15	Gombe 330kV	Yola 330kV	Jos 330kV
BAUCHI	Yola	Yola 132kV	90	Yola 330kV	Gombe 330kV	Jos 330kV
			680			Average

Yola Disco noted the following corrections to the table:

- That the total MVA in Yola Disco is 428 not 680.
- That the actual MVA that Yola Disco utilizes is 283 MVA.

- That Yola Disco has 43 feeders not 46 as recorded by TCN.

Table 5-60: Substations in Yola Disco Franchise Area

REGION	DISCO	STATION	Capacity (MVA)	330 KV 1	330 KV 2	330 KV 3
BAUCHI	Yola	Biu 132kV	30	Gombe 330kV	Molai 330kV	Jos 330kV
BAUCHI	Yola	Damaturu 132kV	60	Damaturu 330kV		
BAUCHI	Yola	Damboa 132kV	40	Gombe 330kV	Molai 330kV	Jos 330kV
KADUNA	Yola	Hadejia 132kV	60	Kumbotso 330KV		
BAUCHI	Yola	Jalingo 132kV	60	Yola 330kV	Gombe 330kV	Jos 330kV
BAUCHI	Yola	Maiduguri 132kV	105	Molai 330kV	Gombe 330kV	Jos 330kV
BAUCHI	Yola	Mayo-Belwa 132kV	40	Yola 330kV	Gombe 330kV	Jos 330kV
BAUCHI	Yola	Molai 132kV	120	Molai 330kV		
BAUCHI	Yola	Potiskum 132kV	60	Gombe 330kV	Molai 330kV	Jos 330kV
BAUCHI	Yola	Savannah 132kV	15	Gombe 330kV	Yola 330kV	Jos 330kV
BAUCHI	Yola	Yola 132kV	90	Yola 330kV	Gombe 330kV	Jos 330kV
			680			Average

Table 5-61 and Table 5-62 show the utilization factors of the 11 substations in Yola Discos. TCN asserted to Yola Disco that the 11 substations are grossly underutilized as shown in Table 5-61 and Table 5-62.

Table 5-61: Utilization Factors of Substations in Yola Disco Franchise Area

STATION	Capacity (MVA)	Jan-21	Feb-21	Mar-21	Apr-21	May-21	Jun-21	Jul-21	Aug-21	%
Biu 132kV	30	14.03	14.03	13.78	12.95	7.86	9.56	10.16	10.10	58.45%
Damaturu 132kV	60	9.16	10.25	11.95	15.11	15.22	10.76	11.89	11.75	31.71%
Damboa 132kV	40	-	0.01	0.09	-	-	-	-	-	0.27%
Hadejia 132kV	60	3.41	3.37	3.72	3.28	4.12	3.50	3.01	3.55	8.59%
Jalingo 132kV	60	18.38	19.32	18.97	20.56	17.00	15.37	17.74	18.45	42.84%
Maiduguri 132kV	105	21.22	-	1.87	-	-	-	-	-	25.26%
Mayo-Belwa 132kV	40	7.14	6.67	6.15	5.46	5.55	4.63	6.53	6.28	22.31%
Molai 132kV	120	6.64	-	0.52	-	-	-	-	-	6.92%
Potiskum 132kV	60	17.96	16.24	18.98	20.82	19.89	15.48	16.13	15.66	43.39%
Savannah 132kV	15	4.20	4.08	4.08	4.03	3.38	2.94	3.01	2.77	35.02%
Yola 132kV	90	34.95	37.20	39.99	40.26	35.70	32.17	34.98	35.62	55.92%
	680	137.09	111.17	120.11	122.48	108.72	94.40	103.43	104.17	25.20%

Table 5-62: Utilization Factors of Substations in Yola Disco Franchise Area

STATION	Max Jan-21	Max Feb-21	Max Mar-21	Max of Max	% Utilization
Biu 132kV	20.3	20.8	21	21	87.50%
Damaturu 132kV	16.3	17.3	19	19	39.58%
Damboa 132kV	0	3.5	3.3	3.5	10.94%
Hadejia 132kV	6.1	5.8	8.5	8.5	17.71%
Jalingo 132kV	27.6	28.4	26.8	28.4	59.17%
Maiduguri 132kV	48.4	0	37.6	48.4	57.62%
Mayo-Belwa 132kV	24.3	10.5	19.1	24.3	75.94%
Molai 132kV	15.4	0	15.7	15.7	16.35%
Potiskum 132kV	30.9	27.7	29.7	30.9	64.38%
Savannah 132kV	10.6	11.6	10.9	11.6	96.67%
Yola 132kV	51	55.3	57.1	57.1	79.31%
	250.9	180.9	248.7	268.4	49.34%

5.13.3 Yola Disco PIP

The approved NERC's Yola PIP energy trajectory is shown in Table 5-63.

Table 5-63: Yola PIP energy growth submission

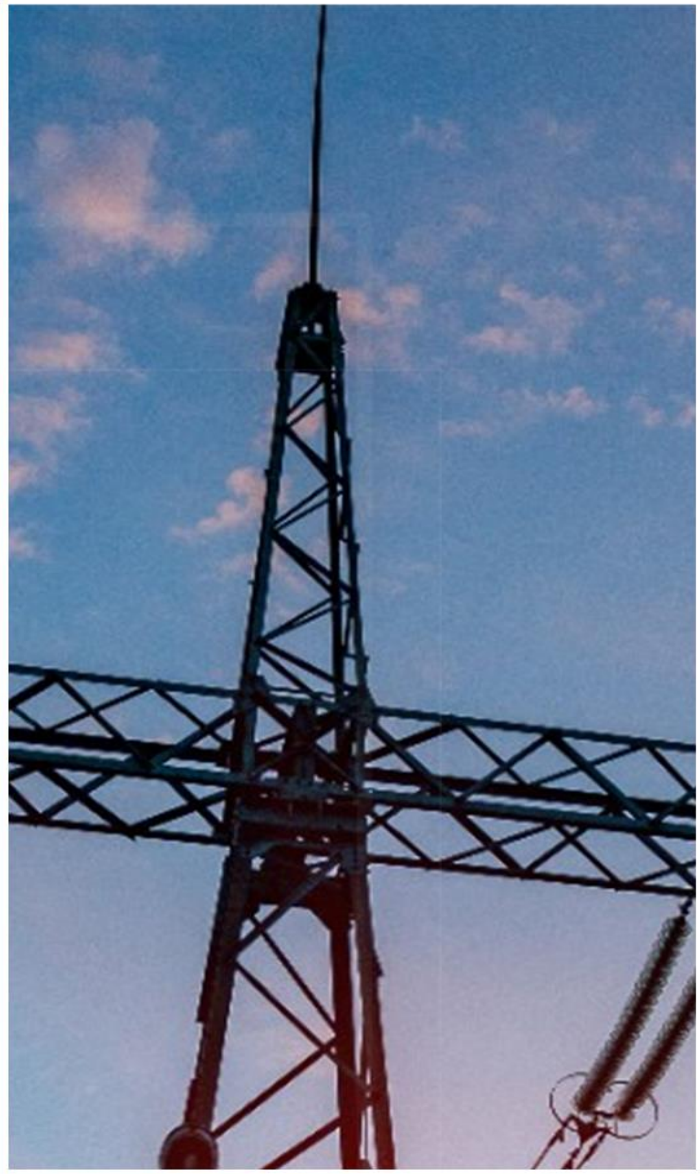
Disco	Current Energy Delivered (MWh/h)	PIP Year 1 Target (MWh/h)	PIP Year 2 Target (MWh/h)	PIP Year 3 Target (MWh/h)	PIP Year 4 Target (MWh/h)	PIP Year 5 Target (MWh/h)	Service Improvement Target (MWh/h)
Yola	40.07	66.58	93.08	119.59	146.10	172.60	132.53

Yola Disco could not break down the energy growth by Substations given that the Disco Management just changed hands. Yola Disco said they will develop and send the breakdown once the new management has settled down.

5.13.4 Discussions

- Yola Disco declared that the new management just took over 1st of January 2022. That the new management is yet to settle in properly and once they settle in properly, they will be able to engage with TCN more productively.
- TCN team raised the issue of tariff bands, which Yola Disco replied that they are still working on.
- TCN and Yola teams agreed to fix a later date for another meeting.
- Yola will make its other requests known.

6
PROJECTS IN DISCO FRANCISE AREAS



6.1 Major Transmission Projects in each Discos

TCN as a company has always been embarking on projects to maintain the vast transmission assets that make up its transmission network. TCN is also the industry leader in expanding its ability to serve its customers (Discos, Gencos, International Customers and Eligible Customers) by constantly embarking on greenfield projects to expand its network.

There are over 200 interface projects spread across the eleven distribution companies. Some of the projects ranges from capacity improvement, construction of transmission substations, reconductoring of existing lines, construction of new lines, replacement of transformers and many more. These projects have been identified as critical projects that can help improve the distribution/transmission capacity and ensure that more power can be delivered to the distribution companies. These projects when completed will mostly meet the needs of the eleven Discos.

These projects carried out are categorized based on their funding sources. The categories of the proposed projects are SLA, WB NETAP, AFD Northern Corridor & Abuja Ring Feeding Scheme and FGN&IGR Projects.

Table 6-1 below provides a summary of the number of projects across the 11 distribution companies

Table 6-1: Summary of Transmission/Distribution Interface Projects by Discos

DISCO	Number of SLA projects	Number of WB NETAP Projects	Number of FGN&IGR Projects	Number of PPI Projects	Abuja Trx. Scheme	NTEP	Northern Corridor	JICA LAGOS /OGUN	Total
Abuja	7	3		7	9		7		33
Benin	11	5	16	0		4			36
Eko	10	6	3	5				4	28
Enugu	4	8	25	1		1			39
Ibadan	10	3	15	1				9	38
Ikeja	9	3	0	0					12
Jos	4	2	6	1			1		14
Kaduna	8	1	5	3		5	7		29
Kano	6	4	18	2		1	3		34
PH	7	3	9	0					19
Yola	0	8	7	0					15
TCN			3	2			5	2	12

Total	*76*	*46*	*107*	*22*	*9*	*11*	*23*	*15*	309

6.2 ABUJA ELECTRICITY DISTRIBUTION COMPANY

TCN is currently implementing 33 projects in the Abuja Disco Franchise area, the projects are listed in the next sections by project categories.

6.2.1 SLA PROJECTS:

1. Re-conductoring of 132kV Apo-Karu-Keffi- Akwanga transmission line by TCN (to improve wheeling capacity by 80-200MW) - 139.5km with 250mm2 ACCC "Oriole" Conductor)
2. Karu Substation 132/33kV TS: Upgrade of 2x60MVA 132/33kV to 2x100MVA 132/33kV Transformers at Karu Transmission Station (To resolve transformer capacity limitation at Karu TS)
3. Gwagwalada Substation 132/33kV TS: Replacement of faulty 60MVA, 132/33kV power Transformer at Gwagwalada 2X60MVA, 132/33kV TS to improve power supply by NIPP
4. Transformers Spares: Power Transformers (2x150MVA)
5. Transformers Spares: Power Transformers (2x100MVA)
6. Transformers Spares: Power Transformers (2x60MVA)
7. 1 x 60 MVA Mobile Substations

6.2.2 WORLD BANK NETAP PROJECTS:

1. Shiroro 330kV TS:
   - Replacement of obsolete Control and Relay Panels with Digital Control System,
   - Replacement of High Voltage 330kV Switchgears and Associated Equipment
2. Abuja Central Area 132/33kV TS:
   - Upgrading of 2x60MVA with 2x100MVA 132/33kV Power Transformer
   - Rehabilitation of civil structures of the Control Room and Digital Control System at Abuja Central Area
3. Kainji 330kV TS:
   - Rehabilitation of 330kV Substation, High Voltage Switchgears, Associated Equipment.
   - Rehabilitation of Control Room including Digital Control System at Kainji

6.2.3 FGN & IGR PROJECTS:

None

6.2.4 PPI PROJECTS:

1. Katampe 330/132/33kV TS:
    a. Design, Engineering, Supply and Installation of: 1X150MVA 330/132/33kV transformer

    b. Design, Engineering, Supply and Installation of: and 2x100MVA 132/33kV transformers.
    c. Associated Primary, Secondary Switchgears and Control/Protection Systems.
    d. Associated Medium Voltage Equipment
    e. Associated Civil Works
    f. Testing & Commissioning.
2. Apo 132/33KV TS: Installation of 1X60MVA,132/33kV Transformer, Secondary Current Transformers and Disconnect switches, Control/Protection Panel, Testing & Commissioning and Removal of the Existing 45MVA transformer at Apo.
3. Kukwaba 132/33kV TS: Installation of : 1)2X100MVA,132/33kV Transformers, 132kV Primary and 33kV Secondary Switchgears, Control/Protection Systems and extension of Substation Automation System, civil works and Testing & Commissioning.
4. Jebba 330/132/33KV TS Installation of 1X60MVA,132/33kV Transformer, 132kV Primary and 33kV Secondary Switchgears, Control/Protection Systems and extension of Substation Automation System, All civil works and Testing & Commissioning.
5. World Trade Centre Abuja 132/33KV TS: Construction of 132kv GIS with 2x60MVA ,132/33kv Transformer Substation At World Trade Centre Abuja.
6. Ministry of Defence 132/33kV TS: Construction of 132kv GIS with 2x60mva Transformer Substation At Ministry Of Defence
7. 132kV Line: Construction of 13km length of underground 132KV 400mm XLPE cable double circuit transmission line in 100-150mm constructed duct, including Manholes. 132kv double circuit underground cable from Central Area to Ministry of Defence (5km), Ministry of Defence to WTC (2km), Kukwaba to WTC (6km)

6.2.5 ABUJA TRANSMISSION RING SCHEME

1. New Apo 330/132/33kV TS: Construction of complete new 330/132/33kV substation at New Apo (Pigba)
    a) 2X150MVA 330/132/33kV transformers
    b) 3X60MVA,132/33kV transformers
    c) 330kV,132kV,33kV primary and secondary switchgears, Control/protection systems and automation.
    d) 6 X 132kV line bay
    e) 3 X 132kV line bay extension at Old Apo 132kV Substation.
    f) 2x 330kV line bays extension at Lafia
    g) 9X33kV distribution feeders all civil works, testing and commissioning.

2. West Main (Lugbe) 330/132/33kV TS: Construction of complete new 330/132/33kV AIS substation at West Main (Lugbe)
    a) 2X150MVA 330/132/33kV Transformers
    b) 3X60MVA,132/33kV 132/33kV Transformers (with 132kV outdoor GIS Switchgear)
    c) 330kV, 132kV, 33kV primary and secondary switchgears, Control/protection systems and automation.
    d) 2 X 330kV line bay and 4 X 132kV line bays
    e) 33kV indoor metal clad switchgears
    f) 9X33kV distribution feeders all civil works, testing and commissioning.

3. Kuje 3X60MVA 132/33kV TS: Construction of complete new 132/33kV substation at Kuje
    a) 3X60MVA,132/33kV transformers
    b) 132kV,33kV primary and secondary switchgears, Control/protection systems and automation.
    c) 4 X 132kV line Bay
    d) 9X33kV distribution feeders all civil works, testing and commissioning.

4. Wumba 2X60MVA 132/33kV TS: Construction of complete new 132/33kV substation at Wumba/Lokogoma
    a) 2X60MVA,132/33kV transformers
    b) 132kV,33kV primary and secondary switchgears, Control/protection systems and automation.
    c) 2 X 132kV line Bay
    d) 2 X 5km underground 132kV XLPE Cable line, from New Apo to Wumba/Lokogoma
    e) 6X33kV distribution feeders all civil works, testing and commissioning.

5. Gwarimpa 2X60MVA 132/33kV TS: Construction of complete new 132/33kV GIS substation at Gwarimpa
    a) 2X60MVA,132/33kV transformers,
    b) 132kV GIS Primary and 33kV Metal clad secondary switchgears, Control/protection systems and automation.
    c) OHL / Underground Cable termination of the existing 132KV DC Katampe – Suleja Transmission line.
        - laying of 4x1km 132kV Underground XPLE Cable
    d) 6X33kV distribution feeders all civil works, testing and commissioning
6. Construction of about 172km of new 330kV double circuit line from Lafia 330kV 330/132/33kV substation to the proposed New Apo (Pigba) 330/132/33kV substation.

7. Construction of about 11km (7km) of new 132kV double circuit line from New Apo (Pigba) 330/132/33kV substation to Old Apo 132/33kV substation
8. Construction of 42km (35km) of new 132kV double circuit line from New Apo 330/132/33kV substation to the Kuje 132/33kV substation.
9. Construction of 29km of new 132kV double circuit line from the proposed Kuje 132/33kV Substation to West Main (Lugbe) 330/132/33V substation

6.2.6 AFD NORTHERN CORRIDOR PROJECTS

1. Lambata 132/33kV TS: Construction of complete new 132/33kV Substation at Lambata
    a) 1X60 MVA,132/33kV transformer
    b) Turn in Turn out Minna - Suleja 132KV DC
2. Kainji 330/132/33kV TS: Rehabilitation Work:
    a) Urgent replacement of Kainji / Jebba 330kV line 1 - 330kV Circuit Breaker at Kainji TS.
3. Jebba 330/132/33kV TS: Rehabilitation Work:
    a) Replacing the existing very old (1968) Marilli 80MVA 330/132/13.8kV, 2T1 transformer with 1x150MVA 330/132/33kV
    b) Reinforcement with 1X60MVA, 132/33kV transformer
    c) Reinforcement with 3 number 33KV feeder control and protection panels
4. Jebba 330/132/33kV TS: Rehabilitation Work:
    a) Urgent replacement of 1 no. Jebba T/S 75MX reactor 2R2 CB - that exploded
5. Jebba 330/132/33kV TS: Rehabilitation Work:
    a) Replacement of 11 no. 330kV circuit breakers at Jebba 330kV switchyard. The existing CB's are obsolete no parts and spares available.
6. Jebba 330kV Power Station TS: Rehabilitation Work:
    a) Replacement of 8nos. 330KV obsolete Circuit Breakers.. The existing CB's are obsolete no parts and spares available.
7. Shiroro 330/132/33kV TS: Rehabilitation Work:
    a) Replacement of 330kV obsolete hydraulic SF6, circuit breakers and associated motorized Isolators at Shiroro TS

6.2.7 COMPLETED PROJECTS AFTER START OF DISCUSSION WITH DISCOS

1. Kubwa 132/33kV TS: Replacement of faulty 60MVA Transformer at Kubwa 132/33kV TS
2. Katampe TS to Central Area Abuja TS: Retermination and repair of the punctured Katampe – Central Area 132kV Line 2 underground cable
3. Lafia Substation 330/132/33kV TS: 2x150MVA, 330/132/33kV; 2x60MVA, 132/33kV Substation at Lafia with Turn-in Turn-Out at Lafia TS (NIPP is handling the project)

6.3 BENIN ELECTRICITY DISTRIBUTION COMPANY

TCN is currently implementing 36 projects in the Benin Disco Franchise area, the projects are listed in the next sections by project categories.

6.3.1 SLA PROJECTS:

1. Reconductoring of 132kV Oshogbo - Akure Single Circuit transmission line.
2. Reconductoring of undersized conductor on the 132KV line between Ughelli and Effurun (10Km)
3. Oghara 132kV TS:
    a. Replacement of 3No 132kV and 9Nos 33kV Current transformers and
    b. Differential relay at Oghara 132kV TS to restore the standby 30MVA power transformer
4. Asaba 330/132/33kV TS;
    a. Replacement of the faulty 1x150MVA, 330/132kV Power Transformer
    b. Upgrading of 2x60MVA with 2x100MVA, 132kV/33kV, Power Transformers
    c. Construction of additional 2X33kV Feeder Bays
5. Ihovbor 330/132/33KV TS: Construction of 2 numbers of additional 33kV Line Bays
6. Okada 132/33kV TS:
    a. Replacement of faulty grounding on 1x40MVA, 132/33kV.
    b. Replacement of differential relay and surge Arrester on 1x40MVA transformer.
7. Afisere 132/33kV TS: Upgrading of faulty 1x30MVA, 132/33kV Transformer with 1x60MVA power transformer
8. Transformers Spares: Power Transformers (2x150MVA)
9. Transformers Spares: Power Transformers (2x100MVA)
10. Transformers Spares: Power Transformers (2x60MVA)
11. 1 x 60 MVA Mobile Substations

6.3.2 WORLD BANK NETAP PROJECTS:

1. Ondo 132/33kV TS:
    - Upgrading of 2 x 30MVA with 2x 60MVA,132/33kV Power Transformers
    - Replacement of High Voltage Switchgears, Control & Relay panel with Digital Control system and
    - Conversion of 6nos. 33kV Indoor to 8No Outdoor. Rehabilitation of control room
2. Irrua TS 132/33kV TS: Supply and installation of 100MVA 132/33KV power Transformer and associated Switchgears at Irrua TS.
3. Delta 132/33kV TS:
    - Reinforcement with 1 x 150MVA 330/132kV Interbus Transformer,
    - Reinforcement with 1 x 100MVA 132/33KV Power Transformer
    - Replacement of High Voltage Switchgears, and Associated Equipment.
    - Replacement of Obsolete Control and Relay Panels with Digital Control System

4. Effurun 132/33kV TS:
    - Replacement of defective 1x 60MVA 132/33kV with a new 1x 1000MVA 132/33KV Power Transformer
    - Replacement High Voltage Switchgears, and Associated Equipment
    - Installation of 4 No Additional Feeder Bays at Effurun
5. Benin 330/132/33kV TS:
    - Reinforcement with 1 x 150MVA 330/132kV Power Transformers
    - Reinforcement with 1 x 100MVA 132/33KV Power Transformer
    - Replacement of High Voltage Switchgears, and Associated Equipment.
    - Replacement of Obsolete Control and Relay Panels with Digital Control System

6.3.3 AFDB NIGERIAN TRANSMISSION EXPANSION PLAN

1. Reconstruction of one of Delta-Benin 330kV Transmission Line (107 km) Double Circuit to Quad Conductor 330 Double Circuit Line
2. Gilli-Gilli 132/33kV TS: Construction of complete new 132/33kV Substation at Gilli-Gilli
    a) 2X60 MVA,132/33kV transformers
    b) 6 X 33kV feeder bay
3. Construction of new Double Circuit (DC) 132kV Okada-Gilli-Gilli
4. Construction of new DC Transmission Line 132kV Sapele - Odilli DC Transmission Line

6.3.4 FGN & IGR PROJECTS:

1. Benin-Azura-Ajaokuta 330KV DC Transmission line with turn in and out at Azura Substation
2. Benin North-Oshogbo 330KV DC line with one SC turning in and out to New Akure substation
3. 2 X 150MVA 330/132kV S/S and 2 X 60MVA 132/33kV substation, Akure
4. Construction of Ado-Ekiti (Ikere)-Ijesha Isu 132kV Double Circuit Transmission Line
5. Construction of Ijesha-Isu - Ilupeju 132kV Double Circuit Transmission Line
6. Construction and Installation of 2x60MVA, 132/33KV Substation at Ijesha-Isu with 6x132KV Line bays Extension/Switching station at Ado-Ekiti (Ikere)
7. Construction and Installation of 2x60MVA, 132/33KV Substation at Ilupeju and 2x132KV Line bays Extension at Ijesha-Isu
8. Construction of 132kV Okpai-Kwale DC Transmission Line
9. Construction of 1 x 150MVA, 330/132kV Substation at Okpai
10. Construction of 1 x 60MVA, 132/33kV Substation at Kwale
11. Construction of Kwale-Nsukwa 132kV Double Circuit Transmission Line (40km)
12. Construction of 2X60MVA,132/33kV at Nsukka
13. Obajana-Okeagbe 132kV DC line
14. Construction of 132kV Okeagbe-Ikare-Akoko Double Circuit Transmission Line (15km)

15. Construction of 2x60MVA, 132/33KV Substation at Ikare-Akoko and 2x132KV Line bays Extension at Okeagbe
16. 2x60MVA 132/33kV substation at Okeagbe, Ondo State and line bays extension at Obajana
17. 2x 150MVA 330/132KV substation at Omotosho
18. 2x60MVA, 132/33kV Substation at Ose LGA Headquarters, Ondo State

6.4 EKO ELECTRICITY DISTRIBUTION COMPANY

TCN is currently implementing 28 projects in the Eko Disco Franchise area, the projects are listed in the next sections by project categories.

6.4.1 SLA PROJECTS:

1. Akoka 1X40MVA & 1x45MVA TS:
    a. Upgrading of 1X40MVA & 1x45MVA with 2 x60MVA, 132/33kV Power Transformer at Akoka TS
    b. Construction of additional 33kV feeder bay
    c. Conversion of indoor Circuit breaker to outdoor.
2. Isolo 132/33kV TS:
    a. Replacement of faulty 60MVA 132/33kV Transformer with 100MVA,132/33kV.
    b. Installation of 3nos 33kVA Feeder bays
3. Itire 132/33kV TS: Replacement of failed 60MVA transformer at Itire TS
4. Ojo TS 132/33kV TS:
    a. Construct 3nos 33kV bays at the transmission station
    b. Rehabilitation of problematic indoor circuit breakers -(Elimson -Turkey type)- Faulty 33kV panel to be replaced for System Reliability
5. Agbara TS 132/33kV TS:
    a. Upgrading of 2x45MVA with 2x100MVA, 132/33kV Transformers.
    b. Construction of additional ??x33kV feeder bays
6. Ajah 132/33kV T/S:
    a. Installation of 1x100MVA, 132/33kV Transformers at Aja TS
    b. Construction of additional outdoor 3x33kV feeder bays
7. Transformers Spares: Power Transformers (2x150MVA)
8. Transformers Spares: Power Transformers (2x100MVA)
9. Transformers Spares: Power Transformers (2x60MVA)
10. 1 x 60 MVA Mobile Substations

6.4.2 WORLD BANK NETAP PROJECTS:

1. Ijora 132kV/33kV TS:
    - Upgrading of 2 x 30MVA with 2 x 100MVA 132/33kV.

- Rehabilitation of civil structures of the Control Room and Digital Control System

2. Lekki 330kV/132kV/33kV TS:
    - Supply & Installation of 1 x300MVA 330/132kV and 2x100MVA 132/33kV Power Transformers
    - High Voltage Switchgears and Associated Equipment
3. Alagbon 330kV/132kV/33kV TS:
    - Supply & Installation of 1 x300MVA 330/132kV, 2 x 100MVA 132/33kV Power Transformers
    - Switchgears and Associated Equipment
4. Akoka 132kV/33kV TS:
    - Rehabilitation of building structure and sinking surrounding area
    - Replacement of obsolete 132kV equipment, 33KV Metal clad Switchgears, Control & Relay panel
    - Reinforcement with 1x 60MVA 132/33KV Power Transformer.
    - Refurbishment of the 2x 45MVA transformers and GIS component
5. Amuwo Odofin 132kV/33kV TS:
    - Rehabilitation of building structure and sinking surrounding area
    - Replacement of obsolete 132kV equipment, 33KV Metal clad Switchgears, Control & Relay panel
    - Reinforcement with 2x 60MVA 132/33KV Power Transformer.
    - Refurbishment of the 1x 30MVA transformers and GIS components at TS
6. Itire 132kV/33kV TS:
    - Rehabilitation of building structure and sinking surrounding area
    - Replacement of obsolete 132kV equipment, 33KV Metal clad Switchgears, Control & Relay panel
    - Reinforcement with 1x 60MVA 132/33KV Power Transformer.
    - Refurbishment of the 1 x 40 & 60MVA transformers and GIS components at Itire TS

6.4.3 JICA LAGOS/OGUN TRANSMISSION PROJECTS:

1. Ajegunle (New Agbara) 330/132/33kV TS: Construction of complete new 330/132/33kV AIS substation at Ajegunle (New Agbara)
    a) 2X150MVA 330/132/33kV transformers
    b) 2X60 MVA,132/33kV transformers
    c) 330kV,132kV,33kV primary and secondary switchgears, Control/protection systems and automation.
    d) 6 X 330kV line bays
    e) 4 X 132kV line bay
    f) 6 x 33kV line bays
    g) 2 x 132kV line bays extension at the existing Agbara 132/33KV
2. Badagary 132/33kV TS: Construction of complete new 132/33kV AIS substation at Badagry

a) 2X60 MVA,132/33kV transformers
b) 132kV,33kV primary and secondary switchgears, Control/protection systems and automation.
c) 2 x 132kV line bays
d) 6 x 33kV line bays

3. Construction of about 21.7km of new 132kV double circuit line from new New Agbara (Ajegunle) 330/132/33kV substation to existing Agbara 132/33kV substation.
4. Construction of 36.2km of new 132kV double circuit line from New Agbara(Ajegunle) 330/132/33kV substation to the proposed Badagary 132/33kV substation.

6.4.4 FGN & IGR PROJECTS:

1. Eko Atlantic City Transmission Line: Engineering Design, Procurement, Construction and Commissioning of 132Kv double circuit Transmission line from Lekki Substation to the proposed 132/33kV Atlantic City proposed substation on Steel Poles towers with pile foundations
2. Eko Atlantic City Transmission Substation: Engineering Design, Procurement, Construction and Commissioning of 2 X 60MVA 132/33kV Eko Atlantic City GIS
3. Ajah 330kV/132kV TS: Replacement of GIS Circuit Breaker

6.4.5 PPI PROJECTS:

1. Akangba 330kV/132KV TS:
   a. Addition of 330/132kV transformer with a 300MVA, 330/132kV transformer of similar parameter with the present 300MVA 330/132kV transformer at the station.
   b. 2 X 330kV line bay in Double Busbar scheme.
   c. Testing & Commissioning
2. New Ijora 330KV/132/33KV TS: Construction of 2X150MVA, 330/132kV and 2X60 MVA, 132/33kV substations fully equipped to have
   a. 330kV,132kV double busbars
   b. Fully equipped 330kV & 132kV Transformer diameter in breaker and half configuration
   c. Fully equipped 330kV Line diameter in breaker and half configuration.
   d. 6X33 feeder bays
   e. One fully equipped transformer and line spare diameter.
3. EPZ Lekki Free Trade Zone 330kV/132kV/33kV TS: Construction of 2X150MVA, 330/132kV and 2X60 MVA, 132/33kV substations fully equipped to have
   a. 330kV,132kV double busbars
   b. Fully equipped 330kV & 132kV Transformer diameter in breaker and half configuration
   c. Fully equipped 330kV Line diameter in breaker and half configuration.
   d. 6X33 feeder bays
   e. One fully equipped transformer and line spare diameter.

4. Epe 330kV/132kV/33kV TS: Construction of 2X150MVA, 330/132kV and 2X60 MVA, 132/33kV substations fully equipped to have
    a. 330kV,132kV double busbars
    b. Fully equipped 330kV & 132kV Transformer diameter in breaker and half configuration
    c. Fully equipped 330kV Line diameter in breaker and half configuration.
    d. 6X33 feeder bays
    e. One fully equipped transformer and line spare diameter.
5. Alagbon 132kV/33kV TS:
    a. Construction of additional 2X60 MVA, 132/33kV, Substation fully equipped to have:
        i. 132kV double busbar
        ii. Fully equipped one Transformer diameter in breaker and half configuration
        iii. One fully equipped transformer and line spare diameter
    b. Construction of 2X330kV Line Bay Extension

6.4.6 COMPLETED PROJECTS AFTER START OF DISCUSSION WITH DISCOS

1. Grid network enhancement: Restoration of the 2nd Egbin-Ajah 330kV line for system reliability

6.5 ENUGU ELECTRICITY DISTRIBUTION COMPANY

TCN is currently implementing 39 projects in the Enugu Disco Franchise area, the projects are listed in the next sections by project categories.

6.5.1 SLA PROJECTS:

1. Transformers Spares: Power Transformers (2x150MVA)
2. Transformers Spares: Power Transformers (2x100MVA)
3. Transformers Spares: Power Transformers (2x60MVA)
4. 1 x 60 MVA Mobile Substations

6.5.2 WORLD BANK NETAP PROJECTS:

1. Alaoji 330kV/132kV TS:
    - Rehabilitation of 330kV Substation, Control Room, Digital Control System
    - Replacement of High Voltage Switchgears and Associated equipment
2. Aba 132kV/33kV TS:
    - Rehabilitation of 132kV Substation, 132kV Control Room, Digital Control System

- Replacement of High Voltage Switchgears and Associated equipment

3. New Haven 132kV/33kV TS:
   - Reinforcement with 1 x 150MVA 330/132/33kV, 2 x 60MVA Transformers with Associated Equipment
   - Replacement of High Voltage Switchgears
   - Rehabilitation of Control Room with Digital Control System
4. GCM 132kV/33kV TS:
   - Reinforcement with 1 No. 60MVA 132/33kV Power Transformers
   - Replacement of High Voltage Switchgears and Associated Equipment
5. Abakalili 132kV/33kV TS:
   - Upgrade of 1 x 30MVA to 60MVA 132/33kV Power Transformer, High Voltage Switchgears and Associated Equipment at Abakaliki
   - Replacement of High Voltage Switchgears and Associated Equipment
6. Oji River 132kV/33kV TS:
   - Reinforcement with 1No. 60MVA 132/33kV Power Transformers
   - Replacement of High Voltage Switchgears and Associated Equipment
7. Ugwuaji 132kV/33kV TS:
   - Supply & Installation of 1 x 75Mvar Reactor
   - Reinforcement with 1 x 60MVA 132/33kV
   - Replacement of High Voltage Switchgears and Associated Equipment
8. Umuahia 132kV/33kV TS:
   - Reinforcement with 100MVA 132/33kV Power Transformers
   - Extension of 132kV Bus with 3 No. Additional Feeder Bays at Umuahia

6.5.3 AFDB NIGERIAN TRANSMISSION EXPANSION PLAN

1. Reconstruction of one of Alaoji-Ihiala-Onitsha 330kV Transmission Line (138kM) Double Circuit to Quad Conductor 330 Double Circuit Line

6.5.4 FGN & IGR PROJECTS:

1. Ohafia 132kV/33kV TS: Construction of 2x30/40MVA
2. Amasiri 132kV/33kV TS:
   - Construction of 2x60MVA, 132/33kV substation at Amasiri, Afikpo
   - 2x132kV line bay extension at Abakaliki
3. Okigwe 132kV/33kV TS: Construction of 2x30/40MVA 132/33kV Substation,
4. Nnewi 132kV/33kV TS: Construction of 2x60 MVA 132kV substation
5. Arochukwu 132kV/33kV TS: Construction of 2x30/40MVA 132/33kV substation
6. Ideato 132kV/33kV TS:
   - Construction of 2x60MVA, 132/33kV substation at Ideato
   - 2x132kV line bays extension at Okigwe

7. Aboh Mbaise 132kV/33kV TS:
   - Construction of 2x60MVA, 132/33kV substation at Aboh Mbaise
   - 2x132kV line bays extension at Owerri
8. Mbalano 132kV/33kV TS: Construction of 2x30/40MVA 132/33kV substation
9. Mpu 132kV/33kV TS:
   - Construction of 2x60MVA,132/33kV substation at Mpu
   - 2x132kV line bay extension at Nnenwe
10. Nnenwe 132kV/33kV TS: Construction of 2x60MVA, 132/33kV substation
11. Ibughubu Umuchu 132kV/33kV TS:
    - Construction of 2x60MVA, 132/33kV substation
    - 2x132kV Line Bays Extension at Agwu-Awka
12. Aguleri 132kV/33kV TS: Construction of 2x60MVA, 132/33kV Substation
13. Umoghara 330/132/33kV TS: Construction and Installation of 2x150MVA, 330/132/33kV Substation at Umoghara (with a proposed Ugwuaji-Umoghara 330kV DC Transmission Line)
14. Amansi 330/132/33kV TS: Construction and Installation of 2x150MVA, 330/132/33KV; 2x60MVA, 132/33kV Substation at Amansi with 6x132kV Line Bays Extension at Amansi.
15. Ohafia - Arochukwu 132KV Line
16. Abakaliki - Amasiri 132kV DC line
17. Onitsha - Oba - Nnewi - Ideato- Okigwe 132kv DC Line
18. Owerri - Aboh Mbaise 132KV DC Line
19. Nnenwe-Mpu 132kV DC line
20. Umuahia-Ohafia 132kv SC line
21. Ugwuaji-Nnenwe 132kV DC line
22. Umuahia - Mbalano 132kV SC Line,
23. Mbalano-Okigwe 132kV SC Line,
24. Construction of 132kV Agu Akwa-Umuchu DC Transmission Line (55km)
25. Construction of Amansi-Aguleri 132kV Double Circuit Transmission Line (40km)

6.5.5 PPI PROJECTS:

1. Onitsha 330/132/33kV TS:
   a) Design, Engineering, Supply and Installation of: 1X150MVA 330/132/33kV transformer
   b) Associated Primary, Secondary Switchgears and Control/Protection Systems.
   c) Associated Medium Voltage Equipment
   d) Associated Civil Works
   e) Testing & Commissioning.

6.6 IBADAN ELECTRICTY DISTRIBUTION COMPANY

TCN is currently implementing 38 projects in the Ibadan Disco Franchise area, the projects are listed in the next sections by project categories.

6.6.1 SLA PROJECTS:

1. Ijebu-Ode 2X30MVA, 1 X60MVA, 132/33kV TS:
    a) Replacement of faulty 60MVA, 132/33kV transformer (T3) at Ijebu-Ode
    b) Replacement of faulty 60MVA 132/33kV Transformer with 100MVA,132/33kV.
    c) Installation of 3nos 33kVA Feeder bays
2. Jericho 1X 45MVA, 1X40MVA, 132/33KV TS:
    a) Upgrading of 1x40MVA & 1x45MVA Mobitra with 2x60MVA, 132/33kV Transformer including 2x33kV feeder bays
3. Reconductoring of Ayede-Ibadan North 132kV DC Transmission Line (18km)
4. Ile-Ife 2 X 30MVA, 132/33kV TS: Installation of 1x60MVA, 132/33kV Transformer which is already on plinth including 2x33kv feeder bays for connection.
5. Ayede 3X150MVA, 330/132/33kV TS: Installation of additional 1x150MVA, 330/132KV transformer
6. Ibadan-North 2x60MVA, 132/33kV TS: Upgrading of 2x60MVA, 132/33KV transformers to 2X100MVA, 132/33KV transformers.
7. Transformers Spares: Power Transformers (2x150MVA)
8. Transformers Spares: Power Transformers (2x100MVA)
9. Transformers Spares: Power Transformers (2x60MVA)
10. 1 x 60 MVA Mobile Substations

6.6.2 WORLD BANK NETAP PROJECTS:

1. Osogbo 330kV/132kV TS:
    - Upgrading of 1x 90MVA 330/132kV transformer to 1x300MVA transformer
    - Reinforcement with 1x100MVA 330/132kV Power Transformers
    - Replacement of High Voltage Switchgears and Associated equipment
    - Installation of a 75MX Reactor
    - renovation of control room at Osogbo

2. Ilorin 132kV/33kV TS:
    - Reinforcement with 2 x100MVA 132/33kV Power Transformers,
    - High Voltage Switchgears, and Associated Equipment.
    - Construction of New Control Room
    - Replacement of control & relay panel with Digital Control System (DCS)

3. Ota 132kV/33kV TS:
    - Upgrading of the 1 x 30MVA and 1 x 40 MVA with 2 x 100MVA 132/33kV Power Transformers,
    - Replacement of High Voltage Switchgears and Associated equipment

6.6.3 JICA LAGOS/OGUN TRANSMISSION PROJECTS:

1. Likosi 330/132/33kV TS: Construction of complete new 330/132/33kV AIS substation at Likosi (Ogijo)
   a) 2X150MVA 330/132/33kV transformers
   b) 2X100 MVA,132/33kV transformers
   c) 330kV,132kV,33kV primary and secondary switchgears, Control/protection systems and automation.
   d) 10x 330kV line bays
   e) 6 X 132kV line bay
   f) 6 x 33kV line bays
   g) Termination works with the existing 330 KV Transmission lines

2. Ejio 330/132/33kV TS: Construction of complete new 330/132/33kV AIS substation at Ejio (Arigbajo)
   a) 2X150MVA 330/132/33kV transformers
   b) 2X60 MVA,132/33kV transformers
   c) 330kV,132kV,33kV primary and secondary switchgears, Control/protection systems and automation.
   d) 12x 330kV line bays
   e) 2 X 132kV line bay
   f) 6 x 33kV line bays
   g) Construction of 2 x 330kV line bays extension at Olorunsogo 330kV switchyard
   h) Construction of 2 x 132kV line bays extension at New Abeokuta 132/33KV substation

3. Makogi (MFM) 330/132/33kV TS: Construction of complete new 330/132/33kV AIS substation at Makogi (MFM)
   a) 2X150MVA 330/132/33kV transformers
   b) 2X60 MVA,132/33kV transformers
   c) 330kV,132kV,33kV primary and secondary switchgears, Control/protection systems and automation.
   d) 4x 330kV line bays
   e) x X 132kV line bay
   f) 6 x 33kV line bays

4. Abule Oba (Redeem) 132/33kV TS: Construction of complete new 132/33kV AIS substation at Abule Oba (Redeem)
   a) 2X60 MVA,132/33kV transformers
   b) 132kV,33kV primary and secondary switchgears, Control/protection systems and automation.
   c) 6 x 33kV line bays
5. Construction of 5.1km of 2x 330kV double circuit line (multi circuits) from Makogi 330/132/33kV substation to the existing Omotoso /IkejaWest double circuit line.

6. Construction of 12.5km of new 330kV double circuit line from new Ejio 330/132/33kV substation to Olorunsogo 330kV switchyard inclusive of 1.5km 2x 330KV DC multi circuits line.
7. Construction of about 35.5km of new 132kV double circuit line from new Ejio 330/132/33kV substation to New Abeokuta 132/33kV substation.
8. Construction of 7.78km of new 132kV double circuit line from Likosi 330/132/33kV substation to the proposed Redeem 132/33kV substation.
9. Construction of 2.41km of new 2x 132kV double circuit (multi circuits)(quad) line from the proposed Likosi 330/132/33kV substation to Ikorodu /Shagamu 132kV double circuit line.

6.6.4 FGN & IGR PROJECTS:

1. Shonga 132kV/33kV TS: Construction of 2x60MVA, 132/33KV substation
2. Shaki 132kV/33kV TS:
    a. Construction of 2x60MVA, 132/33KV Substation at Shaki
    b. 2x132KV Line bays Extension at Iseyin
3. Ogbomosho 132kV/33kV TS: Construction of 2 x 60MVA 132/33kV Substation
4. Ede 132kV/33kV TS: Construction of 2 x 60MVA 132/33kV Substation
5. Lanlate 132kV/33kV TS:
    a. Construction of 2x30/40 MVA, 132/33 kV substation at Lanlate
    b. 2 x132KV Line Bays at New Abeokuta 132/33 kV substation
6. Igangan 132kV/33kV TS: Construction of 2x60MVA 132/33KV Substation
7. Igboora 132kV/33kV Switching Station: Construction of 132/33KV Switching Station
8. Construction of New Abeokuta – Igboora - Lalante 132kV DC Line and 132kV Double Circuit tee-off at Igboora -Igangan
9. Construction of Ganmo - Ogbomosho 132kV Line (45KM)
10. Construction of Erukan - Omotosho 330KV DC Trx. Line
11. Construction of Ganmo - Shonga 132KV DC Line
12. Construction of 132kV Iseyin - Shaki Double Circuit Transmission Line (86km)
13. Construction of Kainji – Kiama – Shaki – Isheyi - Lanlante 132kV Double Circuit Transmission Line (211km)

6.6.5 PPI PROJECTS

1. Eleyele Ibadan 132kV/33kV TS: Construction of 2X60 MVA, 132/33kV, Substation fully equipped to have:
    a) 132kV double busbar
    b) Fully equipped one Transformer diameter in breaker and half configuration
    c) Fully equipped 132kV Line diameter in breaker and half configuration.
    d) One fully equipped transformer and line spare diameter.

6.6.6 COMPLETED PROJECTS AFTER START OF DISCUSSION WITH DISCOS

1. Finished construction of Ikorodu - Odogunyan - Shagamu 132KV DC Transmission Line.

6.7 IKEJA ELECTRIC

TCN is currently implementing 12 projects in the Ikeja Disco Franchise area, the projects are listed in the next sections by project categories.

6.7.1 SLA PROJECTS:

1. Egbin 330kV/132kV TS
    a. Additional 33kV line bay at Egbin 132/33kV Substation
2. Oke Aro 330/132/33kV TS:
    a. Replacement of Differential protection relay and other materials on 300MVA, 330/132/33kV transformer at Oke Aro 330/132/33kV Substation.
    b. Installation of additional 1x100MVA, 132/33kV Power Transformer.
    c. Installation of additional 3x33kV feeder bays at Oke Aro TS
3. Isolo 132/33kV T/S:
    a. Upgrading of T3 45MVA transformer to 60MVA, 132/33kV to accommodate more load
    b. Upgrading of 1x30MVA tx to 1x60MVA, 132/33kV transformer
4. Itire 1x30, 1x40MVA, 1x60MVA, 132/33kV T/S:
    a. Upgrading of 1x30MVA to 1x60MVA, 132/33kV transformer,
    b. Upgrading of 1x40MVA to 1x100MVA,132/33kV power transformer
5. Oworonshoki 2x30MVA T/S:
    a. Replacement of 1x30MVA transformer with 1x60MVA, 132/33kV Power Transformer
    b. construction of associated additional 2x33kV feeder Bay at Oworonshoki TS
6. Transformers Spares: Power Transformers (2x150MVA)
7. Transformers Spares: Power Transformers (2x100MVA)
8. Transformers Spares: Power Transformers (2x60MVA)
9. 1 x 60 MVA Mobile Substations

6.7.2 WORLD BANK NETAP PROJECTS:

1. Egbin 132kV/33kV TS:
    a) Replacement of obsolete Control and Relay Panels with Digital Control System.
    b) Rehabilitation of Control Room, High Voltage Switchgears and Associated Equipment
2. Alausa 132kV/33kV TS:
    a) Reinforcement with addition of 1 x 100MVA 132/33kV Power Transformer
    b) Replacement of High Voltage Switchgears and Associated Equipment
3. Maryland 132kV/33kV TS:

a) Upgrading of 2 x 30MVA to 2 x 100MVA 132/33kV Power Transformers,
b) Replacement of High Voltage Switchgears and Associated Equipment

6.8 JOS ELECTRICITY DISTRIBUTION COMPANY

TCN is currently implementing 14 projects in the Ikeja Disco Franchise area, the projects are listed in the next sections by project categories.

6.8.1 SLA PROJECTS:

1. Transformers Spares: Power Transformers (2x150MVA)
2. Transformers Spares: Power Transformers (2x100MVA)
3. Transformers Spares: Power Transformers (2x60MVA)
4. 1 x 60 MVA Mobile Substations

6.8.2 WORLD BANK NETAP PROJECTS:

1. Gombe 330kV/132kV/33kV TS:
    a. Reinforcement with 1 x 300MVA 330/132kV and 1 x 100MVA 132/33kV Transformers
    b. Replacement of High Voltage Switchgears, and associated equipment
    c. 3 No Additional Feeder Bays
2. Jos 330kV/132kV/33kV TS:
    d. Reinforcement with 1 x 300MVA 330/132kV and 1 x 100MVA 132/33kV Transformers
    e. Replacement of High Voltage Switchgears, and associated equipment
    f. Rehabilitation of Civil Structures of the Control Room and Digital Control System at Jos TS

6.8.3 AFD NORTHERN CORRIDOR PROJECTS

1. Bauchi 330/132/33kV TS: Construction of complete new 330/132/33kV Substation at Bauchi by turning in and turning out of the existing 3 30kV SC Jos-Gombe line at Bauchi,
    a) 2X150MVA 330/132/33kV transformers
    b) 2X60 MVA,132/33kV transformers
    c) 330kV,132kV,33kV primary and secondary switchgears, Control/protection systems and automation.
    d) 4 x 330kV line bays
    e) 2 x 132kV line bays
    f) 6 X 33kV feeder bay
    g) 6 x 33kV feeder bays
    h) 2x330kV line bay extension at Katsina 330/132/33kV substation.

6.8.4 FGN & IGR PROJECTS:

1. Kafanchan 132kV/33kV TS: Construction of 2 x 60MVA 132/33kV Substation
2. North Bank 132kV/33kV TS:
   a. Construction of 2 x 60MVA 132/33kV Substation
   b. 2x132KV Line bays Extension at Apir substation
3. Zaki Biam 132kV/33kV TS: Construction of 2 x 60MVA 132/33kV Substation
   - To be taken-off from Newly Constructed Kashinbilla-Yandev- Wukari 132kV Line
4. Construction of Makeri - Pankshin 132KV DC Line
5. Construction of Nguru - Hadejia 132kv DC Transmission Line (150km) with 2x60MVA, 132/33kV substations at Nguru with 2 x 132kV Bay Extenstion at Hadejia.
6. Construction of Apir - North Bank 132kV Double Circuit Transmission Line (18km)

6.8.5 PPI PROJECTS:

1. Toro 132kV/33kV TS:
   a. Construction of 132kv GIS Substation With 2x60 MVA, 132/33kv Transformer Substation at Toro Bauchi
   b. Construction of 2No. Special galvanized steel Lattice towers for line in and out for the Jos-Bauchi 132kv double circuit line at Toro Bauchi

6.8.6 COMPLETED PROJECTS AFTER START OF DISCUSSION WITH DISCOS

1. Jos 330kV/132kV/33kV TS: Transposition of 330kV Ugwuaji-Makurdi Line
2. The installation of 75MVAR Reactor at Jos 330kV/132kV/33kV Transmission Station

6.9 KADUNA ELECTRIC:

TCN is currently implementing 32 projects in the Kaduna Disco Franchise area, the projects are listed in the next sections by project categories.

6.9.1 SLA PROJECTS:

1. Gusau 132kV/33kV TS
   - Replacement of 1x30 MVA to 1x60 MVA, 132/33kV Transformer Gusau 132/33kV TS
2. Argungu 2x30MVA T/S: Construction and installation of 1x45MVA Mobitra 132/33kV down dropper Transmission Station at Argungu
3. Sokoto 2x30MVA T/S: Upgrading of 1x30 MVA T2 to 1x60 MVA at Sokoto 132/33kV TS
4. Reconductoring of Zaria – Funtua - Gusau 132kV Transmission Line (190KM)
5. Transformers Spares: Power Transformers (2x150MVA)
6. Transformers Spares: Power Transformers (2x100MVA)
7. Transformers Spares: Power Transformers (2x60MVA)

8. 1 x 60 MVA Mobile Substations

6.9.2 WORLD BANK NETAP PROJECTS:

1. Birnin Kebbi 330kV/132kV/33kV TS:
    a) Reinforcement with 2 x150MVA 330/132kV
    b) Installation of 1 x 60MVA 132/33kV Power Transformers with associated 3no. Outgoing 33kV Feeders
    c) Rehabilitation of Control Room at Birnin Kebbi

6.9.3 AFD NORTHERN CORRIDOR PROJECTS

1. 330kV DC transmission line Kainji-Birnin Kebbi (Kalgo) (following the existing ROW of the SC 330kV line) and 6 x 330kV bay extension at B/Kebbi and 2 x 330kV bay extension at Kainji
2. Birnin Kebbi (Kalgo)– Sokoto 330kV DC transmission line on the existing 132kV Birnin Kebbi Sokoto ROW and reconducting the existing 132 kV single circuit Birnin-Kebbi line to double its capacity
3. Kalgo 330/132/33kV TS: Construction of complete new 330/132/33kV Substation at Kalgo
    a) 1X150MVA 330/132/33kV transformers
    b) 1X100 MVA,132/33kV transformers
    c) 330kV,132kV,33kV primary and secondary switchgears, Control/protection systems and automation.
    d) 6 x 330kV line bays
    e) 6 x 330kV bay extension at B/Kebbi
    f) 2 x 330kV bay extension at Kainji
4. Sokoto 330/132/33kV TS: Construction of complete new 330/132/33kV Substation at New Sokoto
    a) 2X150MVA 330/132/33kV transformers
    b) 2X60 MVA,132/33kV transformers
    c) 330kV,132kV,33kV primary and secondary switchgears, Control/protection systems and automation.
    d) 4 x 330kV line bays
    e) 2 x 132kV line bays

5. Fakon Sarki-Argungu 132/33kV TS: Construction of complete new 132/33kV Substation at Fakon Sarki-Argungu
    a) 2X60 MVA,132/33kV transformer
    b) Turn in Turn out Birnin Kebbi-Sokoto 132KV Line
6. Birnin Gwari 132/33kV TS: Construction of complete new 132/33kV Substation at Birnin Gwari
    a) 2X60 MVA,132/33kV transformer
    b) High Voltage Switchgears and Associated Equipment

c) Construction of three (3) bays at Tegina Substation

7. Yelwa- Yawuri 132/33kV TS: Construction of complete new 132/33kV Substation at Birnin Gwari
    a) 1X60 MVA,132/33kV transformer
    b) High Voltage Switchgears and Associated Equipment
    c) Construction of 1x330kV Line Bay extensions and rehabilitation of the existing 1x330kV line bay both at Kaduna and Shiroro substations.

6.9.4 AFDB NIGERIAN TRANSMISSION EXPANSION PLAN

1. Zaria 330/132/33kV TS: Construction of complete new 330/132/33kV Substation at Zaria by turning in and turning out of the existing 330kV SC Kaduna Kano line at Zaria,
    a) 2X150MVA 330/132/33kV transformers
    b) 2X60 MVA,132/33kV transformers
    c) 330kV,132kV,33kV primary and secondary switchgears, Control/protection systems and automation.
    d) 6 x 330kV line bays
    e) 2 x 132kV line bays
    f) 6 X 33kV feeder bay

2. Millennium City, Kaduna 330/132/33kV TS: Construction of complete new 330/132/33kV Substation at Millennium City, Kaduna by turning in and turning out of the existing 330kV DC Kaduna Jos line at Millennium City,
    a) 2X150MVA 330/132/33kV transformers
    b) 2X60 MVA,132/33kV transformers
    c) 330kV,132kV,33kV primary and secondary switchgears, Control/protection systems and automation.
    d) 6 x 330kV line bay extension
    e) 2 x 132kV line bays
    f) 6 X 33kV feeder bay
3. Rigasa, Kaduna 132/33kV TS: Construction of complete new 132/33kV Substation at Rigasa by turning in and turning out of the existing 132kV DC Kaduna Zaria line at Rigasa
    a) 2X60 MVA,132/33kV transformers
    b) 6 X 33kV feeder bay
4. Rigachikun, Kaduna 132/33kV TS: Construction of complete new 132/33kV Substation at Rigasa by turning in and turning out of the existing 132kV DC Kaduna Zaria line at Rigachikun,
    a) 2X60 MVA,132/33kV transformers
    b) 3 X 33kV feeder bay
5. Jaji, Kaduna 132/33kV TS: Construction of complete new 132/33kV Substation at Jaji by turning in and turning out of the existing 132kV DC Kaduna - Zaria line at Jaji

a) 2X60 MVA,132/33kV transformers
b) 6 X 33kV feeder bay

6.9.5 FGN & IGR PROJECTS:

1. Birnin Kudu 132kV/33kV TS: Construction and Installation of 2x60MVA, 132/33KV Substation
2. Kachia 132kV/33kV TS: 2x60MVA substation at Kachia with 2x132kV line Bays at Kwoi.
3. Construction of Kaduna Power Plant to Mando Road 132kV Line and Substation Extension
4. Construction of Kafanchan-Kwoi-Kachia 132kV DC line
5. Construction of Birnin Kebbi - Zuru -Yauri 132kV Single Circuit Transmission Line on Double Circuit Towers

6.9.6 PPI PROJECTS:

1. Mando 330/132/33KV TS:
    a) Installation of 1X150MVA 330/132/33kV transformer
    b) Installation of 1X60MVA, 132/33kV transformers
    c) Extension of existing 330kV and 132kV busbar structures at Mando,
    d) Primary, Secondary Switchgears and Control/Protection systems,
    e) All civil works and Testing & Commissioning.
2. Gusau 330/132/33KV TS:
    a) Installation of 1X60MVA,132/33kV Transformers,
    b) Installation of Earthing transformer
    c) 132kV Primary and 33kV Secondary switchgears
    d) Control/Protection systems
    e) All civil works
    f) Testing & Commissioning.
3. Talatan Mafara 330/132/33KV TS:
    g) Installation of 1X60MVA,132/33kV Transformers,
    h) Installation of Earthing transformer
    i) 132kV Primary and 33kV Secondary switchgears
    j) Control/Protection systems
    k) All civil works
    l) Testing & Commissioning.

6.10 KANO ELECTRICITY DISTRIBUTION COMPANY

TCN is currently implementing 34 projects in the Kano Disco Franchise area, the projects are listed in the next sections by project categories.

6.10.1 SLA PROJECTS:

1. Wudil 132/33kV TS: Installation of additional 60MVA 132/33kV transformer to enable evacuation of power from Wudil T/S to Kano and deload Dakata and Dan-Agundi Substations and create flexibility
2. Reconductoring of Kankia – Katsina 132kV Transmission line (70km)
3. Transformers Spares: Power Transformers (2x150MVA)
4. Transformers Spares: Power Transformers (2x100MVA)
5. Transformers Spares: Power Transformers (2x60MVA)
6. 1 x 60 MVA Mobile Substations

6.10.2 WORLD BANK NETAP PROJECTS:

1. Kumbotsho 330kV/132kV TS:
    - Reinforcement with 1 x 300MVA 330/132kV Power Transformer,
    - Replacement of High Voltage Switchgears and Associated Equipment
    - Replacement of Control and Relay Panel with Digital Control System
2. Dakata 330kV/132kV TS:
    - Reinforcement with 1 x 100MVA 132/33kV Power Transformer, Switchgears
    - Replacement of High Voltage Switchgears and Associated Equipment
    - Replacement of Control and Relay Panel with Digital Control System
    - Rehabilitation of Control Room
    - Installation of Additional 3 No. Feeders Bay and at Dakata

3. Kankia 132kV/33kV TS:
    - Replacement of Faulty 1 x 30MVA
    - Upgrading of 1 x 30MVA Transformers to 2 x60MVA 132/33kV Transformers
    - Replacement of High Voltage Switchgears and Associated Equipment
    - High Voltage Switchgears and Associated Equipment
    - Replacement of Control and Relay Panel with Digital Control System

4. Dan Agundi 132kV/33kV TS:
    - Reinforcement of 1 x 100MVA 132/33kV Transformers
    - Replacement of High Voltage Switchgears and Associated Equipment
    - Replacement of Control and Relay Panel with Digital Control System
    - Rehabilitation of Control Room

6.10.3 AFD NORTHERN CORRIDOR PROJECTS

1. Construction of length of 330kV DC twin line between Katsina – Daura – Gwiwa – Jogana – Kura.
2. Daura 330/132/33kV TS: Construction of complete new 330/132/33kV Substation at Daura
    a) 2X150MVA 330/132/33kV transformers
    b) 2X60 MVA,132/33kV transformers

   c) 330kV,132kV,33kV primary and secondary switchgears, Control/protection systems and automation.
   d) 4 x 330kV line bays
   e) 6 x 33kV feeder bays
   f) 2x330kV line bay extension at Katsina 330/132/33kV substation.
3. Jogana 330/132/33kV TS: Construction of complete new 330/132/33kV Substation at Jogana
   a) 2X150MVA 330/132/33kV transformers
   b) 2X60 MVA,132/33kV transformers
   c) 330kV,132kV,33kV primary and secondary switchgears, Control/protection systems and automation.
   d) 6 x 330kV line bays
   e) 6 x 33kV feeder bays
   f) 2x330kV line bay extension at Katsina 330/132/33kV substation.

6.10.4 AFDB NIGERIAN TRANSMISSION EXPANSION PLAN

1. Reconstruction of one of Kaduna - Kano 330kV Transmission Line Double Circuit to Quad Conductor 330 Double Circuit Line

6.10.5 FGN & IGR PROJECTS:

1. Kurfi 132kV/33kV TS: Construction of 2x60MVA, 132/33kV substation at Kurfi
2. Malumfashi 132kV/33kV TS: Construction of 2x60MVA, 132/33kV substation at Malumfashi
3. Karaye 132kV/33kV TS: Construction of 2x60MVA, 132/33kV Substation at Karaye
4. Damabatta 132kV/33kV TS: Construction of 2x60MVA, 132/33kV substation at Dambatta, Kano State.
5. Katsina 330kV/132kV/33kV TS:
   - Construction of 2x150MVA 330/132kV and 2x60MVA, 132/33kV Substation at Katsina
   - 2x330kV line bays extension at Kumbotso
6. Babura 132kV/33kV TS:
   - Construction and Installation of 2x60MVA, 132/33KV Substation at Babura
   - 4x132KV Line bays Extension at Dambatta
7. Kazaure 132kV/33kV TS:
   - Construction and Installation of 2x60MVA, 132/33KV Substation at Kazaure
   - with 4 x 132 KV line bays
8. Dutsinma 132kV/33kV TS: Construction of 2x60MVA, 132/33kV substation
9. Kankara 132kV/33kV TS: Construction of 2x60MVA 2x60MVA, 132/33kV substation
10. Mashi 132kV/33kV TS:
    - Construction and Installation of 2x60MVA, 132/33KV Substation at Mashi
    - 4x132KV Line bays Extension with turn in turn out at Katsina- Daura Line

11. Missau 132kV/33kV TS:

    - Construction and Installation of 2x60MVA, 132/33KV Substation at Missau
    - 2x132KV Line bays Extension at Gwaram and Azare

12. Construction of 40km Dutse – Birnin Kudu 132 KV line
13. Construction of Katsina- Daura 132kV DC line Katsina State
14. Construction of Kano-Katsina 330KV DC Transmission Line
15. Construction of Katsina-Kurfi-Dutsinma-Kankara-Malumfashi 132KV Line
16. Construction of Kumbotso (Daura)-Dambatta 132KV Line
17. Construction of Dambatta-Babura 132kV DC Transmission Line Plus Turn in Turn out Daura - Dambatta 132kV DC Line at Kazare
18. Construction of Azare-Misau-Gwaram-Ningi-Birnin Kudu-Dutse 132kV DC Transmission Line and some associated substations.
    -

6.10.6 PPI PROJECTS:

1. Funtua 132kV/33kV TS:
    a. Design, Engineering, Supply & Installation of : 1)2X60MVA, 132/33kV Transformers.
    b. Earthing Transformers
    c. 132kV Primary and 33kV Secondary Switchgears.
    d. Control/Protection Systems
    e. All civil works
    f. Testing & Commissioning.

2. Kwanar Dangora 132kV/33kV TS:
    a. Design, Engineering, Supply & Installation of : 1)1X60MVA, 132/33kV Transformers.
    b. 132kV Primary and 33kV Secondary Switchgears.
    c. Control/Protection Systems
    d. All civil works
    e. Testing & Commissioning.

6.10.7 COMPLETED PROJECTS AFTER START OF DISCUSSION WITH DISCOS

1. Bichi 132kV/33kV TS: Construction of 2x60MVA, 132/33kV Substation at Bichi

6.11 PORT HARCOURT ELECTRICITY DISTRIBUTION COMPANY

TCN is currently implementing 19 projects in the Port Harcourt Disco Franchise area, the projects are listed in the next sections by project categories.

6.11.1 SLA PROJECTS:

1. Elelenwo 132/33kV TS:
    - Addition of 2nd 1 x60MVA, 132/33kV transformer
    - Installation of 3x33kV feeder Bays"
2. Rumuosi 132/33kV TS:
    - Installation of additional 1x60MVA,132/33kV transformer
    - Replacement of faulty bushing on Transformer TR2"
3. Port Harcourt Mains TS:
    - Extension of 1 circuit (Z2) of 132kV Omoku D/C transmission line from Z2 Port-Harcourt Main 132/33kV TS – 24"
4. Transformers Spares: Power Transformers (2x150MVA)
5. Transformers Spares: Power Transformers (2x100MVA)
6. Transformers Spares: Power Transformers (2x60MVA)
7. 1 x 60 MVA Mobile Substations

6.11.2 WORLD BANK NETAP PROJECTS:

1. Port Harcourt Main 132kV/33kV TS:
    - Reinforcement with 1 x 100MVA 132/33kV Power Transformers,
    - Replacement of High Voltage Switchgears and Associated Equipment
    - Replacement of Control and Relay Panel with Digital Control System
    - Rehabilitation of Control Room
2. Port Harcourt Town 132kV/33kV TS:
    - Reinforcement with 1 x 100MVA 132/33kV Power Transformers,
    - Replacement of High Voltage Switchgears and Associated Equipment
    - Replacement of Control and Relay Panel with Digital Control System
    - Rehabilitation of Control Room
3. Itu 132kV/33kV TS:
    - Reinforcement with 1 x 60 MVA 132/33kV Power Transformers,
    - Replacement of High Voltage Switchgears and Associated Equipment
    - Replacement of Control and Relay Panel with Digital Control System
    - Rehabilitation of Control Room

6.11.3 FGN & IGR PROJECTS:

1. Ogoja 132kV/33kV TS: Construction of 2x60MVA, 132/33kV Substation
2. Ekori 132kV/33kV TS:
    a) Construction of 2x60 MVA 132/33kV substation at Ekori, Ugep
    b) 8x132kV line bays extension at Ekori, Calabar and Ikom.
3. Oron 132kV/33kV TS:
    a) Construction of 2X60MVA, 132/33kV Substation at Oron
    b) 2x132kV line bays extension at Eket with full accompaniments of six (6) nos 33kV feeders

4. Construction of Eket - Oron 132kV DC Transmission Line (41km)
5. Construction of Obudu - Ogoja 132KV DC Line Cross River State
6. Construction of 2x330kV line bays extensions each at Delta and Port Harcourt substations
7. Construction of Delta-Port Harcourt 330kV DC line
8. Construction of Yenagoa - Oporoma 132kv DC Transmission Line (50km)
9. Construction of 132kV Calabar -Ikom Double Circuit Transmission Line (220km)

6.12 YOLA ELECTRICITY DISTRIBUTION

TCN is currently implementing 15 projects in the Yola Disco Franchise area, the projects are listed in the next sections by project categories.

6.12.1 WORLD BANK NETAP PROJECTS:

1. Yola 330kV/132kV/33kV TS:
    a) Reinforcement with 1 x 150MVA 330/132kV transformer
    b) Reinforcement 2x 100MVA 132/33kV transformers,
    c) Replacement of High Voltage Switchgears and Associated Equipment
    d) 3 No Additional Feeder Bays at Yola
2. Mayo Belwa 132kV/33kV TS:
    a) Reinforcement with 1 x 150MVA 330kV/132kV transformer
    b) Replacement of High Voltage Switchgears and Associated Equipment
    c) 3 No Additional Feeder Bays at Yola

3. Damboa 132kV/33kV TS:
    a) Reinforcement with 2x 60MVA 132/33kV Power Transformers,
    b) Replacement of High Voltage Switchgears and Associated Equipment
    c) Complete Rehabilitation of Substation at Biu
        - Replacement of Control and Relay Panel with Digital Control System
        - Rehabilitation of Control Room
4. Damaturu 330kV/132kV TS:
    a) Reinforcement with 1Nos. 150MVA 330/132kV transformer
    b) Replacement of High Voltage Switchgears and Associated Equipment
    c) 3 No Additional Feeder Bays at Damaturu
5. Biu 132kV/33kV TS:
    a) Reinforcement with 1 x 60MVA 132/33kV transformer,
    b) Replacement of High Voltage Switchgears and Associated Equipment
    c) Complete Rehabilitation of Substation at Biu
        - Replacement of Control and Relay Panel with Digital Control System
        - Rehabilitation of Control Room
6. Maiduguri 132kV/33kV TS:
    a) Reinforcement with 1 x 150 MVA 330kV/33kV transformer

b) Replacement of High Voltage Switchgears and Associated Equipment
c) 3 No Additional Feeder Bays at Maiduguri

7. Bauchi 132kV/33kV TS:
    a) Upgrading of 22.5MVA and 30MVA Transformers to 2X 60MVA 132/33kV Transformers
    b) Rehabilitation of Control Room with Digital Control System
    c) Replacement of High Voltage Switchgears and Associated Equipment
8. Jalingo 132kV/33kV TS:
    a) Upgrading from 132kV to 330kV Substation with 1x150MVA, 330/132/33kV Power Transformers and 1 x 100MVA 132/33kV Transformer,
    b) High Voltage Switchgears and Associated Equipment.
    c) Construction of 330/132kV Control Room at Jalingo

6.12.2 <u>FGN & IGR PROJECTS:</u>

1. Little Gombi 132kV/33kV TS: Construction of 2x60MVA, 132/33kV substation at Little Gombi
2. Song 132kV/33kV TS: Construction of 2x60MVA, 132/33kV substations at Song
3. Mubi 132kV/33kV TS: Construction of 2x60MVA 132/33kV substations at Mubi
4. Gulak 132kV/33kV TS: Construction of 2x60MVA 132/33kV substations at Gulak
5. Gashua 132kV/33kV TS:
    - Construction of 2x60MVA 132/33KV Substation at Gashua
    - 2 x 132KV Line bays Extension at Damaturu and Nguru
6. Damaturu – Gashua - Nguru 132kV DC Transmission Line (245km)
7. Yola – Song - Mubi-Gulak 132kV DC line

6.13 TCN WIDE PROJECTS

The following projects cut across two or more discos and serve to reinforce the bulk grid network for the benefit of all grid users.

6.13.1 <u>AFD NORTHERN CORRIDOR PROJECTS</u>

1. Replacement of 28 spans of Sky wire for 330kV Shiroro Jebba line 2
2. Replacement of 36 spans of Sky wire for 132kV Apo - Keffi line.
3. Replacement of 32 spans of Sky wire for 132kV Minna - Bida line.
4. Replacement of 9 spans of Sky wire each for 330kV Jebba - Osogbo lines 1 & 2 and 330kV Jebba - Ganmo line
5. Reconstruction and upgrading of 1 of the 2 single circuits 330kV transmission lines 1 or 2 from Shiroro PS to Mando (Kaduna) to a Double Circuit, Quad conductor Shiroro Mando (Kaduna) transmission lines 1 or 2. Line
    a) Line bay extension at Mando and Shiroro

6.13.2 JICA LAGOS/OGUN TRANSMISSION PROJECTS:

1. Construction of 29.6km of new 330kV double circuit line from new Ejio 330/132/33kV substation to Ajegunle (New Agbara) 330/132/33kV substation
   a) inclusive of 6.95km 2x 330KV DC multi circuits up till the existing Oshogbo/IkejaWest single circuit line.
2. Construction of 48.8km of new 330kV double circuit (DC) line from Likosi 330/132/33kV substation to Ejio 330/132/33kV substation.

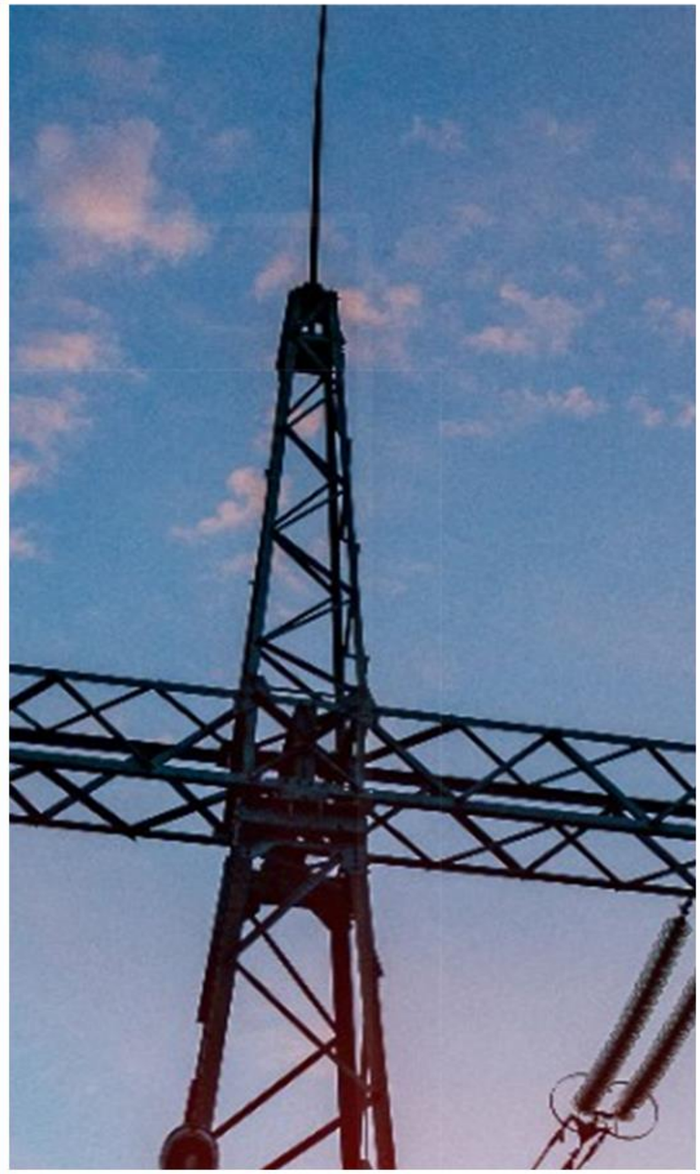
6.13.3 FGN & IGR PROJECTS:

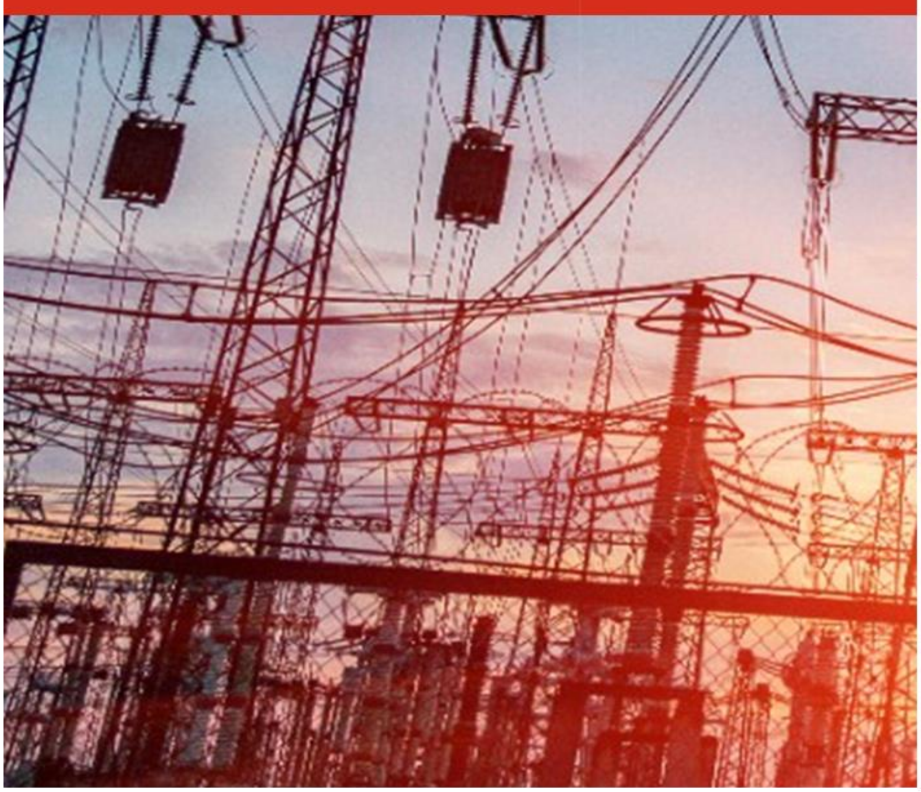
1. Omotosho-Epe-Aja 330KV DC Line.
2. Construction of 2nd Kaduna - Jos 330kV Transmission Line
3. Construction of 2x330kV line bay extensions at each of Kaduna and Kano substations

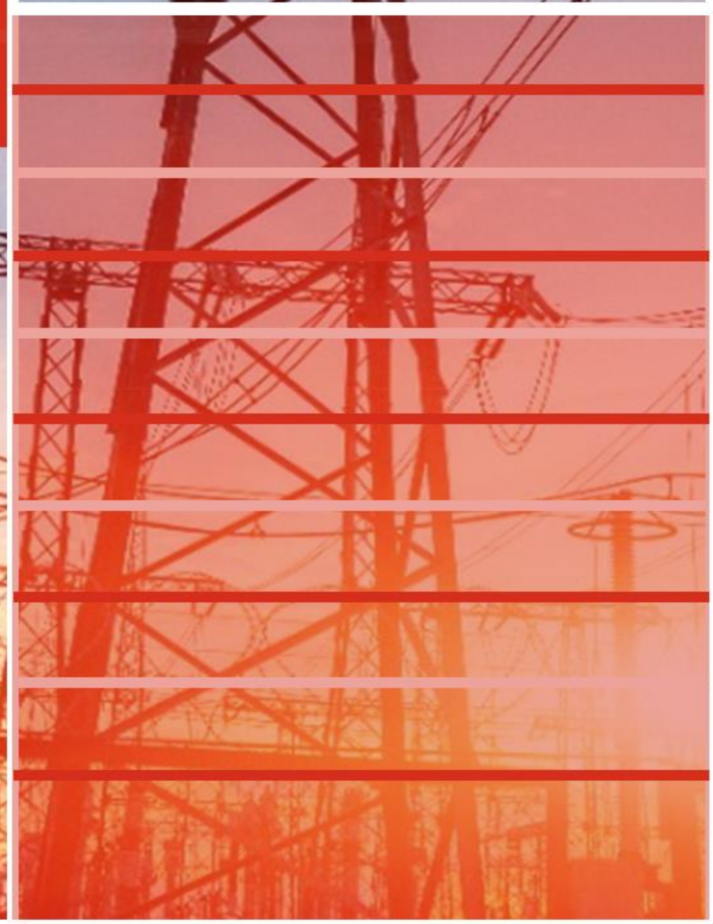
6.13.4 PPI PROJECTS:

1. Epe - Lekki EPZ(25km) 330kv Double Circuit Transmission Line.
2. Akangba - New Ijora - Alagbon (7km) 330kv Double Circuit Transmission Line
   a. Including dismantling of existing 132kv double circuit lines on the same corridor and the construction of multi circuit towers on the 4km part

7
MEETING THE DISCOS NEEDS







7.1 Introduction

In it is guideline to TCN, NERC provided specific guidelines for the preparation of PIP by the TCN for the alignment of the transmission and distribution networks plans amongst other performance improvement objectives. The alignment principles in the guidelines are:

I. NERC expect TCN to give due regards to the load demand/energy offtake growth and PIPs of the Discos.
II. TCN's PIP shall be evaluated on the robustness of the consultation process leading to the preparation of the PIP. Apart from reading and understanding the PIPs of the DisCos, TCN is expected to duly consult with DisCos and GenCos in order to avoid misalignments between transmission infrastructure development in the gas supply and transportation infrastructure.
III. One of the stated objectives of the PIP is to: align TCN's investment with those of GenCos and DisCos to enable optimal utilization of generation and network and capacity for improved service delivery

In developing this PIP, TCN considered the following guiding principles given by NERC.

I. NERC expect TCN to give due regards to the load demand/energy offtake growth and PIPs of the Discos.
II. Ensure execution of targeted investments towards addressing the misalignment at transmission and distribution interface points.
III. TCN's PIP shall be evaluated on the robustness of the consultation process leading to the preparation of the PIP. Apart from reading and understanding the PIPs of the DisCos, TCN is expected to duly consult with DisCos and GenCos in order to avoid misalignments between transmission infrastructure development in the gas supply and transportation infrastructure.
IV. One of the stated objectives of the PIP is to: align TCN's investment with those of GenCos and DisCos to enable optimal utilization of generation and network and capacity for improved service delivery

The following section discusses the needs of the Discos

Starting from 2020, TCN has actively and constructively engaged the Discos on their needs. A lot of the meetings were held at the instance of the regulator NERC. At such engagements the Discos discussed extensively the areas they seek improvement from TCN. Also, the Discos, in some their reports, have outlined some of the areas in their franchise zone that they required urgent transmission interventions. The lists of Discos needs are produced below and tagged.

7.2 Abuja Electricity Distribution Company

7.2.1 Substation Capacity Challenge

1. ***AEDC.SC**.01/Central Area 3X60MVA, 132/33kV TS*
   - **Need**
     a) Rehabilitation of Bay to radiate more 33kV feeders by TCN to replace Bus Coupler and 2nos 33kV Indoor Breaker to evacuate more power-(Improve power supply by 20MW)
   - **Solution**
     a) Station is undergoing rehabilitation under World Bank NETAP project.

2. ***AEDC.SC**.02/Gwagwalada 132/33kV TS*
   - **Need**
     a) Replacement of faulty 60MVA 132/33kV power Transformer
   - **Solution**
     - Procurement for new transformer being done by NDPHC

3. ***AEDC.SC**.04/Minna 132/33kV TS*
   - **Need**
     a) Minna 2X60MVA, 132/33kV TS Upgrading of HV Cables from 185mmsq XLPE to 300mmsq 1core on 60MVA, 132/33kV TR7.

4. ***AEDC.SC**.05/Kubwa 132/33kV TS*
   - **Need**
     a) Replacement of faulty 60MVA 132/33kV power Transformer.
   - **Solution**
     a) Done

5. ***AEDC.SC**.06/Ministry of Defense 132/33kV TS*
   - **Need**
     a) Build New Substation
   - **Solution**
     a) Under FGNPC Projects

6. ***AEDC.SC.****07/World Trade Center 132/33kV TS*

- **Need**
  a) Build New Substation
- **Solution**
  a) Under FGNPC Projects

7.2.2 Line Improvement Request

1. ***AEDC.LC.****01*

Reactivation of Line II from Katampe to Central Area TS

- **Solution**

a) Under FGNPC Projects

2. ***AEDC.LC.****02*

Reconducting of 132kV Apo-Karu-Keffi- Akwanga transmission line by TCN (to improve wheeling capacity by 80-200MW)

- **Solution**

a) Under SLA Projects

3. ***AEDC.LC.****03*

Central Area - Ministry of Defense - World Trade Center Transmission Line:

- 2Km 132kV Double Circuit Underground Tranmission Line from Central Area TS- to- Ministry of Defense TS- World Trade CenterTS
- **Solution**

a) Under FGNPC Projects

4. ***AEDC.LC.****04*

Kukwaba- World Trade Center Transmission Line:

- 6Km 132kV Double Circuit Underground Tranmission Line from Kukwaba TS-to-World Trade CenterTS
- **Solution**

a) Under FGNPC Projects

7.3 Benin Electricity Distribution Company

7.3.1 Substation Based Request

1. ***BEDC.SC.**01/Benin 132/33kV TS*
   - **Need**
     - Installation of 100MVA, 132/33KV Transformer
   - **Solution**
     - Under the World Bank NETAP Project
2. ***BEDC.SC.**02/Benin 132/33kV TS*
   - **Need**
     - Replacement of 40MVA Mobitra with 60MVA, 132/33kV transformer
   - **Solution**
     - Under SLA Projects
3. ***BEDC.SC.**03/Benin 132/33kV TS*
   - **Need**
     - Replacement of lost 120MVA power due to Failure of 2x60MVA Power Transformers [T21 and T23]
   - **Solution**
     - Under SLA Projects
4. ***BEDC.SC.**04/Ondo 132/33kV TS*
   - **Need**
     - 33kv BS 1 of indoor switchgear is out on fault.
   - **Solution**
     - Under World Bank NETAP Projects
5. ***BEDC.SC.**04/Ondo 132/33kV TS*
   - **Need**
     - Replacement of Grounding Transformer at Ondo TS
   - **Solution**
     - Under World Bank NETAP Projects
6. ***BEDC.SC.**06/Ondo 132/33kV TS*
   - **Need**

    - Replacement of Indoor Circuit Breaker
  - **Solution**
    - Under World Bank NETAP Projects

7. ***BEDC.SC.****07/Ondo 132/33kV TS*
  - **Need**
    - Replacement of Indoor Circuit Breaker
  - **Solution**
    - Under World Bank NETAP Projects

8. ***BEDC.SC.****08/Oghara 132/33kV TS*
  - **Need**
    - 30MVA T1 Power Transformer is out on fault ever since the commissioning of TS in 2015
  - **Solution**
    - Under SLA Projects

9. ***BEDC.SC.****09/Oghara 132/33kV TS*
  - **Need**
    - Replacement of 132/33kV CTs
  - **Solution**
    - Under SLA Projects

10. ***BEDC.SC.****10/Effurun 132/33kV TS*
  - **Need**
    - Failure of 1 no 60mva power transformer
  - **Solution**
    - Under SLA Projects

11. ***BEDC.SC.****11/Asaba 330kV/132kV TS*
  - **Need**
    - One number of 330kV/132KV, 150 MVA Power Transformer is out
  - **Solution**
    - Under SLA Projects

12. ***BEDC.SC.****12/Asaba 132kV/33kV TS*

- Need
  - 2x 132kV/33kV, 60 MVA Power Transformers are grossly overloaded - Additional Capacity Required at Asaba 2 X 60mva, 132/33kV TS.
- Solution
  - Under SLA Projects

*13.**BEDC.SC.**13/Okada 132kV/33kV TS*

- Need
  - 1 No 40 MVA Transformer is not available due to failure of grounding transformer. Replacement of grounding transformer
- Solution
  - Under SLA Projects

*14.**BEDC.SC.**14/Okitipupa 132kV/33kV TS*

- Need
  - Substation needs to completed.

*15.**BEDC.SC.**15/Afiesere 132kV/33kV TS*

- Need

30/40 MVA power transformer failure

- Solution
  - Under SLA Projects

*16.**BEDC.SC.**16/Irrua 132kV/33kV TS*

- Need

Uprate 30mva power transformer to be 60 MVA

- Solution
  - Under World Bank NETAP Projects

17.***BEDC.SC.**17/Oke - Agbe 132kV/33kV TS*

- Need

Construction of 132/33kV TS at Oke-Agbe

- Solution
  - Under FGN/IGR Projects

*18.**BEDC.SC.**18/Omotosho 132kV/33kV TS*

- Need

To be constructed to provide power in Omotosho and Ore Axis

- **Solution**
  - Under FGN/IGR Projects

19. ***BEDC.SC****.19/Benin 330kV/132kV/33kV TS*

- **Need**

- Benin 330/132/33KV TS: Loss of 120MVA power to Benin city due to failure of 2x60MVA Power Transformers [T21 and T23]

- **Solution**
  - Under the World Bank NETAP Project

7.3.2 Line Improvement Request

1. ***BEDC.LC****.01*

   Reconductoring of Oshogbo - Akure-Ondo 132kV Line.

2. ***BEDC.LC****.02*
   Completion of Benin North - Osogbo 330kV Transmission Line

   - **Solution**
     - Under the FGN/IGR Project
     - Encountering Right of Way Challenges

3. ***BEDC.LC****.03*

   Load limitation due to undersized conductor on the 132KV line between Oshogbo and Akure affecting the following substations:

   a. Akure 132kV TS
   b. Ado Ekiti 132 kV TS

4. ***BEDC.LC****.04*

   Load limitation in Effurun 132kV/33kV due to undersized conductor on the 132KV line between Ughelli and Effurun

7.4 Eko Electricity Distribution Company

7.4.1 Substation Based Request

1. ***EKEDC.SC***.01/Ijora 132/33kV TS

Need

- Upgrading of the 2x30MVA, 1x40MVA & 1x45MVA transformers to 3x60MVA 132/33kV transformers

Solution

- Under the World Bank NETAP Project

2. ***EKEDC.SC***.02/Ijora 132/33kV TS
    - **Need**

Installation of additional 1No 33kV line bay

3. ***EKEDC.SC***.03/Agbara 132/33kV TS

Need

- Upgrading of 2 X45 MVA, 132/33kV with 2 x 60MVA, 132/33kV Transformers

Solution

- Under SLA Projects

4. ***EKEDC.SC***.04/Agbara 132/33kV TS

Need

- Construction of 3 nos additional 33kV line bays

Solution

- Under SLA Projects

5. ***EKEDC.SC***.05/Amuwo 132/33kV TS

Need

- Repair and rehabilitation of 132kV GIS Breaker

Solution

- Under the World Bank NETAP Project

6. ***EKEDC.SC***.06/Amuwo 132/33kV TS

Need

- Current Transformer Limitation of the indoor panels. Movement of 60MVA 132/33KV Transformer outdoors to release more transformer capacity

Solution

- Under the World Bank NETAP Project

7. ***EKEDC.SC***.07/Amuwo 132/33kV TS

Need

- Construction of 3 nos additional 33kV line bays

Solution

- Under the World Bank NETAP Project

8. ***EKEDC.SC***.08/Amuwo 132/33kV TS

Need

- Upgrading of 2X30MVA, 132/33kV to 2 x 60MVA, 132/33kV Transformers

Solution

- Under the World Bank NETAP Project

9. ***EKEDC.SC***.09/Akangba 330kV/132kV TS

Need

- Consider installing additional 300MVA 330/132kV Transformer for station redundancy

Solution

- Under the PIP Project

10. ***EKEDC.SC***.10/Ojo 132/33kV TS

Need

- Construct 3nos 33kV bays at the transmission station

Solution

- Under the SLA Project

11. ***EKEDC.SC***.11/Ojo 132/33kV TS

Need

- Rehabilitation of problematic indoor circuit breakers (Elimson -Turkey type)- Faulty 33kV panel to be replaced

Solution

- Under the SLA Project

12. ***EKEDC.SC***.12/Isolo 132/33kV TS

Need

Repair or Replace faulty 60MVA Transformer

Solution

- Under the SLA Project

13. ***EKEDC.SC***.13/Isolo 132/33kV TS

Need

Installation of 3nos 33kVA Feeder bays

Solution

- Under the SLA Project

14.***EKEDC.SC***.14/Apapa Road 132/33kV TS

Need

- Rehabilitation of Apapa road TS 132kV GIS

15.***EKEDC.SC***.15/Apapa Road 132/33kV TS

Need

- Upgrading of 2 X45 MVA, 132/33kV with 2 x 60MVA

16.***EKEDC.SC***.16/Apapa Road 132/33kV TS

Need

- Construction of additional 33kV line bays

17.***EKEDC.SC***.17/Itire Road 132/33kV TS

Need

- Replacement of failed 60MVA transformer

Solution

- Done

18.***EKEDC.SC***.18/Lekki 132/33kV TS

Need

- Installation of additional 1x60MVA 132/33kV transformer

Solution

- Under World Bank NETAP

19.***EKEDC.SC***.19/Lekki 330kV/132kV TS

Need

- Installation of additional 300MVA 330/132kV Transformer.

Solution

- Under World Bank NETAP

20.***EKEDC.SC***.20/Ajah 330kV/132kV TS

Need

- Rehabilitation of Aja 330kV GIS (Project Improvement - Reliability)

Solution

21.***EKEDC.SC***.21/Ajah 330kV/132kV TS

Need

- 2nos additional Bays needed

Solution

- Under SLA Projects

22.***EKEDC.SC***.22/Ajah 330kV/132kV TS

Need

Repair/Replacement of failed 150 MVA 330/132kV Transformer

Solution

- Under SLA Projects

23.***EKEDC.SC***.23/Alagbon 132kV/33kV TS

Need

Replacement of burnt 60MVA 132/33kV Transformer

Solution

- Under World Bank NETAP

24.***EKEDC.SC***.24/Alagbon 330kV/132kV TS

Need

Installation of additional 300MVA, 330/132kV

Solution

- Under World Bank NETAP

25.***EKEDC.SC***.25/Akoka 132/33kV TS

Need

Completion of the ongoing outdoor bays at Akoka T/S to replace obsolete and unservicable 33KV Rayrolle indoor panels

Solution

- Under SLA Projects

26.***EKEDC.SC***.26/Akoka 132/33kV TS

Need

Upgrading of 1 X40MVA & 1 x 45MVA to 2 x 60MVA, 132/33kV

Solution

- Under SLA Projects

7.5 Enugu Electricity Distribution Company

7.5.1 Substation Based Request

1. ***EEDC.SC.***01/Ugwuaji 132/33kV TS

Need

- Completion of Nnenwe 1 X 60MVA TS. (to reduce Feeder length of 568.21km)
- Disco - Existing Amechi 33kV Feeder length is 568.21km New critical project, passing through Agbani and Agwu. TCN- TCN Project suffering due to lack of funds.

Solution

- Under FGN/IGR Projects

2. ***EEDC.SC.***02/Nnewi 132/33kV TS

Need

- Completion of Nnewi 2x60MVA Transmission project and 132kV Onitsha-Nnewi line. (to reduce Feeder length of 189.96km)

Solution

- Under FGN/IGR Projects

3. ***EEDC.SC.***03/Ihiala 132/33kV TS

Need

- Completion of Ihiala 1 X 60MVA. (to reduce Feeder length of 205.7km)

Solution

- Under FGN/IGR Projects

4. ***EEDC.SC.***04/Awada 132/33kV TS

Need

Commissioning of 1 X 100MVA Transformer at Awada. (to reduce Feeder length of 113.8km)

5. ***EEDC.SC***.05/Nibo 132/33kV TS

Need

Completion of Installation of 1 X 60MVA Power TRF in Nibo . (to reduce Agulu Feeder length of 220.29km and Neni Feeder length of 113.44km)

Solution

6. ***EEDC.SC***.06/ Amasiri 132/33kV TS

Need

Complete the construction of Amasiri 1 X 60MVA T/S.

- to reduce Ezillo Feeder length of 256.53km
- Itigidi Feeder length of 217.17km
- to reduce Yahe Feeder length of 227.37km
- to reduce Ishieke Feeder length of 198.54km

Solution

- Under FGN/IGR Projects

7. ***EEDC.SC***.07/Oji River 132/33kV TS

Need

Complete installation of 1 x 60MVA, 132/33kV Transformer

- (to stop Load sheddding on Udi, Achi, Oji-Urban and Orumba 33kV Feeders)

Solution

- Under World Bank/NETAP Projects

8. ***EEDC.SC***.08/Agu Awka 132/33kV TS

Need

Complete installation of 1 x 60MVA, 132/33kV Transformer

- Commission the Agu-Awka 2 X 60MVA T/S. (To improve supply to Aguleri and Enugwu Ukwu)

Solution

Done

9. ***EEDC.SC***.09/GCM 132/33kV TS

Need

Complete Installation of 100MVA, 132/33KV.

Solution

- Under World Bank/NETAP Projects

10.***EEDC.SC***.10/ Okigwe 132/33kV TS

Need

Construction/Completion of Okigwe 2 X 60MVA T/S. (to reduce Okigwe Feeder length of 399.37km and improve supply to Okigwe, Mbaise and Orlu)

Solution

- Under FGN/IGR Project

11.***EEDC.SC***.11/ Orlu 132/33kV TS

Need

- Construction /Completion of Orlu 2 X 60MVA. (to reduce Orlu Feeder length of 265.22km and improve supply to Orlu and Akokwa)

Solution

- Under FGN/IGR Project

12.***EEDC.SC***.12/ Arochukwu 132/33kV TS

Need

Construction/Completion of Arochukwu 1 X 40MVA.

- (to reduce Orlu Feeder length of 211.16km and improve supply to Mbaise, Obowo, Umuawada, Okpofe and Uvuru)
- (to reduce Arochukwu 33kV Feeder length of 150.35km and improve supply to Arochukwu, Ihechiowa and Nporo)
- Installation of 1 X 60MVA at Arochukwu (to reduce Ohiya 33kV Feeder length of 269.15km and improve supply to Isiukwuato, Ohafia, Arochukwu, Item, Ntigha and Obowo)

Solution

- Under FGN/IGR Project

13.***EEDC.SC***.13/ Egbu 132/33kV TS

Need

- Installation of 2 X 60MVA at Egbu and replacement of bad 33KV Breakers. (to reduce Airport Feeder length of 180.26km and improve supply to Ngo-Okpala)

14.***EEDC.SC***.14/ Aboh-Mbiase 132/33kV TS

Need

- Completion of the 2 X60MVA Project.

Solution

- Under FGN/IGR Project

15. ***EEDC.SC***.15/ Oguta - Owerri 132/33kV TS

Need

Provision of Bay for New Oguta 33kV line

Solution

7.5.2 Line Improvement Request

1. ***EEDC.LC***.01

   Afikpo T/S Construction of 132kV Abakiliki- Amasiri TL

2. ***EEDC.LC***.02

   Upgrading of 330kV Onitsha - Enugu Transmission Line

7.6 Ibadan Electricity Distribution Company

7.6.1 Substation Based Request

1. ***IBEDC.SC***.01/Ayede 330kV/132kV/33kV TS

Need

Utilization of the idle (third) 150MVA, 330/132KV Transformer

2. ***IBEDC.SC***.02/Ayede 330kV/132kV/33kV TS

Need

Replacement of burnt 150MVA, 330/132kV Transformer

Solution

Done

3. ***IBEDC.SC***.03/Ibadan North 330kV/132kV/33kV TS

Need

Installation of additional 100MVA, 132/33kV transformer

Solution

SLA Projects

4. ***IBEDC.SC***.04/Jebba 330kV/132kV/33kV TS

Need

Replacing the 80MVA 330/132/13.8kV, 2T1 trafo with 1x150MVA 330/132/33kV plus 1X60MVA, 132/33kV trafo

Solution

AFD Northern Corridor Projects

5. *IBEDC.SC*.05/Jebba 132kV/33kV TS

Need

Jebba 132/33KV TS: Upgrading of the station transformer capacity.

Solution

AFD Northern Corridor Projects

6. *IBEDC.SC*.06/Ilorin 132kV/33kV TS

Need

Installation of 100MVA, 132/33kV to relieve the overloaded 60MVA & 30MVA transformer at the station.

Solution

Done

7. *IBEDC.SC*.07/Sagamu 132kV/33kV TS

Need

Completion of Installation of additional 2 x 60MVA, 132/33kV transformers and associated out-door 33KV switch-gears.

Solution

World Bank NETAP Project

8. *IBEDC.SC*.08/Sagamu 132kV/33kV TS

Need

Conversion of all indoor breakers to outdoor breakers at Sagamu T/S.

Solution

World Bank NETAP Project

9. *IBEDC.SC*.09/Ofa 132kV/33kV TS

Need

Upgrade of 40MVA to 60MVA transformer capacity

Solution

10.*IBEDC.SC*.10/Osogbo 132kV/33kV TS

Need

Installation of additional 60MVA, 132/33kV transformer

Solution

Done

11.*IBEDC.SC*.11/Ile-Ife 132kV/33kV TS

Need

- Installation of 60MVA 132/33kV Transformer which is already on plinth and and associated out-going feeder bays

Solution

SLA Projects

12.*IBEDC.SC*.12/Ile-Ife 132kV/33kV TS

Need

Installation of breakers

Solution

SLA Projects

13.*IBEDC.SC*.13/Ijebu Ode 132kV/33kV TS

Need

Replacement of failed 60MVA, 132/33kV transformer

Solution

SLA Projects

14.*IBEDC.SC*.14/Ijebu Ode 132kV/33kV TS

Need

Replace damaged 33kV Circuit Breaker at the station

Solution

SLA Projects

15.*IBEDC.SC*.15/Iseyin 132kV/33kV TS

Need

Installation of additional 30MVA, 132/33kV transformer

16.***IBEDC.SC***.16/Oyo 132kV/33kV TS

Need

Installation of 30MVA Mobitra transformer at Oyo Substation

17.***IBEDC.SC***.17/Jericho 132kV/33kV TS

Need

Repair of 132KV Tap-Changer on the 45MVA Mobitra

Solution

Done

18.***IBEDC.SC***.18/Jericho 132kV/33kV TS

Need

Uprating of TI - 45MVA and T2 - 40MVA 132/33kV transformers to 2 X 60MVA transformers

Solution

SLA Projects

19.***IBEDC.SC***.19/Eleyele 132kV/33kV TS

Need

Construction of new 2 X 30MVA Substation in Eleyele Ibadan

Solution

FGNPC Projects

20.***IBEDC.SC***.20/Agbara 132kV/33kV TS

Need

Uprating of the station transformer capacity because other 33kV feeders belong to Eko and Ikeja Discos therefore causing our 20MW Lusada feeder to be pegged at 13.8MW

Solution

SLA Projects

7.6.2 Line Improvement Request

1. *IBEDC.LC*.01

   Increase the capacity of Osogbo-Offa 132kV line

2. *IBEDC.LC*.02

   Uprating and Dualization of the Ayede-Sagamu-Ijebu ode 132KV line to increase its capacity. The Line limited to 70MW at present.

   a) Construction of 2x132kV line from Ayede to Sagamu to relieve the existing underrated line.

3. *IBEDC.LC*.03

   Dualization and Reinforcement of the Ikorodu - Sagamu 132KV Line to increase Capacity to Sagamu axis and to relief the 132KV line from Ayede

   Solution

   Done

4. *IBEDC.LC*.04

   Reconductoring of the Offa Omu-Aran 132KV line; upgrading the 132kV line from 150mm² to 250mm²

5. *IBEDC.LC*.05

   Completion of Omuaran - Egbe 132kV Dual Circuit Line to feed the new 2 X 30MVA Substation in Egbe, Kogi State

6. *IBEDC.LC*.06

   Ota Reconductoring of undersized 132kV Ikeja West - Ota line to enhance capacity of the line for power evacuation

   Solution

   Ongoing under FGN/IGR Projects

7.7 Ikeja Electricity Distribution Company

7.7.1 Substation Based Request

1. *IKEDC.SC*.01/Alausa 132kV/33kV TS

Need

TCN to create capacity for the newly completed Oregun 33KV feeder.

Solution

World Bank NETAP Project

2. *IKEDC.SC*.02/Alausa 132kV/33kV TS

Need

TCN to create Capacity for LASG complexes on Alausa 33kV feeder

Solution

World Bank NETAP Project

3. *IKEDC.SC*.03/Alausa 132kV/33kV TS

Need

Capacity for Opebi ISS to radiate two new proposed 11KV feeders

Solution to Alausa Issues

a) 10MW network reconfiguration at Ogba and Alausa Substation

b) Reinforcement with 2x100MVA 132/33kV Power Transformer, High voltage Switchgears and associated equipment

c) Convert the indoor arrangement of the 45MVA to outdoor to avoid the kind of issues we are currently experiencing in Oworo

d) Completion of proposed 132kV line via Oke Aro.

Solution

World Bank NETAP Project

4. ***IKEDC.SC***.04/Oworonshoki 132kV/33kV TS

Need

Urgent replacement of faulty 2x30MVA power transformers

Solution

SLA Projects

5. ***IKEDC.SC***.05/Oworonshoki 132kV/33kV TS

Need

Quick completion of 2nos. 33kV Outdoor bays under construction

Solution

Done

6. ***IKEDC.SC***.06/Oworonshoki 132kV/33kV TS

Need

URGENT Replacement of the faulty 33kV indoor breakers.

Solution

Done

7. ***IKEDC.SC***.07/Oworonshoki 132kV/33kV TS

Need

TCN to create additional capacity on New Oworo ISS upgrade from 1*15MVA to 2*15MVA)

Solution

SLA Projects

8. ***IKEDC.SC***.08/Itire 132kV/33kV TS

Need

Urgent replacement of the faulty 60MVA Transformer while awaiting additional 60MVA transformer for reinforcement

Solution

Done

9. ***IKEDC.SC***.09/Itire 132kV/33kV TS

Need

Upgrading of T1 30MVA To 60MVA transformer.

Solution

Itire 132/33kV Transformer Station. (TCN to replace the faulty 60MVA to allow IE radiate new proposed 33KV feeder for Laspotech Isolo/Abimbola ISS and proposed 2 New 11KV feeder. TCN 60MVA to allow for capacity on Ago-Line 1 to connect to FESTAC Shoprite/Golden Tulip)

Done

10.***IKEDC.SC***.10/Akoka 132kV/33kV TS

Need

Urgent completion of conversion of 33kV indoor breaker to outdoor breaker
TCN completion of the Indoor to Outdoor breaker conversion will allow for the ongoing/suspended 33KV feeder to bring up 68 Military ISS with 3 11KV feeder radiation. IE to radiate new 33KV feeder to Igbobi ISS & Mushin ISS)

Solution

11.***IKEDC.SC***.11/Maryland 132kV/33kV TS

Need

Upgrading of 2 x 30MVA to 2 x 100MVA 132/33kV Power Transformers, High Voltage Switchgears and Associated Equipment.

Solution

World Bank NETAP Projects

12.***IKEDC.SC***.12/Maryland 132kV/33kV TS

Need

Replace the CT on Maryland Alausa feeder to 400/1A

Solution

World Bank NETAP Projects

13.***IKEDC.SC***.013/Ilupeju 132kV/33kV TS

Need

Upgrading of 2x15MVA 132/11kV transformers to 2x60MVA 132/33KV power transformers

Solution

Completed

14.***IKEDC.SC***.14/Ilupeju 132kV/33kV TS

Need

Repair on the faulty 45MVA

Solution

Completed

TCN upgrade of the 60MVA to allow for:
1. 1new 11KV feeder each on Ilupeju ISS & Mushin ISS
2. Separate the 33KV feeder feeding Mushin ISS and Local ISS

15.***IKEDC.SC***.15/Egbin 132kV/33kV TS

Need

Completion of 100MVA 132/33KV power transformer installation.

Solution

Completed

16.***IKEDC.SC***.16/Amuwo 132kV/33kV TS

Need

Upgrading of 2 x 30MVA transformer to 2 X 60MVA transformer by TCN

Solution

World Bank NETAP Projects

17.***IKEDC.SC***.17/Oke Aro 132kV/33kV TS

Need

Uprating of the 2X60MVA to 2X 100MVA to allow us pick our feeders

Solution

SLA Projects

18.***IKEDC.SC***.18/Proposed Kara/Berger 132kV/33kV TS

Need

Propose KARA/BERGER Station. To Take care of Lagos - Ibadan Expressway axis (We need about 40MW)

19.***IKEDC.SC***.19/Ikorodu 132kV/33kV TS

Need

Upgrading of T1 and T4 60MVA to 100MVA transformers to accommodates our proposed ISS in Ikorodu axis

Solution

20.***IKEDC.SC***.20/Ejigbo 132kV/33kV TS

Need

Upgrading of T3 60MVA to 100MVA transformer to accommodate proposed ISS

Solution

21.***IKEDC.SC***.21/Ayobo 132kV/33kV TS

Need

Upgrading of 2X60MVA to 2X100MVA transformer to accommodate proposed ISS

Solution

22.***IKEDC.SC***.022/Isolo 132kV/33kV TS

Need

Upgrading of T3 45MVA transformer to accommodate proposed ISS

Solution

SLA Projects

23.***IKEDC.SC***.23/Magodo – Isheri 132kV/33kV TS

Need

Construction of a new 1x60MVA 132/33KV power transformer capacity Transmission substation.

Solution

7.8 Jos Electricity Distribution Company

7.8.1 Substation Based Request

1. ***JEDC.SC***.01/Jos 330kV/132kV/33kV TS

Need

Installation of 75MVAR Reactor

Solution

Available

2. ***JEDC.SC***.02/Makeri 132kV/33kV TS

Need

Completion and Commissioning of Pankshin 2X30MVA, 132/33kV TS. (To reduce Dorowa Feeder [radiating length feeding 14 out of 17 LGAs in Plateau State resulting in poor voltage profile and low availability)

Solution

3. ***JEDC.SC***.03/Pankshin 132kV/33kV TS

Need

Installation/Commissioning of 60MVA,132/33KV Transformer yet to be completed.

Solution

4. ***JEDC.SC***.04/Gombe 132kV/33kV TS

Need

Completion of Biliri 132kV TS (to reduce Kumo Feeder length resulting in poor voltage profile and low availability) .

Solution

5. ***JEDC.SC***.05/Toro 132kV/33kV TS

Need

Construction of new 2 x 60MVA, 132kV/33kV TS substation.

Solution

FGNPC Project

6. ***JEDC.SC***.06/Yandev 132kV/33kV TS

Need

Completion and commissioning of the second 60MVA 123/33kV Transformer at Yandev TS

Solution

7. ***JEDC.SC***.07/Yandev 132kV/33kV TS

Need

Remote OLTC not installed on the dedicated 40MVA 132/33KV Transformer for better management of voltage fluctuations at Dangote Cement Plant

Solution

8. ***JEDC.SC***.08/Apir 132kV/33kV TS

Need

Proposed upgrading of 40MVA,132/33KV Mobitra to 60MVA,132/33KV power transformer at Apir Transmission Station Makurdi

Solution

9. ***JEDC.SC***.09/Bauchi 132kV/33kV TS

Need

Completion of 33kV Bay, leading to Load restriction of between 25-30MW.

Solution

7.8.2 Line Improvement Request

1. ***JEDC.LC***.01

   Poor voltage profile on Ashaka 132kV line radiating from Gombe TS and 132kV bypass towers to Ashaka

2. ***JEDC.LC***.02

   Transposition of 330kV ENUGU-MAKURDI-JOS Line. Project will include the Installation of 75MVAR Reactor

   Solution

   Done

3. ***JEDC.LC***.03

   Tr Construction and erection of 10nos suspension towers of 132kV Pankshin- Makeri Line

4. ***JEDC.LC***.04

- Pronounced voltage imbalance amongst the three phases at 330kv voltage level is cascaded down to 132kv, 33kv & 11kv voltage levels in our franchise states of Gombe, Bauchi, Plateau and Benue

7.9 Kaduna Electricity Distribution Company

7.9.1 Substation Based Request

1. ***KAEDC.SC***.01/Kaduna Township 132kV/33kV TS

Need

TCN & KAEDCO to jointly investigate the issues of poor voltage profile in the areas of Kaduna Town to improve quality of supply.

Solution

2. ***KAEDC.SC***.02/Kaduna Township 132kV/33kV TS

Need

Reactivation Of Faulty 60MVA, 132/33kv Power Transformer T3

Solution

There are transformers under the SLA project

3. ***KAEDC.SC***.03/Kaduna Township 132kV/33kV TS

Need

Reactivation Of Capacitor Banks at Kaduna Town Transmission Station For Voltage Correction & Power Quality Improvement

Solution

4. ***KAEDC.SC***.04/Kaduna Township 132kV/33kV TS

Need

Reactivation Of Capacitor Banks At Kaduna Town Transmission Station For Voltage Correction & Power Quality Improvement

Solution

5. ***KAEDC.SC***.05/Kaduna Township 132kV/33kV TS

Need

Upgrade Of HV Cables From 185mm2 XLPE To 300mm2x1 Core On 60MVA, 132/33KV Power Transformer (T1B)

Solution

6. ***KAEDC.SC***.06/Kaduna Main 132kV/33kV TS

Need

Reactivation Of Capacitor Banks At Mando Kaduna Transmission Station For Voltage Correction & Power Quality Improvement

Solution

7. ***KAEDC.SC***.07/Kaduna Main 132kV/33kV TS

Need

Transformer T2 Carrying Only One Feeder 33kv Water Works While Transformer T3 Carrying 4nos Feeders- There Is A **Need** To Rearrange The Feeders To Allow Maximum Utilization Of The Installed Capacity

Solution

8. ***KAEDC.SC***.08/Kaduna Main 132kV/33kV TS

Need

Additional 132/33kv Transmission Station At Eastern Byepass Kaduna To Take Care Of The Growing Expansion In The Region

Solution

9. ***KAEDC.SC***.09/Zaria 132kV/33kV TS

Need

Installation Of Capacitor Banks At Zaria Transmission Station For Voltage Correction & Power Quality Improvement

Solution

10. ***KAEDC.SC***.10/Zaria 132kV/33kV TS

Need

The transmission Station at Kwanar Dangora should be transferred to be feeding from Kano Source

Solution

11. ***KAEDC.SC***.11/Birnin Kebbi 132kV/33kV TS

Need

Installation Of Capacitor Banks At Sokoto Transmission Station For Voltage Correction & Power Quality Improvement

Solution

12. ***KAEDC.SC***.12/Birnin Kebbi 132kV/33kV TS

Need

Upgrading Of Existing 90mva

Solution

World Bank/NETAP

13.***KAEDC.SC***.13/Gusau 132kV/33kV TS

Need

Installation of Capacitor banks at Gusau T/S for Voltage Correction and Power Quality Improvement

Solution

14.***KAEDC.SC***.14/Millennium City 132kV/33kV TS

Need

Construction of new substation

Solution

Ongoing by Kaduna State

15.***KAEDC.SC***.15/ New Industrial Zone 132kV/33kV TS

Need

Construction of new substation at New Industrial Zone along Kaduna – Abuja express way

Solution

16.***KAEDC.SC***.16/Mando 330/132/33kV TS

Need

Completion of installation of 150MVA 330/132/33kV power transformer and provision of additional 2Nos 33kv line bays.

Solution

Under FGNPC Projects

7.9.2 Line Improvement Request

1. ***KAEDC.LC***.01

   Reconductoring And Upgrading the Weak Overloaded 132kv Line serving Gusau 132/33kV TS

2. ***KAEDC.LC***.02

   Reconductoring And Upgrading The Weak Overloaded Birnin Kebbi-Sokoto-Talata Mafara 132kv Line

3. ***KAEDC.LC***.03

Reconductoring And Upgrading The Weak Overloaded 132kv Line (Zaria- Funtua- Kwa Dabua- Talata Mafara Transmission Line)

4. *KAEDC.LC*.04

   Reconductoring of Birnin Kebbi-Sokoto 132kV Transmission Line

   Solution
   Done

5. *KAEDC.LC*.05

   Recoductoring of Mando-Zaria- Kwano Dangora 132kV line.

   Solution
   Under FGNPC Projects

7.10 Kano Electricity Distribution Company

7.10.1 Substation Based Request

1. *KEDC.SC*.01/ Walalambe – 2 x 40MVA T/S
   Need

   Construction of Walalambe T/S – 2 x 40MVA – Installation is in progress. Equipment is on site

2. *KEDC.SC*.02/ Kumbotso Transmission 132/33kV TS
   Need

   Creation of additional bays and addition of transformer for flexibility (The entire station load 160MVA is relying on one trafor T4A, 150MVA, without any flexibility making loading of 33kV Feeders difficult).

   Solution

   World Bank/NETAP Projects

3. *KEDC.SC*.03/ Rimi Zakar 330kV/132kV
   Need

   Construction of proposed Rimi Zakar 2 x 150MVA 330kV/132kV T/S. (to relieve 1 TS servicing 4 State and parts of Niger Republic)

   Solution

   Under FGN/IGR Projects

4. *KEDC.SC*.04/ Proposed Katsina 2 x 150MVA T/S.
   Need

Construction of proposed Katisna 2 x 150MVA T/S.

Solution

Under FGN/IGR Projects

5. *KEDC.SC*.05/ WUDIL 132/33kV TS.
   Need

   Installation of additional 60MVA 132/33kV transformer to enable evacuation of power from Wudil T/S to Kano and deload Dakata and Danagundi Substations. To create flexibility

   Solution

   Under SLA Projects

6. *KEDC.SC*.06/ Jogana – 2 x 60MVA T/S
   Need

   Construction of new Jogena – 2 x 60MVA T/S

   Solution

   Under AFD Norther Corridor Projects

7. *KEDC.SC*.07/ WUDIL 132/33kV TS.
   Need

   Deployemnt of Mobile 132/33kV sub-stations

   Solution

   Done

8. *KEDC.SC*.08/ TCN

   Refurbishment of all 132kV S/ Capacitor Banks

7.10.2 Line Improvement Request

1. *KEDC.LC*.01

   Kaduna-Kano 2nd 330kV line- Expedite action on completion of the project. TL cannot be loaded beyond 350MW and is the only line feeding - Kano, Katsina, Jigawa and part of Bauchi. (Proposed Capacity - 2,400MW)

2. *KEDC.LC*.02

   Reconductoring of Kumboso-Dakata-Hadejia 132kV line.

3. *KEDC.LC*.03

The 132kV Line from Kumbotso TS to Dakata TS, is undersized and overloaded. The line can only accommodate 70MW safely.

4. ***KEDC.LC***.04

132kV line from Kumbotso to Dan Agundi is undersized and overloaded. The Line feeds half of Kano. TCN will need to implement a relief project

5. ***KEDC.LC***.05

The 132kV Hadejia TL will need to be reconductored.

6. ***KEDC.LC***.06

Construction of 330kV Transmission Line at Rimi Zakari to Mando

7. ***KEDC.LC***.07

Reconductoring of Kankia 132kV TL. The Line has a history of low voltage due to undersized Conductor. (Feeders are rural but combined load demand of 30MW).

7.11 Port Harcourt Electricity Distribution Company

7.11.1 Substation Based Request

1. ***PHEDC.SC***.01/ Rumuosi 132/33kV TS

Need

Upgrade of existing 40MVA to 2x60MVA power transformers along with breakers and 33kV bays subject to handover to TCN

Solution

Under SLA Projects

2. ***PHEDC.SC***.02/ Rumuolumeni 132/33kV TS

Need

Construction of proposed 2x60MVA at Rumuolumeni TS

Solution

3. ***PHEDC.SC***.03/ PH Mains 132/33kV TS

Need

Procurement of spare breakers at PH Mains and outfitting of bay and upgrade of PH Mains by 1x90MVA

Solution

Under World Bank/NETAP

4. ***PHEDC.SC***.04/ PH Mains 132/33kV TS

Need

Provision of additional 33kV bay and Breakers

Solution

Under World Bank/NETAP

5. ***PHEDC.SC***.05/ ADIABOR 132/33kV TS

Need

Completion of Adiabor 132/33kV 2x60MVA T/S. TCN to interface with NIPP to handover the S/S.

Solution

6. ***PHEDC.SC***.06/ ELELEWON 132/33kV TS

Need

Installation of additional 60MVA 132/33kV Transformer at Elelewon TS.

Solution

Under SLA Projects

7. ***PHEDC.SC***.07/ ELELEWON 132/33kV TS

Need

Commissioning of idle 60MVA at Elelenwo to complement existing 60MVA 132/33kV and Handover from Govt to TCN.

Solution

Under SLA Projects

8. ***PHEDC.SC***.08/ Eneka/Rumundara132/33kV TS

Need

Construction/installation of 2x60MVA 132/33kV Transmission substation at Eneka/Rumudara axis.

Solution

9. ***PHEDC.SC***.09/ PH Town 132/33kV TS

Need

Upgrade existing 60MVA to 1x 100MVA

Solution

Under World Bank/NETAP

10. ***PHEDC.SC***.10/ Ikom 132/33kV TS

Need

Completion and Commissioning of On-going TS at Ikom

Solution

Under FGN/IGR Projects

11. ***PHEDC.SC***.11/ Ogoja 132/33kV TS

Need

Completion and Commissioning of On-going TS at Ogoja

Solution

Under FGN/IGR Project

12. ***PHEDC.SC***.12/ Obudu 132/33kV TS

Need

Completion and Commissioning of On-going TS at Obudu

Solution

Under FGN/IGR Projects

13. ***PHEDC.SC***.13/ Eneka 132/33kV TS

Need

Construction of new 2x60MVA at Eneka TS

Solution

14. ***PHEDC.SC***.14/ Ekim 132/33kV TS

Need

Deployment of Mobile 132/33kV sub-stations at Ekim TS

Solution

7.11.2 Line Improvement Request

1. ***PHEDC.LC***.01

Commissioning of On-going 330KV Transmission Line to Onne TS

2. ***PHEDC.LC***.02

78km 330kV Double Circuit Transmission Line from Ikot Abasi TS- to-Ikot Ekpene TS

7.12 Yola Electricity Distribution Company

7.12.1 Substation Based Request

1. ***YEDC.SC***.01/ Damaturu 330/132/33kV TS

Need

Construction of 150MVA, 330/132kV & 1X60MVA,132/33kV TX Substation at Damaturu

Solution

Completed

2. ***YEDC.SC***.02/ Damaturu 330/132/33kV TS

Need

Provision of Outdoor 33kV Circuit Breaker with other High Voltage Switchgears

Solution

World Bank/NETAP

3. ***YEDC.SC***.03/ MAIDUGURI (MOLAI) 330/132/33kV TS

Need

Construction of 150MVA, 330/132 & 1X60MVA,132/33kV TX Substation at Maiduguri

Solution

Completed

4. ***YEDC.SC***.04/ YOLA TOWN 330/132/33kV TS

Need

Installation of 1 X150MVA 330/132kV Transformer and 1 x 100MVA, 132/33kV to relieve the existing 1 x 30MVA , 132/33kV Transformer.

Solution

World Bank/NETAP

5. ***YEDC.SC***.05/ TAKUM 132/33kV TS

Need

Construction of 2x60MVA, 132/33kV Transmission S/S at Takum.

Solution

Completed

6. ***YEDC.SC***.06/ WUKARI 132/33kV TS

Need

Construction of 2x60MVA, 132/33kV Transmission S/S at Wukari.

Solution

Completed

7. ***YEDC.SC***.07/ JALINGO 132/33kV TS

Need

Uprating of existing 2 x 30/40MVA, 132/33KV to 2 x 60MVA transformers.

Solution

World Bank/NETAP Projects

8. ***YEDC.SC***.08/ JALINGO 132/33kV TS

Need

To transfer one of the outgoing 33kV Feeders from the Overloaded 30/40MVA, 132/33KV (T1B) to T1A for proper load off-take.

Solution

World Bank/NETAP Projects

9. ***YEDC.SC***.09/ Maiduiguri 132/33kV TS

Need

Uprating of 1 x 15MVA, 132/11kV (T3) Power transformer to 1 x 60MVA 132/33kV

Solution

World Bank/NETAP Projects

10. ***YEDC.SC***.10/ Song 132/33kV TS

Need

Completion of 2 X 60MVA 132/33kV TS to address the persistent extreme low voltage along that axis.

Solution

Ongoing Under FGN projects

11. ***YEDC.SC***.11/ Gombi 132/33kV TS

Need

Completion of 2 X 60MVA 132/33kV TS to address the persistent extreme low voltage along that axis.

Solution

Ongoing under FGN projects

12. ***YEDC.SC***.12/ Mubi 132/33kV TS

Need

Completion of 2 X 60MVA 132/33kV TS to address the persistent extreme low voltage along that axis.

Solution

Ongoing Under FGN projects

13. ***YEDC.SC***.13/ Madagali 132/33kV TS

Need

Construction of new 2 X 60MVA 132/33kV TS to address the persistent extreme low voltage along that axis.

Solution

14. ***YEDC.SC***.14/ Mutum Biyu 132/33kV TS

Need

Construction of 2 X 60MVA 132/33kV TS at Mutum Biyu TS

Solution

15. ***YEDC.SC***.15/ Biu 132/33kV TS

Need

Uprating of 1 x 15MVA 132/33kV to 1 X 60MVA 132/33kV at Biu TS.

Solution

World Bank/NETAP Projects

16. ***YEDC.SC***.16/ Nguru 132/33kV TS

Need

Construction of 2 X 60MVA 132/33kV TS at Nguru TS

Solution

17. ***YEDC.SC***.17/ Gashua 132/33kV TS

Need

Construction of 2 X 60MVA 132/33kV TS at Gashua TS

Solution

Under FGN/IGR Projects

18. ***YEDC.SC***.18/ Jada 132/33kV TS

Need

Construction of 2 X 60MVA 132/33kV TS at Jada TS

Solution

19. ***YEDC.SC***.19/ Ganye 132/33kV TS

Need

Construction of 2 X 60MVA 132/33kV TS at Ganye TS

Solution

20. ***YEDC.SC***.20/ Monguno 132/33kV TS

Need

Construction of 2 X 60MVA 132/33kV TS at Monguno TS

Solution

21. ***YEDC.SC***.21/ Gajiram 132/33kV TS

Need

Construction of 2 X 60MVA 132/33kV TS at Gajiram TS

Solution

22. ***YEDC.SC***.22/ Bama 132/33kV TS

Need

Construction of 2 X 60MVA 132/33kV TS at Bama TS

Solution

23. ***YEDC.SC***.23/ Bali 132/33kV TS

Need

Construction of 2 X 60MVA Bali 32/33kV TS

Solution

7.12.2 Line Improvement Request

1. ***YEDC.LC***.01

   Maintenance on Gombe to Potiskum 132KV Transmission Line; Identification and replacement of all faulty 132kV insulators to ensure continuity of service to customers in Potiskum and environs.

2. ***YEDC.LC***.02

   Re-conductoring of the 132kV overhead line from Damboa to Baga road to address the Load limitation.

3. ***YEDC.LC***.03

   Construction and installation of 132kV Line and associated 132/33kV Transmission station at Song, Gombi, Mubi and Madagali to address the persistent extreme low voltage along that axis.

4. ***YEDC.LC***.04

   Extension of 132kV line from Jalingo to Mutum Biyu

5. ***YEDC.LC***.05

   Extension of 132kV line from Damaturu to Nguru and Gashua

6. ***YEDC.LC***.06

   Construction and installation of 132kV Line at Song, Gombi, Mubi and Madagali to address the persistent extreme low voltage along that axis

7. ***YEDC.LC***.07

   Re-conductoring of the 132kV line from Gombe to Damboa

8. ***YEDC.LC***.08

   Construction of 132kV overhead line from Mayo-Belwa to Jada and Ganye

9. ***YEDC.LC***.09

   Extension of 132kV Line at Monguno, Gajiram and Bama.

10. ***YEDC.LC***.10

    Extension of 132kV line from Takum to Bali

7.13 Summary of Disco Requests

Table 7-1 summarizes the request of the Discos. There is a total of 179 substations-based requests and a total of 44 lines-based requests, making a total of 223 requests. 59 substations requests are outstanding, while 120 requests have been addressed (completed or on going).
34 lines requests are outstanding, while 10 requests have been addressed (completed or on going). TCN is currently working on 58.30% of the requests.

Table 7-1: Summary of Requests from Discos

Disco	Substation Request	Substation Request Addressed	Substation Request under consideration	Line Request	Line Request Addressed	Line Request under consideration
Abuja	6	5	1	4	4	0
Benin	19	17	2	4	1	3
Eko	26	22	4	0	0	0
Enugu	15	11	4	2	0	2
Ibadan	20	15	5	6	2	4
Ikeja	23	14	9	0	0	
Jos	9	2	7	4	1	3
Kaduna	16	5	11	5	2	3
Kano	8	6	2	7	0	7
PH	14	9	5	2	0	2
Yola	23	14	9	10	0	10
Total	**179**	**120**	**59**	**44**	**10**	**34**
Total Percent		**67.0%**	**33.0%**		**22.7%**	**77.3%**

As part of ensuring quality services to the Discos, TCN will consider the merit of the 59 substations and 10 lines requests (representing 41.7% of Discos' request). If there is evidence that the request will not lead to stranded capacity, necessary procurement actions will be done to initiate them as projects. However, TCN has identified a substantial part of the line requests to have merit, due to undersized conductors.

8 PROJECT SELECTION FOR 2023

8.1 Introduction

In this Volume 1 of the PIP, TCN has come up with a list of projects that will be initiated, continued and completed in the year 2023. Comprehensive five years projects list will be given in Volume 2, based on Discos and NERC's feedback on this Volume.

Substantial amount of the AFD project will be completed in the year 2023. In addition, several World Bank Substation components rehabilitation and control infrastructure projects would have been completed. TCN in the year 2023 will continue to maintain its substations and transmission line assets. In addition, TCN will initiate new projects relating to digital transformation, smart grid and grid automation and performance intelligence.

8.2 Projects to be Completed

Projects expected to be completed in the year 2023 are discussed below by funding categories.

8.2.1 Abuja Ring Fence Projects to be Completed

It is expected that all the projects in the AFD Abuja Ring Fence Project will be completed by the end of 2023. Table 8-1 shows the lists of all the projects.

Table 8-1: Abuja Ring Fence Projects to be completed in year 2023.

No	DISCOS	Region	Station 1	Station 2	Project Description
1	AEDC	ABUJA	New Apo 330/132/33		Construction of complete new 330/132/33kV substation at New Apo (Pigba) a) 2X150MVA 330/132/33kV transformers b) 3X60MVA,132/33kV transformers c) 330kV,132kV,33kV primary and secondary switchgears, Control/protection systems and automation. d) 6 X 132kV line bay e) 3 X 132kV line bay extension at Old Apo 132kV Substation. f) 2x 330kV line bays extension at Lafia g) 9X33kV distribution feeders all civil works, testing and commissioning.

2	AEDC	ABUJA	Lugbe 330/132/33		1. Construction of complete new 330/132/33kV AIS substation at West Main (Lugbe). a) 2X150MVA 330/132/33kV Transformers. b) 3X60MVA,132/33kV 132/33kV Transformers (with 132kV outdoor GIS Switchgear). c) 330kV,132kV,33kV primary and secondary switchgears, Control/protection systems and automation. d) 2 X 330kV line bay and 4 X 132kV line bays. e) 33kV indoor metal clad switchgears. f) 9X33kV distribution feeders all civil works, testing and commissioning.
3	AEDC	ABUJA	Kuje 132		Construction of complete new 132/33kV substation at Kuje a) 3X60MVA,132/33kV transformers b) 132kV,33kV primary and secondary switchgears, Control/protection systems and automation. c) 4 X 132kV line Bay d) 9X33kV distribution feeders all civil works, testing and commissioning.
4	AEDC	ABUJA	Wumba 132		1. Construction of complete new 132/33kV substation at Wumba/Lokogoma. a) 2X60MVA,132/33kV transformers. b) 132kV,33kV primary and secondary switchgears, Control/protection systems and automation. c) 2 X 132kV line Bay d) 2 X 5km underground 132kV XLPE Cable line, from New Apo to Wumba/Lokogoma. e) 6X33kV distribution feeders all civil works, testing and commissioning.

5	AEDC	ABUJA	Gwarimpa 132		1. Construction of complete new 132/33kV GIS substation at Gwarimpa. a) 2X60MVA,132/33kV transformers, b) 132kV GIS Primary and 33kV Metal clad secondary switchgears, Control/protection systems and automation. c) OHL / Underground Cable termination of the existing 132KV DC Katampe – Suleja Transmission line. · laying of 4x1km 132kV Underground XPLE Cable. d) 6X33kV distribution feeders all civil works, testing and commissioning
6	AEDC	ABUJA	Lafia 330	New Apo 330	Construction of about 143km(172km) of new 330kV double circuit line from Lafia 330kV 330/132/33kV substation to the proposed New Apo (Pigba) 330/132/33kV substation.
7	AEDC	ABUJA	New Apo 132	Old Apo 132	Construction of about 11km (7km) of new 132kV double circuit line from New Apo (Pigba) 330/132/33kV substation to Old Apo 132/33kV substation
8	AEDC	ABUJA	New Apo 132	Kuje 132	Construction of 42km (35km) of new 132kV double circuit line from New Apo 330/132/33kV substation to the Kuje 132/33kV substation.
9	AEDC	ABUJA	Lugbe 132	Kuje 132	Construction of 29km of new 132kV double circuit line from the proposed Kuje 132/33kV Substation to West Main (Lugbe) 330/132/33V substation

8.2.2 World Bank NETAP

It is expected that all the projects in the World Bank NETAP Project would have been completed apart from the SCADA/EMS/Communication work stream of the project.

8.2.3 FGN/IGR Projects

Some projects being funded by the IGR of TCN will be completed. However, the number of projects is dependent on the energy availability from generators and payment performance of Discos.

8.2.4 Maintenance Activities

TCN prioritizes the maintenance of its equipment, and this tradition will continue in the year 2023.

8.3 Proposed Projects to be Initiated under PSRP Support of the World Bank

The World Bank has extended a “Payment for Performance” loan to TCN under the Power Sector Recovery Program (PSRP). TCN has proposed to spend about 98 million USD for improvement of its processes, especially in digital transformation, smart grid and grid automation and performance intelligence. These proposed projects are listed in Table 8-2.

Table 8-2: PSPR Proposed Projects for year 2023

#	Project Description	Amount (USD)
1	Procurement and Installation of Weather Station at Grid Critical Nodes	375,000
2	Operational Intelligence Tool for System Performance Management	5,000,000
3	Upgrade of the current IoT system and expansion to areas not already covered	2,000,000
4	Development of Market Operator's Software, Processes and Systems	10,000,000
5	Review and Development of Long term Transmission Expansion Plan.	5,000,000
6	Upgrade, rehabilitation and digitization of about 70 old substations not covered under the NEPTAP project	35,000,000
7	Procurement of Critical spares for prompt network maintenance	20,000,000
8	Ten (10) Drones for patrol of transmission lines in the 10 transmission regions	10,000,000
9	Development of customised tool for Monitoring and Evaluation of the system	3,000,000
10	Procurement of Protection System Lab set	150,000
11	Strategies and Processes Development and Consultancy	3,000,000

12	Consultancy on the Readines, Preparation and Impact of Seperation of ISO from TCN	2,000,000
13	Project Consultancy Support	1,250,000
14	Operations and Logistical Support	500,000
15	Operational and Monintoring Vehicles	1,000,000
	TOTAL	**98,275,000**

8.4 Revenue from IGR

8.4.1 Overview of TCN's Revenue from IGR

From the MYTO Model, TCN is expected to receive about 200 billion Naira in the year 2023. However, historically, generation shortages and Discos remittance performance have significantly affected TCN's actual revenue. Using the first 9 months of year 2023 as a reference, it expected TCN will only 99 billion from the eleven Discos. TCN is expected to make about 4 billion Naira and 30 million USD from Non Discos customers. Out of this revenue TCN is expected to payback the Discos about 5 billion Naira for Economic Merit Order Deviation (EMOD) deviations and about 6 Billion Naira for SLA projects refunds, leaving TCN with only 92 Billion Naira. TCN has an Administrative and Fixed Costs of about 62 billion Naira.

8.4.2 Revenue available from IGR for Maintenance and Projects

TCN will have about 30 Billion Naira and 30 million USD for debt payments, project completion, maintenance activities and debt payments in the year 2023.