



PERFORMANCE IMPROVEMENT PLAN (2020-2024)



PORT HARCOURT ELECTRICITY DISTRIBUTION PLC

October 17, 2019

Draft Version

Table of Contents

| | |
|--|----|
| 1. Executive Summary..... | 6 |
| 2. Introduction to PHED | 8 |
| 2.1. Vision, Mission and Values..... | 11 |
| 2.2. Objective | 12 |
| 2.3. Journey so far..... | 13 |
| 3. Overview of PIP..... | 16 |
| 3.1. Achievements 2014-2019 | 16 |
| 3.2. Challenges | 19 |
| 3.3. Service Gaps..... | 21 |
| 3.4. Stakeholder Views..... | 22 |
| 3.5. PIP Strategy and Approach | 25 |
| 3.6. Process Adopted | 29 |
| 3.6.1. Stakeholder Engagement..... | 29 |
| 3.6.2. Demand Forecast Study | 29 |
| 3.6.3. Capex Plan..... | 31 |
| 4. PHED Network Infrastructure | 32 |
| 4.1. Overview | 32 |
| 4.2. Existing Infrastructure with current scenario | 33 |
| 4.3. Projects executed during 2014-19 | 38 |
| 4.4. Challenges and Limitations | 43 |
| 4.4.1. Power Supply | 43 |
| 4.4.2. Transmission Challenges and Limitations | 46 |
| 4.4.3. Distribution Network Challenges and Limitations | 47 |
| 5. Detailed Plans | 49 |
| 5.1. Technical | 49 |
| 5.1.1. Demand Growth..... | 50 |
| 5.1.2. Loss Reduction | 51 |
| 5.1.3. Reliability..... | 54 |
| 5.1.4. Energy Management and Audit | 58 |
| 5.1.5. Technical Investment Plan | 59 |
| 5.1.6. Proposed Network & System Projects | 61 |
| 5.1.7. Impact and Outcome of Proposed Projects..... | 62 |
| 5.2. Commercial and Customer Service | 64 |
| 5.2.1. Metering..... | 64 |
| 5.2.2. Billing..... | 66 |
| 5.2.3. Collection | 67 |

| | | |
|--------|--|-----|
| 5.2.4. | Customer Service | 73 |
| 5.3. | Process Re-Engineering..... | 77 |
| 5.3.1. | Process Strategy..... | 77 |
| 5.3.2. | Implementation and Capacity building..... | 80 |
| 5.3.3. | Process Plan | 83 |
| 5.3.4. | Process Audit..... | 85 |
| 5.3.5. | New Process Development | 85 |
| 5.3.6. | Process Improvement | 86 |
| 5.3.7. | Handholding Support to Staff | 86 |
| 5.3.8. | Training of Process Champion | 86 |
| 5.3.9. | Process Standardization and Certification | 86 |
| 5.4. | IT and Automation | 87 |
| 5.4.1. | Information Technology Plan and Status..... | 88 |
| 5.5. | People Planning and Management..... | 94 |
| 5.5.1. | Review of Existing Operations | 94 |
| 5.5.2. | Challenges | 96 |
| 5.5.3. | Human Resource Strategy..... | 96 |
| 5.5.4. | HR Key Interventions..... | 97 |
| 5.5.5. | Manpower Deployment..... | 99 |
| 5.5.6. | Training and Capacity Building Plan for Staff..... | 100 |
| 5.5.7. | Performance Management System | 103 |
| 5.6. | Safety | 106 |
| 6. | Financial Plans..... | 107 |
| 6.1. | Historical Performance | 107 |
| 6.2. | Market Obligations | 107 |
| 6.3. | ATC&C Loss Reduction | 108 |
| 6.4. | 5 Years Financial Projections..... | 108 |
| 6.4.1. | Capital Expenditure (CAPEX) Plan | 109 |
| 6.4.2. | Operating Expense (OPEX)..... | 110 |
| 6.4.3. | Cost Reflective Tariff | 110 |
| 6.5. | Investment Funding Strategy..... | 111 |
| 7. | Risk Assessment and Mitigation | 112 |
| 8. | KPI Projections | 115 |
| 9. | Monitoring Framework..... | 117 |
| 10. | Annexures | 118 |

List of Tables

| | |
|---|----|
| Table 1: PHED at Glance..... | 9 |
| Table 2: PHED Network at Glance..... | 9 |
| Table 3: Existing Organisation Structure..... | 10 |
| Table 4: Management Focus 2014-19..... | 16 |
| Table 5: Key Achievements 2014-19..... | 17 |
| Table 6: External Challenges | 19 |
| Table 7: Internal Challenges..... | 20 |
| Table 8: Service Delivery gaps..... | 21 |
| Table 9: Summary of External Engagements | 23 |
| Table 10: Summary of Internal Engagements..... | 23 |
| Table 11: Engagement Programme Feedback | 24 |
| Table 12: Potential Customer population..... | 30 |
| Table 13: Potential Customer Demand..... | 30 |
| Table 14: Capex Plan 2020-2024..... | 31 |
| Table 15: Capex Distribution in Network..... | 31 |
| Table 16: Transmission Lines in PHED Network..... | 33 |
| Table 17: PHED Distribution Network configuration | 34 |
| Table 18: Public Distribution transformers..... | 35 |
| Table 19: Private Distribution Transformer | 35 |
| Table 20: Number of Network projects completed | 38 |
| Table 21: Details of Projects Completed since 2014..... | 38 |
| Table 22: Challenges in Electricity Value Chain | 43 |
| Table 23: IPP Capacity..... | 44 |
| Table 24: Power availability from upcoming NIPP/ IPPs..... | 45 |
| Table 25: Transmission Stations and their installed capacities | 46 |
| Table 26: 33KV Feeder Loading..... | 47 |
| Table 27: Manned Injection S/S Load status..... | 47 |
| Table 28: Type of issues in Ageing equipment in Injection Substations..... | 48 |
| Table 29: Five Year Vision of Network Improvement | 49 |
| Table 30: Implementation plan for Demand Growth Project..... | 51 |
| Table 31: Implementation plan for HVDS and Cabling | 52 |
| Table 32: Implementation plan for installation of Capacitor Bank..... | 52 |
| Table 33: Implementation Plan for Demand Growth Projects | 53 |
| Table 34: Implementation plan for Substation Automation..... | 54 |
| Table 35: implementation plan for DTR de-rating to 11/0.415kVA..... | 55 |
| Table 36: Implementation plan for Autoreclosure, Sectionalizer and RMU..... | 55 |
| Table 37: Maintenance Module..... | 56 |
| Table 38: Containment Module | 57 |
| Table 39: Implementation Plan for Maintenance..... | 57 |
| Table 40: Implementation plan for safety and security project | 58 |
| Table 41: Feeder metering implementation plan..... | 58 |
| Table 42: Classification of Proposed Projects | 61 |
| Table 43: Summary of Projects | 61 |
| Table 44: Meter Installation Planning..... | 65 |
| Table 45: MDA Debt..... | 69 |
| Table 46: Intensity of Payment Collection Initiatives w.r.t. Area Profile | 72 |
| Table 47: Key Strategies..... | 74 |
| Table 48: Process Gap Identification | 78 |

| | |
|--|-----|
| Table 49: Processes identified and drafted in 2018 and 2019..... | 79 |
| Table 50: FY 2019 Process Training Statistics | 80 |
| Table 51: Yearly Activity Calendar Process Re-Engineering..... | 81 |
| Table 52: Process Plan 2020-24 | 83 |
| Table 53: IT and Automation Plan 2020-24 | 88 |
| Table 54: Existing Manpower Strength..... | 95 |
| Table 55: Balance Score card implementation | 104 |
| Table 56: HR Plan and KPIs..... | 105 |
| Table 57: Historical Performance..... | 107 |
| Table 58: ATC&C Loss Trend | 108 |
| Table 59: Financial Projections | 108 |
| Table 62: Funding Options | 111 |
| Table 63: Risk Assessment and Mitigation Strategy | 112 |
| Table 64: Key Business Parameters – Projections | 115 |

DRAFT

List of Figures

| | |
|---|-----|
| Figure 1: Map of Nigeria highlighting PHED covered States..... | 8 |
| Figure 2: Customer Growth | 13 |
| Figure 3: Input Energy & Sales | 14 |
| Figure 4: Billing and Collection..... | 14 |
| Figure 5: ATC&C and Collection Efficiency..... | 15 |
| Figure 6: Stakeholder Meetings & Business Planning Workshop | 22 |
| Figure 7: Integrated Approach | 25 |
| Figure 8: Strategic Goals | 26 |
| Figure 9: Planning Horizon | 27 |
| Figure 10: Planning horizon of key Strategic Interventions..... | 28 |
| Figure 11: HT Network Map..... | 34 |
| Figure 12: SLD of PHED network..... | 37 |
| Figure 13: Factors Driving Demand Growth | 50 |
| Figure 14: Substation Automation | 54 |
| Figure 15: Feeder Metering | 59 |
| Figure 16: Goals set to improve Revenue Cycle..... | 64 |
| Figure 17: Metering Plan..... | 65 |
| Figure 18: MAP Flag Off | 65 |
| Figure 19: Customer Enumeration and LT Network | 67 |
| Figure 20: Smart PoS for Spot Collection | 68 |
| Figure 21: Bill Revision Camp | 70 |
| Figure 22: Process Strategy..... | 77 |
| Figure 23: Process Trainings | 81 |
| Figure 24: Sample of an audit result..... | 82 |
| Figure 25: Audit of Departments | 82 |
| Figure 26: Process audit non conformity report sample | 83 |
| Figure 27: Sample Audit parameters | 85 |
| Figure 28: DL Enhance..... | 88 |
| Figure 29: Salient features of the existing HR policies..... | 94 |
| Figure 30: Existing PHED Organisation Structure..... | 95 |
| Figure 31: HR Strategy | 97 |
| Figure 32: Proposed Human Resource Strategy | 97 |
| Figure 33: Key Activities..... | 99 |
| Figure 34: Proposed Training and Development Strategy..... | 100 |
| Figure 35: Planned Trainings..... | 102 |
| Figure 36: PHED employees Interactions..... | 102 |
| Figure 37: Balance Score Card Philosophy..... | 104 |
| Figure 38: Cost Reflective Tariff vs MYTO..... | 110 |
| Figure 39: Key KPIs Trend..... | 116 |

1. Executive Summary

The Power sector of Nigeria has been experiencing a very turbulent time post-privatization. The main objective of privatization of the Nigeria's power sector was to attract private investment and to achieve higher efficiency in service delivery. The hope was that the entry of investors into the sector would improve power generation and distribution across the country. More than five years after privatization, the sector has been facing a major setback as liquidity, manpower and other challenges have continued to haunt the sector. Discos are unable to meet up with their performance agreement, as agreed to with BPE at privatization, due to plethora of reasons which has led National Electricity Regulatory Commission (NERC) to request all Discos to come up with their 5 year Performance Improvement Plans (PIP) that will see performance rapidly improved between 2020 – 2024.

Port Harcourt Electricity Distribution Plc (PHED), one of the eleven privatised Discos envisions to be the most efficient and sustainable utility company in Nigeria and the preferred service provider with a reputation for reliability and excellent customer service.

PHED came into existence on the 1st of November 2013, when the Government formally handed over the reins of ownership. Presently, PHED is part owned by 4Power Consortium Ltd and Federal Government of Nigeria through Ministry of Finance Inc and Bureau of Public Enterprises (BPE) in the ratio of 60:40 respectively. The headquarter is located at 1 Moscow Road in Old GRA, Rivers State.

PHED provides power for a total of 18.9 million people in 4 states of Nigeria including Rivers, Bayelsa, Cross River and Akwa Ibom. The service area of PHED is spread over 49,087 Sq. Km covering more than half a million customers with average annual supply of about 2,000 MUs served through 112 Injection Substations, 74 No. 33 KV feeders, 227 No. 11 KV feeders and 9,683 distribution transformers.

PHED has developed a PIP for the next five years starting 2020 in line with the guidelines designed by NERC, the vision of the Electric Power Sector Reform Act and the Power Sector Recovery Program (PSRP). In developing this plan, PHED's performance in the last five years of operations was reviewed and all the constraints that led to non-performance were identified and evaluated. The overall strategy aims to align the entire organization towards achievement of corporate goals, devise a strategy which shall lead to improvements in the financial performance, reinforce the organization values, ensure sustainable growth and enhance operational efficiencies.

This document therefore contains PHED's priorities and initiatives that are planned to transform the business across all segments and customer mix, in next five years. PHED has embarked upon the key objectives of efficiently managing the operations, metering all customers, rehabilitating and modernizing the existing distribution system, expanding the electrical network to provide reliable power to new customers and achieving the key performance targets, achieving commercial viability for the Company and improving service delivery to the Customers.

The total capex for achieving the PIP is estimated to be 106.13 Bn Naira distributed across Network and Systems (61.78 Bn), Customer metering (41.65 Bn), IT and Automation (1.21 Bn) and Admin and General (1.5 Bn). The network capex is further divided in four service delivery improvement areas, namely, Demand Growth (15.29 Bn), Loss Reduction (24.03 Bn), Reliability (12.66 Bn), and Business Enablers (9.8 Bn). The plan also envisages doubling the customer base leading to installation of more than 800,000 customer meters through Meter Asset Provider (MAP). Being mindful of the existing state of 33 KV and 11 KV Network that is hampering smooth flow of energy, PHED has decided to



spend 67% of its Network and Systems capex on 33 KV Network projects (20.8%), 33/11 KV Injection substations (19.5%) and 11 KV Network projects (6.2%) besides investing 32.3% in 33/11/0.415 distribution transformers, 3.4 B (5.5%) on AB cabling of LT Network. Also on IT intervention 9.8 B for SCADA and other Automation implementation is provisioned.

With this capex and the implementation plan monitoring, PHED aims to reduce its ATC&C losses from 61.3% in the year 2019 to 21% in the year 2024.

The success of this plan, however, hinges on a tariff that is reflective of both capital expenditure and operating costs. It is PHED's expectation that at the end of the PIP review, PHED will get a tariff and tariff structure that will support this performance based program to bring about its transformation and turnaround.

DRAFT

2. Introduction to PHED

The Port Harcourt Electricity Distribution Plc (PHED) is a private electric distributor that provides power for a total of 18 million people in 4 states of Nigeria including Rivers, Bayelsa, Cross River and Akwa Ibom. PHED came into existence on the 1st of November 2013, when the Government formally handed over the reins of ownership. Presently, PHED is owned by 4Power Consortium Ltd. The headquarters are located at 1 Moscow Road in Old GRA, Rivers State.

PHED is governed by a professional Board presently comprising of eight result oriented individuals with impeccable track record and industry expertise. Out of the eight members, six members are nominated by M/s 4Power Consortium Ltd (which holds 60% equity of PHED) while the Director General, BPE (through his nominated representative) represents the BPE and Ministry of Finance Inc (which together hold 40% equity of PHED). Apart from these seven members, the PHED Board also appointed an Independent Director having exceptional industrial, administrative and political standing. The Chairman and Vice Chairman of the Board are Non-Executive Directors while one of the Board Members is a full time Director acting as MD/CEO of PHED.

The objective of PHED is to provide its customers with a more reliable and efficient electricity supply, increase the availability of power supply, improve customer satisfaction, and work to the highest standards of professionalism and integrity; which will stimulate the economy and empower growth.

PHED believes that through this approach it will become the first choice supplier for customers – domestic, industrial, commercial and corporate – who are looking for reliable and adequate power supplies.

Figure 1: Map of Nigeria highlighting PHED covered States



PHED is located in oil rich region of the Niger Delta in Nigeria. PHED serves a customer population of over half a Million. The Federal Government of Nigeria has a continuous desire to improve the living conditions of the Niger Delta people and PHED sees it as a key and strategic opportunity in achieving its objectives through the provision of reliable and quality power in PHED’s coverage area.

Port Harcourt area is a major industrial centre, having large number of multinational firms as well as other industrial units particularly petroleum industries. Rivers State is one of the wealthiest states in Nigeria in terms of Gross Domestic Product (GDP) and foreign exchange inflows from the oil industry.

Table 1: PHED at Glance

| | Rivers | Bayelsa | Akwa Ibom | Cross River | PHED Total |
|-----------------------|-----------|-----------|-----------|-------------|------------|
| Service Area (Sq. Km) | 11,077 | 10,773 | 7,081 | 20,156 | 49,087 |
| No of IBCs | 5 | 1 | 2 | 2 | 10 |
| No of BSCs | 20 | 4 | 10 | 8 | 42 |
| No of fault centres | 9 | - | 10 | 9 | 28 |
| State Population | 7,303,900 | 2,278,000 | 5,482,200 | 3,866,300 | 18,930,400 |
| #Customer Population | 310,444 | 41,725 | 106,361 | 77,313 | 535,843 |

#Source of Information:- National Population Commission and National Bureau of Statistics Estimates

Table 2: PHED Network at Glance

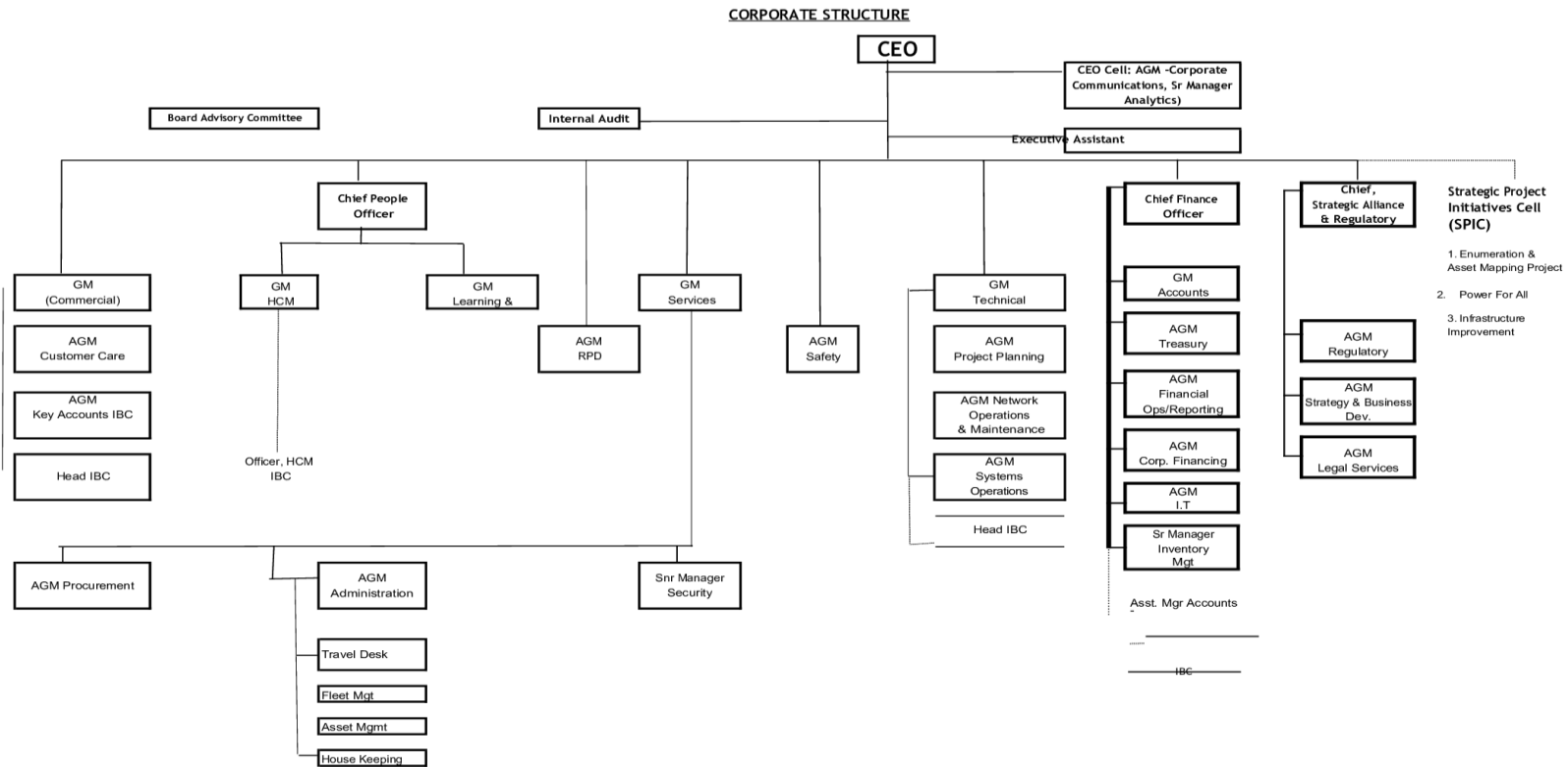
| S/N | Description | Number |
|-----|---------------------------|--------|
| 1 | Injection S/s | 58 |
| 2 | Average Load (MVA) | 10 |
| 3 | Total Capacity (MVA) | 990 |
| 4 | 33KV Feeders | 74 |
| 5 | 11KV Feeders | 227 |
| 6 | Distribution transformers | 9683 |

PHED is guided by the conditions of service of the Power Holding Company of Nigeria (PHCN). The company operations are run by 1,239 staff members. Most of the staff members were inherited from PHCN.

PHED has centralized hierarchical structure with various business units. The Head Office drives the business operations by taking key business strategic decisions and is supported by Integrated Business Centers (IBCs) located at various places in implementations of strategic decisions and policies of the organization.

The management of company is led by Chief Executive Officer (CEO) alongwith other Executive cadre heading Finance, People, Commercial, Technical, Regulatory, Services and Revenue Protection functions. The operations at field level are managed by Integrated Business Centre Heads and team of experienced technical experts.

Table 3: Existing Organisation Structure



2.1. Vision, Mission and Values

Our Vision

To make Port Harcourt Electricity Distribution Company the most efficient and sustainable utility company in Nigeria and the preferred service provider with a reputation for reliability and excellent customer service.

Our Mission

To supply quality and reliable power safely to our valued customers, to ignite socio-economic growth while relying on our highly innovative and motivated workforce.

Core Values

Collaboration: We will engage constructively with our partners to achieve a win-win results

Respect: We will treat our employees, partners, customers and communities with respect and integrity

Execution Speed and Excellence: We will drive operating effectiveness by eliminating duplication, leveraging scale, ensuring compliance and improving systems

Accountability: We will hold ourselves accountable to our stakeholders by conducting our business in ways that sustains business performance and growth

Tenacity: We will relentlessly invest time, expertise and resources to address complex power challenges and deliver solutions that improve the quality of life in our communities

Integrity: We will place integrity at the core of everything we do

Value our Customers: We will strive to deliver exceptional service, react quickly to resolve issues when identified, keep our service and work environment safe and always keep our doors open to our customers

Equity and Fairness for Employees: We will foster a high performing culture that is based on equity and fairness and motivates our employees to create value and make a difference in the business, in the lives of the customers and the communities they live and work.

2.2. Objective

This Performance Improvement Plan aims to achieve the following objectives

- Business turnaround
- Meeting stakeholders expectations
- Meeting MYTO expectations
- Reducing Losses
- Improve customer satisfaction

To achieve the above mentioned objectives, PHED has identified and focussed on five key business areas **Financial, Customer, Regulatory, Operations, Learning and Growth**

Financial

- Reduce ATC&C Loss
- Optimize Power Procurement Cost
- Reduce Distribution Cost
- Maximize Rate of Return

Customer

- Build Customer loyalty
- Effective Follow up

Regulatory

- Extend reach of electricity to more population at affordable cost

Operations

- Procurement Process
- Effective Enforcement
- Reliability of Distribution System
- Accurate Metering and Billing
- Power Availability
- Enhanced Communication
- Effective Complaint Redressal
- Power Optimization
- Uninterrupted Power Supply

Learning & Growth

- People Development
- Business Excellence
- Employee Engagement
- Culture Building
- Institutionalization, Innovation and Knowledge Management

2.3. Journey so far

PHED started its journey as a privatised Disco on 1st November 2013. Over the years, customer population has grown by 22% and correspondingly the Energy consumed has grown over 18%. The ATC&C between 2016 & 2019 was at highest mainly due to the National recession of 2016. However, the numbers have started improving gradually since 2018.

In the year 2015, PHED faced severe impact from steep inflation followed by upward revision in tariff and thereafter freeing of it. These adversaries have taken PHED to all time low in its performance. All efforts since then have been to stem the downward spiral and set the company on a recovery path. The performance trend shows that even if targets were not met, there have been a steady improvement in performance indices. ATC&C has shown a steady decline after climaxing in 2017. In the same vein, collection efficiency got to an all-time low in 2016, but has steadily increased since then, 2019 has averaged above 50% collection efficiency.

Figure 2: Customer Growth

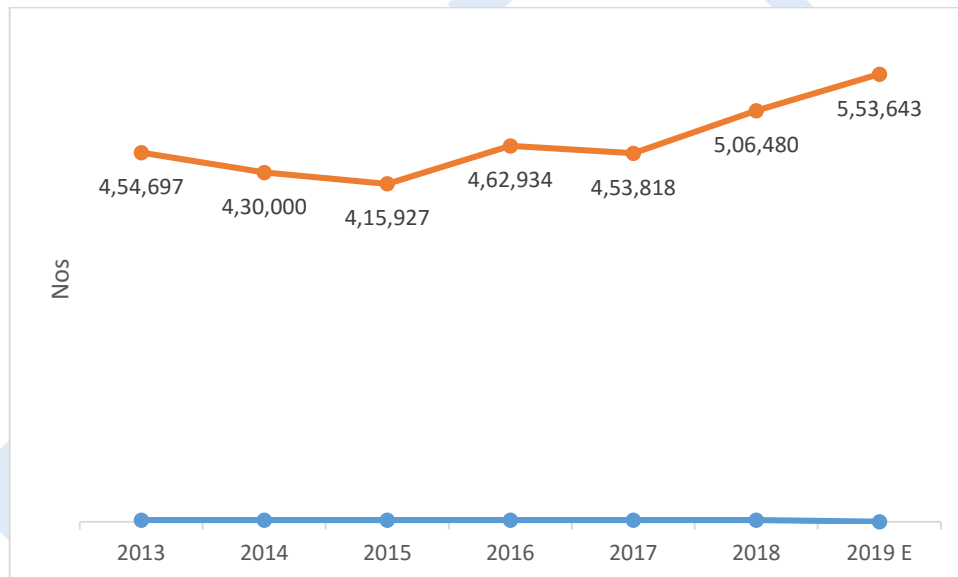
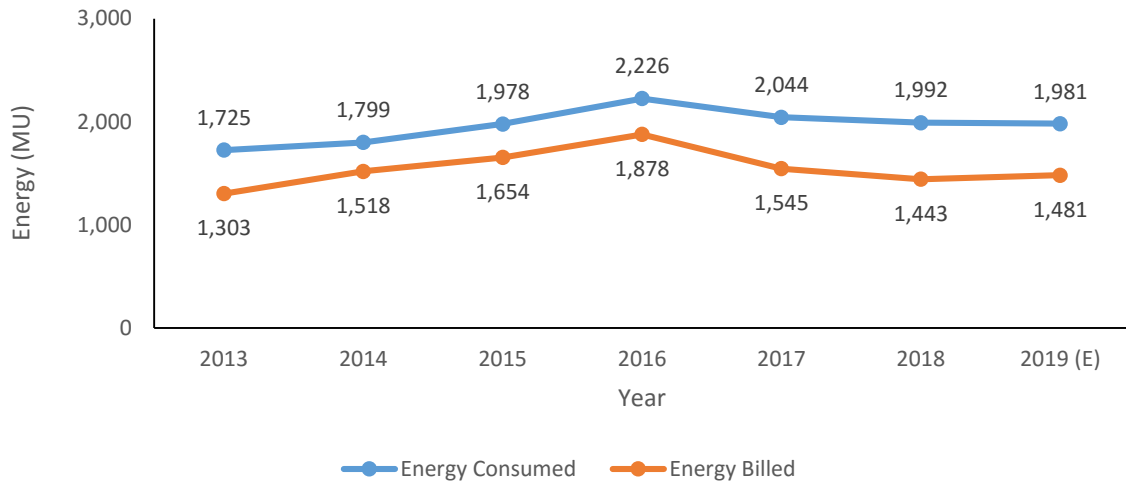
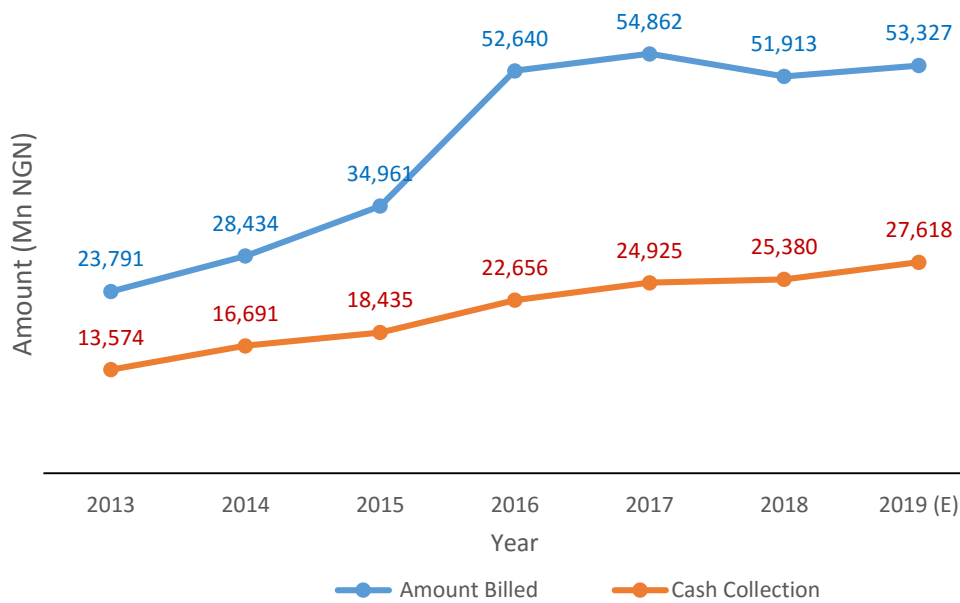


Figure 3: Input Energy & Sales



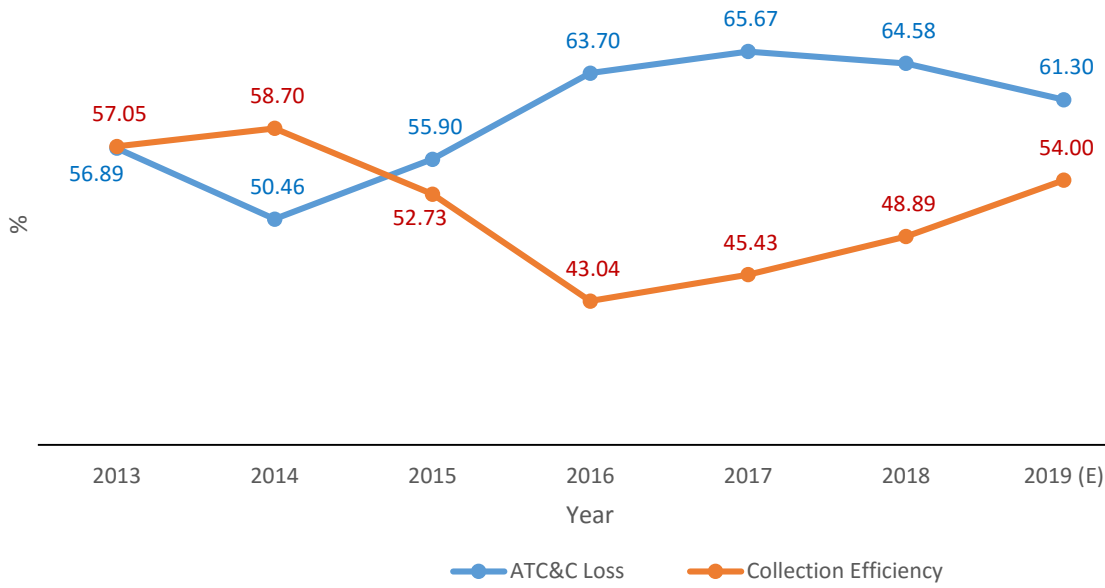
Input energy was ramped up until 2016, and with metering of over 100,000 customers the energy consumption trend showed a little and is gradually picking up again.

Figure 4: Billing and Collection



PHED evidenced a step rise in Revenue Billing due to upward revision in tariff as a result of minor review of MYTO tariff order in 2015.

Figure 5: ATC&C and Collection Efficiency



There has been a steady improvement in performance indices. Collection efficiency got to an all-time low in 2016, but has steadily increased since then, 2019 has averaged about 54% collection efficiency. ATC&C has shown a steady decline after climaxing in 2017.

DRAFT

3. Overview of PIP

3.1. Achievements 2014-2019

The new Management of privatised PHED took over the operations in November 2013. At that time, being a government owned entity till then, the focus was more or less on operational efficiency improvement with limited thrust on technology intervention, and customer service. The meters were generally conventional, the processes generally bureaucratic and full of red tape and discretionary that resulted in corruption and collusion among staff and customers. Realising the immediate need for turnaround, the Management added their focus towards IT, Network, Advanced Metering, Human Resource and Customer Engagement during 2015-17. In 2018, with the onboarding of new Technical Partner a turnaround business plan for 2018-22 was developed and submitted to the Board, BPE and NERC. The new Technical Partner aimed to replicate their success story in India with renewed focus on People, Process and Technology combined with Operational, Commercial and Customer Service excellence.

Table 4: Management Focus 2014-19

| Business Aspect | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 |
|----------------------------------|------|------|------|------|------|------|
| Operations – MBC | | | | | | |
| IT intervention & Automation | | | | | | |
| Network and System Operations | | | | | | |
| Advanced Metering and Protection | | | | | | |
| Organisation - People Engagement | | | | | | |
| Customer Service | | | | | | |
| Business Process Engineering | | | | | | |

PHED has prioritised adoption of information technology solution “DL Enhance” to modernise, integrate and secure its systems with a view to serving customers cheaper, continuous and reliable power. DL Enhance system offers Power Distribution business specific modules with inbuilt features to fulfill the domain related requirements. PHED has developed inhouse team of experts who have the capability to adapt the solution to ever changing and evolving requirements of the Sector.

Through a planned implementation of various business aspects during financial year 2014-19, PHED achieved a few milestones as outlined in the table below.

Table 5: Key Achievements 2014-19

| Business Aspect | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 |
|----------------------------------|--|--|---|--|---|---|
| Operations – MBC | <p>Carried out baseline study for ATC&C loss</p> <p>Commenced Customer Enumeration – Over 50,000 customers added</p> <p>CAPMI Microfinance Scheme introduced using Ecobank</p> | | <p>Concluded revalidation of 2014 enumerated customers and closed all duplicate connections.</p> <p>Increased verified Customer phone numbers from around 97K to 190K, improved meter reading from 51% to 56% and bill distribution efficiency from 89% to 94%.</p> <p>Launch of Revenue Protection and Electricity Theft Prosecution</p> | <p>Implementation of the new bill format for MD and Non-MD customers</p> <p>Commenced customer to asset mapping</p> | <p>Business Plan Workshops</p> <p>Target Setting for entire field staff</p> | <p>Deployment of Android based Tablet Meter reading Technology for MD Customers</p> |
| IT intervention & Automation | | <p>A new billing platform – U- Vision was commissioned for MD customers to integrate customer data from the legacy Spectrum and AVR billing systems.</p> | <p>Migrated all customers into U-vision creating better control on billing</p> <p>Development work started for ‘Network Status Information System’ to facilitate the Operations for digital recording of the faults, network hierarchy and carrying out Energy Data Management.</p> | <p>Deployed NSIS (Network Status Info System) for in-database recording of faults, network mapping by ‘Dispatch’ & ‘Minor Works’, with the objective of abolishing current manual practices.</p> <p>Developed mobile App (PHED Pay) available on Google play store for bill payments</p> | | <p>A new integrated Metering, Billing & Collection platform - DL Enhance was commissioned</p> |
| Network and System Operations | | | <p>Consolidation of Business Units</p> | <p>Completed the construction of 2x15MVA 33/11kV injection substation at 4 lane Uyo with new 33kV feeder and 4nos 11KV outgoing feeders</p> | <p>Constructed the first dedicated commercial feeder to feed Uniport and UPTH</p> | <p>Commissioning 5 new Commercial feeders</p> |
| Advanced Metering and Protection | | | <p>3,000 Meters installed</p> <p>Completed the installation of single phase CAPMI meters</p> | <p>40,000 single phase prepaid meters installed.</p> <p>Completed metering of all MD customers</p> | <p>60,000 single phase prepaid Meters installed</p> | <p>Launching of the Meter Asset Provider (MAP) Initiative</p> |

| Business Aspect | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 |
|----------------------------------|--|------|--|---|---|---|
| Organisation - People Engagement | Resource Optimization Needs Assessment Staff Assessment Business Structural Alignment | | Migration of payroll to ERP | | Organization Restructuring Redefining of Job Description Training Need Assessment International training for Power Distribution Training | Balance Scorecard Documentation of HR policies |
| Customer Service | | | Held 78 community engagements and appeared in 16 Radio and 4 Television talk-shows, while reaching out to 6,200 Corps members. Created awareness sessions at 60 primary/secondary schools on 'Energy Efficiency'. | | | Commenced On Spot collection |
| Business Process Engineering | | | | Documentation of Standard Operating Procedures for key activities | As is Study and Gap Analysis Process Documentation Process Training Process Implementation Process Audits | Process Improvement Process Automation Regular Audits Implementation of Process weightage in Balance Scorecard |

3.2. Challenges

The industry has over the years been faced with numerous challenges, both internal and external which have affected the performance of NESI in general and PHED in particular. Some of the challenges are fundamental business aspects to PHED, namely, Tariff shortfall, MYTO, Legal and Regulatory, Debt, TCN etc.

PHED has continued to struggle with lack of cost-reflective end-user tariff and minor tariff review implementation. Some assumptions including projected generation levels and exchange rate, in MYTO did not reflect reality.

Another serious challenge is rampant energy theft which threatens the financial sustainability of PHED who serves the most turbulent areas of Nigeria.

Few of these challenges with primary impact have been highlighted in the table below.

Table 6: External Challenges

| Business Aspect | External Challenges | Details | Degree of Impact | Tenure of Impact |
|------------------------------|----------------------|--|------------------|------------------|
| Financial | Tariff Shortfall | <ol style="list-style-type: none"> 1. Lack of cost reflective tariff in 2017, 2018 and 2019 2. Freezing of R2 tariff in 2016 3. No minor reviews in 2017 and 2018 | High | Long |
| Financial | MYTO Assumptions | <ol style="list-style-type: none"> 1. Projected generation levels 2. Loss target 3. Generation cost 4. Transmission and admin cost 5. Inflation rate 6. Exchange rate | High | Long |
| Operations | Environmental | Damage to distribution network due to incessant rains and flooding | Medium | Short |
| Operations | Legal and Regulatory | <ol style="list-style-type: none"> 1. Anti-vandalism and theft laws 2. Late Payment fines and surcharge 3. Cumbersome disconnection procedure 4. Poaching of big customers by Generators | Medium | Long |
| Operations | MDA debt | <ol style="list-style-type: none"> 1. Recovery from MDAs 2. Resistance to Metering | High | Long |
| Network and System Operation | TCN | <ol style="list-style-type: none"> 1. Wheeling of energy to high loss and difficult to manage areas 2. Non adherence to overall nominations 3. Capacity constraints to meet customer demand in Port Harcourt City | High | Long |

Table 7: Internal Challenges

| Business Aspect | Internal Challenges | Details | Degree of Impact | Tenure of Impact |
|----------------------------------|---------------------|---|------------------|------------------|
| Financial | Funding | 1. No Working Capital affected ability to meet operational expenses 2. Absence of funding affected execution of projects | High | Long |
| Operations | Communities | Entitlement mind-set of host communities of Transmission and Generation Companies in Ahoda, Afam, Oyigbo, etc. | High | Long |
| Operations | Energy Theft | Energy theft through illegal tampering / damage of electric metering devices and bypass | High | Long |
| Operations | Safety Issues | Houses and Construction under the Network | High | Medium |
| Operations | Security Threats | Frequent kidnapping of field staff and attack on cashiers | Medium | Long |
| Network and System Operation | Network constraint | 1. Dilapidated and Overloaded Network 2. Poor workmanship and Quality of Material 3. Lack of Standardisation of Network design 4. Lengthy feeders with sparse population 5. Inaccessible Remote and Swampy Areas 6. Generating Stations and the resultant High Voltage | High | Long |
| Network and System Operation | Vandalism | Destruction of infrastructure i.e. DTR, Cables, OH line materials | High | Long |
| Network and System Operation | Load Management | Frequent Voltage fluctuations and Reliability issues | Medium | Medium |
| Organisation - People Management | Human Resource | 1. Dearth of skilled manpower 2. Inadequate Capacity Building | Medium | Medium |
| Business Process Re-engineering | Change Management | 1. Lack of Discipline 2. Work Culture 3. Non Adherence of Processes and Procedures 4. Lack of Ownership and Accountability | Low | Long |

Consequent to the above challenges the Discos in general and PHED in particular face a serious liquidity crisis.

Despite the enormity of the challenges faced, PHED will never lose sight of the fact that as a provider of a critical service, it must be committed to intensifying the efforts in surmounting all challenges.

3.3. Service Gaps

Table 8: Service Delivery gaps

| Service Aspect | Services | Gap details |
|---------------------------|---|--|
| Metering | Customer Metering | PHED is leading amongst the DISCOMs with highest nos. of meters installed during its period; however still 218,936 nos. of customers which is 35% of total customer population, are unmetered including the customers who paid for meters under CAPMI scheme. |
| | Pending New Customers | Every month PHED receives approx. 1000 nos. of application for new connection, the pendency has been increasing since the start of 2019 due to inability to provide meters within the stipulated time period prescribed by NERC |
| | Meter Replacement | PHED has 64,592 defective meters which is 20% of total customers, in the absence of funding for meters PHED has been compelled to default in meeting its obligation of metering its customers |
| Billing | Metered Billing Quality | As at Sept 2019, a total 116,215 nos. of customers are having post paid metering of which 44,670 customers are billed accurately which is 38% efficiency |
| | Estimated Billing | In the Absence of customer load parameters, clubbed with inability of asset performance monitoring, PHED deviates from the adoption of estimated billing methodology thereby increasing complaints from customers alleging of obnoxious bills |
| | Delayed Bill Distribution | Improper marketer to customer ratio has been affecting bill delivery to customers |
| Collection | Absence/Limited of Touch Points | Customers distanced from PHED due to its limited presence and less payment touchpoints, especially in rural area. Also resulted in frequent default in meeting Turnaround Time (TATs) in its services |
| Technical | Project Planning | The culture and skill of proper planning, scoping and execution of projects was lacking and so well intended projects were either poorly scoped, or poorly executed or too long to execute which affected quality of work and also forced customers to remain without supply |
| | Over loaded and Radial Network | At Port Harcourt town, Constraints of network ability to offtake supply and meet load leads to default in providing reliable and continuous supply to customers |
| Customer Focused Services | Communications | Limited mode of communications and lack of presence, especially in rural areas, has heavily contributed to rise in grievances for improper outage management |
| | Delay in Resolutions | In the absence of automation of process the grievances are handled manually resulting in delayed services and non-complaint to TATs. |
| | Corruption | Poor tracking and customer management at ground scopes for collusion and corruption |
| Safety | Houses and construction under the network | Due to lack of State Govt support to vacate constructed houses under network, numerous lives are under threat |

3.4. Stakeholder Views

State-wise community engagement where different focus group customers i.e. High revenue, High consumption, NGO, corporative society, women group, traditional rulers and government agencies were invited to discuss and capture their issues and probable solutions. Coordination Meetings with TCN and other Discos were also organised to address technical constraints.

Snapshots of some of the interactions;

Figure 6: Stakeholder Meetings & Business Planning Workshop



Table 9: Summary of External Engagements

| External Engagements | Number of Engagements held | Agenda | Outcome of meeting |
|---|----------------------------|--------------------------------|---|
| Communities | 692 | Poor supply | Commitment to improve supply hours based on improved collection |
| | | Failed DTR | |
| | | Over Billing | Introduction of bill revision camps |
| | | Poor response | |
| | | Improvement of cash collection | Provision of meters |
| | | Maintenance | |
| | | Energy Theft | |
| | | Energy Efficiency | |
| | | Meter Request | |
| Industrial Associations | 2 | Master class | |
| NERC and its Forums | 18 | Consultation meeting | Stakeholder engagement |
| | | Hearings | |
| Customer Meet / Townhall Meetings | 732 | Bill revision | Revised Bill |
| | | Energy Efficiency | Meter installation |
| | | MAP | |
| Media – Radio and Television Interactions | 45 | MAP Enumeration | Estimated Billing Outages Customer Awareness |

The inputs from the aforesaid stakeholder engagements were assimilated in the Business Plan which was deliberated with staff, executive management and Board of Directors for their feedback, analysis and inputs.

Table 10: Summary of Internal Engagements

| Internal | Number of engagement held | Agenda | Outcome of meeting |
|----------------------------------|---------------------------|-----------------------------|------------------------------------|
| Board of Directors Meeting | 3 | Performance report | Management & Investment directives |
| | | Committee report | |
| | | Industry issues | |
| | | Management report | |
| Business Meetigns with IBCs/BSCs | 3 | Business Optimization | Improved performance |
| | | Input energy Optimization | Aligned |
| | | Leadership and Team bonding | |
| | | Strategy Sessions | |

Table 11: Engagement Programme Feedback

| Business Aspect | Issues | Resolution |
|----------------------------|------------------------------------|---|
| Commercial | Non availability of meter | Customers mass metering (MAP) |
| | Over Estimated billing | Reduced overbilling through load declaration / assessment |
| | Poor Response of payment | Spot Billing |
| Network & System Operation | High number of DTR failure | Replacement of failed DTR |
| | Poor Infrastructure | Capex Projects |
| People | Job Rotation & New recruitment | Induction of New Employees and Job rotation |
| | Career Progression | Improved remuneration |
| Automation | Accurate Energy Accounting | AMR Metering of all High Revenue and High Consumption Customers |
| | Poor Customer Information System | Implementation of CRM system |
| | Delay in releasing New Connections | Implementation of work flow based IT system |

DRAFT

3.5. PIP Strategy and Approach

PHED adopted an all-inclusive bottoms up stakeholder approach starting with the customers, the investors, regulators etc. to arrive at the output requirement and specifics to meet the requirements of the stakeholders and NESI for the next five years.

The overall strategy aims to align the entire PHED towards achievement of corporate goals. After initial tumultuous years, it is pertinent to devise a strategy which improves the financial performance of PHED, reinforce the PHED values, ensures sustainable growth and enhance operational efficiencies. The strategy, so formed will meet the vision of the Company.



PHED developed this Plan on the philosophy of integration of strategies across six frontiers of Technology, CAPEX, Stakeholder Involvement, Customer centric Services, Business Process Transformation and Capacity Building leveraging the intergation of People, Proesses and Technology to the fullest.

Figure 7: Integrated Approach

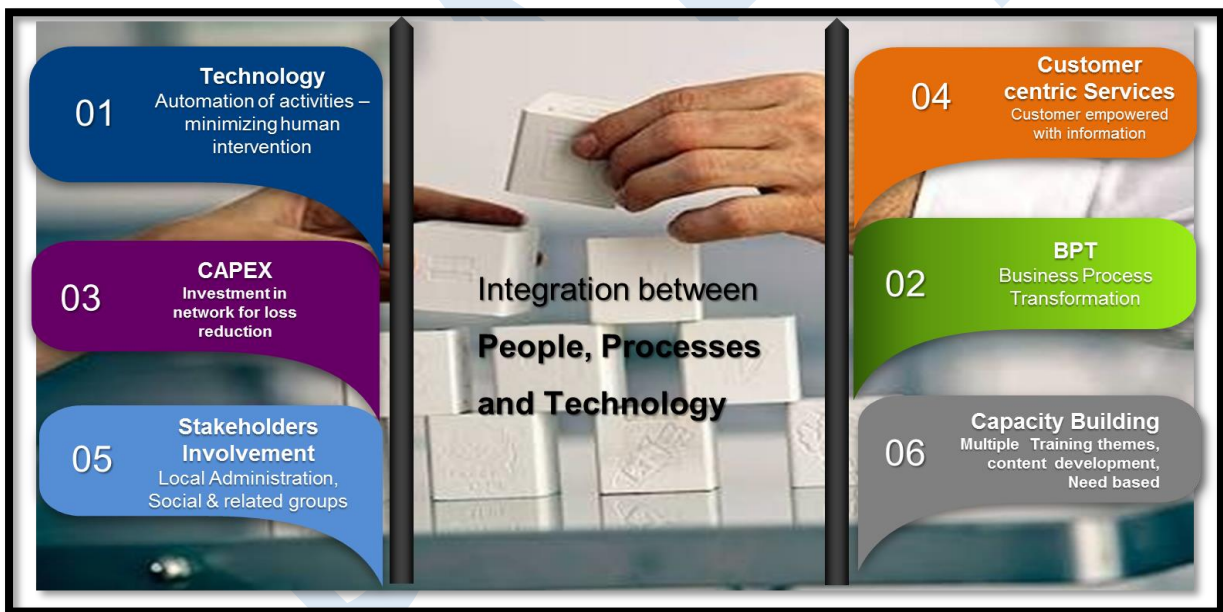
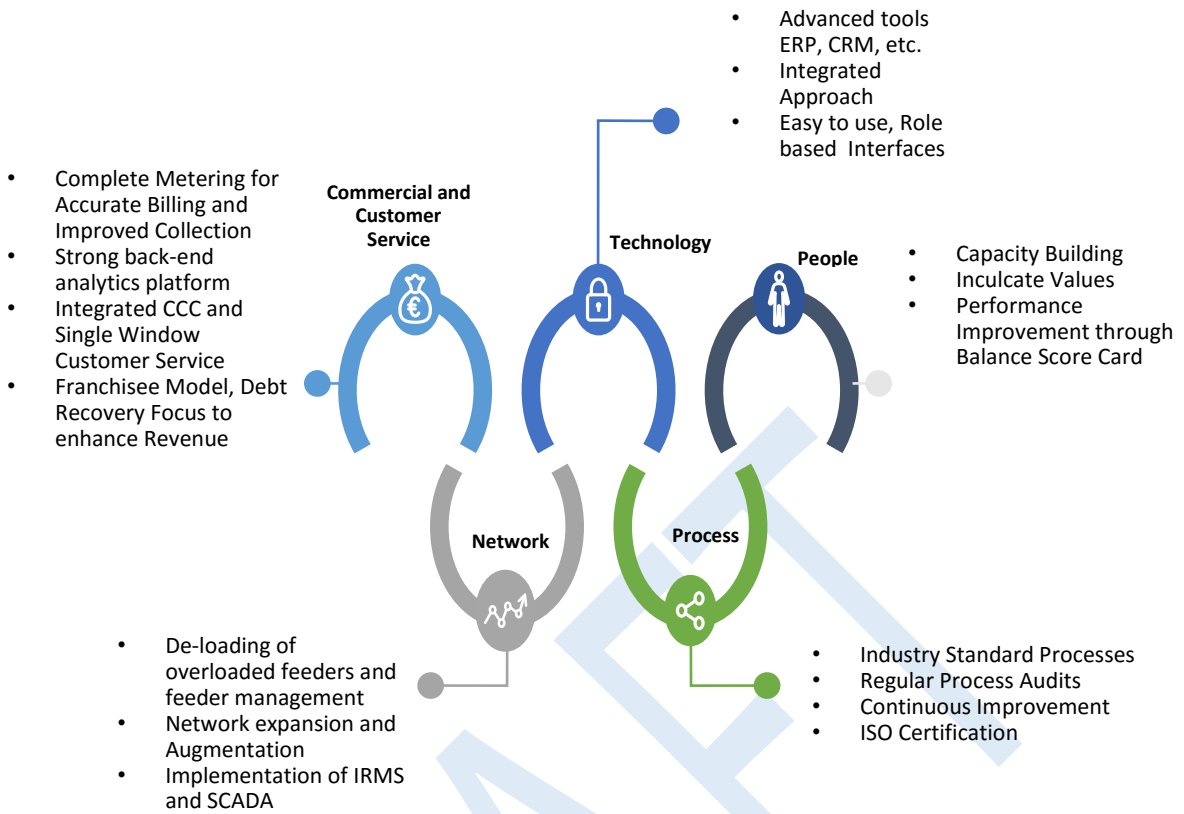


Figure 8: Strategic Goals



The integrated approach backed with strategy is aligned to progressively move towards achievement of the goals thereby key strategic outputs resulting in Business Transformation and financial turnaround of the company.



Planning Horizon

The Strategic planning is based on approach classified under three phases short, medium and long term on the timeline to compliment and to achieve the strategic goals and outputs with the philosophy of integrated approach. This strategic plan looks out over an extended time Horizon of three to five years or more.

Figure 9: Planning Horizon

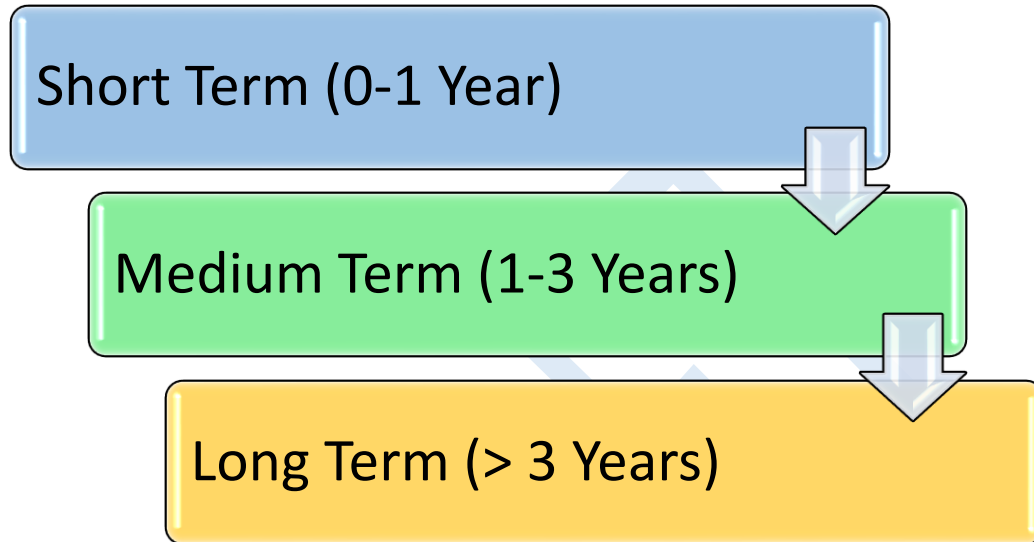


Figure 10: Planning horizon of key Strategic Interventions

| | COMMERCIAL | NETWORK | CUSTOMER CARE | PROCESS | HUMAN RESOURCE | INFORMATION TECHNOLOGY |
|---------|---|---|---|--|--|---|
| 2020 | <ul style="list-style-type: none"> Input Energy Optimization Special focus on cash collection (Current, arrear and RPD) Metering (Customers and Feeder) Strengthening, analytic and monitoring framework Customer database cleanup | <ul style="list-style-type: none"> Only critical n/w for business, continuity and safety focus to be considered for R & M O & M practice to be strengthened to avoid breakdowns and also to reduce technical losses | <ul style="list-style-type: none"> Re-align customer care structure Strengthening Customer Engagement Minimization of customer touch points through IT / Automation | <ul style="list-style-type: none"> Process documentation and Roll – out across departments along with capacity building and process audits. | <ul style="list-style-type: none"> Restructured organization with role clarity at all positions. Capacity building plan roll-out. Resolve legacy employee issues Pay hike and promotions | <ul style="list-style-type: none"> Integration/ interfacing of existing piece meal technologies for single source of truth Technology based monitoring tools for key parameters Introduce new essential business tools |
| 2021-22 | <ul style="list-style-type: none"> Business excellence measures | <ul style="list-style-type: none"> Network Strengthening Technical loss reduction measures | <ul style="list-style-type: none"> 100% Coverage of licensed areas Minimization of customer touch points through IT and Automation Minimization of customer touch points through IT / Automation | <ul style="list-style-type: none"> Ensure process agility | <ul style="list-style-type: none"> Rollout Phase | <ul style="list-style-type: none"> Develop an in-House R & D Team Integration of IT (Information Tech) & OT (Operation Tech) |
| 2023-24 | <ul style="list-style-type: none"> Business excellence measures | <ul style="list-style-type: none"> Automation Technical loss reduction measures | <ul style="list-style-type: none"> Creation of service guarantee cell | <ul style="list-style-type: none"> Ensure process agility | <ul style="list-style-type: none"> Roe-assessment and Corrective actions | <ul style="list-style-type: none"> Introduce new business applications and integration with existing ones |

Short-term approach- Month-on-Month activity plan provided in individual chapters to meet the target

Long-term approach- Final targets assigned, drill down to be done at the start of the FY as per the progress achieved in previous year to cumulatively reach the target set for 2024

DRAFT

3.6. Process Adopted

The approach deployed is out-laid through the following process activities;

Activity 1: Stakeholder Engagement

Activity 2: Demand forecast and network expansion

Activity 3: Setting of output goals

Activity 4: Investment Planning

3.6.1. Stakeholder Engagement

Various engagements were done with Investor Company, Technical Partner, Board of Directors, Executive Management, lower & middle Management (Headquarter as well as Field offices).

The engagements resulted in clarity of thoughts and ownership of the objective and targets across the organisation resulting in an implementable action plan.

The approach adopted was as follows:

- Study and analysis of data
 - Historical trends analysis of energy, customers, tariff, load, revenue, losses
 - Key performance indicators of past tariff years
 - Root cause and SWOT analysis
- Development of annual business plans and quarterly reviews
 - Development of formats and templates
 - Capacity development of the field staff
 - Quarterly and Annual meets with all field and headquarter staff
- Board and Management retreat involving board of PHED and Investor company with Executive Management
- Quarterly Reviews with Foreign Technical Partners

3.6.2. Demand Forecast Study

The objective of the demand forecast is to service the customers' power needs at the most optimal costs. The most important factor characterizing the service is the supply to the customer loads. Other factors include quality, reliability, frequency and duration of the supply outages. The load data of the customers is a key needed to define the requirements of the network capacity, approximate the network losses and estimate the existing network's capability to meet the increasing customer load requirements.

The existing simultaneous demand and the non-simultaneous demand was used as a basis for projecting the demand upto 2024.

The hourly data at 33 kV feeder was used to estimate the simultaneous (coincidental) peak load currently being met. To estimate unconstrained demand, Non-simultaneous peak demand was analysed across all feeders.

To determine/forecast the load demand and customer growth rate, projection analysis of population, energy sales, losses, suppressed peak load demand were carried out over the period for next 5 years.

This projection was based on the average feeder population growth per tariff class over 2018. The above analysis yielded potential customer population upto 1.1 Mn by 2024 as summarized in the table below.

Table 12: Potential Customer population

| Customer Class | Tariff category | 2020 | 2021 | 2022 | 2023 | 2024 |
|----------------------------------|-----------------|----------------|----------------|----------------|------------------|------------------|
| Residential | R1 | 11,208 | 11,321 | 11,435 | 11,550 | 11,666 |
| | R2 | 684,151 | 800,913 | 857,511 | 918,108 | 982,987 |
| | R3 | 582 | 712 | 871 | 1,066 | 1,304 |
| | R4 | 14 | 20 | 29 | 41 | 59 |
| | Total | 695,955 | 812,966 | 869,846 | 930,765 | 996,016 |
| Commercial | C1 | 69,952 | 73,454 | 77,131 | 80,992 | 85,046 |
| | C2 | 2,381 | 2,976 | 3,720 | 4,650 | 5,813 |
| | C3 | 144 | 189 | 248 | 325 | 426 |
| | Total | 72,477 | 76,619 | 81,099 | 85,967 | 91,285 |
| Industrial | D1 | 520 | 605 | 704 | 820 | 955 |
| | D2 | 41 | 46 | 51 | 57 | 64 |
| | D3 | 43 | 50 | 58 | 67 | 78 |
| | Total | 604 | 701 | 813 | 944 | 1,097 |
| Street Light | S1 | 8 | 5 | 3 | 2 | 1 |
| | Total | 8 | 5 | 3 | 2 | 1 |
| Special Tariff | A1 | 5,302 | 6,335 | 7,570 | 9,045 | 10,808 |
| | A2 | 452 | 575 | 731 | 930 | 1,183 |
| | A3 | 58 | 74 | 95 | 122 | 156 |
| | Total | 5,812 | 6,984 | 8,396 | 10,097 | 12,147 |
| Total Number of Customers | | 774,856 | 897,275 | 960,157 | 1,027,775 | 1,100,546 |

Table 13: Potential Customer Demand

| Customer Class | Customer Type | 2020 | 2021 | 2022 | 2023 | 2024 |
|--------------------------|---------------|----------------------|----------------------|----------------------|---------------------|----------------------|
| Residential | R1 | 6,052,320 | 6,860,526 | 6,929,610 | 6,999,300 | 7,069,596 |
| | R2 | 1,784,496,731 | 3,017,518,744 | 2,833,125,626 | 2,873,682,666 | 3,076,754,263 |
| | R3 | 28,713,198 | 44,884,242 | 50,132,979 | 63,109,832 | 77,200,019 |
| | R4 | 9,600,524 | 16,000,873 | 23,201,265 | 33,738,983 | 48,551,219 |
| | Total | 1,828,862,773 | 3,085,264,385 | 2,913,389,480 | 2,977,530,781 | 3,209,575,097 |
| Commercial | C1 | 219,687,972 | 269,133,888 | 282,606,337 | 305,231,615 | 320,509,778 |
| | C2 | 134,875,352 | 206,042,257 | 245,845,875 | 316,087,553 | 395,143,429 |
| | C3 | 73,928,910 | 118,594,292 | 148,542,346 | 200,224,130 | 262,447,628 |
| | Total | 428,492,234 | 593,770,437 | 676,994,558 | 821,543,298 | 978,100,835 |
| Industrial | D1 | 2,373,546 | 3,221,784 | 3,856,099 | 4,491,479 | 5,230,930 |
| | D2 | 3,671,183 | 4,576,542 | 5,073,993 | 5,670,933 | 6,367,363 |
| | D3 | 36,887,198 | 50,040,771 | 59,705,789 | 68,970,480 | 80,293,992 |
| | Total | 42,931,926 | 57,839,097 | 68,635,881 | 79,132,892 | 91,892,285 |
| Street light | S1 | 110,417 | ,89,714 | 45,547 | 28,985 | 14,493 |
| | Total | 110,417 | 89,714 | 45,547 | 28,985 | 14,493 |
| Special Cases | A1 | 27,120,564 | 37,805,275 | 46,466,089 | 55,519,917 | 66,341,544 |
| | A2 | 50,078,564 | 66,891,444 | 87,469,081 | 111,280,773 | 141,553,929 |
| | A3 | 32,395,160 | 43,398,343 | 57,305,920 | 73,592,866 | 94,102,353 |
| | Total | 109,594,288 | 148,095,062 | 191,241,090 | 240,393,556 | 301,997,826 |
| Total Demand (KW) | | 2,409,991,638 | 38,85,058,695 | 3,850,306,556 | 4118,629,512 | 4,581,580,536 |

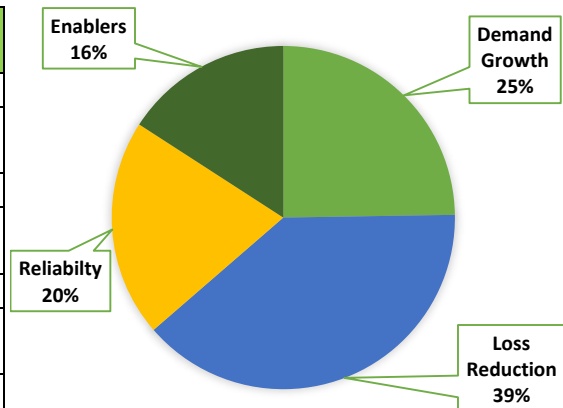
3.6.3. Capex Plan

Table 14: Capex Plan 2020-2024

| Project Category | Unit | Capex for 2020 | Capex for 2021 | Capex for 2022 | Capex for 2023 | Capex for 2024 | Total Capex (2020 - 2024) | Share of Total Capex |
|----------------------------------|-----------------|----------------|----------------|----------------|----------------|----------------|---------------------------|----------------------|
| Demand Growth | Mn Naira | 2,775 | 4,097 | 4,832 | 1,796 | 1,786 | 15,286 | 14.4% |
| Loss Reduction | Mn Naira | 5,135 | 6,128 | 5,069 | 5,152 | 2,545 | 24,029 | 22.6% |
| Reliability | Mn Naira | 3,406 | 3,328 | 3,177 | 2,400 | 345 | 12,656 | 11.9% |
| Enablers | Mn Naira | 469 | 1,371 | 3,696 | 1,352 | 2,915 | 9,804 | 9.2% |
| Network and Systems Total | Mn Naira | 11,786 | 14,924 | 16,774 | 10,701 | 7,591 | 61,775 | 58.2% |
| Customer Metering | Mn Naira | 16,809 | 13,689 | 3,453 | 3,942 | 3,754 | 41,648 | 39.2% |
| IT and Automation | Mn Naira | 272 | 372 | 272 | 172 | 122 | 1,210 | 1.1% |
| Admin and General | Mn Naira | 300 | 300 | 300 | 300 | 300 | 1,500 | 1.4% |
| Grand Total | Mn Naira | 29,167 | 29,285 | 20,799 | 15,115 | 11,767 | 1,06,133 | 100.0% |

Table 15: Capex Distribution in Network

| Project Category | Amount (Mn) | Share of Total Capex |
|--------------------------------|---------------|----------------------|
| Network Project - 33KV | 12,818 | 20.75% |
| Injection Substation - 33/11KV | 12,022 | 19.46% |
| Network Project - 11KV | 3,801 | 6.15% |
| DT Substation - 33/11/0.415KV | 19,930 | 32.26% |
| Deployment of ABC | 3,400 | 5.50% |
| SCADA and Automation System | 9,804 | 15.87% |
| Total Network Capex | 61,775 | 100.0% |



4. PHED Network Infrastructure

4.1. Overview

This section gives an overview of PHED's infrastructure status, challenges and limitations faced by it, in delivering reliable supply and services on its network. It also highlights the power supply vis-à-vis load demand scenario within PHED supply network area.

This part of the report emphasises and highlights identified avenues and its demand for investment to bring PHED system into healthy condition and meet stakeholder expectations with respect to services which have critical role in minimizing technical losses as well as distribution losses.

Port Harcourt Electricity Distribution Plc has been continuously facing many challenges largely due to the state of infrastructure inherited at the time of takeover. In PHED area on takeover, the power supply was for 6-8 hours in a day which has grown over to an average of 12-15 hours per day over past 5 years, while the supply availability has been doubled, still half the day is left unattended. From gap analysis, in upstream i.e. 132KV/33KV transmission network poses major hurdle, especially in Port Harcourt which caters for 50% of PHED's customers with respect to its network or substation capacity constraint in addition to positioning of 132/33KV vis-à-vis PHED's load centres.

Apart from inadequacies at 132KV network substation, constraints in downstream network adds to the deficiency in services. The downstream network has been refrained from investments pre takeover and evidenced minimal investments by PHED post takeover. Several measures have been put in place to overcome these challenges which have begun to yield results though, in a slow manner. However, more is still required in order to bridge the identified gaps in these area.

The challenges faced are as highlighted below:

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

4.2. Existing Infrastructure with current scenario

PHED licensed area is fed from nine 132 kV transmission lines with cumulative capacity of around 950 MVA, twelve 132/33kV Transmission stations having 25 power transformers with total installed capacity of 1,520 MVA. Distribution is carried out through 74 feeders of 33 kV and 227 feeders of 11kV, connected with 132 numbers of injection sub stations (58 manned, 74 unmanned) with the installed capacity of 1,423.7 MVA. Abakiliki Transmission Station having capacity of 90 MVA is in Ebonyi State and not located in our licensed area. Two 33 kv feeders, namely, Ugep and Yahe emanating from 132/33 kV Abakiliki transmission station are being shared between PHED & EEDC.

Table 16: Transmission Lines in PHED Network

| S/N | 132KV Transmission Line Name | 132/33KV Transmission Station Fed | State |
|-----|------------------------------|--|----------------|
| 1 | Afam/Port Harcourt | PHMains / PH Town / Elelewon / Rumuosi | Rivers State |
| 2 | Enugu/Abakaliki | Abakaliki | Ebonyi State |
| 3 | Aba/Itu | Itu | Akwa-Ibom |
| 4 | Alaoji/Owerri | Yenagoa / Ahoada | Bayelsa/Rivers |
| 5 | Odukpani | Calabar | Cross-River |
| 6 | Alaoji/Afam | Afam | Rivers |
| 7 | Omoku | Rumuosi / PH Mains | Rivers |
| 8 | Trans-Amadi | PH Mains | Rivers |
| 9 | Ibom Power | Uyo / Eket | Akwa-Ibom |

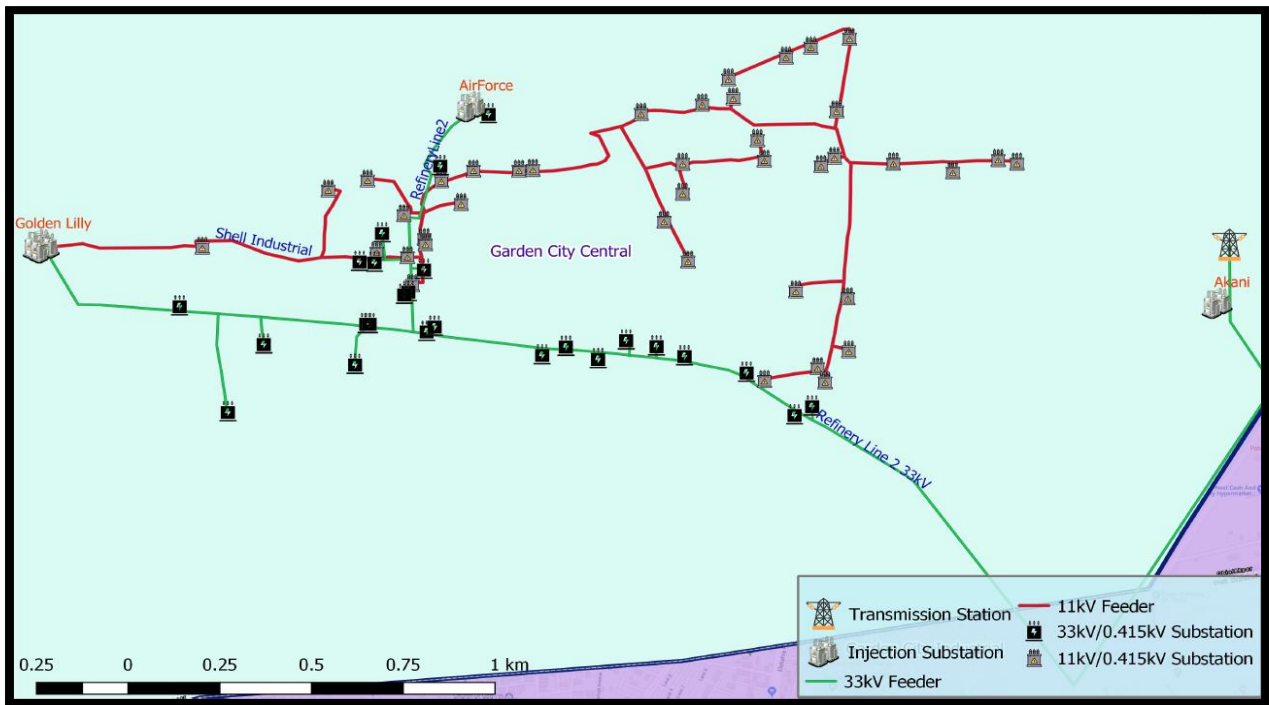
In the public interest and to enable PHED to provide continuous and reliable supply, it is necessary that TCN synchronizes its expansion plan with PHED's expansion plan and appropriate funds are allocated to execute projects on priority basis.

PHED initiated Asset Enumeration and Mapping exercise in 2018, for this an inhouse App on Android based tabs was developed for data capturing of Assets to avoid any errors due to manual data entry. The App with drop down options ensures capturing of mandatory information with allowable values alongwith capturing the key attributes and parameters of each asset it captures the photograph, latitude and longitude of the asset, user name who captured the information and the time stamp. With the facility of time stamp data of each user it is then very easy to compute the productivity of the Enumerators in the field.

While the exercise is almost completed barring few feeders where there are issues with respect to hostile communities. This is also being addressed by joint meetings and the progress in this direction has already started. The HT survey covered the entire Electrical Network Assets starting from TCN Station till Distribution Transformers.

The quality of work is ensured with proper capacity building of the Enumerators by providing them training on the fundamentals of Network assets and their identification. Also the guidelines and checklists were prepared to ensure the quality of work. The data import from tab is directly imported into the Geographical Information System (GIS) Mapping application and the final network layout is prepared with the background of google maps. GIS mapping of one of the feeder is shown below:

Figure 11: HT Network Map



A brief of PHED network profile is presented in below table from the records of data collected, tagged under Aset Enumeration and Mapping exercise

Today PHED has a total of 2,959 of 33/0.415 kV distribution transformers and 6,317, 11/0.415 kV distribution transformer connected to its network. The total transformational capacity of 11/0.415 kV and the 33/0.415kV distribution transformers are 1,615 MVA and 1,466 MVA respectively. The route length for the 33kV, 11kV, and 415V feeders are as shown below.

Table 17: PHED Distribution Network configuration

| Particulars | Unit | Value |
|--|---------|---------|
| Integrated Business Centers | No. | 10 |
| Business Service Centers | No | 42 |
| Fault Centers | No. | 28 |
| Transmission Substations | No. | 12 |
| Installed Transmission Capacity | MVA | 1520 |
| 33/11 kV Power Transformers | No. | 127 |
| Installed 33/11 kV Transformers Capacity | MVA | 1423.7 |
| 33/0.415 kV Transformers | No. | 4171 |
| Installed 33/0.415 kV Transformer Capacity | MVA | 1466 |
| 11/0.415 kV Transformers | No. | 5105 |
| Installed 11/0.415 kV Transformer Capacity | MVA | 1615 |
| No. of 33 KV Feeders | No. | 74 |
| Route Length of 33KV Feeders | Ckt. Km | 7614.61 |
| Route Length of 11KV Feeders | Ckt. Km | 2292.23 |
| Route Length of 415V Lines | Ckt. km | 14500 |
| Longest Urban 33KV Feeder | Ckt. Km | 641.23 |
| Average Route Length of Urban 33KV Feeder | Ckt. Km | 70.35 |

| Particulars | Unit | Value |
|---|---------|--------|
| Longest Rural 33KV Feeder | Ckt. Km | 747.72 |
| Average Route Length of Rural 33KV Feeder | Ckt. Km | 340.49 |

(Source: PHED Comprehensive Status Report for september 2019)

PHED has a total of 9,276 distribution transformers, both 11 KV / 415 V and 33KV / 415V, with a total installed capacity of 3,081 MVA. Two third of them are public transformers predominantly connected to residential areas and small business within the urban and rural locations, while the balance one third caters for other commercial, individual and industries.

PHED has a total of 6,317 public distribution transformers, both 11KV/415V and 33KV/415V, with a total installed capacity of 2,267.4 MVA. The public DTRs connect residential, commercial and industrial customers. Table below showing the DTRs ratings and capacities.

Table 18: Public Distribution transformers

| S/N | Rating (KVA) | Nos | Total Capacity (KVA) |
|--------------|--------------|-------------|----------------------|
| 1 | 25 | 28 | 700 |
| 2 | 50 | 257 | 12,850 |
| 3 | 100 | 133 | 13,300 |
| 4 | 200 | 528 | 105,600 |
| 5 | 250 | 1 | 250 |
| 6 | 300 | 2873 | 861,900 |
| 7 | 315 | 16 | 5,040 |
| 8 | 350 | 1 | 350 |
| 9 | 400 | 4 | 1,600 |
| 10 | 415 | 1 | 415 |
| 11 | 500 | 2451 | 1,225,500 |
| 12 | 750 | 3 | 2,250 |
| 13 | 800 | 3 | 2,400 |
| 14 | 1,000 | 3 | 3,000 |
| 15 | 1,500 | 7 | 10,500 |
| 16 | 2,500 | 6 | 15,000 |
| 17 | 7,500 | 2 | 15,000 |
| TOTAL | | 6317 | 2,275,655 |

In the same vein, PHED has a total of 2,959 private/point load distribution transformers connected to its network, mainly connecting Maximum demand customers, shopping plazas and office complexes, big residential customers among others. Again, the dedicated DTRs connects both at 11KV/415V and 33KV/415V level with installed capacity of 861 MVA.

Table 19: Private Distribution Transformer

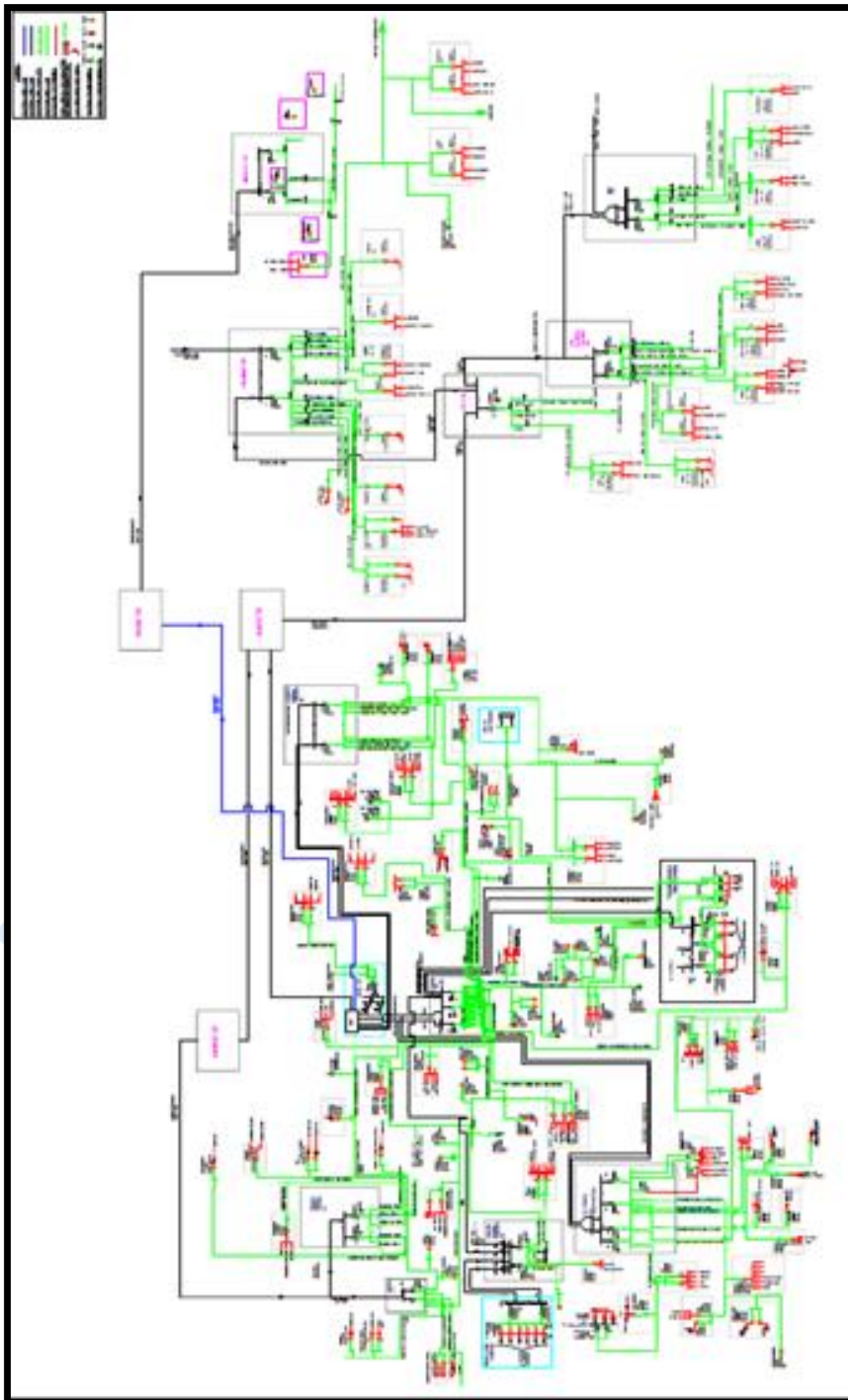
| S/N | Rating (KVA) | Nos | Total Capacity (KVA) |
|-----|--------------|-----|----------------------|
| 1 | 50 | 283 | 14,050 |
| 2 | 100 | 778 | 77,800 |
| 3 | 200 | 657 | 131,400 |
| 4 | 250 | 6 | 1,500 |
| 5 | 300 | 659 | 197,700 |
| 6 | 315 | 9 | 2,835 |
| 7 | 500 | 444 | 222,000 |
| 8 | 630 | 3 | 1,890 |
| 9 | 700 | 1 | 700 |
| 10 | 750 | 9 | 6,750 |

| S/N | Rating (KVA) | Nos | Total Capacity (KVA) |
|--------------|--------------|-------------|----------------------|
| 11 | 800 | 1 | 800 |
| 12 | 1,000 | 47 | 47,000 |
| 13 | 1,250 | 2 | 2,500 |
| 14 | 1,500 | 9 | 13,500 |
| 15 | 1,600 | 10 | 16,000 |
| 16 | 2,000 | 1 | 2,000 |
| 17 | 2,500 | 32 | 8,000 |
| 18 | 4,500 | 1 | 4,500 |
| 19 | 7,500 | 7 | 52,500 |
| Total | | 2959 | 861,375 |

The single line diagram (SLD) shows the network configuration and the flow of energy from Transmission Company of Nigeria (TCN) stations to 33kV feeders, to injection substations and then to 11kV feeders as shown in Figure below.

DRAFT

Figure 12: SLD of PHED network



4.3. Projects executed during 2014-19

With the limited funds available from regular revenue generation, as on date a total of 109 number of projects have been completed. Yearwise number of projects completed is shown in the Table below:

Table 20: Number of Network projects completed

| Year | Reliability | Loss Reduction | Demand Growth | Total |
|-------|-------------|----------------|---------------|-------|
| 2019 | 10 | - | 1 | 11 |
| 2018 | 9 | 1 | 7 | 17 |
| 2017 | 1 | 4 | 4 | 9 |
| 2016 | 13 | - | 11 | 24 |
| 2015 | 24 | 3 | 21 | 48 |
| 2014 | - | - | - | 0 |
| Total | 57 | 8 | 44 | 109 |

Table 21: Details of Projects Completed since 2014

| S/N | Name of Project | Category | Completion Year |
|-----|--|-------------|-----------------|
| 1 | Separation of Le Meridian and 4 Lane from Champion Breweries | Reliability | 2019 |
| 2 | Extension of 33KV Refinery Line 1 to Prime customers Terminating at Trinitate Int. School | Reliability | 2019 |
| 3 | Extension of New Airport 33kv feeder to Habitat Hotel | Reliability | 2019 |
| 4 | Installation of Auto Reclosers on 33KV airport line1 | Reliability | 2019 |
| 5 | Extension of Ekpene Ukpa 33kv feeder to Oron road | Reliability | 2019 |
| 6 | Extension of Parallel 33KV Line from UST 33 KV at 1st Avenue by Agip Road to Agip 1.6 KM Single Circuit and 0.25 KM Dual Circuit & Installation of Breaker | Reliability | 2019 |
| 7 | Commissioning of Air Liquid | Reliability | 2018 |
| 8 | Extension of 33 KV Unicem to Deload Diamond Hill 33 KV feeder | Reliability | 2019 |
| 9 | Installation of 2.5 MVA 33/11 kV Transformer Conversion of 11 KV Qua River to 24*7 Feeder (Grace Bill/Hospital Road | Reliability | 2019 |
| 10 | Extension of 11KV Secretariat Commercial Feeder | Reliability | 2019 |
| 11 | Construction of 6.1 km New UPTH 33 KV commercial Feeder to deload Uniport 33KV Feeder. | Reliability | 2018 |
| 12 | installation of 2.5MVA, 33/11KV Transformer Hotel Presidential | Reliability | 2019 |
| 13 | Installation of 100KVA, 33/0.415KV Auxilliary Transformer at Amadi Junction Injection Substation | Reliability | 2018 |
| 14 | Construction of 0.3Km 11KV overhead lines to by-pass failed 1 x150mm2 x 3core underground cable | Reliability | 2018 |
| 15 | Proposed Rukpokwu 33kv feeder from SARS Road junction to GU Ake Road to pick Eneka/Eliozu 1X15MVA, 33/11kv injection Substation (0,5km Dual and 1.0km)– Pearl Garden Estate. | Reliability | 2018 |
| 16 | Proposed 33KV line to extend Unicem 33KV Feeder to Diamond Hill 33KV Line (Feeding Diamond Hill 2 x 7.5MVA,33/11KV Inj. S/S) | Reliability | 2018 |
| 17 | Dedicated 11KV Feeder and Installation of 2x1000kva, 11/0.415kv substation at four-point Sharaton Hotel Ikot ekpene | Reliability | 2018 |
| 18 | Proposed separation of Le-Meridian Hotel 33kv Feeder from Champion Brewery 14MW at Uyo Transmission Station Le-Meridian (3MW)/Uni Uyo | Reliability | 2018 |
| 19 | Construction of 2.1Km 33KV Overhead Dual Circuit to deload Vintage Estate from overloaded Rumuodomaya 33KV Feeder and connection to Stadium Road 33KV Feeder | Reliability | 2017 |

| S/N | Name of Project | Category | Completion Year |
|-----|--|-------------|-----------------|
| 20 | Extension of Stadium Road 33KV Feeder from Stadium Road Via Inter'l Diagnostic Center along Ezingbu Link Road / Mummy-B Road to GRA Junction (0.45Km Overhead lines) | Reliability | 2016 |
| 21 | Construction of 1.45KV 11KV Dual Circuit to Deload Fimie 11KV Feeder and connect TMC Estate to Trans Amadi 24/7 Project | Reliability | 2016 |
| 22 | Installation of 33KV Transformer Control Pannel on T2 - 15MVA, 33/11KV Power Transformer at UST Injection Substation | Reliability | 2016 |
| 23 | Improvement of earthing on T1BB 15MVA, 33/11KV Transformer at Amadi Junction 3 x 15MVA, 33/11KV Injection Substation | Reliability | 2016 |
| 24 | Replacement and Maintenance of 45m 185mm2 x 3core Cable at NPA 1 x 3.5MVA, 33/11KV Injection Substation Onne | Reliability | 2016 |
| 25 | Rehabilitation of Incomer 11KV Panel Bushings and Maintenance of 35mm2 Single Core XLPE Underground Cable at Novotel 1000KVA, 11/0.415KV Dedicated Substation | Reliability | 2016 |
| 26 | Replacement of 360m faulty 240mm2 x 1core XLPE Cable and maintenance of 33KV outgoing Breaker for existing New Airport 33KV Feeder (Ex. Rumuosi TS) | Reliability | 2016 |
| 27 | Earthing improvement and re-wiring of 2 x 15MVA, 33/11KV Flour Mill Injection Substation, Calabar | Reliability | 2016 |
| 28 | Replacement of 1No 33KV Gang Isolator at Silver Bird 1 x 15MVA, 33/11KV Injection Substation | Reliability | 2016 |
| 29 | Construction of Additional gantry and replacement of 19m of sagged gantry 150mm2 Aluminium Conductor with 150mm2 x 1core XLPE Link Cable at Ikot Ekpene Injection Sbstation | Reliability | 2016 |
| 30 | Replacement of 4No Faulty Outdoor Current Transformer (1No at Reclamation & 3No at Water Works Injection Substations) | Reliability | 2016 |
| 31 | Fabrication and Maintenance of 10No ABB Breaker mechanisms at Golden Lilly, Akani, Silver Bird, Agip-Okporo and Amadi Junction Injection Substations | Reliability | 2016 |
| 32 | Construction of 8spans of 11KV overhead lines to divert collapsed lines on wooden poles to reconnect 3No Isolated Transformers on Rumuorolu 11KV Feeder | Reliability | 2016 |
| 33 | Installation of 11KV 7-Board Panel at Oron Road 2 x 15MVA, 33/11KV Injection Station. | Reliability | 2015 |
| 34 | Installation of 33KV Outdoor Breaker at Eket Transmission Station to replace faulty one on Mbo 33KV Feeder (Ex. Eket 1x60MVA & 1x40MVA, 132/33KV Transmission Station) | Reliability | 2015 |
| 35 | Replacement of Faulty RMU at Naval Base-Pathfinder, Rumuolumeni with recovered RMU from Airport 2.5MVA, 33/11KV Old switch yard un-manned Injection Substation. | Reliability | 2015 |
| 36 | Construction and Installation of 33KV Outdoor Breaker at Calabar Transmission Station to replace faulty Amika 33KV Feeder Outdoor Breaker (Ex. 2 x 60MVA, 132/33KV Transmission Station), Calabar. | Reliability | 2015 |
| 37 | Construction and Installation of 33KV Outdoor Breaker at Uyo Transmission Station to replace faulty Oron Road 33KV Feeder Outdoor Breaker (Ex. Uyo 3 x 60MVA, 132/33KV Transmission Station). | Reliability | 2015 |
| 38 | Replacement of 8No Failed Distribution Transformers across three IBCs (2No in Promise City Main, 2No in Garden City East & 4No in Garden City New) | Reliability | 2015 |
| 39 | Replacement of vandalised protection and power cables at Eleme New-Town 1 x 15MVA, 33/11KV Injection Substation | Reliability | 2015 |
| 40 | Replacement of vandalised 150mm2 x 4cores for 200KVA, 33/0.415KV station/Auxilliary Transformer at Eleme New-Town 1 x 15MVA, 33/11KV Injection Substation | Reliability | 2015 |

| S/N | Name of Project | Category | Completion Year |
|-----|--|----------------|-----------------|
| 41 | Laying Of 360m of 240mm ² x 1core 33KV Underground cable at Rumuosi Transmision Station on the New Airport 33KV Feeder (Ex. Rumuosi 1 x 40MVA, 132/33KV Transmission Station) | Reliability | 2015 |
| 42 | Laying and termination 15m of 150mm ² x 3core Underground cable on Trans Amadi Residential 11KV Feeder beside PH Town TS switch-yard. | Reliability | 2015 |
| 43 | Construction of 0.5Km 11KV Dual Circuit to deload Rivoc 11KV feeder to Water works 11KV feeder from Ordinance Junction to Danjuma drive Junction along Trans Amadi Road | Reliability | 2015 |
| 44 | Reconfiguration of Trans Amadi 2 x 15MVA, 33/11KV Injection Substation to bring in Ordinance 33KV Feeder as second source. | Reliability | 2015 |
| 45 | Completion and commissioning of New Airport 10.8Km 33KV Feeder (Ex. Rumuosi 1 x 40MVA, 132/33KV Transmission Station). | Reliability | 2015 |
| 46 | Relocation of 1.5Km 33KV overhead Lines and construction of 2No 60Ft Towers for Road crossing at Greater Port Harcourt M10 Road/Bridge construction at Igwuruta | Reliability | 2015 |
| 47 | Linking of Rainbow Town 0.6Km 11KV overhead Lines and 2No 500KVA, 11/0.415KV Distribution Substations to Ndahbros 11KV Feeder emanating from Trans Amadi 2 x 15MVA, 33/11KV Injection Substation | Reliability | 2015 |
| 48 | Construction of Stadium Road 1.5Km, 33KV Feeder (Ex. Trans Amadi Gas Power Station) | Reliability | 2015 |
| 49 | Linking of Gulf Estate 0.4Km 11KV overhead Lines and 6No 800KVA, 11/0.415KV Distribution Transformers to Odili Road 11KV Feeder emanating from Okuru 2 x 15MVA, 33/11KV Injection Substation | Reliability | 2015 |
| 50 | Backfeedeing of Aolscon from Ikot Abasi 1 x 7.5MVA, 33/11KV Injection Substation | Reliability | 2015 |
| 51 | Maintenance of 1x7.5MVA in Piamond in Diamond Hill | Reliability | 2015 |
| 52 | Replacement of 33KV outdoor circuit breaker | Reliability | 2015 |
| 53 | Installation and commissioning of 11KV complete 9-Panel Board | Reliability | 2015 |
| 54 | Replacement of failed 1 No red phase indoor 1200-600/5-5-5A current transformer | Reliability | 2015 |
| 55 | Maintenance of Injection Substation | Reliability | 2015 |
| 56 | Replacement of 3 No current transformer for incomer panel | Reliability | 2015 |
| 57 | Relocation of 11 spans of 33KV Feeder at Ikot Abasi Community to avert NGN 20million Law suit. | Loss reduction | 2018 |
| 58 | Deployment of 120,000 Single Phase Prepaid Meters | Loss reduction | 2017 |
| 59 | Procurement and Deployment of Three-Phase Prepaid | Loss reduction | 2017 |
| 60 | Procurement and Installation of Whole Current Meters (Nos) | Loss reduction | 2017 |
| 61 | Procurement and Installation of MD Meters (Nos) | Loss reduction | 2017 |
| 62 | Replacement of burnt T2 - 15MVA, 33/11KV Transformer at Secretariat 2 x 15MVA, 33/11KV Injection Substation with a new one moved from NIPP, Azubie 2 x 15MVA, 33/11KV Injection Substation to Uyo. | Loss reduction | 2015 |
| 63 | Straight through termination on punctured of 150mm ² x 3core underground cable on Owerre Road 11KV Feeder at Fire Service | Loss reduction | 2015 |
| 64 | Construction of 1.3Km 11KV overhead lines Dual Circuit from Rainbow Injection Substation to Fimie Market Junction to relieve Fimie 11KV feeder emanating from Trans Amadi Injection Substation. | Loss reduction | 2015 |
| 65 | Dedicated 11KV feeder for Four Point Sharaton Hotel | Demand growth | 2019 |
| 66 | Commissioning of Ozuoba Injection Substation | Demand growth | 2018 |

| S/N | Name of Project | Category | Completion Year |
|-----|--|---------------|-----------------|
| 67 | Commissioning of Ikot-lyon Injection Substation | Demand growth | 2018 |
| 68 | Installation of 500KVA, 11/0.415KV Relief Transformer Substation at Greater Love, Mbaraja Community, Ozuoba-Port Harcourt. | Demand growth | 2018 |
| 69 | Installation of Pole Mounted 50KVA, 11/0.415KV Relief Transformer Substation along SARS Road, Port Harcourt. | Demand growth | 2018 |
| 70 | Construction of 0.8KM, 33KV overhead Lines and Installation of 300KVA, 33/0.415KV Relief Transformer at Rehoboth Hospital | Demand growth | 2018 |
| 71 | Construction of 0.55KM, 33KV overhead Lines and Installation of 100KVA, 33/0.415KV Relief Transformer at Atinu Hospital | Demand growth | 2018 |
| 72 | Installation of 500KVA, 11/0.415KV Relief Transformer at Mgbaraja New Layout in Ozuoba Community | Demand growth | 2018 |
| 73 | Construction of 0.95Km 33KV overhead lines extension and Installation of 300KVA, 33/0.415KV Relief Substation at Wonwu Crescent by Forces Avenue, Garden City Main IBC. | Demand growth | 2017 |
| 74 | Construction of 0.45Km 33KV overhead lines and Installation of 200KVA, 33/0.415KV Transformer at Le- Eldra Avenue, Off Stadium Road under Garden City Central IBC | Demand growth | 2017 |
| 75 | Installation 500KVA, 11/0.415KV Relief Transformer at Elemenwo Street, GRA Phase II, Port Harcourt | Demand growth | 2017 |
| 76 | Construction of 0.4Km 33KV overhead lines and Installation 500KVA, 33/0.415KV Relief Transformer at Oroma/Okocha Avenue | Demand growth | 2017 |
| 77 | Construction of 500KVA, 33/0.415KV Relief Substation with construction of 8spans HT 33KV overhead lines (0.4Km) at Obiohuru Community | Demand growth | 2016 |
| 78 | Extension of Stadium Road 33KV Feeder along Stadium Road to Airforce Junction and Construction of 1 x 7.5MVA, 33/11KV Injection Substation with 1No SF6 11KV Ring Main Unit | Demand growth | 2016 |
| 79 | Extension of Stadium Road 33KV Feeder from Presidential Hotel Omerelu Street to Elemenwo Street, GRA Phase II | Demand growth | 2016 |
| 80 | Installation of 50KVA, 11/0.415KV HVDS Pole mounted distribution Transformer at Majesty Avenue behind NTA, Port Harcourt. | Demand growth | 2016 |
| 81 | Reconstruction of 11KV overhead line for recommissioning of FCMB 100KVA, 11/0.415KV dedicated Transformer at Bori | Demand growth | 2016 |
| 82 | Construction of 0.45Km 33KV Overhead lines to link Jesuit College 500KVA, 33/0.415KV Dedicated Substation to the New Airport 33KV Feeder on 24/7 Supply. | Demand growth | 2016 |
| 83 | Construction of NLNG 33KV Commercial Feeder (3.0Km with 2No 60Ft Steel Towers for River Crossing) to feed 500KVA, 33/0.415KV Substation at NLNG Facility | Demand growth | 2016 |
| 84 | Construction of 0.3Km 11KV Lines to connect Customers around Bishop Avenue, and Panama Street in Aeroplane Drive on Fimie 11KV 24/7 supply. | Demand growth | 2016 |
| 85 | Installation of 2No 500KVA, 33/0.415KV Relief Distribution Transformers at Victory Estate and Crystal Avenue along Iwofe Rumuolumini Road, Port Harcourt. | Demand growth | 2016 |
| 86 | Construction of 3spans 11KV Dual Circuit to connect Marta Masricodia Cathedral Church 200KVA, 11/0.415KV and other 2No Point Load Transformers on Airforce Base 11KV feeder emanating from Stadium Road 7.5MVA, 33/11KV Injection Substation | Demand growth | 2016 |
| 87 | Installation of 500KVA, 33/0.415KV Distribution Transformer at Corpus Christ Cathedral Church, Kaduna Street | Demand growth | 2016 |
| 88 | Installation of 33KV Outdoor Breaker at Secretariat 2 x 15MVA, 33/11KV Injection Substation on Ibesikpo 33KV Line. | Demand growth | 2015 |
| 89 | Construction of 300KVA, 33/0.415KV Relief Substation William Jumbo Street and construction of 6spans of 0.415KV overhead lines | Demand growth | 2015 |

| S/N | Name of Project | Category | Completion Year |
|-----|--|---------------|-----------------|
| 90 | Construction and completion of 500KVA, 11/0.415KV and laying of 45m, 150mm ² x 3core Underground Cable Relief Substation, at Obiohuru Community, Oyigbo | Demand growth | 2015 |
| 91 | Construction of 0.3Km 33KV overhead line extension on Airport 33KV Feeder with installation of of 500KVA, 33/0.415KV Distribution Substation at Pastorial Center, Igwuruta | Demand growth | 2015 |
| 92 | Commissioning of 7.5MVA, 33/11KV Power Transformer at University of Science and Technology, 0.5Km 33KV overhead lines extension on existing UST 33KV Feeder and 2.4Km 11KV overhead lines to Relief UST 2 x 15MVA, 33/11KV Injection Substation. | Demand growth | 2015 |
| 93 | Commissioning of 750KVA, 33/0.415KV Transformer at Winners Church of God, Kaduna Street, Port Harcourt | Demand growth | 2015 |
| 94 | Extension of Stadium Road 33KV Feeder (Ex. Trans Amadi GT) from Intercontinental Diagnostic Center frontage to GRA Junction (0.5Km) | Demand growth | 2015 |
| 95 | Commissioning of 2x7.5MVA, 33/11KV power transformer (NIPP Project) | Demand growth | 2015 |
| 96 | Commissioning of 1x7.5MVA, 33/11KV power transformer (NIPP Project) | Demand growth | 2015 |
| 97 | Commissioning of 2x15MVA, 33/11KV power transformer | Demand growth | 2015 |
| 98 | Replacement of 1x15MVA, 33/11 power transformer | Demand growth | 2015 |
| 99 | Commissioning of 1x7.5MVA power transformer | Demand growth | 2015 |
| 100 | Commissioning of 2x7.5MVA (NIPP Project) | Demand growth | 2015 |
| 101 | Commissioning of 1x7.5MVA, 33/11KV (NIPP Project) | Demand growth | 2015 |
| 102 | Commissioning of 1x7.5MVA, 33/11KV (NIPP Project) | Demand growth | 2015 |
| 103 | Commissioning of 1x7.5MVA, 33/11KV (NIPP Project) | Demand growth | 2015 |
| 104 | Commissioning of 1x7.5MVA, 33/11 (NIPP Project) | Demand growth | 2015 |
| 105 | Commissioning of 1x7.5MVA, 33/11KV (NIPP Project) | Demand growth | 2015 |
| 106 | Commissioning of 3MVA, 33/11KV Greater Port Harcourt Transformer | Demand growth | 2015 |
| 107 | Commissioning of 3MVA, 33/11KV NPA Project executed by Income Electric | Demand growth | 2015 |
| 108 | Commissioning of 2.5MVA, 33/11KV Power Transformer at Akpajo | Demand growth | 2015 |

4.4. Challenges and Limitations

PHED is expected to bring in improvement in services and meet its obligations as follows:

- To meet demand of customers within its area
- Improved quality and reliability in supply
- Restore/build infrastructure to reach load centers and provide continuous supply
- Maintain its network

While PHED is committed and have taken few initiatives in its downstream network but due to non-jurisdiction on upstream network the challenges continue to persist from generation and transmission.

Table 22: Challenges in Electricity Value Chain

| Streams | System | Challenges |
|------------------------------|--------------|---|
| Upstream (132/33 KV) | Generation | The proximity of PHED supply area to the generating station yield high voltage level resulting to deterioration of network and associated equipment's along with power factor imbalance in system. |
| | Transmission | The mismatch of infrastructure and its capacity between TCN and PHED resulting to demand side management and curtailing of loads to prevent tripping/failures on the network and substation. |
| | | Absence or improper positioning of TCN facilities vis-a-viz PHED's load centre compels PHED to build lengthy networks effecting voltage drop thereby quality of supply. |
| | | Frequent black-outs/tripping at TCN network catering to PHED's customer on low and medium loss feeders impact on customer confidence gained by it. |
| Downstream (upto 33/11KV) | Distribution | Aged network: lack of investment and any continuous growth in load over the years have deteriorated the condition and life span of network, hence frequent breakdowns are experienced across the value chain of network |
| | | Improper specification standardization: Inheritance of lengthy and mix-sized network & systems and absence of project planning resulted poor supply of service delivery efficiency. |
| | | Poor Workmanship: Limited exposure and adoption of best practices exhibited in operations and maintenance of network and systems affects severely compliance to TAT. |

4.4.1. Power Supply

This section gives a brief review of the power supply vis-à-vis load demand scenario in Port Harcourt Electricity Distribution PLC and an analysis of major constraints and problem areas to be specifically targeted for improvement based on available generation. In area under PHED coverage, power is available on an average for 14 hours in a day. Apart from inadequacies in transmission capacity, 33 KV and downstream network, low availability and quality of generation and limitations in upstream 132 KV Transmission Network pose major hurdles in power being available on continuous basis especially in the Port town which is the biggest load and revenue centre. Embedded generation in PHED area of operation as also new plants coming up in future are also shown on the map to indicate the scope of connectivity by way of removing the present transmission constraints and creating new corridors. The approach should be to also explore if new generation capacity coming on stream can be accessed by bridging and building the missing transmission links.

Table 23: IPP Capacity

| Name of Generating Station | Capacity (MW) | Present Availability (MW) | Non-Availability |
|-------------------------------------|---------------|---------------------------|---|
| Trans-Amadi GT | 130 | 0 | 30MW idle since 05/03/2013, switchgear defect |
| Ibom Power GT | 191 | 0 | full capacity to be made available in stages |
| Port Harcourt Refinery excess power | 20 | 0 | PPA negotiation ongoing, need to build evacuation infrastructure |
| Notore | 8 | 0 | Requires evacuation infrastructure |
| Odukpani power Station | 100 | 0 | Full capacity not yet utilized although already exporting to grid |
| Omoku GT | 150 | 22 | |
| Afam GT | 180 | 140 | Work-in-progress to add 2 nd 180 MW unit |

Trans-Amadi, Ibom Power and Omoku GT are purely connected to transmission network, Ibom Power and Afam GT supply to us via TCN network. The common case is that plant constraints of both generation and transmission do not allow full capacities to be evacuated, thereby leading to stranded generation assets in a situation of acute power shortfall. While efforts are necessary to bring back on stream idle capacities via Renovation and Modern facilities for which incremental investments at IPP end shall be required, simultaneous programmes are to be taken up to bridge the gaps in the transmission corridor and build new lines where necessary in order to ensure full power flow from installed capacities and thereby, avoid idling of assets and wastage of scarce resources.

The deficiencies in power supply to PHED operational area have their origin in the upstream transmission network, which is in the domain of the TCN. The expertise and know-how of power transmission also reside TCN. In public interest and to provide electricity customers relief from erratic as well as inadequate power supply, it is necessary that funds are allocated to implement the identified transmission projects by TCN on a priority basis. Such investments are beyond us therefore, have not been included in the capex plan of this Report.

Table below is a study undertaken on transmission network reinforcements to enable access to embedded IPP generation, both existing and new. It is compiled based on information gathered from interactions with TCN and presented as State-wise scenario giving utilized and idle GT capacities as well as existing transmission network constraints and future additions contemplated, including new 330 kV and 132 kV lines and Transmission Stations. Current transmission constraints range from lack of synchronization of GTs and upgrading of power transformers to need for re-conducting, building missing links, completing work-in-progress and repairing dysfunctional switchboards, as identified. Relying on available data and information, short and medium term actions to bring back rated GT capacities to full operation have been identified. An immediate measure has been proposed by reorganizing the existing cable layout and network arrangement that will enable 20 MW power out of the idle capacity under Phase 2 of Trans Amadi GT to be pushed into the 33 kV in the network, thereby providing relief to the current shortage. If the required transmission gaps as identified can also be met, the power availability from both Trans Amadi and Omoku plants can be scaled up further in the short term. While current information is based on available information that could be gathered and will need to be validated, this is an issue to be taken up with TCN in the right earnest in the interest of augmenting the power supply.

Table 24: Power availability from upcoming NIPP/ IPPs

| Name of Generating Station | | Capacity (MW) | State |
|----------------------------|------|---------------|--------------|
| GBARAIN | NIPP | 225 | Bayelsa |
| CALABAR | NIPP | 634.5 | Cross Rivers |
| OMUKU | NIPP | 264.7 | River States |
| ELME | IPP | 95 | Rivers State |
| ODUKPANI | NIPP | 565 | Cross Rivers |

It is necessary to explore the scope in future of contracting a part of these capacities and examine the modalities thereof by undertaking a study of market restrictions and regulatory objections if any. In summary, PHED is exploring the following options of utilizing the generation assets within operational area so as to not only meet the demand shortfall and provide continuity in power supply but also cater to the load growth.

- Increasing power availability from State-controlled IPPs which are generating less than their nameplate capacity ; this will involve ensuring both continuous gas supply as contracted and improving Plant Availability Factor to be guided by contractual obligations.
- Access to embedded generation lying idle or upcoming in the foreseeable future through the National Grid; this will necessitate reinforcement of Transmission network with emphasis on the Rumuosi and Elemenwon transmission stations.
- Access to NIPP generation assets through bilateral Power Purchase Agreements; the approach will be to explore with TCN for access and connectivity to transmission network and work out modalities to receive the additional power directly without routing it through MO / NBET. Regulatory issues, if any, are to be examined.

4.4.2. Transmission Challenges and Limitations

There is an urgent need to strengthen and indeed ramp up the transmission capacity within PHED's coverage area. The current distribution of transmission stations is very lopsided and makes it impossible for PHED to serve customers especially high volume industrial and commercial customers that provide a bulk of the revenue. Below is a table that shows the current transmission stations in PHED operational area and their installed capacities and their current loading. The feeders are categorised for Priority capacity expansion, Necessary capacity expansion and feeders where there is no immediate requirement to expand the capacity. These are highlighted in Red, Yellow and Green colours, respectively.

Table 25: Transmission Stations and their installed capacities

| Transmission Station Name | Transmission Power Transformer (MVA) | Transformer Capacity @ 0.8 Loading Factor (MW) | Maximum Demand (MW) | Loading % | Capacity Expansion Requirement (MW) |
|---------------------------|--------------------------------------|--|---------------------|-----------|-------------------------------------|
| PH MAINS | T1 A 60 MVA | 48 | 59.2 | 123% | 48 |
| | T2 60 MVA | 48 | 66.6 | 139% | |
| | T3 60 MVA | 48 | 76.1 | 159% | |
| PH TOWN | T1 60 MVA | 48 | 54.9 | 114% | 48 |
| | T1 B 30 MVA | 24 | 21.2 | 88% | |
| | T 2A 30 MVA | 24 | 28.7 | 120% | |
| | T2 B 30 MVA | 24 | 18.7 | 78% | |
| AFAM | T1 30 MVA | 24 | 25.2 | 105% | 24 |
| RUMUOSI | T1 40 MVA | 32 | 75.2 | 235% | 48 |
| | T2 60 MVA | Inactive | | | |
| ELENLENWO | T1 60 MVA | 48 | 85.4 | 178% | 48 |
| | T2 60 MVA | Inactive | | | |
| AHOADA | T1 40 MVA | 32 | 24.5 | 77% | 24 |
| | T2 40 MVA | 32 | 31.9 | 100% | |
| YENEGOA | T1 90 MVA | 72 | 45.8 | 64% | 0 |
| | T2 40 MVA | 32 | 31.0 | 97% | |
| ITU | T1A 60 MVA | 48 | 22.3 | 46% | 0 |
| UYO | T3 60 MVA | 48 | 28.3 | 59% | 0 |
| | T1 60 MVA | 48 | 33.7 | 70% | |
| | T2 60 MVA | 48 | 30.5 | 64% | |
| EKET | T1 40 MVA | 32 | 24.6 | 77% | 24 |
| | T1 60 MVA | 48 | 25.9 | 54% | |
| CALABAR | T1 60 MVA | 48 | 42.4 | 88% | 24 |
| | T4 60 MVA | 48 | 15.9 | 33% | |
| | T2 60 MVA | 48 | - | 0% | |
| | T3 60 MVA | 48 | 41.6 | 87% | |
| ABAKILIK | T1 30 MVA | 24 | 34.9 | 48% | |
| | T1 60 MVA | 48 | | | |

Following the above obvious constraint, there is an urgent need to increase the transmission capacity especially within Port Harcourt metropolis to enable any significant increase in load demand to happen.

4.4.3. Distribution Network Challenges and Limitations

33KV Capacity Limitations

Based on the Load Flow analysis, it was observed that due to potential demand and rapid growth in infrastructural development, a number of 33KV & 11KV Lines and injection substations are overloaded. The system can no longer accommodate the load capacity required. Therefore, there is urgent need for capacity upgrade especially in Port Harcourt city.

As a result of limitations observed from the load flow analysis (overloaded equipment and lines, Inadequate number of injection substations to supply, ever increasing population and industrial Growth), the network was modelled again with the intention of simulating new injection substations and new feeders/lines to supply the incremental load demand and relief the overloaded lines/equipment. The tables below describe limitations on 33KV feeders and injection substations and ageing/defective equipment in the injection substations.

Table 26: 33KV Feeder Loading

| Feeder Category | No of Feeders | % |
|--|---------------|-----|
| No. of Feeders Below 70% Loading | 36 | 53% |
| No. of Feeders Between 70% & 90% Loading | 11 | 16% |
| No. of Feeders Above 90% Loading | 21 | 31% |
| No. of Feeders Above 10% Voltage Drop @ Peak Load | 29 | 43% |
| No. of Feeders Above 5% Voltage Drop @ Peak Load | 7 | 10% |
| No of Feeders within allowable voltage Drop @ Peak Load | 32 | 47% |
| No. of Feeders Above 10% Voltage Drop @ Average Load | 14 | 21% |
| No. of Feeders Above 5% Voltage Drop @ Average Load | 8 | 12% |
| No of Feeders within allowable voltage Drop @ Average Load | 46 | 68% |

Total Number of 33 KV feeders - 74

Injection Substations

Table 27: Manned Injection S/S Load status

| Injection Substation Capacity (MVA) | Number | Demand Above 90% | Demand Between 70% & 90% | Demand Less than 70% |
|-------------------------------------|--------|------------------|--------------------------|----------------------|
| 3 X 15 | 2 | 2 | - | - |
| 2 X 15 | 19 | 3 | 5 | 11 |
| 1 X 15 | 24 | 6 | 4 | 14 |
| 2 X 7.5 | 2 | 1 | - | 1 |
| 1 X 7.5 | 11 | 2 | 1 | 8 |
| Total | 58 | 14 | 10 | 34 |

Table 28: Type of issues in Ageing equipment in Injection Substations

| Power Transformer | Switchyard Equipment | Control Room / Tripping Unit |
|--------------------------------|------------------------------------|---|
| Oil Leakage | No sky wire | Bad Floor |
| Bad Windings temperature gauge | Bushy Substation | Poor Illumination |
| Bad Oil Temperature Gauge | Dilapidated Cable trench | Bad / No Air conditioner |
| Bad Oil Indicator | No switchyard gate | Bad/ No Fans |
| Overloaded Transformer | Poor switchyard illumination | No Energy Meter |
| Bad Gasket | No 33kV Voltage Transformer | No / Faulty Battery Charger |
| Bad Seal | No 33kV CT | AC / DC distribution board are all bad. |
| Bad Bushings | Bad Cable Slabs | Bad Extractor fans |
| Weak transformer Plinth | Bad auxiliary transformer isolator | Battery Charger is faulty. |
| Faulty Oil conservator gauge | Poor Drainage System | Bad/No fire extinguisher |
| Bad bucholz relay | No Thunder Arrester | Relays are all bad. |
| No Transformer Coil | No Lightning Arrester | No Differential relay. |
| | No Gantry | Dilapidated Building |
| | Poor Fencing | |
| | No 33kV Outdoor Breaker | |

DRAFT

5. Detailed Plans

5.1. Technical

The Technical Plan under the performance improvement plan is prepared on three philosophies, i.e. demand growth, loss reduction and reliability across value chain of network which include, feeder metering, substation automation, demand growth, de-loading of line load on 33kV feeders, fault identification and isolation, preventive maintenance, voltage profile, safety and security, reliability project to fulfill the objective of meeting customer satisfaction and reduction of T&D loss.

This technical interventions/plans are geared towards achieving the following objectives –

- Accommodation of future load growth
- Reduction of power losses
- Improvement of voltage conditions
- Improvement of power factor
- Improvement of quality of energy supply and reliability
- Reduction in cost of operation and maintenance
- Improvement in safety of personnel and equipment life

Table 29: Five Year Vision of Network Improvement

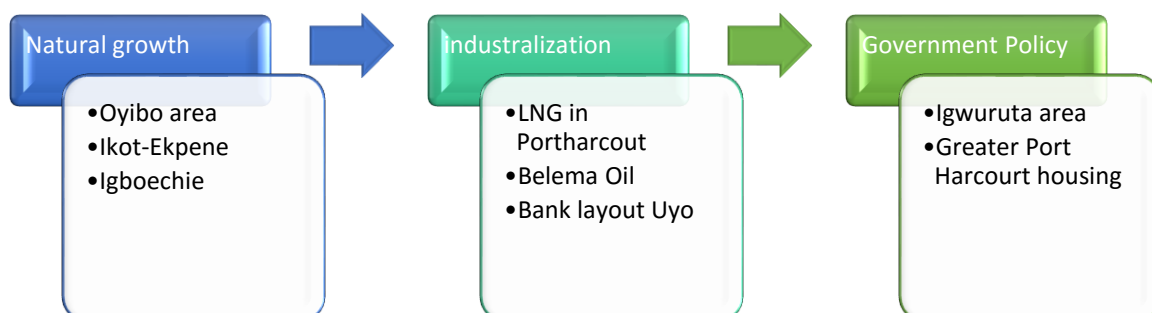
| Sr. No. | Activities | 2020 | 2021 | 2022 | 2023 | 2024 |
|---------|---|------|------|------|------|------|
| 1 | Metering | | | | | |
| | 11KV feeder metering | | | | | |
| | 33KV feeder metering | | | | | |
| 2 | Substation Automation | | | | | |
| | Installation of Numerical Relays | | | | | |
| | Installation of Annunciation | | | | | |
| | Remote Tap Changer Control and Auto Voltage Regulator | | | | | |
| | Installation of SCADA system | | | | | |
| 3 | Demand Growth | | | | | |
| | Construction of New 33KV lines | | | | | |
| | Construction of new Injection Substation | | | | | |
| | Upgradation of Injection Substation | | | | | |
| | Construction of New 11KV lines | | | | | |
| | Installation of Distribution Transformer | | | | | |
| | 33/.415 | | | | | |
| | 11/.415 | | | | | |
| 4 | Deloading of line loads on 33KV feeders | | | | | |
| | Construction of 11KV Feeders | | | | | |
| | Derating of Distribution transformers from 33/0.415 to 11/0.415 | | | | | |
| 5 | Fault Identification and Isolation (Selectivity) | | | | | |
| | Installation of Autoreclosers and sectionalizers | | | | | |
| | Installation of Fault Passage Indicators | | | | | |
| 6 | Preventive Maintenance | | | | | |
| | Mobile workshop for line and substation maintenance | | | | | |
| | Periodic maintenance of injection substations | | | | | |

| Sr. No. | Activities | 2020 | 2021 | 2022 | 2023 | 2024 |
|---------|---|------|------|------|------|------|
| | Periodic load balancing | | | | | |
| | Periodic monitoring of distribution transformer | | | | | |
| | Aging Material Replacement | | | | | |
| | Installation of Battery banks | | | | | |
| | Distribution Substation Maintenance | | | | | |
| | Line Maintenance | | | | | |
| 7 | Voltage Profile | | | | | |
| | Installation of booster substations | | | | | |
| | Installation of capacitor banks | | | | | |
| 8 | Safety & Security | | | | | |
| | Fire Fighting System | | | | | |
| | CCTV installation | | | | | |
| 9 | Loss Reduction | | | | | |
| | Installation of auto recloser | | | | | |
| | Installation of aerial bundled conductor | | | | | |
| | Installation of HVDS | | | | | |
| 10 | Reliability | | | | | |
| | Extension of 33KV lines | | | | | |
| | Reconductoring of under size conductors of the line | | | | | |
| | Bifurcation of 33/11KV feeders | | | | | |
| | 33/11KV feeder redundancy through RMU | | | | | |
| | Multiple source creation at injection substation | | | | | |
| 11 | System Optimization Projects | | | | | |
| | Proposed Installation of gang isolators in 33 KV overhead lines and 33/0.415KV distribution transformers | | | | | |
| | Proposed Installation of gang isolators in 11 KV overhead lines and 11/0.415 KV distribution transformers | | | | | |

5.1.1. Demand Growth

PHED has experienced 62% increase of customers population under PHED network in the last five years making it an average of 12% growth in population per year. This has given rise to incremental energy consumption in the system, the expansion/upgradation of delivery energy to the customers becomes necessary. The growth in the network is a result of natural growth, example is Oyibo area in Port Harcourt, industrialization and government policy.

Figure 13: Factors Driving Demand Growth



Despite the financial constraints twelve new injection substations were commissioned in the last five years.

Network and System Upgradation

Upgradation of the distribution network is one of the activities in this plan to cope with electricity demand growth. The load demand in a distribution network varies with time and location also the network systems (substation and feeders) must respond to the customers load demand at any time.

Network and System Expansion

PHED Network Expansion Plan involves upgrade and construction of new injection substations, construction of new 33KV and 11kV feeders and installation of new/upgrade of distribution transformers to meet with increasing future demands, improve services to underserve customers, remove capacity constraints, and create more reliability and flexibility in the network. This five year plan for demand growth is shown in the table below:

Table 30: Implementation plan for Demand Growth Project

| Description | Units | Qty | 2020 | 2021 | 2022 | 2023 | 2024 |
|--|-------|------|------|------|------|------|------|
| Construction of new 33/11kv/UG lines | KM | 3434 | 28 | 642 | 1280 | 680 | 804 |
| Upgradation/Construction of new injection substation | MVA | 435 | - | 110 | 110 | 110 | 105 |
| Installation of distribution transformer | Nos | 500 | 110 | 125 | 115 | 90 | 60 |

5.1.2. Loss Reduction

The loss reduction strategy focusses on minimising technical and distribution losses on Network. Currently PHED is booking high T&D losses to the tune of 25% due to rampant energy theft and i^2r loss, clubbed with normal wear and tear affects. High rate of technical losses causes poor quality of services offered to customers and reduction in revenue resulting in cash difficulties with all ensuring economics.

In meeting these objectives, PHED proposes to carry out the following to address technical loss reduction in the medium to long term, viz.:

- Installation of HVDS in selected theft prone pockets
- Replacing the existing bare conductors with Ariel Bunched Cables (ABC)
- Commissioning of DTRs at identified load centers
- Re-conducting with ACSR DOG in replacement of AAC, and
- Revamping of LT Network with new conductors.

HVDS and Cabling

The project initiatives that will help to reduce these losses include use of Aerial Bunched Cables (ABC) to prevent illegal connection into the LT lines in the network and installation of HVDS. This will help reduce theft, which will lead to customers to consume to their ability to pay for electricity services their by reduce demand which exactly has the same effect as reduction in technical losses.

Table 31: Implementation plan for HVDS and Cabling

| Description | Unit | Qty | 2020 | 2021 | 2022 | 2023 | 2024 |
|------------------------------------|------|------|------|------|------|------|------|
| HVDS 50/25 KVA | Nos | 4800 | 600 | 1200 | 1200 | 1200 | 600 |
| ABC cable installation on LT lines | Km | 5000 | 1000 | 1000 | 1000 | 1000 | 1000 |

Voltage Profile

The broad outline of immediate network interventions is presented below.

Based on information from load flow study of the existing network, it is evident that the distribution system is overloaded. Improvement of the system network would lead to relief on overloaded feeders, leading to improvement in voltage profile.

Due to the lengthy nature of some feeders like Yahe 33kV feeder, and increase in customers population giving rise to increase in load demand in PHED's network, the voltage profile of these feeders are grossly affected resulting in a voltage drop at the receiving end compared to the sending end. Therefore, causing the customers at the end of the feeder to be underserved which in turn impact negatively on PHED revenue and poor reliability. Voltage improvement initiatives are required and to drive this initiatives requires installation of booster substations and capacitor banks to mitigate the issue of voltage drop and improve the quality of electrical power and gives more efficient operation of the power system.

Table 32: Implementation plan for installation of Capacitor Bank

| Description | Unit | Qty | 2020 | 2021 | 2022 | 2023 | 2024 |
|--------------------|------|-----|------|------|------|------|------|
| Booster substation | No | 25 | 0 | 5 | 10 | 5 | 5 |
| Capacitor bank | No | 282 | 50 | 50 | 50 | 70 | 62 |

| Action | Benefits Envisaged |
|--|---|
| Installation of Capacitor Banks at 11kv side of Injection Substation for both 15MVA and 7.5MVA 33/11kV Transformer | <ul style="list-style-type: none"> Reduction in reactive power will result in the improvement of Power Factor and thereby reducing technical losses Reduction in loss in turn results in saving in energy Improvement in voltage profile |
| Reduction in overloading of feeders by Re-conductoring with ACSR DOG in urban area | <ul style="list-style-type: none"> Shall result in relieving the overloading of feeders, ultimately resulting in the reduction of technical losses |

Network Augmentation

A load demand study and network expansion has been completed and submitted by PHED to the commission. As part of Long Term Network Augmentation Plan spanning from this study, the following activities have been identified, viz.:

- Installation of new 15 MVA Power Transformers based on load profiles of each IBC
- Commissioning of new 33kV and 11 kV feeders for the Power Transformers for optimum load distribution

- Erection and commissioning of few Injection Stations at selected locations based on load centre analysis and demand forecasts
- Commissioning of Source S/S (DTRs) at identified downstream load centers
- Installation of Capacitor Banks at Injection Stations and on DTRs to compensate reactive load
- Rationalizing 33 KV and 11 kV feeders having long lengths with new network configuration to avoid voltage drops beyond allowable limits
- Introduction of Auto Re-closers on 33 kV and 11 kV overhead network at selected locations and also Ring Main Unit (RMU) at indoor sub-stations to enable sectionalisation upon occurrence of faults and minimization of the impact of outages
- Revamping of LT network with new feeders / pillar boxes, replacement of lower-sized conductors or conductors in bad shape
- Replacement of lower-sized conductors for HT lines for balance network other than those which have will be taken up under Short-to-Medium Term Plan for technical loss reduction
- Replacement of untreated wooden poles and accessories for both HT and LT network with conventional steel / concrete poles

The first four sub-items above are coincident with the activity of technical loss reduction, while contributing to network augmentation necessary to accommodate load growth. Specific locations were identified & selected for execution of the plan as a whole after the network is examined and studied in totality post commencement of operations so that holistic solutions that will contribute to improved network performance in terms of both supply quality and reduced technical losses are targeted. Implementation will be prioritized in order to:

- Meet load demand in areas where primary and / or secondary network deficiencies do not allow full power availability;
- Eliminate recurrent faults leading to network outages based on root cause analysis;
- Correct network deficiencies, both upstream and downstream, that lead to pockets of poor voltage supply.
- In terms of geographical areas, areas under State Capitals which suffer from above inadequacies will first be targeted, followed by those where load and customer densities warrant action.
- The load forecast and network expansion plan study broadly suggest that in order to redress current network inadequacies, investments are necessary in installing and augmenting Power Transformers at Injection Sub-stations, adding new 33 kV and 11 kV feeders, re-conductoring of under-sized lines and replacement of both Power Transformers and DTRs not being able to operate at rated capacity.
- Based on the load forecast and network expansion plan study, a Capital Investment Plan for network reinforcement / improvement has been made.

Table 33: Implementation Plan for Demand Growth Projects

| Description | Unit | Qty | 2020 | 2021 | 2022 | 2023 | 2024 |
|--|------|-------|------|------|------|------|------|
| Re-conducting of under sized conductor | Km | 1873 | 300 | 400 | 400 | 400 | 374 |
| Upgradation of DTRs | Nos | 455 | 95 | 110 | 110 | 80 | 60 |
| Replacement of broken poles | Nos | 13000 | 1000 | 6000 | 4000 | 2000 | - |

5.1.3. Reliability

This initiative refers to ability of a power system to provide adequate and stable power to customers. The benefit is the avoidance of customer interruption, cost result from a reduction in power outage occurrence and duration. The project that fall under this initiative among others is re-conducting of under size conductors of the line, substation automation, de-loading of line load on 33kv feeder, fault identification and isolation, preventive maintenance, bifurcation of 33/11kv feeders, 33/11kv feeder redundancy through Ring Main Unit (RMU) and multiple source creation at injection substation.

Substation Automation

Our drive for customer satisfaction has taking us to substation Automation initiative. This involves automation of 58 nos of injection substations in the network. This reliability philosophy will help to improve the operating efficiency of the substations/network, optimization of utility, secure asset, reduce lost time, reduction of operating cost and downtime in the long run. For proper implementation of the substation automation, involves decommissioning all manually/analogue controlled equipment and deployment of full scale SCADA system within five years. The substation automation is depicted in the figure below:

Figure 14: Substation Automation

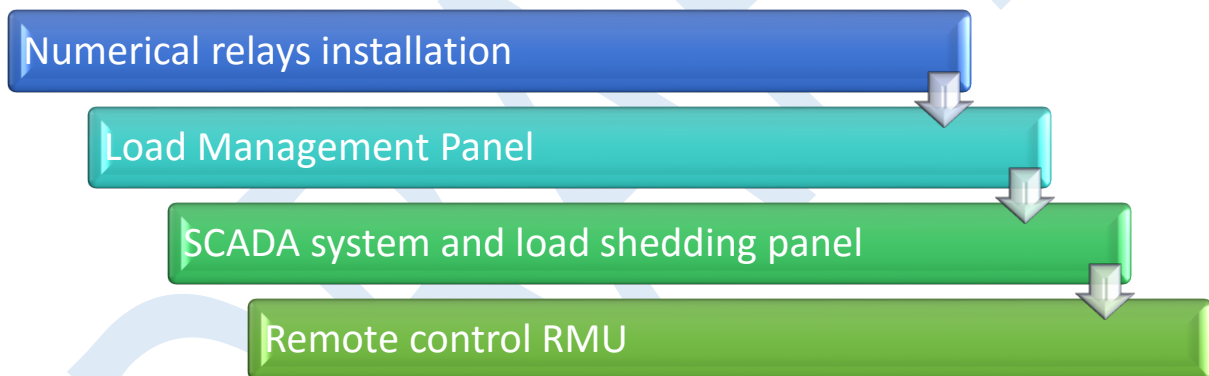


Table 34: Implementation plan for Substation Automation

| Description | Units | Qty | 2020 | 2021 | 2022 | 2023 | 2024 |
|---------------------|-------|-----|------|------|------|------|------|
| Numerical relays | Nos | 13 | 1 | 3 | 3 | 3 | 3 |
| Load shedding panel | Nos | 2 | | | 1 | 1 | |
| SCADA system | Nos | 2 | | | 1 | 1 | |
| Remote control RMU | Nos | 290 | 72 | 73 | 72 | 73 | |

Deloading of line load on 33kv feeders

Presently, PHED has 554.1MVA line loads on 64No 33kv feeders radiating from transmission stations to various injection substations. This impairs the reliability and the quality of supply to customers on 11/0.415kV lines. Deloading of these line loads on 33kv feeders will not only improve the reliability and quality of supply, also for effective load demand control. This is a reliability concept and regulatory requirement of PHED by NEMSA.This consist of derating of 33/0.145Kv to 11/0.415kV transformers and construction of new 11kv feeders. The plan to achieve this objective is shown in the table below

Table 35: implementation plan for DTR de-rating to 11/0.415kVA

| Description | Units | QTY | 2020 | 2021 | 2022 | 2023 | 2024 |
|----------------------------|-------|-----|------|------|------|------|------|
| Proposed de-rating of DTRs | Nos | 500 | 125 | 125 | 125 | 125 | - |

Fault Identification and Isolation

Installation of fault identification and isolation devices on all feeders in the PHED’s network is a reliability concept and elimination of total blackout in entire feeder as only the faulty section will be on isolation during any maintenance activity. Currently, amount of resources spent and downtime involved in restoring power supply back to the customers is high, when feeder goes out on fault. During 10th to 12th May 2019 only PHED lost 587.68 hours on various faulty feeders. In order to reduce the downtime and resources spent in restoring supply to the customers, necessitate the installation of auto reclosers, sectionalizers and fault locator devices.

The autorecloser is an instrument used on the overhead lines to detect and interrupt momentary faults. This helps to improve service continuity by automatically restoring power supply to the line after a momentary fault, improves system stability and reduce manpower requirement. A sectionalizer on the other hand, automatically isolates a faulted section of lines from the healthy part of the distribution system. Fault passage indicator helps to localize fault and provide an efficient cost-effective means of improving system reliability. The five year implementation plan of this initiative is as shown in the table below:

Table 36: Implementation plan for Autoreclosure, Sectionalizer and RMU

| Description | Units | Qty | 2020 | 2021 | 2022 | 2023 | 2024 |
|--|-------|------|------|------|------|------|------|
| Procurement and Installation of 33kV and 11kV Autoreclosures | Nos | 258 | 9 | 64 | 80 | 105 | - |
| Procurement and Installation of 33KV and 11kV sectionalizers | Nos | 1200 | 300 | 300 | 300 | 300 | - |
| Procurement and Installation of Fault passage indicator | Nos | 300 | 75 | 75 | 75 | 75 | - |
| Installation of gang isolator 33kV and 11kV | Nos | 2000 | 200 | 500 | 500 | 500 | 300 |
| Battery Bank installation | Nos | 40 | 10 | 10 | 10 | 10 | - |

Preventive Maintenance

This strategy will help increase life expectancy of assets, minimizes costly breakdown and unplanned outages impending troubles can be identified, and solutions applied, before they become major problem, thereby eliminating premature replacement of equipment. This improves safety and quality condition for personnel and asset, improve energy efficiency, maximize emergency downtime and helps to reduce operational cost and increase in availability.

The strategy to drive this initiative involves:

- Condition monitoring
- Provision of mobile workshop for line and substation maintenance
- Periodic line maintenance and load balancing
- Replacement of ageing material
- Installation of battery banks
- Injection substation maintenance.

Activities planned to be undertaken under inspection and testing initiative to monitor the health of network components are as described below.

Table 37: Maintenance Module

| Sub-module | Description |
|------------------------------|--|
| Condition Monitoring | <ul style="list-style-type: none"> ✓ Status and condition monitoring of all assets of 33 kV and 11 kV network. ✓ Since the entire network in Port Harcourt area is overhead and outdoor type, it is easy to track the defects of the overhead network by simple inspection. ✓ The sort of defects observed are (i) Hot Spot, (ii) Inappropriate Conductor Joints, (iii) No replacement of the faulty equipment, (iv) Damaged Insulators, (v) Close Proximity to other lines etc. ✓ These are potential failure points and the same can be repaired at a minimum cost and efforts. ✓ Monitoring tools, namely "ULTRAPROBE", for detecting partial discharge in switchgears etc. , DGA (Dissolved Gas Analysis) for transformers and IR Camera for detecting hot spots etc. will be very effective particularly for pinpointing potential failure points. |
| Condition Based Maintenance | <ul style="list-style-type: none"> ✓ Switching over to predictive maintenance wherein the equipment has tested for potential failure through status or condition monitoring. ✓ Cost effective maintenance regime in comparison to time bound and preventive maintenance schedules. ✓ Benefits include reduction of faults and R&M expenses and improvement in supply reliability. It also provides a basis to assess the frequency and scope of work for shut-down maintenance. ✓ Documentation is essential to keep track of equipment condition and periodicity of maintenance programme. |
| Quality Based Management | <ul style="list-style-type: none"> ✓ To initiate quality management , following actions are to be taken up: <ul style="list-style-type: none"> ○ Checks and balances of erection of Poles and Accessories ○ Control on Cable Joints and Terminations ○ Root Cause Analysis of all Failures ○ Safe Work Measures |
| Systemized Contingency Plans | <ul style="list-style-type: none"> ✓ In order to systemize the operations, the key requirement is to develop Standard Operating Procedure (SOP) to ensure work quality and provide checks and balances in compliance with the SOP. ✓ Proper documentation and tracking of official communication to all stakeholders is essential. |
| Assets Replacement Programme | <ul style="list-style-type: none"> ✓ Asset replacement can be done mainly on three parameters i.e. (a) Performance, (b) Age and (c) Condition. ✓ In most cases the problem arises due to the second factor since equipment is mostly aged or near to completion of full performance life. Replacement on these parameters might not be cost effective so importance needs to be given on 'performance and condition monitoring'. |
| Asset Security Protection | <ul style="list-style-type: none"> ✓ Since the area under coverage is large and covering four states, it is difficult to guard or protect all the equipment in scattered locations. ✓ Installation of an Intelligence Surveillance System (ISS) by installing security surveillance cameras mounted within the Injection Station premises to protect against vandalism and operation surveillance cameras at strategic locations within the switch room and overlooking transformer bays to facilitate operations and to monitor conditions in unmanned stations. Moreover, with intelligence surveillance system and remote control system the injection sub-stations may be made unmanned. This may reduce the manpower cost and human error. |

Table 38: Containment Module

| Sub-module | Description |
|-------------------------------------|---|
| Graded Protection | <ul style="list-style-type: none"> ✓ Graded Protection is required to achieve correct tripping of circuit breakers upon determining the location of fault and disconnecting the minimum amount of equipment necessary to isolate the same. ✓ Only the relays associated with faulty equipment are required to operate. This distinction is necessary to reduce the upfront cost of lost revenue, manpower wastage and inconvenience to the customers. It is proposed to provide differential relays at the stations and graded protection through trans-lay for overhead network, preferably for 33 kV feeders. ✓ It was gathered that at different stations 33 kV breakers, isolators and other accessories are bypassed after failure and as a result, the entire protection system is largely affected. For any fault at any points in the network, the entire 33 kV feeder is tripped from the transmission station and supply to the vast area is interrupted for a long time. ✓ To avoid such problems, regular replacement of such faulty equipment needs to be covered with suitable asset replacement programme. ✓ Necessary provision of graded protection system by providing appropriate relays, CT/VT arrangements as suitable for different networks in 33 kV and 11 kV is to be implemented to prevent unnecessary tripping and thereby reducing interruption of supply at load centres during any fault beyond the protected zone. |
| Installations of RMU/Auto Reclosers | <ul style="list-style-type: none"> ✓ The reliability of the power system will be vastly improved by providing RMUs at suitable locations after identifying one or few zones considering the length of a feeder. ✓ This will enable engineers to locate the faulty zone after tripping of a feeder and accordingly reducing down time. Also, the installation of RMU with 'fault passage indicator' for both 11 kV & 33 kV feeders will effectively improve the average interruption time in the event of outages. ✓ Considering the vastness of the network and the CAPEX allocation, it is proposed to install 475 RMUs for 11 kV feeders and 75 Auto Reclosers for 33kV feeders as an initial target to enable quick turn-around time and restoration of supply upon occurrence of faults. |
| Business Continuity Management | <ul style="list-style-type: none"> ✓ Business Continuity Plan will provide us with a common set of procedures at all levels of management to deal with critical incidents in a seamless and coordinated manner. The company will enhance its ability to preserve the continuity of supply, preserve its relation with key stakeholders and maintain highest service quality to its customers. ✓ The scalability of response is oriented along with the definition of emergency levels that dictates the basis for management mobilization and follow up actions. |

Table 39: Implementation Plan for Maintenance

| Description | Unit | Qty | 2020 | 2021 | 2022 | 2023 | 2024 |
|-------------------------|------|--------|------|-------|-------|-------|-------|
| LV line control project | Lots | 5500 | 275 | 1306 | 1306 | 1306 | 1306 |
| Re-enforcement project | Lots | 39 | 3 | 9 | 9 | 9 | 9 |
| HV control Project | Lots | 13 | 2 | 1 | 3 | 4 | 3 |
| Standardization project | Lots | 9775 | 575 | 2300 | 2300 | 2300 | 23 |
| Emergency Item | Lots | 63,830 | 5230 | 14650 | 14650 | 14650 | 14650 |

Safety and Security

The safety and security of equipment in injection and distribution substation is paramount to reliability of the distribution network. Therefore installation of CCTV and firefighting system help to protect the distribution equipment from vandals and fire outbreak. Installation of security equipment such as cameras in voltage points not only help deter or thwart unauthorized access and break-ins, but also track the movement of personnel and equipment to ensure safe operations and maintenance. Loss of a substation equipment due to fire outbreak could result in severe or monumental loss in revenue.

Table 40: Implementation plan for safety and security project

| Description | Unit | QTY | 2020 | 2021 | 2022 | 2023 | 2024 |
|----------------------|------|-----|------|------|------|------|------|
| Installation of CCTV | Lots | 58 | 10 | 10 | 14 | 10 | 14 |
| Fire fighting system | Lots | 58 | 10 | 14 | 10 | 14 | 10 |

5.1.4. Energy Management and Audit

Currently PHED has seventy four No. 33kv feeders and two hundred twenty seven (227) 11kv feeders in its network.

The growth rate of the 33kv and 11kv feeders for the past four years indicates growth of 15.6% and 6.99% respectively. In the commitment to energy accounting, all the 33kv feeders and 9 No. 11kv feeders were metered in the last four years. Presently, 11kv feeder metering project is ongoing and 40 feeders have already been metered making it a total of forty-nine (49 nos) 11kv feeders metered across network.

Energy accountability is a key measurement process to identify electricity loss in electrical distribution system. For implementation of proper energy audit, recording of energy consumption is required at different level of network which necessitates metering at all injection/trading points in the network till the consumption point at customer premise. Therefore, metering of all 33 KV and 11kv feeders in the network will improve energy accountability, proper billing of customers and increase in revenue hence, load flow analysis, energy management, healthy network, that will help manage cost effectively and improve customer service.

Table 41: Feeder metering implementation plan

| Description | Unit | Qty | 2020 | 2021 | 2022 | 2023 | 2024 |
|----------------------|------|------|------|------|------|------|------|
| 33kv feeder metering | Nos | 20 | | 4 | 10 | 2 | 4 |
| 11kv feeder metering | Nos | 269 | 227 | 20 | 12 | 10 | - |
| DTR metering | Nos | 9500 | 2000 | 2500 | 2500 | 2500 | - |
| CT/VT bulk metering | Nos | 3000 | 1000 | 1500 | 500 | - | - |

Figure 15: Feeder Metering



5.1.5. Technical Investment Plan

Capital Investment Plan has been developed, structured and phased out, giving weightage to reduction of ATC&C losses and network reinforcements, which include system strengthening as well as routine up-gradation for development of distribution network, with the aim to maintain a reliable and quality power supply to the customers. Both the physical plan and financial plan have been developed for the next five years. The Plan envisages massive investment in a 5-year period, and represents a substantial scale-up from earlier adopted CAPEX in MYTO 2015.

The significant point is that due to the current liquidity challenge in the industry and the attendant effect of lack of investment in the network, the distribution network is heavily handicapped to meet the desired standards of network performance and ensure supply reliability even when power is available, and also a lot of customers are currently off the grid. An apparent fall-out is that the customers, who are willing and able to pay, but faced with lack of service are now reluctant to pay for electricity that they consume, while a few industrial and commercial customers and even residential estates, have resorted to self-power generation due to abundant availability of fuel in the region. To compound the situation, metering of customers is grossly inadequate in that the entire cross-section of customers is not covered, thereby leading to major sources of revenue erosion. A further problem is that in the absence of metering, consumption is billed on estimated basis, thereby pre-empting energy accounting and accurate revenue capture. There is also the regulatory directive that 100% metering of all customers is to be completed howbeit, through the MAP scheme.

It is in such context that a capex plan of the size included in this Performance Improvement Plan is considered necessary to restore the integrity and reliability of the distribution system, bridge the metering gaps and ensure service delivery as per the desired standards

Capacitor Banks

It is proposed to install about 282 Nos capacitor banks on both 33 KV and 11 kV during the five-year period to improve the power factor to about 0.95. PHED also proposed to improve power factor at Low Tension (LT) level by installing capacitor banks fitted with Automatic Power Factor Controllers (APFC) on the secondary side of distribution transformers.

Energy Audit

Identification of loss-prone areas will be done through statistical energy audit at different voltage levels of the network. All 33 kV feeders, major 11kV feeders and about 60% of DTRs have been proposed to be progressively metered for the purpose of energy audit.

33/11 kV Transformers at Injection Substations

PHED has considered a total of 19 nos. new 33/11 kV transformers under different heads. Total capacity addition would be 360 MVA which is estimated to cater to future load growth and relieve overloaded transformers with appropriate network reorganization.

33 kV and 11 kV Feeder Network and Re-conductoring

New 33 kV and 11 kV feeders proposed are associated with establishment of Injection Substations. Accordingly, an estimate has been made for erection of 699 km of 33 kV and 736 km of 11 kV lines on the consideration that a large section is grossly overloaded and conductors are under-sized. For optimum capacity utilization of the installed overhead network, re-conductoring has been proposed for 509.14 km of 33 kV and 1363.91 km of 11 kV lines. Presently, a large number of 33 kV are of long lengths beyond standard practice.

Ring Main Unit (RMU) and Auto Re-closers

PHED has proposed a total of 163nos. RMUs considering an installation rate of 3 to 4 per 11 kV feeder to facilitate sectionalisation of the network upon occurrence of faults or during outage in order to improve supply reliability. Such RMUs will help in faster restoration of supply and provide safety to the working personnel. Auto Re-closers have been planned to be installed to clear transient faults affecting the overhead network and facilitate both sectionalisation of lines and minimization of outages in the event of a lasting fault.

Distribution Transformers (33/0.4 kV , 11/0.4 kV)

New distribution transformers have been featured to achieve the objectives of ATC&C loss reduction, improving supply reliability, network augmentation for future load growth as well as replacement of defective stock. The capacity addition target in the 5-year period is 590 MVA.

Replacement of Defective Equipment

PHED has considered replacement of few defective equipment viz. Control Relay Indication (CRI) Panels at Injection Substations, 33kV outdoor Circuit Breakers, 11kV Switch Boards, Isolators, etc.

LT Network Re-organization

The activity will include reinforcement of concrete poles, replacement of feeder pillars, re-conductoring and stringing new lines in association with technical loss control, installation of new DTRs and network renewal.

Other Assets

Various items, e.g. IT infrastructure, civil construction, furniture / fixtures, tools / tackles, vehicles etc. have been considered under this head. IT Infrastructure includes application software of Billing, Meter Data Base Management, Fault Management, Customer Relationship Management etc. with the related hardware. Civil works will include new or renovation of cash offices, renovation / up-grading of existing Substation buildings to enable addition to or replacement of switchboard, CRI panels, circuit breakers, isolators etc.

5.1.6. Proposed Network & System Projects

In the absence of proper metering arrangements, it is difficult to establish transmission and distribution loss. However, from a pilot study on few feeders an average T&D loss of 25% has been assessed. This figure has been considered as a T&D loss for entire PHED network is out analysis.

The assessed T&D loss of 25% is more than double of the industry standards of 8-12% in developing nations. With the aim to achieve T&D losses of 12% the total capex of 50.3 Billion is planned over a period of 5 years. The capex planned is distributed with an objective to address Demand Growth, Loss Reduction and Reliability alongwith IT automation and other areas.

Table 42: Classification of Proposed Projects

| Proposed Improvement | No. of projects |
|--------------------------|-----------------|
| Network Expansion | 50 |
| Reliability | 21 |
| HV Control Projects | 13 |
| Demand Growth | 12 |
| Loss Reduction | 12 |
| Standardization Projects | 9 |
| LV Control Project | 5 |
| Re-enforcement Projects | 4 |
| Feeder & DTR Metering | 4 |
| Control Cables | 3 |
| Grand Total | 133 |

Table 43: Summary of Projects

| Category | Projects | Description | Units | 2020 | 2021 | 2022 | 2023 | 2024 | Total |
|----------------|--------------------------------|--|-------|------|------|------|------|------|-------|
| Demand Growth | Network Project - 33KV | 1. New 33KV Feeders 2. 33KV Feeder Extension | KM | 24 | 80 | 360 | 100 | 134 | 698 |
| | Injection Substation - 33/11KV | 1. New Injection Substations 2. Capacity Addition | Nos | 0 | 6 | 7 | 4 | 3 | 20 |
| | Network Project - 11KV | 1. New 11KV Feeders 2. 11KV Feeder Extension | KM | 4 | 62 | 420 | 80 | 170 | 736 |
| | DT Substation - 33/11/0.415KV | 1. New 11/0.415KV Dtrs | Nos | 0 | 0 | 0 | 0 | 0 | 0 |
| | LT Lines | 1. New 11/0.415KV Dtrs | Nos | 0 | 0 | 0 | 0 | 0 | 0 |
| Loss Reduction | Network Project - 33KV | Re-conductoring of 33KV Lines | KM | 120 | 160 | 160 | 160 | 150 | 750 |
| | Injection Substation - 33/11KV | Booster Stations | Nos | 5 | 5 | 10 | 5 | 5 | 30 |

| Category | Projects | Description | Units | 2020 | 2021 | 2022 | 2023 | 2024 | Total |
|-------------|--------------------------------|---|-------|------|------|------|------|------|-------|
| | Network Project - 11KV | Re-conductoring of 11KV Lines | KM | 180 | 240 | 240 | 240 | 224 | 1124 |
| | DT Substation - 33/11/0.415KV | Installation of 50/25KVA HVDS | Nos | 600 | 1200 | 1200 | 1200 | 600 | 4800 |
| | LT Lines | Deployment of ABC | KM | 0 | 200 | 500 | 500 | 500 | 1700 |
| Reliability | Network Project - 33KV | 1. Installation of 33KV Autoreclosers & Sectionalizers | Nos | 125 | 125 | 125 | 125 | 0 | 500 |
| | Injection Substation - 33/11KV | 1. Replacement of Defective/Old Control Panels 2. Replacement of Battery Banks 3. Replacement of Defective Relays | Nos | 17 | 33 | 17 | 18 | 0 | 85 |
| | Network Project - 11KV | 1. Installation of 11KV Autorecloser & Sectionalizer | Nos | 300 | 300 | 300 | 300 | 0 | 1200 |
| | DT Substation - 33/11/0.415KV | 1. Derating of 33KV to 11KV Dtrs 2. Installation of Replacement and relief Dtrs | Nos | 235 | 250 | 240 | 215 | 60 | 1000 |
| | LT Lines | 1. New 11/0.415KV Dtrs | Nos | 0 | 0 | 0 | 0 | 0 | 0 |
| | Energy Accounting | 33KV Feeder Metering | Nos | 0 | 4 | 10 | 2 | 4 | 20 |
| Enablers | Energy Accounting | 11KV Feeder Metering | Nos | 227 | 20 | 12 | 10 | 0 | 269 |
| | IT | SCADA and Automation System | Nos | 0 | 0 | 1 | 1 | 0 | 2 |
| | Tools | Tools & Equipment | Nos | 38 | 77 | 78 | 59 | 60 | 312 |
| | | | | | | | | | |

5.1.7. Impact and Outcome of Proposed Projects

The impact of the proposed projects shall be to:

- Reduce distribution loss
- Improve reliability of supply
- Improved energy efficiency

The outcome will be improved infrastructure health, configuration and efficient working to provide reliable and sustainable supply to PHED customers, which will lead to socio economic growth of the area. Below are broad categories where impact is planned and expected.

Distribution Capacity Expansion

Distribution projects that significantly increase the capacity of the power distribution system bring additional power generation to new or existing customers. The rationale for increasing distribution capacity to existing customers would be that their demand for power has increased, and there is either surplus power capacity available elsewhere in the grid or new generation coming online that must be

brought to these customers. In other words, over the long term, distribution capacity expansion would almost always be accompanied by power generation capacity expansion.

Technical Loss Reduction

The most common positive impact of the aforesaid projects, particularly upgrades or renovations of existing network and distribution system, shall be reduction in technical losses within the network system. By upgrading transformers and other substation components, performing additional maintenance, and other interventions, these project types result in lower technical losses, so that more of the available power is delivered to the consumers. This is true for both ongoing projects and proposed projects in entire distribution system including any new network expansion or line is added to the system.

Increased Reliability

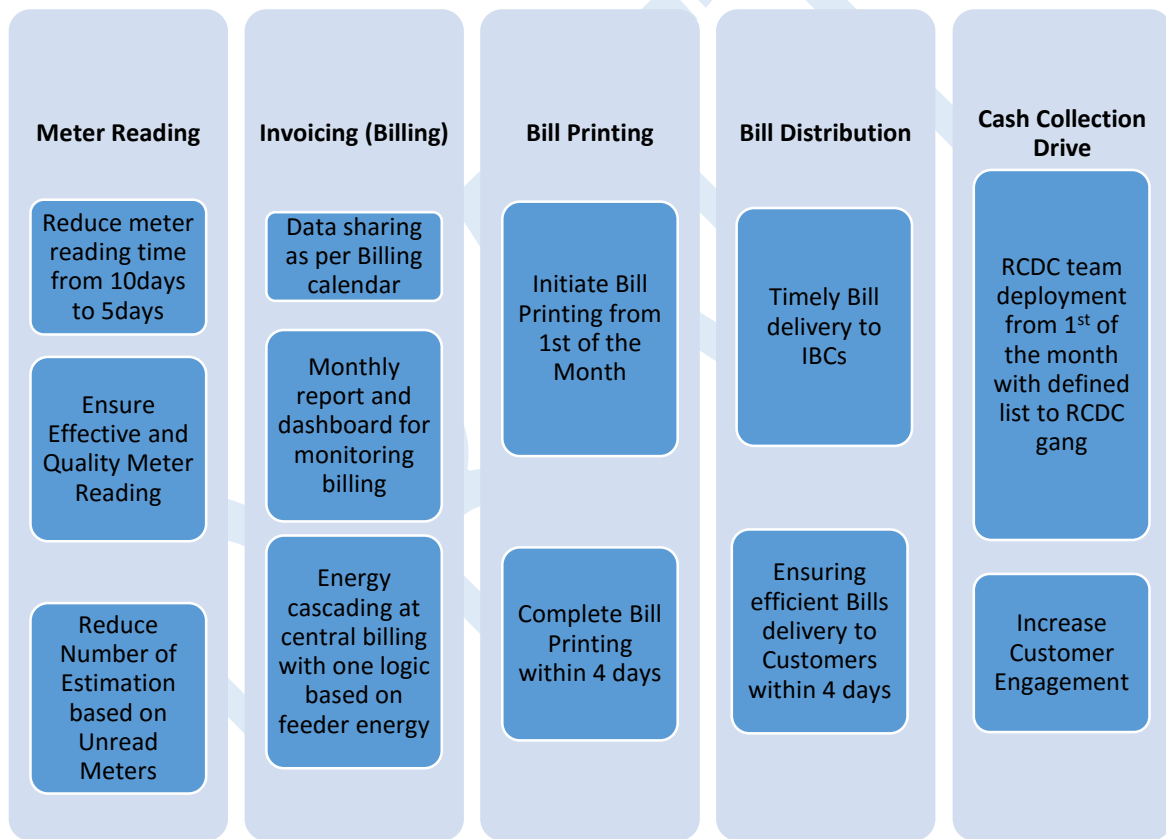
Not only do system upgrades and rehabilitation reduce technical losses, but they also increase the reliability of the distribution system so that there are fewer power outages for customers. These outages are costly for customers not only because they may lose production (a factory that loses power) or inventory (cold storage or supermarket), but also because they may purchase backup power supplies (for example, diesel generators) to protect against outages. Although these backup power supplies may only operate during power outages, they must be maintained throughout the year. Also these power backups contribute towards polluting the environment. So with bigger vision of clean energy and clean environment PHED is committed to its customers to provide reliable supply.

5.2. Commercial and Customer Service

Prima facie the commercial losses are on account of either or both due to poor energy billing and collection losses resulting from poor customer coverage and response, default by customers, unwillingness or inability of customers to pay in full, leading to part payment. Also non updation or delay in enrollment of customers into the billing fold and improper recordings by measuring instruments due to technical errors contribute to the overall commercial losses.

At present PHED's is having commercial loss to the tune of 37.5% and this plan aims to bridge this gap to minimise these losses to the tune of 4% over a period of five years. This plan has taken comprehensive approach to bridge the gaps across all aspects of Revenue Cycle Management. The following aspects are covered under the Revenue Cycle management; Meter Reading, Billing, Bill Printing, Bill Distribution and Cash Collection.

Figure 16: Goals set to improve Revenue Cycle



5.2.1. Metering

Metering is one of the major enablers in improving operational efficiency and reduction in commercial losses. The PIP advocates for 100% metering of customers covering unmetered, Post paid meters, new connections and separation from enumeration exercise with the help of MAP service providers. The Plan emphasizes on attaining 100% customer metering within two and half years by end of 2022. The table below details the year on year metering plan.

Figure 17: Metering Plan

| Particulars | Unit | 2020 | 2021 | 2022 | 2023 | 2024 | Total |
|----------------------|------------|---------------|---------------|--------------|--------------|--------------|---------------|
| Post-paid to Prepaid | Nos | 113947 | 164676 | - | - | - | 278623 |
| New Customers | Nos | 68738 | 77244 | 16715 | 25018 | 30612 | 218327 |
| Separation | Nos | 74168 | 93770 | 39973 | - | - | 207911 |
| Meter Replacement | Nos | 20362 | 25493 | 27194 | 27944 | 28862 | 129855 |
| Total | Nos | 277215 | 361183 | 83882 | 52962 | 59474 | 834716 |

This approach brings discipline and improves paying behaviour of the customers. Several initiatives have been designed to meet this objectives and they are briefly outlined below.

Mass Meter Roll Out Under MAP

PHED has engaged two MAP service providers. Their scope is to install meters to all unmetered customers, to replace all obsolete analogue meters, and faulty meters with single phase and three phase pre-paid meters as the case maybe. The initiative has commenced with the expectation of completing the first phase in 2021. This scheme will mitigate against all billing related complaints such high estimated billing and also improve the paying lifestyle of the customer to PHED.

Table 44: Meter Installation Planning

| IBC | Total Population | Total Install | 2019 | 2020 | 2021 | 2022 | 2023 | 2024 | Progress Bar |
|------------------------|------------------|---------------|----------|---------------|---------------|----------|----------|----------|--------------|
| Garden City Central | 4868 | - | - | - | - | - | - | - | |
| Garden City East | 36228 | 32428 | - | 12720 | 19708 | - | - | - | ■ ■ |
| Garden City Industrial | 28283 | 21081 | - | 15712 | 5369 | - | - | - | ■ ■ |
| Garden City Main | 16713 | 15863 | - | 4240 | 11623 | - | - | - | ■ ■ |
| Garden City New | 64771 | 62446 | - | 12720 | 49726 | - | - | - | ■ ■ |
| Glory City Main | 32595 | 30145 | - | 15900 | 14245 | - | - | - | ■ ■ |
| Paradise City Main | 30728 | 26078 | - | 13308 | 12770 | - | - | - | ■ ■ |
| Paradise City North | 21511 | 20811 | - | 8480 | 12331 | - | - | - | ■ ■ |
| Promise City Main | 58274 | 52145 | - | 18628 | 33517 | - | - | - | ■ ■ |
| Promise City South | 23476 | 17626 | - | 12239 | 5387 | - | - | - | ■ ■ |
| Total | 317447 | 278623 | - | 113947 | 164676 | - | - | - | ■ ■ |

Figure 18: MAP Flag Off



100% Accuracy of Meter Reading – Post paid meters

PHED currently has more than 116,214 nos. of customers having post paid conventional meters. This strategy includes the institutionalization of various checks to ensure that all post-paid meters are duly read. This is intended to achieve through

- The introduction of IT based application for Photo based Meter Reading. This requires the use of 350 nos of GPS enabled Android Tab to facilitate capturing of consumption readings, which aids to instill accountability, improving productivity and accuracy of meter data. This strategy will be phased out by 2021 when 100% prepaid meter installation shall be completed.
- Secondly, supervisory checks - will be put in place whereby sample checks will be conducted across the books by the Business Unit Managers who are expected to validate 3% of the meter read / submitted values, the Customer service manager to validate 3%, the Business service centre manager to conduct the same for 5% of the metered read population prior to eventual billing.

Replacement of Analogue Meters of MD customers with AMR Technology

MD customers account for 15%- 18% of total energy received by PHED and accounts for 45% of total monthly revenue collection. At present PHED's performance is heavily influenced by its MD customers, it has total of 3099 nos. of MD customers of which 1,350 number of customer meters are yet to be migrated to AMR. Under this plan PHED intends to achieve 100% AMR metering of MD customers by 2021; all MD customers' with Analog meters shall be converted to AMR systems equipped with communication modem. The AMR automatically collects consumption, diagnostic, and status data from meter devices and transfers that data to a central database for billing, troubleshooting, and analysing. Currently, PHED has 3,100 MD customers.

5.2.2. Billing

In the past PHED has been experiencing challenges with respect to estimated bills which are computed following the NERC prescribed regulation. Over a period, the grievances has increased affect on bill distribution efficiency; customers have denied to receive or oblige the bills and hence affected the PHED's revenue performance.

Generating right bill based on the correct energy consumption data is of utmost importance for any Distribution utility in order to realize right revenue. To this end, PHED has plan to take comprehensive strategic initiative of introducing smart technologies and applications to automate billing processes and introduce transparency to regain customers confidence on the quality of bills. The intervention of technology and automation have been put in place over 5 years as short, medium and long term improvement measures:

App based Spot Billing using Android Tab

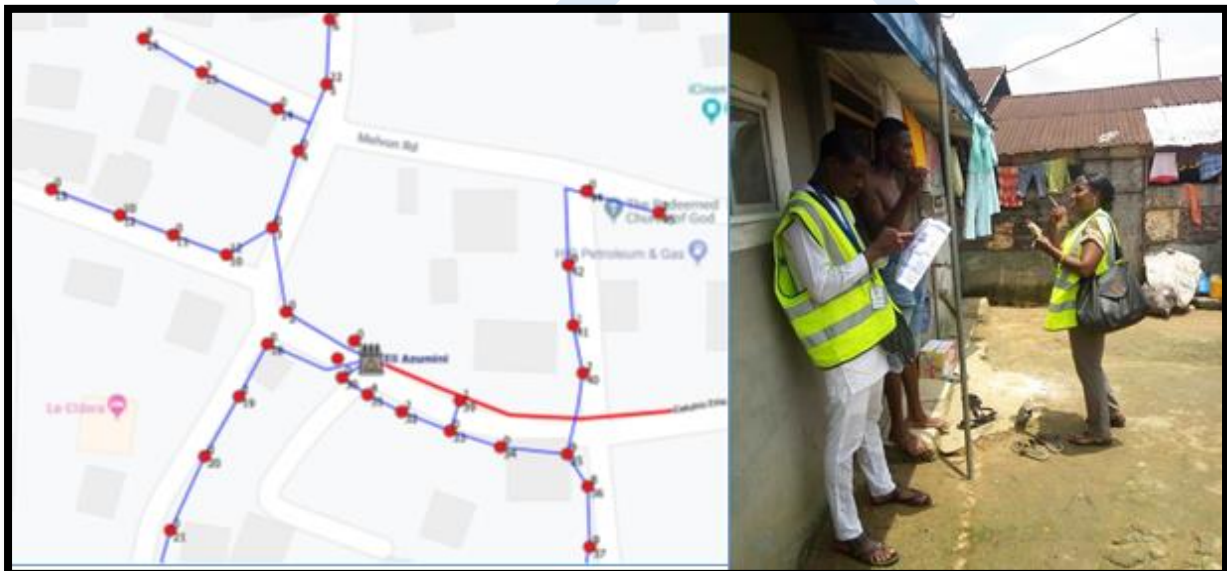
Tab based Photo Meter Reading application is exercised on pilot basis in two urban business units for post-paid metered customers this year. The technology ensures that the meters are read accurately with controls that ensure evidence by way of picture. The extension of this application is the Spot Billing where customers get the opportunity of verifying their bill instantly and making immediate

payment, in case they like to do so. The second benefit is that it reduces the burden on PHED on number of bills to be processed and distributed as this is done online on real-time basis.

Customer Enumeration

The Enumeration of customers and asset mapping of Low Tension (LT) Network was initiated in 2018 and is on the verge of completion. This has not only helped in knowing the existing customers but has also identified customers who are illegally connected to the network and are potential customers. This exercise is also helping in planning the metering roll out under MAP scheme as the entire LT Network and the number of customers connected to the poles are known. With the geographical map in the background, all the inputs required for the detailed planning are now available. This data would help PHED in expanding the customer base, reducing the T&D losses and add to the overall Revenue of the company thereby taking it a step closer to financial sustainability. The sample LT Network on geographical map and interaction with Customer is shown in the figure below:

Figure 19: Customer Enumeration and LT Network



5.2.3. Collection

This plan adopts philosophy of migration from Cash base to “less Cash” approach using technology supported with IT applications. PHED strategise towards ensuring the sustainability of the company and has been designed to redress for the underlisted challenges:

- Customer Coverage
- Recovery of outstanding debts
 - Debt recovery outsourcing
 - Reconnection and Diconnection
 - Bill Revision Camps (BRC)

In addition to above measures, PHED has also planned to bring in policy to adress the grievances that are difficult to reconcile and may invite legal expenses, two such policy that are under development are :

- Out-of-Court Settlement
- One-time Settlement Scheme

- 100% Payment
 - Minimize Part Payment
 - Debt recovery outsourcing
 - Delay payment surcharge
- Revenue Protection and assurance

Payment Collection Agents

PHED is expecting the growth in the agency population to customer ratio of 1:500 in the Q2 of 2020. PHED is aggressively expanding all payment channels to include but not limited to the following i.e. web, mobile, ATM, Bank, wallets etc, making remittance for energy consumed and vending at the convenience of the customer.

Spot Collection App

In the quest to improve customer outreach and service excellence, the on-the Spot-Collection initiative was launched in the Q3 of 2019, first of its kind in Nigeria. The objective of this initiative is to offer cutting edge customer service to the customers to migrate operations from cash based to less cash eliminating

- Manual errors
- Corruption
- Cash misappropriation
- Delay in customer data updation
- Fixing accountability
- Real time performance monitoring & improving productivity

Figure 20: Smart PoS for Spot Collection



New Business Service Centres

Additional 57 nos business service centres will be added to achieve close reach to customers and provide timely services to 1,12,000 customers with an average bill amount of 650 million Naira per month.

Collection Gateway

Increasing collection gateways will increase the ease of services and multiple options for the customer and create convenience for the customer which will in turn improve the collection.

Debt Recovery Outsourcing

This concept entails outsourcing of debt collection to recovery agents. This is aimed at reducing backlog debt owed by customers to PHED and increase collection. The Debt Recovery Agency shall perform the recovery of customers' debt based on the delinquent list provided by PHED i.e. revenue older than three months owed to PHED by customers for electricity supply and related energy supply services. For this purpose, a scope of service has been developed which clearly defines the obligation of both the agency and PHED for driving effective delivery. Excerpt of the scope are as stated:

- To engage with customers contained in the delinquent customers list; this could be done using various communication channels to be deployed by PHED/ the Agency
- To interface with PHED with respect to Bill Reconciliation of the customers contained in the delinquent customer list
- To conduct disconnection of delinquent customers as per the list given by PHED
- To conduct monitoring of the disconnected customer to ensure that they do not reconnect illegally
- To reconnect customers who have either paid or agreed for payment plan, as the list given by PHED

This strategy is planned for implementation with effect from the first quarter of FY 2020 and structured with the implementation timelines for the migration of post-paid Non-MD customers to pre-paid.

Government Dues

PHED strategy towards State owned debt from FY2020 is to form a liaising team at the HQ. The responsibility of this team will be to create synergy with the government that will ensure prompt payment of bills and improved service delivery.

Table 45: MDA Debt

| Figures in Million Naira | 2015 | 2016 | 2017 | 2018 | 2019 |
|--------------------------|-----------------|-----------------|-----------------|-----------------|-----------------|
| Local Government | 1.19 | 18.60 | 27.60 | 66.52 | 74.46 |
| State Government | 931.25 | 1,428.59 | 1,967.12 | 2,365.46 | 2,365.89 |
| Federal Government | 1,534.53 | 2,536.91 | 3,542.98 | 4,309.47 | 4,949.34 |
| Total | 2,466.96 | 3,984.10 | 5,537.70 | 6,741.45 | 7,389.68 |

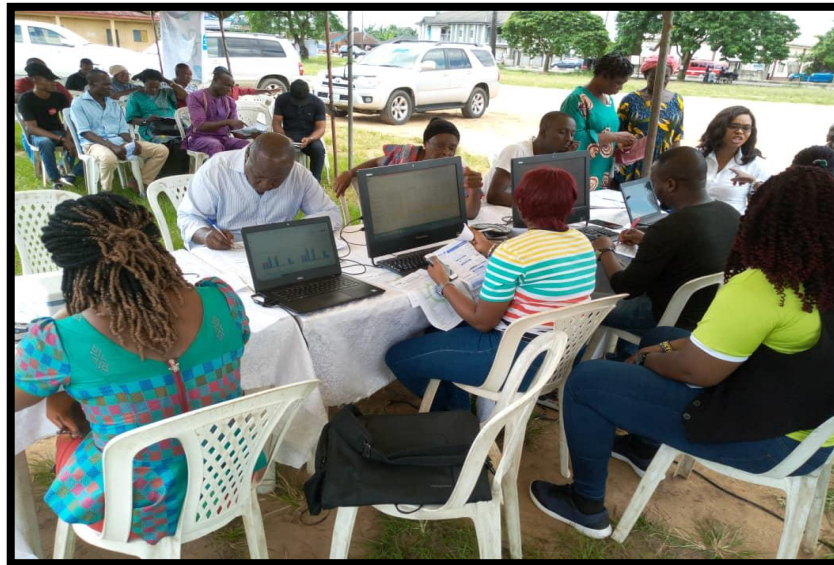
Effective Disconnection and Follow-up

System based list of defaulters (both connected and disconnected) on daily basis to be provided to disconnection team with daily target for disconnection and follow up of disconnected customer. The daily movement of the team will be monitored by the IBC Heads and to be reported to the Regional managers for tracking.

Bill Revision Camps

PHED has been suffering from the Billing disputes of unmeterd estimated billing customers resulting on huge debt on such customers. To encourage customers to clear their debts. We have embarked upon the initiative of setting up Bill Revision Camps from time to time across PHED service area. These Bill Revisions have helped in regaining confidence of customers and many of them are becoming paying customers. From the FY 2020, PHED will be implementing the use of automated Bill Revision model for effective implementation of revised bill on real-time basis and ultimately improve customers confidence.

Figure 21: Bill Revision Camp



PHED's outstanding receivables as at June 2019 is approximately 74 bn. From ageing analysis, it is observed that month on month average outstanding of 2 Bn naira is generated which is expected to grow up further with rise in tariff from minor review in the coming years.

Majority of customers belong to R2 category who have low ability to pay and due to accumulation of huge outstanding, owing to irregular payments or estimated bills. These customers have stopped paying and this habit amongst customers is increasing fast. In order to arrest this habit and recover the debt owed by customers, PHED proposed the following two initiatives

Out-of-Court Settlement

Total 28 cases pending at the court with ₦1.41Bn amount associated with them. Counsellor to be hired for settlement of the cases and an incentive of 5% of the settled amount may be provided. This will increase the customers confidence and reduce exposure to external litigation.

One-time Settlement Scheme

PHED's objective towards this initiative is to give opportunity to the defaulters to settle their dues by introducing OTS scheme on periodic basis to reduce the outstanding dues. Plan for rebate of 20% on the outstanding dues is as per the below chart. It may be carried out for 10-11 days of the respective month starting from 21st until the end of the month.

Distribution Franchisee

PHED will in the FY 2020, franchise a demarcated area to a selected franchisee to create favourable business model that would attract third party investments in the supply of adequate, safe, reliable and prudently managed electricity to PHED customers. The Franchisee will conduct its business using the trade mark, trade name and other uniquely defined identities of PHED with a predefined term of reference and compensation packages for a defined period of time.

The PHED franchising has been unbundled from the NERC original model into the following models based on the peculiarity of the challenges.

- Revenue Collection Based Franchise
- Input Based Revenue Franchise
- Input based franchise
- Operation & Maintenance franchisee
- Community Co-operative Franchise

The implementation of the Distribution Franchising is expected to provide the following contributions:

- Bridging of Power Supply Deficit; where applicable the franchisee may be required to source for more energy from other sources to augment for the deficit from the existing source
- Improved Customer Satisfaction
- Technological Improvements
- Better Service

Revenue Protection

Revenue Protection Department is to Prevent, Detect and Recover from the thefts that are associated with the Electrical Energy. More elaborately, RPD team visits the premises of the customers for inspecting the Energy meter and the associated equipment and provides the report accordingly. The reason behind that is to confirm whether theft of electricity is there or not. And whenever the theft is discovered the supply of the premise is disconnected and corresponding amounts for theft of Electricity is recovered by the Department.

Re-configuration of RPD: With the introduction of more and more pre-paid metering, the role of RPD team will also change and the RPD teams will be on inspection at all times to detect any theft / meter bypass by the customers, as it is rampant practice in PHED area.

Strategy of operation: By collection of information from field by visiting during dark / night time and making it operational during day hours.

In addition to that the above strategy, the Sweep operation shall be conducted on high loss making feeders. On the Sweep operation the door to door inspection of meter and Electricity supply system of every customer is carried out.

For continuous chase up the selected feeders, dedicated teams will be deployed round the year. These teams will be effective after the Feeder sweep teams Swept the Feeders. The thought behind this is the Vending on those feeders should not decrease after the Sweep drive. These teams will also assure that there will be no theft on those feeders.

Focus is to put on utilizing the new document (Field audit forms, disconnection notice, provisional assessment, final assessment forms, and commitment form) within the time frame and disconnection on spot is to be strictly effective. Focus will be given on committed but not paid cases and the booked but not responded cases.

Owing to the wide scope and customer population, especially with the influx of installations of meters for all customer under the MAP project, the department has planned for expansion in the number of field teams to enable them to visit not less than 25% of the entire Non MD customer population within one year and so on. The teams will also cover up all the high-value, MD customers once in every four months to confirm neither there is theft nor Loss of Revenue.

Focus will be provided for every newly installed meters so that they must meet the standard meter installation procedure.

Strong back-end analytics team: A back-end analytics team shall be deployed at the revenue protection department whose solitary responsibility will be analysing the historical data and to provide inputs to the revenue protection team on daily basis so that the field team investigation time can be optimized and theft detection can be narrowed down by the data made available. With this the probability of converting the visits into theft cases will be increased.

Database for suspected list: Own data base for suspected list shall to be prepared by gathering information from field and at IBC level

Meter testing of MD customers: Every customer meter will be tested once in every six months including inactive customers

PHED spread over vast area having diverse geographies and culture with some of the places are difficult to approach or operate. It is not possible to touch all the areas with same intensity. Keeping this diversity and operability in mind, the intensity of above devised initiatives has been strategised.

The implementation of above strategies shall be driven based on characteristics of Area and Customers.

- Geographical area profile
- Customer profile
- Historical habit of customers
- Law and Order situation
- Approach and communication Infrastructure

Table 46: Intensity of Payment Collection Initiatives w.r.t. Area Profile

| Initiatives | Peri Urban | Manageable area | Un manageable area | Urban area |
|---------------------------|------------|-----------------|--------------------|------------|
| Spot Collection | | | | |
| Bill revision camps | | | | |
| Part Payment | | | | |
| One time Settlement | | | | |
| Government Dues | | | | |
| Out of court | | | | |
| Community Engagement | | | | |
| Distribution Franchisee | | | | |
| Debt Recovery Outsourcing | | | | |

5.2.4. Customer Service

Customer Charter

PHED as a customer centric organization with a large customer base has lots of complaints and inquiries to attend to in order to satisfy its customers. In a bid to reduce these complaints and inquiries, a ready guide and insight to the organization's mission, function and obligation to the customers necessitates the Customer Charter.

From January 2018 to June 2019, number of customer complaints received increased from an average of 2,206 to 3,199 per month. This gave rise to a total of 26,472 in 2018 to a projection of 38,388 by the end of 2019 i.e. 45% increment.

With a handy customer charter available to all the customers, these complaints will reduce, rate of fraud against customer will reduce and customers would be well informed and overall customer satisfaction would improve.

The customer charter covers all customer centric aspects of the Metering, Billing and Collection (MCB) functions in PHED. In essence, this initiative will give the customers insight and relative closeness to the company by taking the following into cognizance.

- Overview of PHED as an organization
- Customer Care services and complaint redressal process
- PHED Touch Points
- Frequent Ask Questions
- PHED management's contacts

With a copy of this charter in every home of PHED customers, the customer enlightenment and satisfaction would surely improve.

My Voice Day

My Voice Day initiative is veered towards customer's complaint redressal. It will be a Day set aside for the customers' voices to be heard through a robust and formal platform that will guarantee expeditious resolution of conflicts brought before it. It is a strategy to improve the customer experience by incorporating and fast tracking customers' feedbacks into the business operations. Simply stated, it will provide customers the opportunity to address their unattended queries, complaints etc. that were previously registered either via the call centre, customer service desk, but not resolved.

The major aim of My Voice Day initiative is to reduce the external exposure to litigations. It will also help to increase the customers' confidence in the organization as it will be providing expeditious resolution of conflicts registered by the customers after hearing from them on the spot, depending on the nature of the problem.

This initiative is to be held once every month across all IBCs in the state. This will drastically reduce the number of complaints filed to NERC or Court.

Below table shows the number of complaints that has gone to NERC and Court and the cost implication on us as an organisation.

Customer Engagement

PHED recognize that its cash flow problems have as much to do with its own performance as with customer intransigence. People dislike paying for a service unless they believe it has value and meets their needs and expectations. PHED is proactive in reaching out to its public, soliciting its input (and often, weathering its pent up frustration), and describing the actions that will be taken, and how they will benefit both PHED and the customer.

Journey from merely providing Electricity to “Customer-Centricity”

To be truly customer-centric PHED started by obsessing over customer experience. PHED designs its systems, policies, procedures, and processes from a customer’s perspective. At PHED one of the mantras is to “make it easy”. Importantly, make it easy for customers and employees. More often than not, simplifying a process or a policy to make it easy for customers is also the most efficient and, almost by definition, the lowest cost.

Key Customer Meet

60% of the revenue generation comes from the high revenue customers. In order to appreciate the customers and also to foster the KYC initiative of the company, PHED therefore will be conducting on quarterly basis, an informal/social event with selected high revenue customers. This event is designed to connect the customers with the business goal of PHED and also to provide the customers the opportunity to be enlightened about the policies that govern the electricity industry. Broadly put, the objective of this initiative are as stated thus:

- Understanding customers need
- Understanding customers industry challenges
- Customer appreciation
- Customer perspective
- Building/strengthening relationship

The event will have PHED giving insights to its commercial and technical plan for the short, medium and long term, the regulatory policies that govern the industry, the current debt and revenue profile of the company, appreciation/recognition of all customers present, feedback sessions and selected customer across different business areas to highlight their business energy need. This initiative will take place quarterly and rotates across the four states.

Table 47: Key Strategies

| Sr. No. | Activities | 2020 | 2021 | 2022 | 2023 | 2024 |
|---------|---|------|------|------|------|------|
| 1 | Customer Service & Customer Relationship | | | | | |
| | Implementation of Complaint resolution TAT | | | | | |
| | Implementation of internal grievance redressal cell | | | | | |
| | Implementation of CRM and associated tools | | | | | |

| Sr. No. | Activities | 2020 | 2021 | 2022 | 2023 | 2024 |
|---------|---|------|------|------|------|------|
| | Restructuring of effective call center | | | | | |
| | VoC-Voice of customer | | | | | |
| 2 | Enhancing Customer Experience | | | | | |
| | Know your customer | | | | | |
| | Implementation of P-Connect (PHED-Connect) | | | | | |
| | Facebook/Twitter/YouTube/Live-Chat | | | | | |
| | Advance payment scheme to earn interest | | | | | |
| | Pay & Win scheme | | | | | |
| | Cash-back offers- Cashless Transactions | | | | | |
| 3 | PHED Branding- Customer Empowerment | | | | | |
| | Customer charter (hand book) | | | | | |
| | Customer self-employment orientation- Vocational training | | | | | |
| | Video conferencing customer service | | | | | |
| 4 | Creation of stakeholder & Brand Ambassadors-Customer Accreditation Cell | | | | | |
| | Youth energy champions- Schools and Tiny Toddlers | | | | | |
| | Senior citizen meets | | | | | |
| | Women meets | | | | | |
| | HRB & MD customer meet | | | | | |
| 5 | Ease of Service | | | | | |
| | New Service Connection | | | | | |
| | On-Spot New service connection (Tab photo based) | | | | | |
| 6 | Efficiency Improvement | | | | | |
| | Input Energy Management | | | | | |
| | Customer Categorization of Feeders (High Revenue Base & High Customer Base): | | | | | |
| | Alternate reliable source of supply – Embedded Generation/Off-Grid | | | | | |
| | Feeder Sanitization | | | | | |
| | Feeder Manager | | | | | |
| 7 | Metering | | | | | |
| | 100% accuracy of customer metering | | | | | |
| | Mass meter rollout | | | | | |
| | Replacement of analog meter with AMR | | | | | |
| | New Connection through Prepaid Meter | | | | | |
| | Feeder metering-33 & 11 KV | | | | | |
| | DT metering | | | | | |
| 8 | Billing | | | | | |
| | App based spot billing (Photo Based) | | | | | |
| | Improvement in Accuracy of estimated billing | | | | | |
| | Automated bill revision module | | | | | |
| 9 | Collection | | | | | |
| | One time settlement scheme | | | | | |
| | Collection work flow system | | | | | |
| | Outbound dialers | | | | | |
| | Mobile app based Spot Collection System | | | | | |
| | State/IBC level billing & printing system | | | | | |
| | Distribution franchisee (Feeder wise, BSC wise, IBC wise, Substation level, DT level, WSHG) | | | | | |

| Sr. No. | Activities | 2020 | 2021 | 2022 | 2023 | 2024 |
|---------|--|------|------|------|------|------|
| | Outsourcing of specialize activity- Metering, Debt Collection, NSC | | | | | |
| 10 | Customer branding and CSR activity- PCB strategy | | | | | |
| | Special focus on low pyramid communities | | | | | |
| | Free NSC/reduced cost | | | | | |
| | Health care/Education/Life Insurance | | | | | |
| | Employment | | | | | |
| | Social Collaboration (NGO, church etc.) - Awareness creation, theft control, energy conservation | | | | | |
| 11 | E-Initiatives | | | | | |
| | SMS PULL/PUSH and Email service | | | | | |
| | Mapping through google maps of PHED avenues | | | | | |
| 12 | IT Support | | | | | |
| | Automated enforcement assessment module | | | | | |
| | Integration of MBC | | | | | |

DRAFT

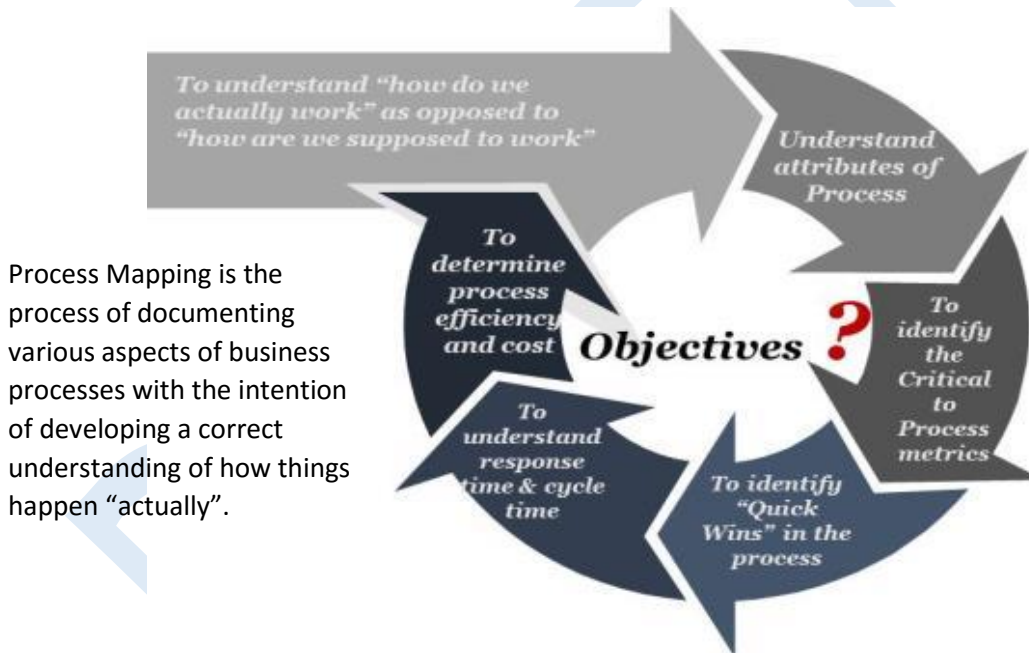
5.3. Process Re-Engineering

In PHED the customer is strength, future and existence in the business. The approach toward work is a key importance to PHED as a business unit and to the organisation, hence PHED shall be ensuring that, in satisfying the customer and achieving full automation within 2020-2024 the manual processes will be perfected and ready for full automation. As a step to better improve the processes, in 2018 and 2019, interaction with stakeholders were conducted and processes drafted covering areas of gaps and for better services.

In Process re-engineering, it starts with looking at current practices, SOPs, SLAs, risk and responsibility for finding gaps followed by interaction with stakeholders for identifying further gaps. These gaps are carefully studied in line with global standards and regulations as it relates to the power sector. The strategy in Re engineering system and processes is hereby shown below.

5.3.1. Process Strategy

Figure 22: Process Strategy



Process Mapping is the process of documenting various aspects of business processes with the intention of developing a correct understanding of how things happen “actually”.







Identifying gaps

Within 2018 and 2019, PHED has been able to map out a total of sixty five (65) fine-tuned processes across various functions following the identification of gaps that needed urgent process development and roll out in the system. Each of the processes drafted is discussed with the process owners for acceptance before being rolled out. Below is an example of a process (Meter reading of MD customers). Gaps were identified and accordingly solutions were mapped which will mitigate the gaps along-with the enabler required and the benefit from the same. The below table enlists the gap identification for the process of Meter Reading of MD Customers.

Table 48: Process Gap Identification

| S. No. | Gap Identified | Solution Proposed | Enabler Required | Benefit |
|--------|--|---|--|---|
| 1 | AMR Data is sent Manually to the Billing Department | The Billing Engine was directly used to pull the data from the AMRs | Enable the IT software to do so. | Effective Billing and timely readiness of bill for MD Customers |
| 2 | The Meter Reading Target not given from Higher Authority | A Prepopulated Reading Sheet is provided monthly for each marketer by the MD Coordinator with the defined list of Customers to be read for the Month. | A Pre-Populated Sheet prepared by MD Coordinator and Eliminate Book Code Folders | All meter was read and the present meter status is ascertained. |
| 3 | No Structured Mechanism to monitor the Customer Coverage on daily Basis. | Daily meter Reading Sheet and Daily Monitoring on the Target Vs Achievement of Meter Reading for every Marketer. | | Slippages are reduced in meter reading and customer satisfaction is improved. |
| 4 | A large amount of Estimated Billing is Done, and No Contribution done during meter reading cycle | Visit at least twice before billing the Customer on average and Maintain Record | | All customers are billed correctly as to ensure that all customer are visited at least twice |
| 5 | There is no Monitoring/ record Keeping from MD Coordinator's Side on Marketer's Performance or Checking of any Ethical Issues on Field | Having a Check Reading Record (Done Physically by visiting the Customer Premise to check if the reading taken is right as written by Marketer) | Additional Responsibility for MD Coordinator | Expanding Authority to Field and Regular Checks will reduce the Scope of Ethical Issues. Improved supervision |

Processes were mapped accordingly, and the gaps are filled by reengineering the current processes as well as documenting. All Processes documented have the following format:

| | | | | | |
|---|---|---|---|--|---|
|  |  |  |  |  |  |
| Triggers (Start of Activities) | Responsibility | Activity | Output/ Records | Business Risks of Compliance | Control/ SLA |

All these processes are coupled with Supporting Formats as Required, Process Quantifiers and Auditing Parameters.

Following are the benefits of the new processes:

- Responsibility of role is clearly defined
- Improve internal communication
- Customer satisfaction
- Improved turnaround time
- Well defined SLA's Risk against most of the activities
- Identified risks are well resolved.

- Same result across the organization
- Same service rendered across the organization

The aim of Business Process Re-engineering (BPR) is to change the organization for the best. However, as BPR is a radical rather than incremental change, it is not a surprise that ‘resistance to change’ was seen as a major barrier to the success of BPR in 2018 but there is more acceptability in 2019. PHED has also linked the Process Performance with the Balance Score Card so as to bring about the discipline in working. For the people, BPR is perceived as a threat to their jobs, either a threat directly to their existence or a threat to the quality and content of their jobs. To overcome this barrier and for smooth transition, each process was discussed with the functional heads and sign off was taken from them since the functional heads are the drivers and a key success factor of change. After sign off by the respective functional heads, the roll out of the processes was done and monitoring took place in a span of 3 months before process audit was done.

Table 49: Processes identified and drafted in 2018 and 2019

| Function | Process |
|--|--|
| Analytics | <ul style="list-style-type: none"> • Analytics |
| Energy Management | <ul style="list-style-type: none"> • Energy Management |
| Ancillary Services | <ul style="list-style-type: none"> • Community Engagement • Procurement • External Communication |
| New service connections | <ul style="list-style-type: none"> • New service Connections MD • New service Connections Non MD • New Service Connection – MAP (MD and Non MD) |
| CAPEX | <ul style="list-style-type: none"> • Mass Metering Installation |
| Preventive Maintenance | <ul style="list-style-type: none"> • Preventive Maintenance LT |
| Revenue Protection | <ul style="list-style-type: none"> • Revenue Protection |
| Material & Stores | <ul style="list-style-type: none"> • Receipt • Issuance • Field Returns & Warranty • Reconciliation & Audit |
| Customer Services | <ul style="list-style-type: none"> • Customer Care • 16 Service Response Documents |
| Arrear Recovery | <ul style="list-style-type: none"> • Arrears & Disconnection Management |
| Commercial | <ul style="list-style-type: none"> • Meter Reading - NON MD • Meter Reading - MD • Bill Processing – Metered (Non MD) • Bill Processing – Unmetered • Bill Processing - MD • Bill Distribution • Collection Management • Spot Collection • Bill Revision • Active to Inactive • Debt Recovery |
| Measurement Analysis and Improvement | <ul style="list-style-type: none"> • Internal Auditing |
| Management Review & Planning | <ul style="list-style-type: none"> • Policies, Directions & Quantifiers • Planning, Monitoring & Review of Plans |
| Resource Management: Human Resources & Admin | <ul style="list-style-type: none"> • Payroll • Recruitment • Promotion • Resignation |

| Function | Process |
|------------------------|---|
| | <ul style="list-style-type: none"> • Retirement • Termination • Disciplinary Action • HOTO – (Hand Over Take Over) |
| Technical | <ul style="list-style-type: none"> • Usage of Transformer oil in the workshop • Vegetation Control • Repairs/ Return of Faulty Transformer • Movement of Assets • Outage Management • Rapid Response • Normal Response |
| Information technology | <ul style="list-style-type: none"> • IT Assets Replacement • IT Assets repairs/ Stolen |
| MAP | <ul style="list-style-type: none"> • Network Rehabilitation and Premise certification • Bill Reconciliation • Payment for Meter Installation • New Service Connection (redefined for MAP) |

5.3.2. Implementation and Capacity building

Training

To inculcate the new processes among the stakeholders, training was carried out in June to August, 2018 and February to March, 2019. Another training is planned for October, 2019. The functional heads were trained first since they were mainly the process owners and this was followed with the training of the entire staff.

The team to manage system and processes were selected and some recruited to enhance the team. At the formation of the team, training of the Trainers of different functions was done in 2018 and a refresher training for 2019. After building capacity internally with the Process team (Champions), they were deployed to the business at different location to handhold the staff at their day to day function so as to enable better perform at their jobs and also create support to the staff. In 2019, the table below show the trainings and pictures during the training in 2019.

Table 50: FY 2019 Process Training Statistics

| Location Covered | Processes Covered | Number of Process Sessions | Number of Trainings in 2019 |
|------------------|-------------------|----------------------------|-----------------------------|
| 55 | 57 | 450+ | 6 |

Figure 23: Process Trainings



Monitoring and Auditing

After the roll out of the new processes, monitoring and auditing is utmost required so as to ensure that the processes are engraved into the subconscious mind. The first Process Audit was carried out within October to December, 2018. Following the outcome of the 2018 audit score which was published across the business, a quarterly audit was introduced in 2019 to increase the number of checks and also the process champions were increased across the business to effectively correct the observed gaps (Non – conformities). Till now three (3) audit have been conducted and a lot of improvement have been observed but more and constant improvement is still needed to sustain the expected results in future. Surprise checks were also introduced in 2019. Below show the Calendar for 2019 as well as an example of one of the process audit reports.

Table 51: Yearly Activity Calendar Process Re-Engineering

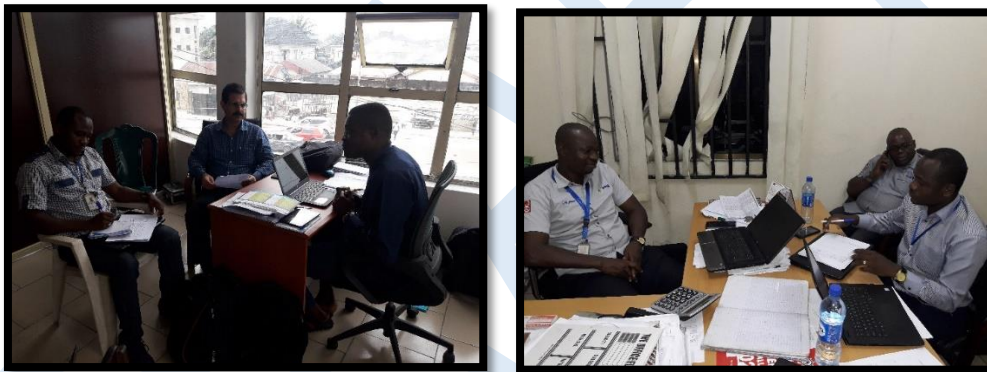
| Activity | FY 2019 | | | | | | | | | | | |
|--|---------|----|----|----|----|----|----|----|----|-----|-----|-----|
| | M1 | M2 | M3 | M4 | M5 | M6 | M7 | M8 | M9 | M10 | M11 | M12 |
| Process Transformation / Alignment with Automation | | | | | | | | | | | | |
| Process Training | | | | | | | | | | | | |
| Handholding Support to Staff | | | | | | | | | | | | |
| Process Audit | | | | | | | | | | | | |
| New Process Development | | | | | | | | | | | | |
| Train the Process Champions | | | | | | | | | | | | |

Figure 24: Sample of an audit result

| IBC Name | Q1, 2019 | | Q4, 2018 | | QoQ Improvement |
|----------|----------|------|----------|------|-----------------|
| | Score | Rank | Score | Rank | |
| GCN | 91.5 | 1 | 42.1 | 6 | ↑ 117.2 |
| GCC | 90.9 | 2 | 57.0 | 4 | ↑ 59.5 |
| PaCM | 85.2 | 3 | 24.6 | 9 | ↑ 246.8 |
| GCM | 74.3 | 4 | 58.8 | 2 | ↑ 26.4 |
| GCI | 73.1 | 5 | 54.9 | 5 | ↑ 33.2 |
| PrCS | 68.2 | 6 | 33.3 | 8 | ↑ 104.6 |
| GICM | 64.7 | 7 | 60.7 | 1 | ↑ 6.5 |
| PrCM | 59.7 | 8 | 34.7 | 7 | ↑ 72.1 |
| PaCN | 59.0 | 9 | 15.1 | 10 | ↑ 290.0 |
| GCE | 35.6 | 10 | 58.2 | 3 | ↓ -38.9 |

| Legend | |
|--------------|---------|
| Excellent | >80 |
| Very Good | 70-79 |
| Good | 60-69 |
| Satisfactory | 50 - 59 |
| Poor | <50 |

Figure 25: Audit of Departments



Re-evaluation for Improvement

From the Process Audit and daily feedback from the Process champions and user, identified gaps are recorded in what is regarded as non-compliance reports (5 Whys Master Sheet). This non-compliance reports are looked at thoroughly with the process owners and improvement is inputted to existing processes when necessary and communicated to the users with the Process champion handholding the users on a daily basis for improvement. A sample of a non-conformities form as issued for noncompliance is shown below and the next table show a summary of recorded non conformities for the audit as archived.

Figure 26: Process audit non conformity report sample

| 5 Whys Master Sheet | | | | | | | | |
|------------------------------|----------------|-----------|-----------------|-----------------|----------------|---|--|---------------------------|
| SI | NCR. No. | Function | Date of Audit | Target Date | Process | NCR | (5 Whys) Why (1) | Corrective Action Plan |
| FY19/Q2/NC/PHED /PRO/AUD/001 | 201810/ORZ/001 | BSM | 03/06/2019, Mon | 10/06/2019, Mon | MR-NonMD | No sharing of exceptional case list | Oversight | Conctant Supervision |
| FY19/Q2/NC/PHED /PRO/AUD/002 | 201810/ORZ/002 | BSM | 03/06/2019, Mon | 10/06/2019, Mon | BRC | No BRC attendance registe | No awareness of keeping that record | Conctant Supervision |
| FY19/Q2/NC/PHED /PRO/AUD/003 | 201810/ORZ/003 | Marketers | 03/06/2019, Mon | 10/06/2019, Mon | MR-NonMD | No evidence of sharing the exceptional case list with BSM | No awareness of keeping that record | Conctant Supervision |
| FY19/Q2/NC/PHED /PRO/AUD/004 | 201810/ORZ/004 | BSM | 03/06/2019, Mon | 10/06/2019, Mon | MR-NonMD | Not sharing exceptional case list with RPD & Metering Engr. | No awareness of keeping that record | Conctant Supervision |
| FY19/Q2/NC/PHED /PRO/AUD/005 | 201810/ORZ/005 | BSM | 03/06/2019, Mon | 10/06/2019, Mon | MR-NonMD | No consolidated meter reading list | Complaint of lack of tool such as internet facility to | Conctant Supervision |
| FY19/Q2/NC/PHED /PRO/AUD/006 | 201810/ORZ/006 | BSM | 03/06/2019, Mon | 10/06/2019, Mon | BRC | No BRC attendance register | No awareness of keeping that record | Conctant Supervision |
| FY19/Q2/NC/PHED /PRO/AUD/007 | 201810/ORZ/007 | Marketers | 03/06/2019, Mon | 10/06/2019, Mon | Overbill-NonMD | No Marketers field report for overbilling cases | No awareness of keeping that record | Conctant Supervision |
| FY19/Q2/NC/PHED /PRO/AUD/008 | 201810/ORZ/008 | CCO | 03/06/2019, Mon | 10/06/2019, Mon | NSC-NonMD | No call register for follow up calls on new connections | Poor customer relationship mgt. | Conctant Supervision |

5.3.3. Process Plan

In order to sustain the achievement for 2019 and to achieve the target of being an ISO certified organization in the next five years, an elaborate plan has been drafted as shown in the table below. This plan will be followed for the purpose of improving customer satisfaction, improving employee productivity. Turnaround time (TAT) will surely improve through effective internal communication which will increase Profitability of Organisation. Whenever customers are satisfied, there is no doubt that the revenue will increase, PHED is absolutely committed to providing services for the maximum satisfaction of their customers via standard processes.

Table 52: Process Plan 2020-24

| Sr. No. | Activities | 2020 | 2021 | 2022 | 2023 | 2024 |
|---------|--|------|------|------|------|------|
| 1 | Process Training | | | | | |
| | Staff Training on Processes (New & Improved) | | | | | |
| | New Employee Training on Processes (On Boarding) | | | | | |
| 2 | Process Compliance | | | | | |
| | Process Audit | | | | | |
| | Process Score Reporting | | | | | |
| | Surprise Check and Visit | | | | | |
| 3 | New Process Development | | | | | |
| | Technical Processes | | | | | |
| | Energy Management | | | | | |
| | Metering | | | | | |
| | IT Processes | | | | | |
| | Material Management | | | | | |
| | HR | | | | | |
| | Regulatory Process | | | | | |
| | Internal Audit | | | | | |
| | Legal | | | | | |
| | Finance/Accounting | | | | | |
| 4 | Process Improvement | | | | | |

| Sr. No. | Activities | 2020 | 2021 | 2022 | 2023 | 2024 |
|---------|---|------|------|------|------|------|
| | Existing Process Transformation/Alignment with Automation | | | | | |
| | Handholding support to staff (Including New Employees) | | | | | |
| | Train of Process Champions at IBCs | | | | | |
| | Continuous Process Improvement | | | | | |
| 5 | Process Standardization and Certification | | | | | |
| | ISO Training to Process Team | | | | | |
| | ISO Certification | | | | | |
| | 5S Training to Process Champions | | | | | |
| | 5S implementation | | | | | |

The activities planned for 2020 to 2024 are as follows:

Process Training

In 2018 – 2019, over 70% of total PHED staff and 87% of commercial staff have been trained on various processes as it relates to their jobs. Training will never be enough and PHED is committed to continue in training and retraining of its staff to maximize performance and improvement in customer satisfaction. In the next five years, PHED is targeting the training of all staff both new and existing staff. Process writing is a continuous activity that must be communicated to users and proper plan must be put in practice to promote understanding as well improvement in the use of these processes during their day to day activities.

Staff Training of Processes

New and revised processes will be shared to all staff and training will be conducted half yearly for the next five years to better equip the staff in response and the appropriate action to take as it relates to regulation and service level agreement of the business. Improved processes shall be stressed on for emphasis to better serve the customers. Along with the existing staff, the new staff will also be taken through the entire processes and policies during these trainings. Specialized training on role based training which relate to the employee core areas of function will be separately conducted. Handholding will also follow after the training sessions so as to keep the new staff on track.

Process Compliance

If processes are developed, deplored and implemented, it must be measured to ascertain compliance. In order to measure the process performance compliance, strategies, parameters and measurement criteria are put in place to check staff improvement via audit, reporting and Surprise Checks and visit. A sample of this parameter is hereby shown below.

Figure 27: Sample Audit parameters

| Sl no. | Process | Evaluation parameter | Staff | Level | Max Score | Opolo |
|--------|----------|--|----------|-------|-----------|-------|
| 1 | MR-NonMD | Monthly / Daily Reading Plan & Schedule by BSM on the 2nd of the month | BSM | BSC | 5.0 | NA |
| 2 | MR-NonMD | Ensure the 'Meter Reading Activity' starts on 5th of every month (5th for April & June, 6th for May) | BSM | BSC | 5.0 | NA |
| 3 | MR-NonMD | Manpower Availability Management 2nd of the month | BSM | BSC | 5.0 | NA |
| 4 | MR-NonMD | Evidence of starting Meter Reading Activity on 5th of every month (5th for April & June, 6th for May) | Marketer | BSC | 5.0 | 5.0 |
| 5 | MR-NonMD | Sending of Meter Reading daily to the BSM/CMRBD | Marketer | BSC | 5.0 | 5.0 |
| 6 | MR-NonMD | Send Meters Not Read list showing details of customer(s) (with date and time) whose premise(s), after twice visitation was/were not accessible for meter reading during the meter reading cycle to BSM/CMRBD | Marketer | BSC | 5.0 | 5.0 |
| 7 | MR-NonMD | Sending of BSC daily meter reading to CMRBD HQ | BSM | BSC | 5.0 | NA |
| 8 | MR-NonMD | Exception list with customer details, if any (like Meter Status Burnt/ Stopped/No Display or ethical) & forwarding to the BSM on daily basis. | Marketer | BSC | 5.0 | 4.5 |
| 9 | MR-NonMD | Exception list with customer details, if any (like Meter Status Burnt/ Stopped/No Display or ethical) & forwarding to the CSM on daily basis. | BSM | BSC | 5.0 | NA |
| 10 | MR-NonMD | Sharing List of exceptional cases daily to the concerned dept (RPD / Metering) by BSM | BSM | BSC | 5.0 | NA |
| 11 | MR-NonMD | Check Meter Reading by BSM (3% of each marketer's target) daily and sending of report to CMRBD HQ | BSM | BSC | 5.0 | NA |
| 12 | MR-NonMD | Marketer's Performance Analysis (Marketers Target vs Achievement and sharing daily to MRBD Coord HQ | BSM | BSC | 5.0 | NA |
| 13 | MR-NonMD | Sharing of the consolidated excel sheet (meter reading, customer details) by BSM to CSM at the end of each cycle | BSM | BSC | 5.0 | NA |

5.3.4. Process Audit

Process audit is a check that is done quarterly to ensure that developed processes is being followed. Non conformities are issued to staff that has gaps during these audit so as to clearly show the areas for improvement. These marked areas for improvement are discussed with the affected staff by the process champion to close out so as to avoid services that are not expected. An audit score is derived from these activities in numbers to show performance across the business.

Process Reporting

From process audit, scorecard is developed and reported across the business for each of the audit exercises, improvement plan/strategies are developed and followed rigorously to ensure compliance before the next periodic process audit.

This reporting is targeted towards creating a healthy competition amongst staff so as to be of best performance thereby promoting customer's satisfaction and prompt response to expected services. For sample Audit Score Card, please refer Annexure 1: Process Audit Score Card.

Surprise Checks and Visit

After each process audit, for compliance and adherence, surprise checks will be conducted at random location for the purpose of measuring performance before the next periodic audit. After each surprise visit, a report will be made to evaluate performance again and handholding intensified if gaps are still identified.

5.3.5. New Process Development

New processes are developed as the need arises and area of gaps identified. These processes are developed as it relates to each department - Technical Processes, Energy Management, Metering, IT

Processes, Material Management, Human Resources, Regulatory Processes, Internal Audit, Legal, Revenue Protection Department and Finance/Accounting.

Every developed processes is shared with the process owners and training is conducted immediately on these processes that are closed out and rolled into operations.

5.3.6. Process Improvement

Every process that is developed has to be followed and checked for improvement if there is any. Improvement is to ensure that the business does not go obsolete, as there will be policies at various times and processes must be improved to align to innovations.

Existing Process Transformation/ Alignment with Automation

Every automation needs an existing process to run on. In the next five years, PHED shall be working with the Information Technology (IT) to perfect its automation systems. Every activity that requires automation shall be documented and training carried out to users to ensure seamless transfer of operation.

Automation is a direct product of good processes hence PHED shall ensure that the processes are used and understood properly via various evaluation steps before automating due processes.

5.3.7. Handholding Support to Staff

Handholding is the support rendered to users on the job to show the users exactly the stepwise approach towards carrying out their jobs. This will be continuous throughout the five (5) years plan as support towards becoming a customer satisfying company. PHED is committed to seamless transfer of knowledge, improved customer satisfaction via Processes & automation, improved revenue, aiming at being ISO certified within the next five years, hence PHED has already trained and positioned Process trained staff at all of its business locations to effectively drive this initiative. The further planning is shown in the plan.

5.3.8. Training of Process Champion

Process champions are the ones at each location that will be supporting (handholding) the staff daily across the Integrated Business Centre (IBC). This group of specially trained staff will further be trained and retrained in the next five years to promote enhanced performance.

5.3.9. Process Standardization and Certification

As one of the goals for this activity is for the company to be ISO certified within the defined period. One of the steps towards achieving this goal is to prepare the process team towards certification. PHED is committed towards getting the best training for the drivers of this initiative at all levels towards customer satisfaction and becoming the best among the discos. The entire initiative of the Process team shall lead PHED to a milestone of ISO certification.

5.4. IT and Automation

Till now, the approach of the PHED towards IT implementation has been piecemeal with standalone applications deployed for a limited operational use. IT has been used as a tool to address a specific issue or two at a time and not as a long-term, holistic strategy. There is a human intervention even in processes which are IT enabled thus under-utilizing the advantage of introduction of technology and therefore, there is plenty of scope for the adoption of new and improved IT applications.

Regulation has opened up new opportunities, forcing utilities to expand the focus from simply providing energy, to rethink the strategies and align them more closely with customer needs. PHED is therefore renewing activity directed at improvements in operations, use of information technology and automation of business processes. Additionally, more cross-functional business processes and customer service-focused solutions are being introduced to improve operational efficiency, maintain and expand the customer base.

As customers and business partners increasingly demand greater empowerment, PHED seeks to improve interactions and relationships in the entire business ecosystems by enhancing software capabilities for collaboration, gaining deeper customer and market insight and improving process management. The IT initiatives were planned with an objective of streamlining essential business processes along with strengthening of decision support system.

PHED has prioritised adoption of information technology solutions “DL Enhance” to modernise, integrate and secure its systems.

The DL Enhance Series is a comprehensive state-of-the-art integrated solution. It is a utility specific solution that addresses the end to end requirements of the utility business processes offering exhaustive functionalities with best industry practices. PHED is in the process of implementing seven of its modules addressing Meter Reading, Billing, Collection, Energy Management, CRM, MIS and New Service Connection – integrated with the existing prepaid recharge system. So far 5 modules have been rolled out while the other two are under pilot run.

- DL Enhance-MBC
- DL Enhance-Energy Management
- DL on Board-New Service Connection
- DL Insight-Dashboard & MIS
- DL Connect- CRM

Benefits

The various benefits that various stakeholders of PHED would derive from DL Enhance are:

Management: Consistent and correct information, energy accounting, effective monitoring at all levels, data-based decision-making, shorter cycle time leading to quicker realisation of revenue, fewer consumer grievances

Users: One-time data entry eliminating duplicity of work, online data entry validation eliminating data entry errors, flow of information across the various departments seamlessly, faster response to consumers’ queries, focus on core activities,

Consumers: Accurate bills, faster service time, single window service, data-based dispute settlement, user-friendly services through internet, SMS, IVRS, etc.

Figure 28: DL Enhance



5.4.1. Information Technology Plan and Status

The IT initiatives in FY 2020-24 are planned with an objective of streamlining essential business processes along with strengthening of decision support system.

Every plan as shared in the table is further explained in details for clarity. In the way of committing to employees service delivery and customer experience of PHED and in turn satisfy the customer, PHED plans to go full automation via deployment of advanced IT systems & application over the period of 5 years it is clearly shown in the table. The 5 year vision of IT & automation also covers all business aspects of various departments with PHED.

Table 53: IT and Automation Plan 2020-24

| Sr. No. | Projects/Activities | Completed | 2020 | 2021 | 2022 | 2023 | 2024 |
|---------|--|-----------|------|------|------|------|------|
| 1 | Strategies and Business Requirement | | | | | | |
| | Execution of Policy, Process, procedure and security | | | | | | |
| | Project Management System | | | | | | |
| 2 | Customer Service | | | | | | |
| | New Service Connection | | | | | | |
| | Mobile Photometer Reading | | | | | | |
| | Customer Engagement Management System with social media integrations | | | | | | |

| Sr. No. | Projects/Activities | Completed | 2020 | 2021 | 2022 | 2023 | 2024 |
|---------|---|-----------|------|------|------|------|------|
| | PHED API for 1 st level customer service by Agents | | | | | | |
| | Works Management system | | | | | | |
| | Attribute Change Management System (CRMD) | | | | | | |
| | E-bill and SMS bill transmission and Payment | | | | | | |
| | PHED USSD channel for payment and Customer interaction. | | | | | | |
| | PHED Call centre Interactive Voice Response Upgrade | | | | | | |
| | PHED Call Centre Monitoring and Quality assurance system | | | | | | |
| 3 | Billing | | | | | | |
| | Pre Bill Validation | | | | | | |
| | Billing and Collection Module | | | | | | |
| | Post Bill Analysis | | | | | | |
| | Spot Billing system | | | | | | |
| | Decentralized Bill Printing | | | | | | |
| 4 | Energy Accounting and Auditing | | | | | | |
| | AMR MD Customers Metering and analytics | | | | | | |
| | Optimized MAP system for non-MD metering | | | | | | |
| | 100% AMR Feeder Metering and analytics | | | | | | |
| | 100% AMR DTR Metering and analytics | | | | | | |
| | Network and Customer Enumeration/GIS Upgrades and Integration to Billing after Validations | | | | | | |
| | RPD Module | | | | | | |
| | Customer KYC Upgrade | | | | | | |
| 5 | Enterprise Mobility | | | | | | |
| | Spot Collection System | | | | | | |
| | PHED Customer Mobile Apps | | | | | | |
| | Customers Self Service | | | | | | |
| | Bill Payment | | | | | | |
| | Complaint registration | | | | | | |
| | NSC Application | | | | | | |
| | Theft and Anti-corruption Reporting | | | | | | |
| | Billing & Payment history | | | | | | |
| | Load shedding timetables | | | | | | |
| | Customer Meter readings and bill Forecast for MDs | | | | | | |
| | PHED Staff Field App | | | | | | |
| | Mobile Photometer Reading | | | | | | |
| | New Service Connection | | | | | | |
| | Meter replacement entry system | | | | | | |
| | Network Maintenance Field app with integration into Attendance Management system, NSIS/ Enumeration/GIS system (DC-Nine Mobile app) | | | | | | |

| Sr. No. | Projects/Activities | Completed | 2020 | 2021 | 2022 | 2023 | 2024 |
|---------|---------------------------------------|-----------|------|------|------|------|------|
| 6 | ERP Application | | | | | | |
| | Human Resource Management System | | | | | | |
| | Performance Management System | | | | | | |
| | Learning Management System | | | | | | |
| | Attendance Management System | | | | | | |
| 7 | Business Intelligence and Analytics | | | | | | |
| | BI Tool | | | | | | |
| | MIS Management | | | | | | |
| 8 | Intranet and Portals | | | | | | |
| | New PHED website | | | | | | |
| | PHED Staff Intranet | | | | | | |
| 9 | PHED Data Centre and Connectivity | | | | | | |
| | Service Request Management System | | | | | | |
| | Wide Area Network Expansion till BSCs | | | | | | |
| | Data Centre Colocation | | | | | | |
| | Backup Management | | | | | | |
| | PHED Owned tier 3 datacenter setup | | | | | | |
| 10 | Network Status Information System | | | | | | |
| | Outage Management system | | | | | | |
| | Network Asset management System | | | | | | |
| | No Power Complaint | | | | | | |
| | Load Shedding and Energy Scheduling | | | | | | |

Customer Relationship Management (CRM)

CRM is a technology for managing all your company's relationships and interactions with customers and potential customers. The goal is simple: Improve business relationships. A CRM system helps companies stay connected to customers, streamline processes, and improve profitability.

CRM is a complete suite for Meter management, Payment, Complaint management, Service requests, Bill Correction with DoA and Duplicate bill. It is working in four states simultaneously for 0.8Mn customers in database for CRM, Billing, Collection, Meter Reading, Spot Billing and Dashboards. This has been deployed and will be improved upon in the next five (5) Years.

New Service Connection (NSC)

The efficiency of a new connection process for providing electricity can be measured by its time, cost and number of procedures. NSC system is providing at door-step (On Spot Connection) service for all field activities.

PHED provides all business operations related to new connection, from customer application, document verification & digitization, technical feasibility, commercial feasibility, deduping of applicant from existing database, security deposit invoice generation, security deposit amount collection, and meter installation then customer registration in STS device. All activities are dependent to previous activity and every activity is monitored by predefined turnaround time (TAT). This initiative has been developed and deployed into assuage in 2019.

Photo Meter Reading and Validation System

Marketers use Mobile app to take meter reading image, input Meter Readings, run validations in online mode and view final usage statistics to improve productivity, eliminate errors and implement discipline. Scheduling of the routes for marketers. Capturing of GPS co-ordinates at the time of photo capturing.

This complete system has two modules, one for photo meter reading and second is reading and meter photo validation system. The Meter Reader captures Lat/Long of the customer's meter position, and using this same for route and sequencing purpose. This initiative has been completed and deployed. Area for improvement is being tracked as PHED intends to make it better in the coming year.

Billing System

There are two types of billing, one is demand/bills generated against services (Like name change, load enhancement, meter change etc.), and second is energy bills generated against customer's monthly consumption.

Prepaid Billing/Vending System: PHED has accomplished real time integration with Standard Transfer Specification (STS) Association, SPARK and CEMO (E-Cash) meters for energy vending using their APIs.

Spot Billing

IT has developed an android module, in which the executives are putting monthly meter reading and meter status, based on these inputs, system is generating monthly bill on customer premise, and also taking payment immediately in same application. This module is real time connected with the main database.

Payment Gateway and Wallet Integration

IT has accomplished the integration of payment gateways (Interswitch, Xpresspay, Flutterwave) and wallets (VT Pass, ITEX Etc.) with various payment touch points, like websites, Customer App etc.

Spot Collection

This application has two modules, one for mobile and second for cash tally and real time monitoring of all mobile cashiers. It has been implemented for all PHED customers.

Utility Website

IT has developed websites for all PHED customers. Here the customers can register their account number and do the payment by themselves. Also, the customers can do their payment via internet banking using same website.

Document Management System

Document Management System is integrated with CRM as well as this can be used individual also, here any department can put their important data in server. In NSC process, all KYC document will

upload in system with unique identifier for that particular NSC customer. In Vigilance, all site visit documents and evidences can be uploaded in DMS system through vigilance process.

Pull SMS

Using this service, IT has developed mechanism to send information to customers according to specific key word requests. TinyURL based push SMS through which customer can see bill summary, duplicate bill and payment of his outstanding amount.

Escalation Process

Developed & implemented on Field Escalation process for New Service Connection, to install meter at customer premises at stipulated time lines, customer complaints and service request escalation level was from Customer Care Executive to Chief Executive Officer.

Business Intellegence (BI) Tool implementation

PHED is creating inhouse team for analytics using BI tool with integration of all other busoness applications, this team will help all business users to increase effeciency.

Vigilance Analytics

Using meter events, expected electricity theft customers list is being generated, and forwarded to vigilance department, end to end closure of such cases from lead to theft booking and collection is being recorded.

100% AMR Feeder and DT Metering and Analytics

The 100% AMR metering of all feeders and DTRs with enumeration/GIS integration will go a long way to keep track and account for energy collected, identify losses, plug all leakages while enabling us to provide Premium power to the paying customers.

Incidence Recording Management System (IRMS)

Technical department operations are being monitored using IT automation. The system is used to capture input energy and support dispatch centre to give more energy on low loss feeders. Give timely alerts for asset maintenance to responsible staff. This module works at the System Control level and maintains the Faults, Shutdowns, Breakdowns and Power cuts, the effected element and reason, resource allocation and de-allocation, and duration of the fault. It provides the GIS Report of Areas where Power Supply is not available. This module is real time connected with call centre application so that call centre executive can answer to customer with correct and real time information. The Report (Pictorial as well as Tabular data) is forwarded to the management.

System Integration

Standard APIs for all systems integration so that logically all data will present in single place for every business user.

Work Management System

Planned Work Management System is an end-to-end Cloud based Infrastructure Project and Scheme Monitoring application that enables PHED to manage projects and monitor schemes with confidence and ease. The software is visionary; it is specially designed for PHED project management system. DC-Nine allows easy user-end based configuration without having to rely on heavy time-consuming code defined customization.

Starting new projects under it becomes a breeze. This application is a user end application on mobile or tablet devices starts to reflect what is required of personnel at field levels. Mobiles and tablets are used to capture field data such as surveys, inspections (both material and work), material usage, and employee performance, work updating, etc.

E-Bill and SMS Bill Transmission and Payment

As part of the efforts to make bill payments and vending more seamless and convenient, PHED plans to partner with a few fintech companies to provide automatic push and SMS bill messages and emails to customers that allow for direct debits of bank accounts by just following on screen prompts.

PHED USSD channel for payment and Customer Interaction

PHED is already in advanced stages of provisioning a unique USSD code that will be used to power payments and simple customer interactions like check account balance, report generic faults and check CRM ticket status. This activity shall be completely implemented in 2020.

PHED Call Centre Interactive Voice Response

Due to its customer centric focus PHED intends to install a more robust IVR and call centre solution that will allow automated call allocation by DTMF tones, automated scheduling and recording of calls and other metrics so as to aid monitoring, quality assurance and training purposes.

System is responsible for call centre operations like CSAT calling, Daily call report, Answer level report, ACHT(Avg. Call Handling Time) report, Call quality with fatal report, Call forecasting report and CWN (Critically watched number) report etc.

Decentralized Bill Printing

As part of the IT teams mandate to drive efficiency, bill printing shall be decentralised to two other locations namely UYO and Calabar so as to cut down the expenses, time and risk in transporting bills from port-Harcourt to all areas of operations.

RPD Module and Customer KYC Upgrade

To combat energy theft via identity theft or a lack of, PHED is planning an upgrade of her KYC process and documentation needs so as to limit this scourge. Also the OMS DL-Enhance is scheduled to have a revenue protection module integrated with the GIS platform that will analyse payment data and generate lists and areas of delinquent and non-paying customers for further regulated actions.

5.5. People Planning and Management

To support the PIP, PHED proposes an effective alignment of Management and staffing plan with the business plan accordingly

Consequently, PHED has taken into consideration a review of current operation, improved organizational design as well as future of work and roles based on changes emerging from adoption of technology and best practice.



5.5.1. Review of Existing Operations

This section summarizes the existing corporate strategy aspects of PHED, and HR practices being followed in the organisation, including the existing organization structure and present status of manpower deployment.

Figure 29: Salient features of the existing HR policies

| | |
|--|---|
| Service Conditions | <ul style="list-style-type: none"> Guided by the policies of PHED Conditions of Service with Union at advance stage |
| Employee Classification | <ul style="list-style-type: none"> Five broad categories, namely Junior Staff; Officer, Middle Management; and Executive Management. |
| Recruitment | <ul style="list-style-type: none"> For Grades B1 and above, recruitment is carried out at a National Level and locally for Categories A1 to A4. The minimum age for recruitment is 16 years. Recruitment is locally sourced and centrally processed for all categories. |
| Type of Appointments | <ul style="list-style-type: none"> A) Permanent B) On Contract C) Outsourced |
| Working Hours | <ul style="list-style-type: none"> 40 Hours a Week; Working Hours (Mon to Fri) -8.00 AM to 5.00 PM with one Hour Lunch Break |
| Standard Employee Disciplinary Clauses | <ul style="list-style-type: none"> Surcharge may be levied against an Employee as a way of recovering Fund or Value of Property lost due to Negligence |
| Salaries and Wages: | <ul style="list-style-type: none"> Productivity bonus is paid monthly to staff as part of their monthly salaries . |
| Leave | <ul style="list-style-type: none"> E1 and Above get 30 working days leave and 25 working days for D1-D4 and B5 - A1 21 working days ; Medical Leave: 30 days in a year. |
| Recognized Trade Unions | <ul style="list-style-type: none"> National Union of Electricity Employees (NUEE); Senior Staff Association of Electricity & Allied Companies (SSAEAC) |
| Annual Performance Evaluation | <ul style="list-style-type: none"> Based on Balance score card and setting of individual Key Performance Indicators, done at the beginning of the year and appraised bi-annually |
| Training | <ul style="list-style-type: none"> Based on Annual Performance Evaluation, internally conducted TNA by PHED Academy |
| Retirement Age | <ul style="list-style-type: none"> Statutory Retirement shall occur as soon as the Employee attains the Age of 60 years or completes 35 years of Service, whichever is earlier. |

Figure 30: Existing PHED Organisation Structure

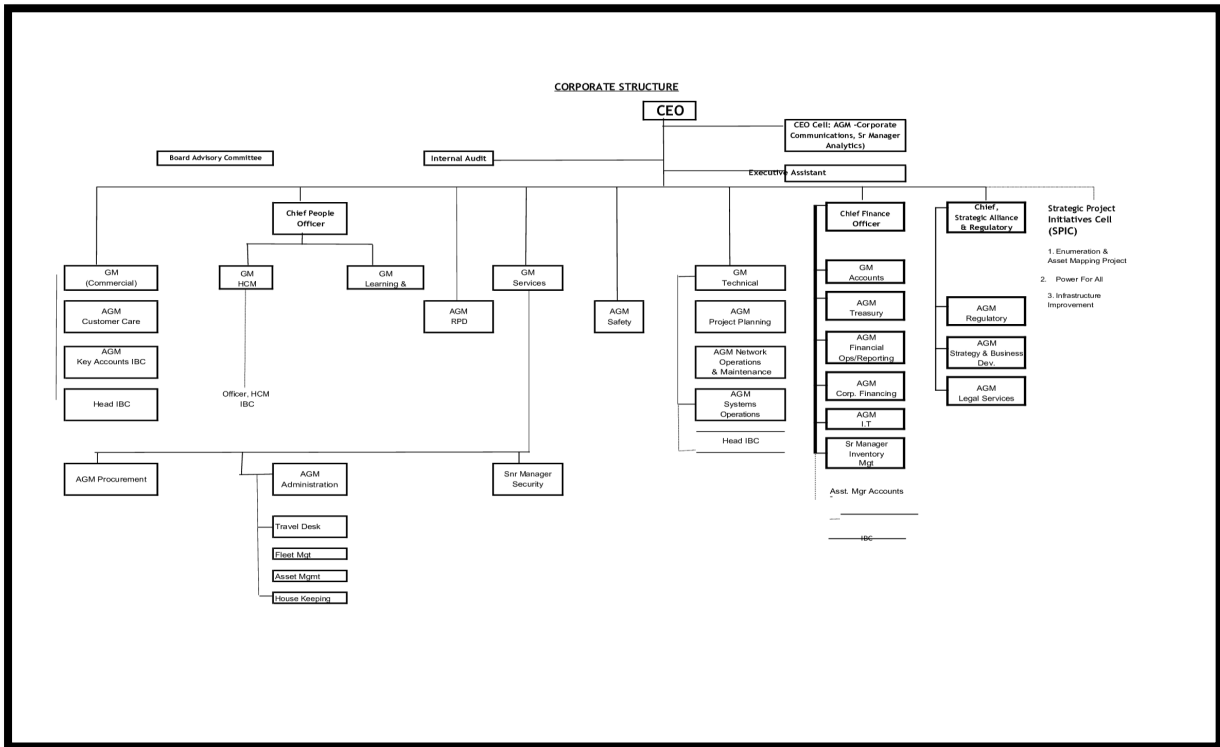


Table 54: Existing Manpower Strength

| SN | Location | Technical | Commercial | Support | Grand Total |
|----|----------|-----------|------------|---------|-------------|
| 1 | HQ | 84 | 62 | 122 | 284 |
| 2 | PMO | - | - | 21 | 21 |
| 3 | GCC | 52 | 36 | 4 | 92 |
| 4 | GCE | 37 | 34 | 5 | 76 |
| 5 | GCI | 57 | 41 | 4 | 102 |
| 6 | GCM | 35 | 28 | 4 | 67 |
| 7 | GCN | 64 | 64 | 5 | 133 |
| 8 | GLCM | 34 | 28 | 4 | 66 |
| 9 | PACM | 48 | 52 | 6 | 106 |
| 10 | PACN | 31 | 27 | 3 | 61 |
| 11 | PRCM | 65 | 71 | 3 | 139 |
| 12 | PRCS | 46 | 42 | 4 | 92 |
| | | | | | 1239 |

5.5.2. Challenges

As per the prevailing system and processes in the organization, PHED is facing multi-fold challenges across the organization. There has been lack of business-oriented approach in the functioning PHED. Absence of appraisals, salary increment has



resulted in low morale of the employees. Further, it observed that the structure is flat with no clarity on the role and responsibilities

- Lack of business-driven approach
- High dependency on manual work for data & information collation
- Inter-Department communication gap
- Lack of availability of documentation of records
- Lacking spirit of accountability
- Punctuality & lacking work discipline
- Prevailing ethical issue of Corrupt System and Practices
- Wide span of control for decision making position
- Lacking of role clarity
- Silo operations of departments
- No salary revision for past 4 years
- Disparity giving rise to persisting issue of legacy staff and new recruits
- Policy framework required to regulate processes such as Training, Salary, Promotion, Transfer, Delegation of Power and others

5.5.3. Human Resource Strategy

Human resource is considered as a critical task of the Human resource function. The managerial aspect of staffing involves manning the organization structure through proper and effective selection as well as the appraisal and development of the personnel in the organization.

PHED's success is made by its people however staffing decisions are more complex than they used to be. Not only have the PHED had to think about whether they want an employee or a contractor, but also about offshore options, diversity, and legal obligations. It does not all stop there; once the person is brought in, one has to think about skills development, morale, retention, and the work environment. Hence, success of PHED depend on a well-defined staffing strategy.

Figure 31: HR Strategy

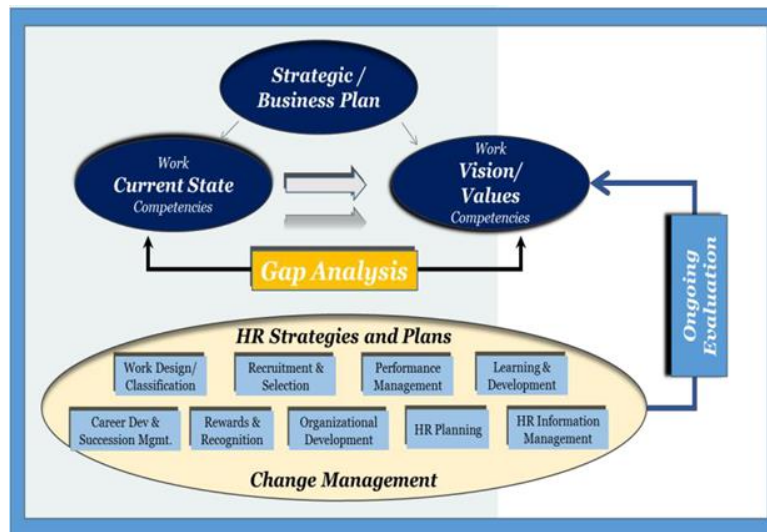
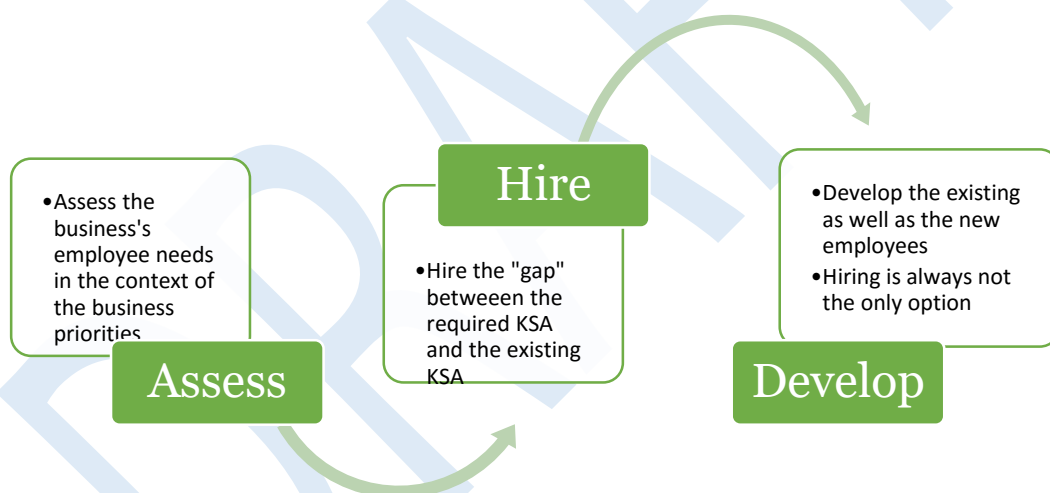


Figure 32: Proposed Human Resource Strategy



A well-defined staffing strategy helps to make an unbiased decision and also put the organization's perspective as a whole.

5.5.4. HR Key Interventions

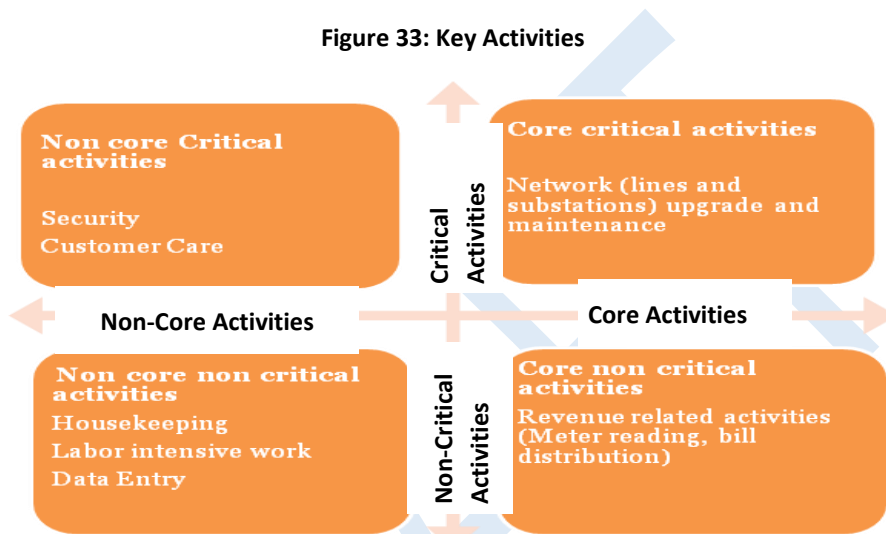
| Sr. No. | Activities | 2020 | 2021 | 2022 | 2023 | 2024 |
|---------|--|------|------|------|------|------|
| 1 | Capacity Development | | | | | |
| | Training Policy/ Implementation/ Review | | | | | |
| | Training Academy | | | | | |
| | Hire accomodation | | | | | |
| | Furnishing along with equipments | | | | | |
| 2 | Training Need Analysis | | | | | |
| | Preperation of training calender for the year | | | | | |
| | Curriculum and facilitator | | | | | |
| | Feedback on course content, faculty and review | | | | | |

| Sr. No. | Activities | 2020 | 2021 | 2022 | 2023 | 2024 |
|----------------|--|------|------|------|------|------|
| | Development Center | | | | | |
| | Assessment center | | | | | |
| | Tie-up with management school and technical institutes of repute | | | | | |
| 3 | Exchange program | | | | | |
| | International | | | | | |
| | Domestic | | | | | |
| 4 | Training Impact Assessment | | | | | |
| | Follow-up action | | | | | |
| 5 | Occasional Training for local communities | | | | | |
| | Norms for selection | | | | | |
| | Design occasional training program | | | | | |
| 6 | Review Organization Structure | | | | | |
| | Delegation of power | | | | | |
| | IBCs as profit center | | | | | |
| 7 | Employee Issues | | | | | |
| | Harmonization of grade | | | | | |
| | Annual increments | | | | | |
| | Promotion | | | | | |
| | Joint Forum with Union | | | | | |
| 8 | Internal Process & Procedures | | | | | |
| | Updation of employee records | | | | | |
| | ERP implementation - Sage | | | | | |
| | Process Mapping & implementation | | | | | |
| | Disciplinary policy and Process | | | | | |
| 9 | Policies | | | | | |
| | Formation of new policies | | | | | |
| | Review | | | | | |
| | Campus placement | | | | | |
| 10 | Work Culture | | | | | |
| | Biometric attendance right upto BSCs | | | | | |
| | Enforcement discipline measures | | | | | |
| | Attendance | | | | | |
| | Dress Code | | | | | |
| | ID card | | | | | |
| 11 | Performance Management System | | | | | |
| | Balance Score Card cascading down to marketers | | | | | |
| | Periodic review & feedback (PIP) | | | | | |
| | Reward & recognition | | | | | |
| | Performance Linked Incentive plan | | | | | |
| 12 | Employee Engagement | | | | | |
| | Birthday/Anniversary celebration | | | | | |
| | Sports (Indoor/Outdoor) | | | | | |
| | Independence day/Democracy Day | | | | | |
| | Children Competitions | | | | | |
| | Health Programs | | | | | |
| | Employee Get together | | | | | |
| Foundation Day | | | | | | |

| Sr. No. | Activities | 2020 | 2021 | 2022 | 2023 | 2024 |
|---------|-----------------------|------|------|------|------|------|
| | Idea of the month | | | | | |
| | Open Door interaction | | | | | |
| | Town Hall | | | | | |

5.5.5. Manpower Deployment

Manpower deployment in any company is done based on the nature and importance of business functions. In power distribution companies, the business goal is commercial in nature. The major functions of a distribution company are as depicted:



For lines and substations operations, the usual deployment is in three shifts, viz., 8 hours per shift. In a single shift, there is a gang of linemen, helpers and engineers.

The nature of the job in power distribution companies is continuous and hence is a perfect example for applying the concept of “flexible rostering” comes in. Rostering includes varying the start time and length of shifts, and the numbers of employees on duty during a work period. A flexible roster is one that varies the patterns and lengths of shifts to improve service delivery, the efficient use of resources and the welfare, health and safety of employees, where this is the normal industrial arrangement in the workplace.

A roster is maintained such that an employee works in a day shift a particular week and in a night shift the consecutive week. This helps in maintaining a balance and each employee works in all the shifts. In a substation or line maintenance, the employee requires multi skills. Multi-skilling would be provided for by a scheme of job-rotation.

Also, due to the critical and continuous nature of work there are many instances of overtime of the employees. For any such instance, overtime and the compensation to the employees shall be according to the compensation acts as defined.

PHED has established a full-fledged Learning and Development department driven by PHED Academy flagship and learning organization model.

HR therefore runs a dual separate function of HCM and L&D. The 2 department are forthrightly led by a Management Staff between AGM - GM supervised by a Chief People Officer. The above enables a dedicated approach to managing training and development.

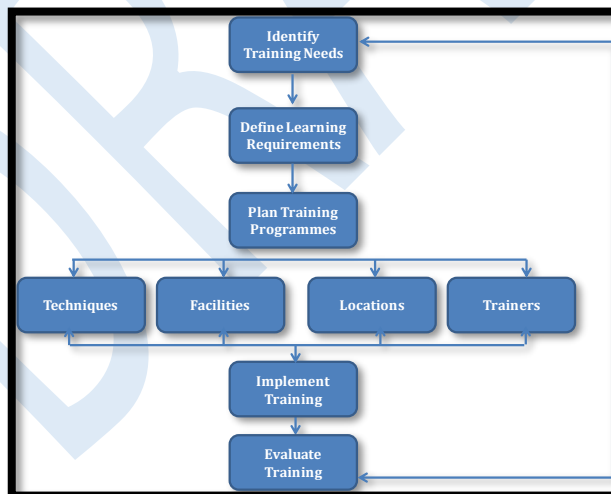
5.5.6. Training and Capacity Building Plan for Staff

It is always healthy in Power Distribution business, which may be considered a people business to train the employees, both of Nigerian & foreign origins to develop close interactions with Customers, Local Opinion Makers & Politicians, Municipal & Government Agencies, Police & Law enforcing agencies, Future Citizens studying in schools and colleges, Society & its Citizens at large. The employees also need to be trained for improving their adaptability to Technology, Global Best Practices, Job Skills and Change Management.

Strategy for Training & Development

Our training programme for Nigerian staff and personnel would be developed with an aim to improve their skills, to expose them to current strategies and technologies, to enable them to compete favourably with other companies, and to improve performance, productivity and profitability Apart from “On-the-job training”, PHED Academy would also plan and schedule planned training programmes, after a detailed training analysis, by analysing jobs, performance appraisal of staff, conducting training surveys and business & HR analysis. The training programmes shall be based on the following model:

Figure 34: Proposed Training and Development Strategy



In the long run, it is also proposes to build an in-house Power Training School, which would essentially focus on local employable youth and provide adequate training to make them suitable for the industry.

Training and capacity building plan will not only involve own employees which is the normal perception but also the employees on contract for overall success in distribution business.

A robust communication plan shall be made as a part of the change management initiative. This will include the formation of a cross-functional team to discuss the strategies to roll out the changes and the implementation action plan.

In the organizational structure proposed, training of employees has been given its due importance guided by the training policy. Training in a DISCOM would necessarily be of two (2) types:

- Technical
- Functional training
- Behavioural / Attitude Development

Since the competence of an employee is equal to the product of knowledge, skill and attitude, under-development in any of them will be inversely proportional to the level of competence for an employee.

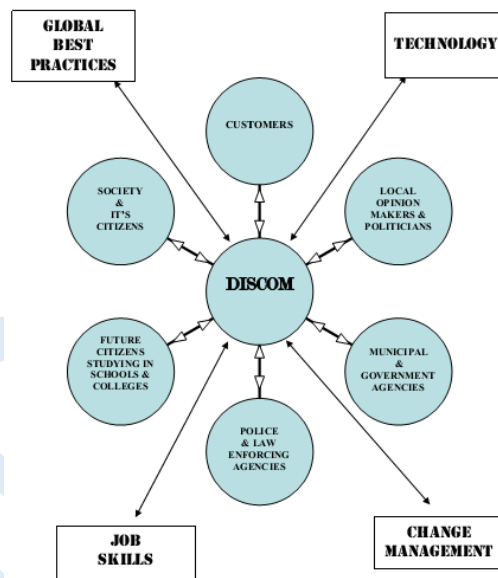
PHED Academy would also leverage on the strategic tie-ups with other globally leading distribution utilities in the training and capacity building of the staff and personnel of PHED, with a balance of both global best practices and the experience from more contextual developing country distribution utility experience.

DRAFT

Figure 35: Planned Trainings

| | | | |
|------------------------|--------------------------------|--|----------------------------|
| Induction Training | Mandatory Training | Supportive Training | Pre-promotional Training |
| Education Up-gradation | Management Development Program | Deputation to Premier Training Institutes/Organisations for training/visit | Training through Tutorials |

Figure 36: PHED employees Interactions



Strategy for Capacity Development

As a part of the capacity development plan, specific career development plan for the employees shall be formulated to help the employees have an insight about the career growth within the company and understand the promotion policies and pre-requisites to get promoted to higher levels. This will ensure that employees are kept motivated and talent is retained.

While contractual employment may be financially beneficial and cost-effective in the long run but procuring skilled manpower as well as contracted employees need to be taken up to keep the employees motivated.

As a part of the training and capacity building of the employees, the Company shall formulate specific policies- procedure manual and make it available in the public domain.

A structured plan is always required to map the gaps in capacities of the employees, and this involves identifying appropriate organisation structure and staffing pattern based on well accepted norms and in light of the responsibilities required to be fulfilled.

For building a well-defined Plan for Capacity Development, there are the following six stages:

- **First Stage:** Understanding the As-Is training infrastructure and plans, understanding the organization structure, Human capital demographics their roles and responsibilities etc.
- **Second Stage:** Requires understanding from the employees their behavioural as well as the functional aspects required to perform job effectively;
- **Third stage:** Involves thorough study of the Structured Interview (conducted in the above two stages) Reports:
 - Identification of the competency based on competency framework;
 - Measurement of competency;
 - Required levels of competency for each job family; and
 - Development of dictionary which involves detail description of the competency based on the indicators. Care should be taken that the indicators should be measurable and gives objective judgment.
- **Fourth Stage:** requires preparation for assessment.
 - Methods of assessment can be either through assessment centres or 360 Degree Feedback
 - If assessment centre is the choice for assessment, then tools has to be ready beforehand
 - Tools should objectively measure the entire competency required.
 - Determine the type of the tools for measuring competency
 - Prepare the schedule for assessment
 - Training to the assessor should indicate their thorough understanding of the competencies and the tools and as to how the behaviour has to be documented.
- **Fifth Stage:** Involves conducting assessment centre. Usually it is a two-day program which would involve giving a brief feedback to the participant about the competencies that has been assessed and where they stand to.
- **Sixth Stage:** Involves detailed report of the competencies assessed and the development plan for the developmental areas.

At the end of this stage, the objective of “transferring knowledge” shall get fulfilled as the gaps shall get identified which shall lead to the identification of the specific training programs.

5.5.7. Performance Management System

Balance Scorecard

Balance Scorecard is a strategic planning and reporting methodology in form of performance matrix used to identify and improve various internal functions of a business and their resulting outcomes. It functions to reinforce analysis take account for a company’s objectives under four separate heads of – Financial, Customer, Operations or Business Processes and People. The balanced scorecard is used to attain objectives, measurements, initiatives and goals that result from these four primary functions of a business. Organizations make use of balance scorecard approach to implement strategy mapping to see where value addition is made within the organization.

Our Approach to Balance Scorecard

Implemented Balance Scorecard would aim at:

- Common Goal of organisation across hierarchy
- Responsibility and Accountability mapped to each individual
- Appropriate hand shaking between departments

Figure 37: Balance Score Card Philosophy



Table 55: Balance Score card implementation

| Encouraging Participation | Monitoring Mechanism | Review Mechanism and Evaluation |
|---|--|---|
| <p>Of both the managers and staff member in planning, setting targets for the individual and in negotiating performance targets which are measurable</p> <p>All activities which would form part of the KRA for an employee to be cascades down into measurable component parts</p> <p>KRAs will be set according to the resources made available</p> | <p>Monitoring mechanism would undertake Quarterly Reviews</p> <p>Transparent publishing of results to encourage and promote competitiveness</p> <p>Targets will be cascaded down to Business Service Centre Managers</p> | <p>Performances will be evaluated annually</p> <p>Based on performance evaluation outcomes, provision for reward and recognition for the performers</p> |

Table 56: HR Plan and KPIs

| Year | 2019 | 2020 | 2021 | 2022 | 2023 | 2024 |
|---|-----------|-----------|-----------|-----------|-----------|-----------|
| Revenue/ Employee (Annual) | 21,821.30 | 24,121.84 | 27,425.33 | 28,804.40 | 32,099.68 | 37,853.31 |
| Staff (Permanent/ Secondees, Contract) | 1,239 | 1,612 | 2,108 | 2,466 | 2,786 | 2,954 |
| No of employees trained (%) | 48.61 | 80 | 90 | 100 | 100 | 100 |
| Attrition | 3% | 2.5% | 2% | 2% | 2% | 2% |

DRAFT

5.6. Safety

At PHED it is believed that the step toward achieving a good safety culture requires creating effective HSE Programs, accountability, managerial decisions about the incentives and disincentives at all levels within the organization.

Our safety campaign for a sustainable safety culture is to close the gap between what PHED as an organization believes to be the safety culture of an organization and what it actually is on ground. PHED safety culture is the key to an incident free workplace; PHED culture is characterized by behaviors that focuses on the identification of hazards and ensure safety for everyone.

Our safety culture elements are well defined in the PHED HSE Management Systems which states the following;

- Compliance with approved PHED HSE Policies
- Compliance with approved Safety Standard Operating Procedures
- Hazard Identification, reporting and incident investigations
- Adequate HSE Communication through
 - In – house Training
 - Toolbox Meetings
 - Public Safety Campaigns
 - Safety Bulletins
 - Leadership commitment and safety site visits
 - Equipment Inspections
- Mandatory Legal and Regulatory Standard Compliance
 - Nigeria Electricity Regulatory Code - NERC
 - Occupational safety and Health Administration – OSHA
 - National Fire Protection Association - NFPA
- Participation in Behavioral Base Safety Programs
- Compliance with Permit to Work requirements

6. Financial Plans

As its base case for performance improvements, PHED Plc has a projected CAPEX plan of ₦64.5bn over the next five years. This CAPEX plan is expected to fund the investment required to meet the ATC&C loss reduction targets according to the Performance Agreements.

6.1. Historical Performance

Years after the privatization of the Nigerian power sector, perennial sectoral issues such as inadequate gas supply, grid capacity limitations, huge collection losses, infrastructural gap and non-cost reflective tariff among other issues have continued to be a challenge to the sector. These have resulted in worsening liquidity challenges for Discos with implication for their ability to meet up with market remittances or required infrastructural upgrade. Consequently, financial performance and ability to raise funds have been adversely affected.

At The time of take-over in 2013, the company's revenue performance was ₦18,986 with cash collection efficiency of 55% and ATC&C loss position of 58%. Over the past years, considering these challenges, PHED's performance is as depicted in the table below.

Table 57: Historical Performance

| All figure in N'm | 2014 | 2015 | 2016 | 2017 | 2018 |
|-------------------------|---------------|----------------|----------------|----------------|----------------|
| Revenue | 27,631 | 33,554 | 49,941 | 52,187 | 48,608 |
| Cost of energy | -24,182 | -28,469 | -44,544 | -49,964 | -53,097 |
| Gross Margin | 3,449 | 5,085 | 5,397 | 2,223 | -4,489 |
| OPEX | -10,569 | -18,610 | -24,672 | -20,949 | -11,425 |
| Operating Loss | -7,120 | -13,525 | -19,275 | -18,726 | -15,914 |
| | | | | | |
| Collection | 16,691 | 18,435 | 22,656 | 24,925 | 25,380 |
| Collection Efficiency | 58.70% | 52.70% | 43.00% | 45.40% | 48.90% |
| Billing Efficiency | 84.40% | 83.60% | 84.30% | 75.60% | 72.40% |
| ATC & C Loss | 50.50% | 55.90% | 63.70% | 65.70% | 64.60% |

6.2. Market Obligations

Given the challenges facing the sector, NERC in a bid to reactivate the sector, computed the market and tariff shortfalls due from and to Discos based on the 2016 – 2018 Minor Review of MYTO 2015. The sum of ₦104.3Bn was recognised by NERC as the tariff shortfall due to PHED Plc for the years 2015 to 2018 as a result of non-cost reflective tariff while the market shortfall due from PHED was computed as ₦126.5Bn being amount due to the market not remitted in the same period by PHED, resulting in a net shortfall position of ₦22.2Bn. PHED has however put up an appeal to NERC having raised additional considerations which, if considered, in the computation of the market shortfall will reduce the liability of PHED to the market.

The implementation of the investment initiatives of this PIP is largely dependent on access to fund from financial institutions and internally generated cash flow. PHED is hopeful that the Commission will favourably consider the appeal brought before it to review downward the net shortfall position of PHED based on the ground of appeal. This will lessen the burden that the huge net shortfall places on PHEDC and ease its access to funds.

6.3. ATC&C Loss Reduction

One of the major considerations in the Performance Agreement between the investors and Bureau for Public Enterprise (BPE) during the privatisation process in 2013, was ATC&C loss reduction commitment. For PHED, the approved Aggregate Technical Commercial and Collection (ATC&C) loss as at 31 October 2013 stood at 55%. Subsequent to take over and given the challenges pre hand over of the assets, the investors were allowed to review the state of infrastructure they acquired which resulted in a revision of the baseline loss target. Based on PHED's study, our ATC&C loss position was 57% but this was later adjusted to 55% by NERC, also retaining the loss reduction targets.

Given the operating environment, it has been difficult to achieve the loss reduction target. Over the last two years however, we have stemmed the worsening trend and are poised to make positive changes in this regard.

Table 58: ATC&C Loss Trend

| ATC&C | Year 1 | Year 2 | Year 3 | Year 4 | Year 5 |
|-------|--------|--------|--------|--------|--------|
| MYTO | 52.94% | 45.00% | 37.13% | 29.70% | 23.76% |
| PHED | 50.46% | 55.90% | 63.70% | 65.67% | 64.58% |

6.4. 5 Years Financial Projections

The Performance Improvement Plan (PIP) has presented another opportunity for PHED to review its initial business plans with a view to charting a course that will result in the transformation of its business over the next five (5) years. In order to achieve the desired loss targets, PHED has identified key initiatives to improve its performance over the period of this Improvement Plan. These initiatives would require huge capital investment as detailed in section 3.6.3.

For the 5 years period of the PIP, PHED's financial projection is as detailed in table below.

Table 59: Financial Projections

| Details (Mn) | 2020 | 2021 | 2022 | 2023 | 2024 |
|---|---------------|---------------|---------------|---------------|---------------|
| Revenue | 72,064 | 74,463 | 87,803 | 102,269 | 112,825 |
| Cost of energy | (54,493) | (54,161) | (61,757) | (70,395) | (76,486) |
| Gross profit | 17,572 | 20,303 | 26,046 | 31,874 | 36,339 |
| Overhead Cost (Opex) | (11,730) | (14,688) | (15,670) | (16,109) | (16,659) |
| Operational Profit | 5,842 | 5,615 | 10,377 | 15,765 | 19,679 |
| Interest Expense | (1,303) | (1,733) | (2,225) | (2,650) | (2,541) |
| Profit for the year After Interest Expense | 4,539 | 3,882 | 8,151 | 13,115 | 17,139 |
| | | | | | |
| Capex Requirement | 12,358 | 15,596 | 17,346 | 11,173 | 8,013 |

| Details (Mn) | 2020 | 2021 | 2022 | 2023 | 2024 |
|-----------------------|------|------|------|------|------|
| Billing efficiency | 71% | 74% | 77% | 79% | 80% |
| Collection Efficiency | 65% | 92% | 97% | 98% | 99% |
| ATC & C | 53% | 32% | 24% | 22% | 21% |

To ensure complete transformation of its business, full financing of the CAPEX Plan, introduction of cost-reflective tariffs and a minimum level of operating expense are required to optimize performance.

6.4.1. Capital Expenditure (CAPEX) Plan

In order to achieve the desired loss target levels required to turn around the business through the implementation of this PIP at a reasonable tariff for its customers, PHED has projected a total capex of ₦64.5bn over the next five (5) years. This Capex has been carefully selected to improve the following areas:

- Loss reduction – Technical, Commercial and Collection losses
- Network Reliability
- Customer service improvements
- Demand Growth
- Health and safety improvements

| Project Category | Unit | Capex for 2020 | Capex for 2021 | Capex for 2022 | Capex for 2023 | Capex for 2024 | Total Capex (2020 - 2024) | Share of Total Capex |
|----------------------------------|-----------------|----------------|----------------|----------------|----------------|----------------|---------------------------|----------------------|
| Demand Growth | Mn Naira | 2,775 | 4,097 | 4,832 | 1,796 | 1,786 | 15,286 | 14.40% |
| Loss Reduction | Mn Naira | 5,135 | 6,128 | 5,069 | 5,152 | 2,545 | 24,029 | 22.60% |
| Reliability | Mn Naira | 3,406 | 3,328 | 3,177 | 2,400 | 345 | 12,656 | 11.90% |
| Enablers | Mn Naira | 469 | 1,371 | 3,696 | 1,352 | 2,915 | 9,804 | 9.20% |
| Network and Systems Total | Mn Naira | 11,786 | 14,924 | 16,774 | 10,701 | 7,591 | 61,775 | 58.20% |
| Customer Metering | Mn Naira | 16,809 | 13,689 | 3,453 | 3,942 | 3,754 | 41,648 | 39.20% |
| IT and Automation | Mn Naira | 272 | 372 | 272 | 172 | 122 | 1,210 | 1.10% |
| Admin and General | Mn Naira | 300 | 300 | 300 | 300 | 300 | 1,500 | 1.40% |
| Grand Total | Mn Naira | 29,167 | 29,285 | 20,799 | 15,115 | 11,767 | 1,06,133 | 100.00% |

In arriving at our proposed capex plan, PHED has considered the State of the network in its area of coverage, the Metering Plan, information technology (ICT) needs, work tools and equipment as well as maintenance required to keep its infrastructure at optimal performance levels.

PHED carried out a technical study in order to determine the state of the existing network, properly evaluate the technical loss reduction and related investments required for network augmentation. In order to enhance energy accountability and minimize losses, metering of feeders, distribution transformers as well as customers are key to achieving our goals in the PIP. Consequently, we plan to

deploy 836,959 meters over the next five years through the MAP across the coverage area and meter our key feeders and distribution transformers.

PHED has also considered other business enablers as important requirement in achieving the PIP goals. One such key enabler is ICT. PHED considers information technology as a key enabler in running an efficient power utility company which would impact improvement in processes and has considered this in arriving at the capex investment in the PIP. Maintenance of asset and meeting work tools and equipment requirement have also been considered in arriving at our capex requirement as fault minimization is key in achieving our targets.

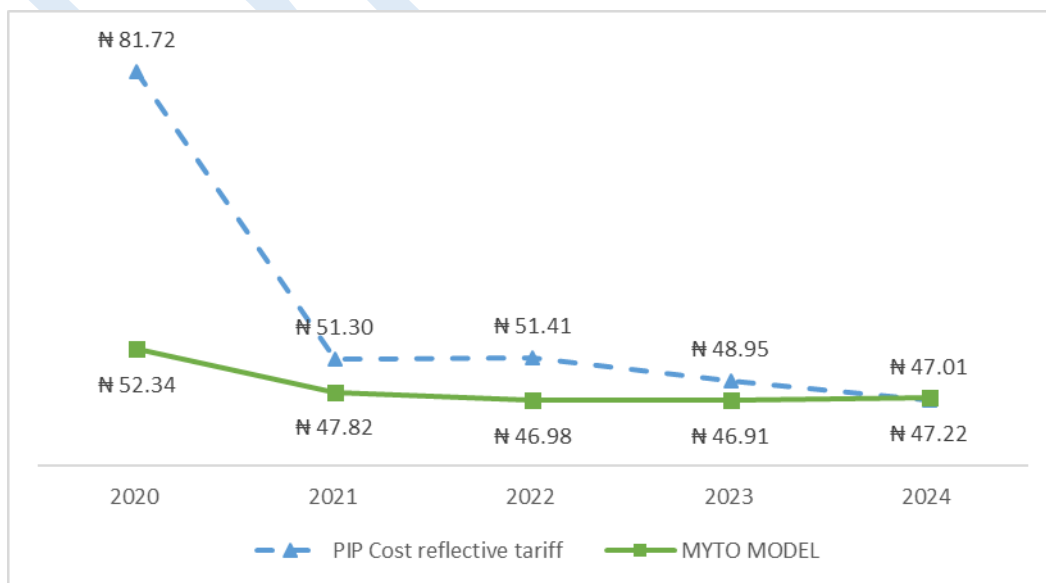
6.4.2. Operating Expense (OPEX)

In determining its operating expenditure requirement within the 5 years period of the PIP, PHED, in addition to its growth plans, loss reduction and business transformation needs, considered its current operating requirements to arrive at a realistic OPEX level that will aid the optimization of its business performance. The OPEX consists primarily of collection expenses, maintenance of network assets and other categories of equipment and office buildings, consultancy services, customer-centric costs, staff costs, security and insurance, transportation costs and office rent, repairs and consumables.

6.4.3. Cost Reflective Tariff

The Minor Review 2019 sets a new tariff for the next five (5) years with a transition to full cost reflectivity by 2020. These tariffs were derived from CAPEX levels of ₦18bn over a five (5) year period and an annual average OPEX levels of approximately ₦13bn respectively. From our analysis of the performance improvements required to drive the turnaround of the business and achieve loss reduction targets per the Performance Agreement, the business requires more robust CAPEX and OPEX limits which will result in a higher tariff compared to what is provided for in MYTO.

Figure 38: Cost Reflective Tariff vs MYTO



6.5. Investment Funding Strategy

PHED is considering funding its N64.5Bn capex requirement from a combination of debt and equity at a ratio of 75/25. Apart from equity funding PHED will explore various options to fund the investment required to achieve the loss trajectory. The funding type will depend on the project type. However, funding options include development finance, term loans and franchising. Summarised below are the projected funding.

Table 60: Funding Options

| Details | Contribution | 2020 (Mn) | 2021 (Mn) | 2022 (Mn) | 2023 (Mn) | 2024 (Mn) |
|----------------------------|--------------|---------------|---------------|---------------|---------------|--------------|
| Equity | 25% | 3090 | 3899 | 4337 | 2793 | 2003 |
| Capital injection | 80% | 2,472 | 3,119 | 3,469 | 2,235 | 1,603 |
| Internal generated revenue | 20% | 618 | 780 | 867 | 559 | 401 |
| Debt | 75% | 9,269 | 11,697 | 13,010 | 8,380 | 6,010 |
| Term Loan | 40% | 3,707 | 4,679 | 5,204 | 3,352 | 2,404 |
| Franchising | 30% | 2,781 | 3,509 | 3,903 | 2,514 | 1,803 |
| Development finance | 30% | 2,781 | 3,509 | 3,903 | 2,514 | 1,803 |
| Total | 100 | 12,358 | 15,596 | 17,346 | 11,173 | 8,013 |

Aside the consideration that will be given to equity funding, PHED will explore the following options available to fund the investments plan outlined herein depending on the project type, fuelling an annual reduction in ATC&C losses, growth in revenue and improvement in quantity and quality of power supply to our customers. This section details the various funding option to be used to finance CAPEX of the company as contained in the PIP document.

7. Risk Assessment and Mitigation

The table below outlines the key risks envisaged by PHED along with its probability of occurrence and degree of impact, both measured as High, Medium and Low. PHED aims to address these risks in terms of risk avoidance, risk reduction, risk transfer and risk retention.

Table 61: Risk Assessment and Mitigation Strategy

| Risk Type | Description of Risk | Probability of Occurrence | Degree of Impact | Mitigation Strategy |
|--|--|---------------------------|------------------|--|
| Capping/ criminalization of estimated bill | Lack of enthusiasm on the part of customers to adopt metering and the resultant excessive revenue shortfall | High | High | Avoidance: PHED will ensure that all customers are metered on time through MAP Scheme |
| Minimum Remittance | PHED must fulfil its minimum remittance obligations to the market viz. 100% settlement of MO's invoice and 21% of NBET's invoice; failure to meet these obligations in any payment cycle will entail penalties/ sanctions | High | High | Avoidance: PHED will ensure compliance to minimum remittance obligation. |
| MDA Debts | In terms of the Minor Tariff Review Order 2019, Discos are responsible for collecting MDA debts, However, no mechanism has been set in place for repayment or collection of MDA debts, to ensure this debt does not become a collection loss for Discos, which was the basis of removal from Disco's Baseline Losses. Additionally, PHED is also expected to disconnect delinquent MDA customers in line with the regulation which, for reasons beyond PHED's control, may place its personnel under threat of bodily harm and abuse | High | High | Retention: The decision on tariffs and the solution to MDA debt payment is outside the direct control of the Discos. It is important for PHED to Negotiate with FGN on unpaid/unsettled debt |
| Meter Assets Providers (MAP) | Given the payment options available to the customer and lack of willingness to pay generally in Niger Delta region, MAP is likely to take much longer time to bridge the metering gap compared to mass metering which apparently might affect the achievement of its loss reduction trajectory | | | Reduction: PHED has managed their MAP contracts to ensure best possible service in the allocated areas of each MAP. The contracts are being closely monitored and facilitated through customer engagements, communication and outreach programme. The customers not adopting the MAP will be served notices and |

| Risk Type | Description of Risk | Probability of Occurrence | Degree of Impact | Mitigation Strategy |
|--|---|---------------------------|------------------|---|
| | | | | disconnected in phased manner. Management is also engaging the state governments formulating special schemes like "Power for All" to provide meters through MAP and undertake system improvement |
| Historical Market and Tariff shortfall and the liability arising therefrom | NERC's calculation of the tariff shortfall and the resultant market shortfall differs from what PHED has and the difference is on account of baseline ATC&C loss and Loss level applicable for 2017 and 2018 considered as years of mutual non performance | High | High | Retention: PHED is relying on the declaration of force majeure in 2015 on various grounds such as - freezing of R2 tariff, - Removal of collection loss - lack of cost reflective tariff - Acceleration of loss reduction trajectory |
| Funding Challenges | Due to non cost reflective tariffs and lack of regular minor reviews Discos financial position had been adversely impacted bringing them to near insolvency. In the current regulatory environment, even the original investors are apprehending the viability of returns on additional investment | | | Retention: PHED proposed in its financial plan other sources of finance such as NDPHC, NDDC, State Govts and Federal Govt Sponsered Schemes (like Siemens) |
| Disconnection and late Payment | The Disconnection and Reconnection Regulations states that a customer must be given a 90-day notice before he can be disconnected. This places an undue debt burden on PHED. While NBET charge us interest, we are not allowed to charge interest to our late-paying customers and non-paying customers and even have to wait for 90 days to disconnect | High | High | Avoidance: 100% Prepaid metering of the remaining unmetred customers |
| Eligible Customers | Loss of high-paying customers meeting the threshold limits thereby leaving low-demand customers with limited ability and/or willingness to pay for electricity. | High | High | Avoidance: After the formalisation of Competitive Transition Charge (CTC), Discos are likely to be compensated for the loss of revenue to a large extent |
| Allowed capex in MYTO | CAPEX, if not allowed as per Discos priority and quantum will impact the | High | High | Reduction: |

| Risk Type | Description of Risk | Probability of Occurrence | Degree of Impact | Mitigation Strategy |
|--|--|---------------------------|------------------|---|
| | required investment and thereby the Outputs planned in this PIP | | | Prioritise avenues having high impact on revenue generation |
| Vandalization and environmental Impact | More than 5000 transformers have been vandalized in past two years. extreme thunderstorm and rainfall has also damaged equipment and materials severely resulting in prolonged outages thereby revenue loss | medium | medium | Sharing: <i>Insurance of assets and sharing of loss through community dialogues</i> Avoidance: <i>Declaring force majeure in case of prolonged insurgency and other specific force majeure events</i> |
| Minor Tariff review | Absence of minor tariff review after issuance of MYTO order 2015 to date has severely impacted its ability to meet the financial obligations and achieving the required loss reduction | High | High | Avoidance: it is open for Discos to declare force majeure under the circumstances, as has happened in 2015 as well, which will postpone meeting the performance commitment required and loss reduction obligation |
| Performance Agreement | PHED is exposed to the extreme risk of BPE's buy back option at \$1 for defaulting in meeting its performance obligation under the agreement. While NERC and BPE acknowledge 2017 and 18 as years of mutual non performance the DISCOs have been insisting that even 2015, 2016 and 2019 should be declared as force majeure years. Otherwise PHED is not likely to achieve its trajectory in the first three years of the loss reduction due to non cost reflective tariffs | High | High | Avoidance: Renegotiation of loss reduction trajectory is seemingly the only option left under such circumstances to ensure continued viability as otherwise in the absence of cost reflective tariff and the unlikely improvement in performance, PHED will most likely be not in a position in raising funds for it. |

8. KPI Projections

This Performance Improvement Plan, which is aimed to transform and turnaround the business over a period of five years, outlines the business goals of the Company, the reasons they are believed attainable, and the plan for reaching those goals. The document details the plan to manage and operate as well as rehabilitate and upgrade the distribution system, strengthen and expand the network to meet new demand, improve metering and reduce ATC&C losses, with the objective of meeting the key performance targets over the period of five years, achieving commercial viability and ensuring improved service delivery to the Customers.

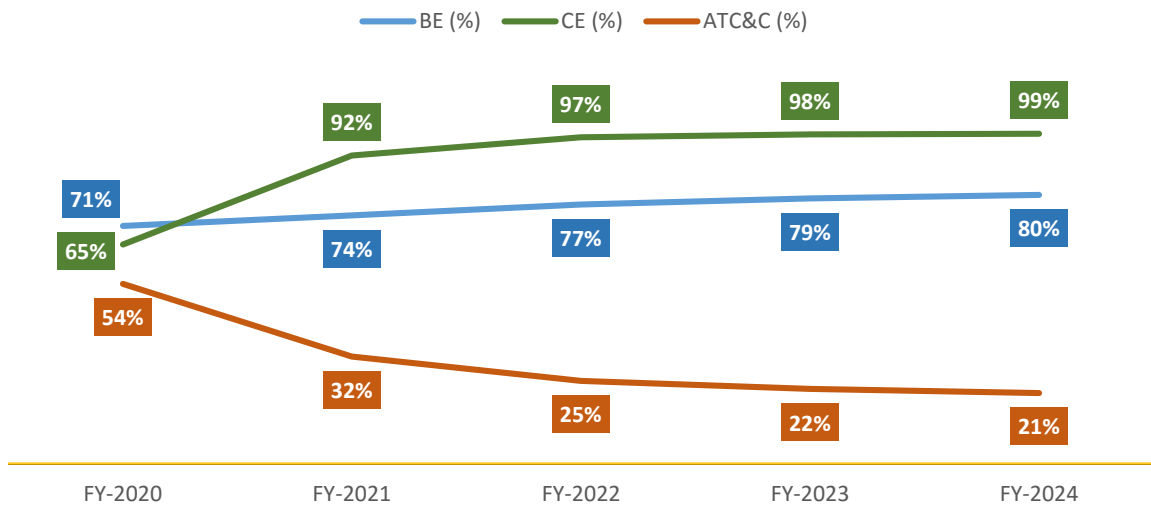
Under this Plan PHED endeavours to attain following levels as mentioned below:

- Growth of customer population from 535,843 to 964,205
- Demand growth from existing level of 2409 MVA to 4581 MVA
- Reduce ATC&C losses from the current level of 61.30% to 21%, which will take PHED business to be sustainable & allow for business excellence;
- Achieve 100% metering of feeders, Interfacing points, DTR's and customer metering through MAP.
- Total 106.13 Bn Naira Capital Investments on Network and Systems, IT & Automations, Administration and Logistics
- Reduce the number of customer interruptions & improvement in Turn around time (TAT)
- Attain zero fatalities and 100% safety compliance
- Improving power supply quality and reliability

Table 62: Key Business Parameters – Projections

| KPIs | Unit | 2020 | 2021 | 2022 | 2023 | 2024 |
|-----------------------|------|-------|-------|-------|-------|-------|
| Energy Received | MUs | 2,093 | 2,103 | 2,413 | 2,754 | 2,981 |
| Billed Energy | MUs | 1,485 | 1,557 | 1,867 | 2,180 | 2,389 |
| Billing Efficiency | % | 70.9% | 74.1% | 77.4% | 79.2% | 80.2% |
| Collection Efficiency | % | 65.4% | 92.0% | 97.4% | 98.3% | 98.5% |
| ATC&C | % | 53.6% | 31.9% | 24.7% | 22.2% | 21.0% |
| MYTO AT&C | % | 29.7% | 23.8% | 23.8% | 23.8% | 23.8% |

Figure 39: Key KPIs Trend

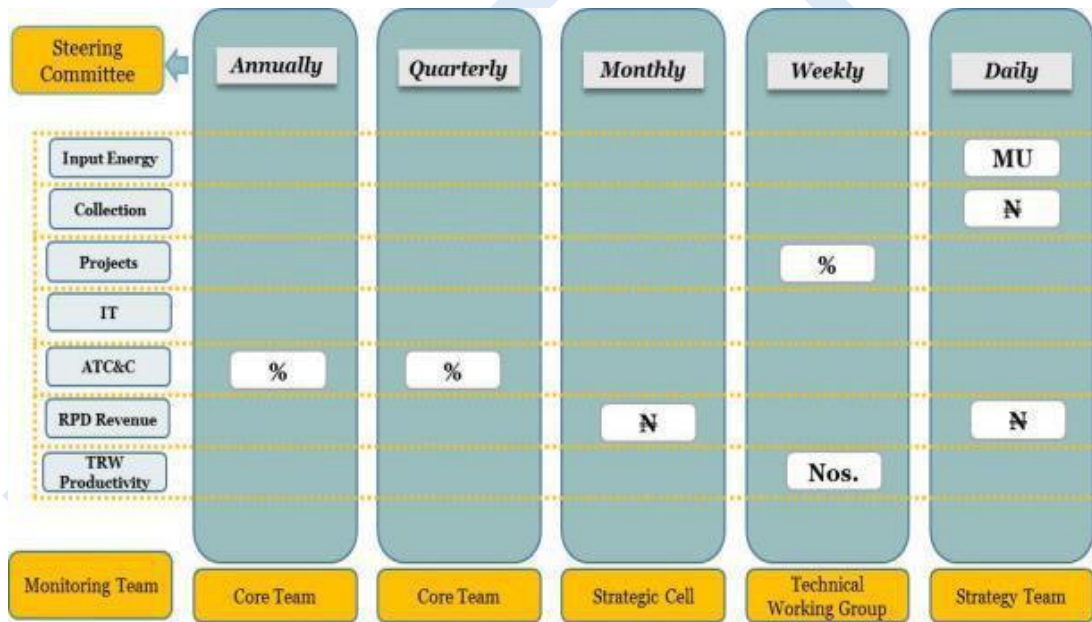


DRAFT

9. Monitoring Framework

- The most important aspect of the PIP is its implementation and thereby, monitoring of key activities is a pre-requisite. PHED have identified need of assigning certain key performance indicators at the micro-level.
- Key performance indicator is defined as the measures that focus on the aspects or areas of organization’s performance that are critical or vital for the ongoing and future success. In order to ensure that the designated objectives are attained, KPIs are specific, measurable, agreed to, realistic, timely and aligned with the plan targets.
- Key Performance Indicators like distribution loss trajectories, collection efficiency trajectories; average tariff hikes etc. will be monitored on a concurrent basis and are crucial for the successful implementation of the plan.

The following framework is proposed to monitor and support the activities and performance-



10. Annexures

Annexure 1: Process Audit Score Card

| PROCESS AUDIT SCORE CARD | | | | | | | | | | | | | |
|--------------------------------------|----------|---------------|----------|------|----------|------|----------|------|---------------|---------|---------|---------|---------|
| BSCs Process Audit Score and Ranking | | | | | | | | | | | | | |
| Sl No. | IBC Name | BSC Name | Q4, 2018 | | Q1, 2019 | | Q2, 2019 | | % Improvement | | Q4 2018 | Q1 2019 | Q2 2019 |
| | | | Score | Rank | Score | Rank | Score | Rank | Q1, 19 | Q2, 19 | | | |
| 1 | GCC | GRA | 73.7 | 2 | 89.2 | 7 | 92.5 | 1 | 21.0 | ↑ 3.8 | | | |
| 2 | GCI | Rumuogba | 65.4 | 8 | 65.1 | 28 | 91.1 | 2 | -0.4 | ↑ 40.0 | | | |
| 3 | PrCM | Mblabong | 42.1 | 19 | 46.9 | 37 | 89.7 | 3 | 11.5 | ↑ 91.0 | | | |
| 4 | GCI | Elelenwo | 87.5 | 6 | 87.5 | 10 | 89.0 | 4 | 29.6 | ↑ 1.7 | | | |
| 5 | PrCM | Secretariat | 27.2 | 35 | 73.9 | 19 | 85.7 | 5 | 171.9 | ↑ 16.0 | | | |
| 6 | GCN | Oyigbo North | 32.9 | 28 | 88.3 | 9 | 84.7 | 6 | 168.3 | ↓ -4.0 | | | |
| 7 | GCE | Rumuolumini | 50.0 | 16 | 27.9 | 42 | 83.1 | 7 | -44.2 | ↑ 197.8 | | | |
| 8 | PrCS | Oron | 37.3 | 21 | 58.9 | 31 | 82.7 | 8 | 57.9 | ↑ 40.4 | | | |
| 9 | GICM | Opolo | 57.0 | 14 | 68.5 | 24 | 80.7 | 9 | 20.1 | ↑ 17.8 | | | |
| 10 | GCE | Diobu | 51.8 | 15 | 34.4 | 40 | 80.2 | 10 | -33.5 | ↑ 133.0 | | | |
| 11 | PrCM | Ikot Ekpene | 35.5 | 26 | 67.8 | 26 | 79.3 | 11 | 90.9 | ↑ 16.9 | | | |
| 12 | PrCM | Abak | 25.9 | 37 | 48.4 | 36 | 78.4 | 12 | 87.0 | ↑ 62.0 | | | |
| 13 | PrCM | Urban 1 | 36.8 | 23 | 66.9 | 27 | 77.1 | 13 | 81.6 | ↑ 15.2 | | | |
| 14 | GCN | Eligbolo | 25.0 | 38 | 95.1 | 3 | 76.5 | 14 | 280.3 | ↓ -19.5 | | | |
| 15 | GCM | Borokiri | 46.1 | 17 | 76.3 | 17 | 75.8 | 15 | 65.6 | ↓ -0.6 | | | |
| 16 | PrCS | Eket | 37.3 | 21 | 78.2 | 16 | 74.5 | 16 | 109.8 | ↓ -4.8 | | | |
| 17 | GCN | Oyigbo South | 57.9 | 13 | 85.0 | 13 | 73.5 | 17 | 46.8 | ↓ -13.5 | | | |
| 18 | PaCM | EdimOtop | 13.2 | 40 | 76.1 | 18 | 72.8 | 18 | 478.2 | ↓ -4.3 | | | |
| 19 | PaCM | Metropolitan | 28.5 | 33 | 89.9 | 6 | 72.2 | 19 | 215.2 | ↓ -19.6 | | | |
| 20 | PrCM | ITU | 40.8 | 20 | 54.5 | 34 | 72.0 | 20 | 33.5 | ↑ 32.2 | | | |
| 21 | GCI | Eleme | 33.3 | 27 | 68.5 | 25 | 71.9 | 21 | 105.4 | ↑ 5.0 | | | |
| 22 | GCC | Orazi | 36.4 | 24 | 86.1 | 11 | 71.9 | 22 | 136.6 | ↓ -16.6 | | | |
| 23 | PrCS | Onne | 30.7 | 30 | 72.2 | 22 | 71.9 | 23 | 135.2 | ↓ -0.5 | | | |
| 24 | GCC | Rumuokalagbo | 43.9 | 18 | 97.4 | 1 | 71.7 | 24 | 122.1 | ↓ -26.4 | | | |
| 25 | GCC | Rumuomasi | 74.1 | 1 | 91.0 | 5 | 71.7 | 24 | 22.8 | ↓ -21.2 | | | |
| 26 | GCI | Okrika | 36.4 | 24 | 73.0 | 21 | 70.9 | 26 | 100.6 | ↓ -2.9 | | | |
| 27 | PaCN | Ogoja | 18.0 | 39 | 58.7 | 32 | 70.6 | 27 | 226.3 | ↑ 20.3 | | | |
| 28 | GCI | Abuloma | 71.9 | 3 | 71.5 | 23 | 69.8 | 28 | -0.6 | ↓ -2.4 | | | |
| 29 | GCM | Moscow | 71.5 | 4 | 73.2 | 20 | 68.3 | 29 | 2.4 | ↓ -6.6 | | | |
| 30 | GICM | Ahaoda | 60.5 | 10 | 80.6 | 15 | 68.1 | 30 | 33.1 | ↓ -15.5 | | | |
| 31 | GCN | Okporo | 30.3 | 31 | 93.8 | 4 | 67.8 | 31 | 209.8 | ↓ -27.7 | | | |
| 32 | PaCN | Obudu | 32.0 | 29 | 58.1 | 33 | 67.7 | 32 | 81.4 | ↑ 16.6 | | | |
| 33 | GCE | Agip | 70.6 | 5 | 51.3 | 35 | 67.6 | 33 | -27.3 | ↑ 31.8 | | | |
| 34 | PaCN | Ugep | 9.2 | 41 | 35.6 | 39 | 66.9 | 34 | 287.0 | ↑ 87.9 | | | |
| 35 | PaCM | Ikot Omin | 30.3 | 31 | 88.7 | 8 | 65.7 | 35 | 193.0 | ↓ -25.9 | | | |
| 36 | GICM | Igbogena | 59.2 | 12 | 45.3 | 38 | 65.4 | 36 | -23.5 | ↑ 44.3 | | | |
| 37 | GICM | Igwuruta | 66.2 | 7 | 64.5 | 29 | 64.6 | 37 | -2.6 | ↑ 0.1 | | | |
| 38 | PrCS | Mkpat Enin | 28.1 | 34 | 63.5 | 30 | 63.3 | 38 | 126.2 | ↓ -1.9 | | | |
| 39 | GCE | Ada George | 60.5 | 10 | 28.6 | 41 | 59.0 | 39 | -53.8 | ↑ 106.5 | | | |
| 40 | PaCM | Calabar South | 26.3 | 36 | 86.1 | 12 | 58.4 | 40 | 227.2 | ↓ -32.2 | | | |
| 41 | PaCN | Ikrom | 1.3 | 42 | 83.6 | 14 | 57.6 | 41 | 6256.6 | ↓ -31.2 | | | |
| 42 | GCN | Obi Wall | 64.5 | 9 | 95.2 | 2 | 55.3 | 42 | 47.7 | ↓ -41.9 | | | |



Scanned with CamScanner

PROCESS AUDIT SCORE CARD

| PHED PROCESS-WISE AUDIT PERFORMANCE REPORT | | | | | | | | | | Q2 2019 | | |
|---|---------------------------------|----------|------|----------|-------|----------|-------|---------------|--------|---------|---------|---------|
| Sl No. | Process | Q4, 2018 | | Q1, 2019 | | Q2, 2019 | | % Improvement | | Q4 2018 | Q1 2019 | Q2 2019 |
| | | Score | Rank | Score | Rank | Score | Rank | Q1, 19 | Q2, 19 | | | |
| 1 | Fuse Call | 38.0 | 65.5 | 88.1 | 22.1 | ↑ | 34.6 | | | | | |
| 2 | Field Complaints | 32.1 | 73.6 | 87.3 | 129.0 | ↑ | 18.6 | | | | | |
| 3 | Overbilled | 51.5 | 66.7 | 77.7 | 29.6 | ↑ | 16.5 | | | | | |
| 4 | Overbilled-Unmet | 38.5 | 85.5 | 76.5 | 121.8 | ↓ | -10.5 | | | | | |
| 5 | Meter Reading MD | NA | NA | 76.4 | NA | ↑ | 76.4 | | | | | |
| 6 | Meter Reading NonMD | 42.3 | 63.9 | 75.5 | 42.3 | ↑ | 75.5 | | | | | |
| 7 | Bill Distribution | 44.9 | 68.0 | 74.7 | 44.9 | ↑ | 74.7 | | | | | |
| 8 | Overbilled-Met | 34.7 | 76.4 | 74.6 | 120.2 | ↓ | -2.3 | | | | | |
| 9 | Meter Defective | NA | NA | 73.2 | NA | ↑ | 73.2 | | | | | |
| 10 | Amtar & Disconnection Maogement | 51.0 | 66.1 | 71.8 | 29.7 | ↑ | 8.5 | | | | | |
| 11 | Bill Processing-Unmetered | 44.3 | 70.5 | 71.4 | 59.3 | ↑ | 1.3 | | | | | |
| 12 | Bill Revision Camp | NA | NA | 71.2 | NA | ↑ | 71.2 | | | | | |
| 13 | Wrong Category | 52.7 | 69.4 | 70.4 | 31.8 | ↑ | 1.4 | | | | | |
| 14 | Preventive Maintenance LT | NA | NA | 69.4 | NA | ↑ | 69.4 | | | | | |
| 15 | NSC-NonMD | 34.5 | 67.6 | 65.7 | 34.5 | ↑ | 65.7 | | | | | |
| 16 | Reading NT | 42.7 | 79.4 | 65.1 | 86.0 | ↓ | -18.0 | | | | | |
| 17 | Tampered | 51.5 | 57.8 | 62.7 | 12.3 | ↑ | 8.4 | | | | | |
| 18 | Collection Maogement | 56.0 | 75.8 | 58.4 | 75.8 | ↑ | 58.4 | | | | | |
| 19 | Revenue Protection | NA | NA | 57.5 | NA | ↑ | 57.5 | | | | | |
| 20 | Non-Posting | 35.4 | 66.9 | 56.0 | 88.9 | ↓ | -16.2 | | | | | |
| 21 | Suspension Closure | 34.5 | 67.6 | 41.7 | 67.6 | ↑ | 41.7 | | | | | |
| 22 | Duplicate Bill | NA | NA | 34.1 | NA | ↑ | 34.1 | | | | | |

| Legend | |
|--------------|--|
| Excellent | |
| Very Good | |
| Good | |
| Satisfactory | |
| Poor | |

| IBC OFFICE AUDIT PERFORMANCE REPORT | | | | | | | | | | Q4 2018 | Q2 2019 |
|--|-----------------|----------|------|----------|------|---------------|---------|---------|--|---------|---------|
| Sl no. | IBC Office Name | Q4, 2018 | | Q2, 2019 | | % Improvement | Q4 2018 | Q2 2019 | | | |
| | | Score | Rank | Score | Rank | | | | | | |
| 1 | GCI | 65.1 | 2 | 82.8 | 1 | ↑ 27.2 | | | | | |
| 2 | PrCS | 62.8 | 3 | 80.5 | 2 | ↑ 28.3 | | | | | |
| 3 | PrCM | 26.8 | 8 | 72.8 | 3 | ↑ 171.9 | | | | | |
| 4 | GCN | 42.1 | 6 | 72.1 | 4 | ↑ 71.3 | | | | | |
| 5 | PaCN | 15.8 | 9 | 67.9 | 5 | ↑ 329.0 | | | | | |
| 6 | GCM | 14.8 | 10 | 67.6 | 6 | ↑ 356.8 | | | | | |
| 7 | GCC | 41.8 | 7 | 64.0 | 7 | ↑ 53.0 | | | | | |
| 8 | GICM | 70.2 | 1 | 61.9 | 8 | ↓ -11.8 | | | | | |
| 9 | GCE | 45.4 | 5 | 56.6 | 9 | ↑ 24.5 | | | | | |
| 10 | PaCM | 61.0 | 4 | 54.7 | 10 | ↓ -10.3 | | | | | |

| Legend | |
|--------------|--|
| Excellent | |
| Very Good | |
| Good | |
| Satisfactory | |
| Poor | |

| IBC-WISE PROCESS AUDIT PERFORMANCE REPORT | | | | | | | | | | Q4 2018 | Q1 2019 | Q2 2019 |
|--|----------|-----------------|------|----------|------|----------|------|---------------|----------|---------|---------|---------|
| Sl no. | IBC Name | Score & Ranking | | | | | | % Improvement | | Q4 2018 | Q1 2019 | Q2 2019 |
| | | Q4, 2018 | Rank | Q1, 2019 | Rank | Q2, 2019 | Rank | Q1, 2019 | Q2, 2019 | | | |
| 1 | GCI | 54.91 | 5 | 73.13 | 5 | 80.10 | 1 | ↑ 33.17 | ↑ 9.54 | | | |
| 2 | PrCM | 34.72 | 7 | 59.74 | 8 | 78.90 | 2 | ↑ 72.05 | ↑ 32.07 | | | |
| 3 | PrCS | 33.33 | 8 | 68.21 | 6 | 74.90 | 3 | ↑ 104.64 | ↑ 9.80 | | | |
| 4 | GCC | 57.00 | 4 | 90.90 | 2 | 74.70 | 4 | ↑ 59.47 | ↓ -17.82 | | | |
| 5 | GCN | 42.11 | 6 | 91.46 | 1 | 71.60 | 5 | ↑ 117.22 | ↓ -21.71 | | | |
| 6 | GCM | 58.77 | 2 | 74.27 | 4 | 69.30 | 6 | ↑ 26.38 | ↓ -6.70 | | | |
| 7 | GCE | 58.22 | 3 | 35.56 | 10 | 67.70 | 7 | ↓ -38.93 | ↑ 90.40 | | | |
| 8 | GICM | 60.75 | 1 | 64.72 | 7 | 67.09 | 8 | ↑ 6.54 | ↑ 3.67 | | | |
| 9 | PaCN | 15.13 | 10 | 59.01 | 9 | 67.08 | 9 | ↑ 289.97 | ↑ 13.68 | | | |
| 10 | PaCM | 24.56 | 9 | 85.18 | 3 | 63.60 | 10 | ↑ 246.80 | ↓ -25.33 | | | |

| Legend | |
|--------------|--|
| Excellent | |
| Very Good | |
| Good | |
| Satisfactory | |
| Poor | |