Tangible Benefits of Implementing Smart Metering Technology in City Power

Mr Aubrey Mochela
GM – ICT
City Power JOHANNESBURG
South Africa
Agenda Items

1. Energy Theft – Broader Context
2. City Power Situation
3. City Power - Smart Metering Strategy
4. Load Limiting Initiatives
5. Revenue Recovery Programme (RRP)
6. Results Achieved
Energy Theft – A Bigger Challenge than You Think

Global Phenomenon

Huge Revenue Loss

Network Overloading

Power Supply Deficit

Community Safety Hazard

Silent Crime
Typical Utility Leakages

**TECHNICAL LOSSES**
- Technical Line & Transformation Losses
- Outage and Overloading
- Load Balancing
- Voltage Regulation Philosophy
- Energy Reconciliation
- Profit Margins
- Inventory Integrity
- Network Monitoring & Visibility

**DISTRIBUTION LOSSES**
- Technical Line & Transformation Losses
- Outage and Overloading
- Load Balancing
- Voltage Regulation Philosophy
- Energy Reconciliation
- Profit Margins
- Inventory Integrity
- Network Monitoring & Visibility

**METERING LOSSES**
- Technical Line & Transformation Losses
- Outage and Overloading
- Load Balancing
- Voltage Regulation Philosophy
- Energy Reconciliation
- Profit Margins
- Inventory Integrity
- Network Monitoring & Visibility

**DISTRICT LOSSES**
- Technical Line & Transformation Losses
- Outage and Overloading
- Load Balancing
- Voltage Regulation Philosophy
- Energy Reconciliation
- Profit Margins
- Inventory Integrity
- Network Monitoring & Visibility

**OPERATIONAL LOSSES**
- Totalizator
- Meter manipulation
- Meter by-pass
- Energy Tapping
- Biased Estimations
- Reading Errors
- Lost Readings
- Stuck & Faulty Metering
- Multiplication Factor Errors

**SALES LOSSES**
- Totalizator
- Meter manipulation
- Meter by-pass
- Energy Tapping
- Biased Estimations
- Reading Errors
- Lost Readings
- Stuck & Faulty Metering
- Multiplication Factor Errors

**BILLING LOSSES**
- Totalizator
- Meter manipulation
- Meter by-pass
- Energy Tapping
- Biased Estimations
- Reading Errors
- Lost Readings
- Stuck & Faulty Metering
- Multiplication Factor Errors

**ACCOUNTING LOSSES**
- Totalizator
- Meter manipulation
- Meter by-pass
- Energy Tapping
- Biased Estimations
- Reading Errors
- Lost Readings
- Stuck & Faulty Metering
- Multiplication Factor Errors

**FINANCIAL LOSSES**
- Totalizator
- Meter manipulation
- Meter by-pass
- Energy Tapping
- Biased Estimations
- Reading Errors
- Lost Readings
- Stuck & Faulty Metering
- Multiplication Factor Errors

**GENERAL LOSSES**
- Totalizator
- Meter manipulation
- Meter by-pass
- Energy Tapping
- Biased Estimations
- Reading Errors
- Lost Readings
- Stuck & Faulty Metering
- Multiplication Factor Errors

**GENERAL ERRORS**
- Totalizator
- Meter manipulation
- Meter by-pass
- Energy Tapping
- Biased Estimations
- Reading Errors
- Lost Readings
- Stuck & Faulty Metering
- Multiplication Factor Errors
The City Power Situation

Sales Revenue Breakdown (%)

Customer Base Statistics

Large Power User
- 4200 Customers
- 57% of Revenue
- Approx. R6.6 Bn

Domestic
- 151,200 Customers
- 30% of Revenue
- Approx. R3.5 Bn

Business
- 12,600 Customers
- 8% of Revenue
- Approx. R928 Mn

Prepaid
- 252,000 Customers
- 5% of Revenue
- Approx. R580 Mn
Revenue Management – Key Focus Areas & Benefits

- Meter Management
  - Energy Balancing
  - Losses Identification & Normalisation

Energy Loss Management

- Improved Cash Flow
- Improved Customer Satisfaction
- Reduced Non-Technical and Technical Losses

Revenue Loss Management

- Revenue Recovery
- Debt Management
- Debt Collections
- Legal Prosecution

Benefits of Effective Revenue Management

- Viable Infrastructure Expansion
- Improved Delivery of Services
- Socially Responsible Public
- Improved Municipal Reputation
What is Smart Metering

Smart Metering is more than remote meter reading...

<table>
<thead>
<tr>
<th>Smart Metering is the...</th>
</tr>
</thead>
<tbody>
<tr>
<td>▪ Automatic reading, processing and transmission of metering data</td>
</tr>
<tr>
<td>▪ Possibility of <strong>bi-directional</strong> data communication in real-time</td>
</tr>
<tr>
<td>▪ Support of <strong>value-add services</strong> and applications e.g. home automation, remote disconnection of supply or load limiting</td>
</tr>
<tr>
<td>▪ Remote update of meter firmware to enable new services</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Smart Metering provides...</th>
</tr>
</thead>
<tbody>
<tr>
<td>▪ Customers with the information they require to become energy savvy and make smarter decisions about energy usage</td>
</tr>
<tr>
<td>▪ Suppliers with the means to better understand and service their customers</td>
</tr>
<tr>
<td>▪ Distributors with an effective tool to better monitor and manage their networks</td>
</tr>
</tbody>
</table>
1. Automated Billing
   - 100,000 Smart Meters Rolled Out to date
   - Protective Structures

2. Time of Use (ToU)
   - Customer Cost Saving Benefit
   - Peak Load Reduction

3. Load Limiting
   - Enforce Domestic Load Reduction
   - Reduce Load Shedding
   - Works with ToU

4. Web Portal
   - Customer Billing Analysis
   - Trending of usage
   - Works with ToU
City Power’s Smart Metering Strategy

CHALLENGES FACED BY CITY POWER

- Meter Reading
- Revenue Recovery
- Accurate Billing
- Reduction of Non-technical losses
- Load Shedding
- Customer Support

Revenue Recovery and Monitoring

- Focus on Key Prioritisation areas and targeted initiatives
- Focus on People and Process
- Track and Report of Energy and Recovery data daily
- Strong Leadership Involvement
- Implement Contractor Performance Indicators

Revenue Protection Technology

- Install Smart Meters (incl. activate load limiting capability of meter)
- Install Protective Enclosures
- Centralise Deployment by a Command Centre

Stakeholder Management

- Customer Awareness and Engagement Campaign
- Stakeholder Engagement
- Build trust by creating visibility and transparency
- Customer Satisfaction through superior support
Smart Metering Solution Overview

- **Customer Web Portal and Phone**
- **END USER**
- **Water Meter**
- **Load Switch**
- **Appliance Control Devices**
- **Home Area Network**
- **Smart Meter**
- **Customer Display**
- **CIU**
- **Wide Area Network**
  - **GPRS / PLC / Wi-Fi**
  - **Wi-Max / Ethernet / RF**
- **CITY POWER DATA CENTRE**
- **Meter Data Collection & Management**
  - **Load Management Consumer Web**
  - **SAP Interfaces**
  - **GIS Integration**
  - **Prepayment**
- **Customer Web Portal and Phone**
LPU Site Normalisation – Example A

Customer Premises
Itron Meter Installation
Protective Structure
LPU Site Normalisation – Example B

Customer Premises  Itron Meter Installation  Protective Structure
Benefits of Smart Metering

- Operational Efficacy
- Non-technical Losses
- Billing Accuracy
- Automated Read Performance
- Revenue Recovery
- Load Limiting
- Real-time Comms

Customer Guaranteed Supply of Electricity with an option to save costs based on behaviour
Load Limiting Phased Roll-Out

Phases:
- **Phase I**
  - 250,000 Domestic Meters
  - Potential 350MW Reduction
  - Load Curtailment
- **Phase II**
  - 450,000 Domestic Meters
  - Potential 750MW Reduction
  - All Supply Zones and Blocks
  - Effective Load Shedding Alternative
- **Phase III**
  - 65,000 Domestic Meters
  - Potential 150MW Reduction Capability
  - CUI – Customer Communications Testing
  - Primary Load Zones

**Customer User Interface**

**City Power Load Limiting Technology**
Load Limiting Infographics

- **Step1** - The smart meter will monitor the load in the house
- **Step2** - If the in-house load is below the load limit threshold (21A), the electricity supply will remain connected
- **Step3a** - If the in-house load is above the load limit threshold (21A), the smart meter will disconnect the main electricity supply
- **Step3b** - If the in-house load is below the load limit threshold, the electricity supply will remain connected
- **Step4** - In the period when the mains is disconnected, please ensure to switch off main contributing loads, during this period

Limited Appliances could be used during Load Limiting
Revenue Recovery Project (RRP) – Snapshot

1st Phase – LPU
- LPU Mining Initiative
- LPU Upload Fails
- LPU Ghosts
- Feed-In Recovery

2nd Phase – Dom & Prepaid
- Domestic Conversion to AMR
- Domestic Ghost
- Domestic Mining Initiative
- Pre-paid Audits

3rd Phase – Sustainability
- Protective Structures
- Value Chain Improvements
- Meter Management Operating Unit
- Data Analytics & Monitoring

Operational Maturity

Mastery Curve

Project Evolution
- Increased Meter Reading Performance
- Reduction in Non-Technical Losses
- Increased Revenue Recovery
- Proactive Monitoring and Management
# RRP Programme – LPU Initiatives

<table>
<thead>
<tr>
<th>Losses Recovery</th>
<th>Key Initiatives</th>
<th>Objectives</th>
<th>Deliverables</th>
</tr>
</thead>
<tbody>
<tr>
<td>Feed-In Recovery</td>
<td>❖ Installation of Check Metering &amp; Verification</td>
<td>✓ Revenue Recovery</td>
<td>✓ System Updates</td>
</tr>
<tr>
<td>Mining</td>
<td>❖ Key Customer Meter Audit &amp; Normalisation</td>
<td>✓ Revenue Recovery</td>
<td>✓ System Updates</td>
</tr>
<tr>
<td>Ghosts</td>
<td>❖ Normalisation of Customers not active on Billing System</td>
<td>✓ Revenue Recovery</td>
<td>✓ System Updates</td>
</tr>
<tr>
<td>Focus Group</td>
<td>❖ Normalise Customers Identified via Data Anomaly Reports</td>
<td>✓ Revenue Recovery</td>
<td>✓ System Updates</td>
</tr>
<tr>
<td></td>
<td>❖ Normalise Customer Tip offs Received</td>
<td>✓ Revenue Recovery</td>
<td>✓ System Updates</td>
</tr>
</tbody>
</table>

| Losses Prevention | Manual Meter Conversions | Conversion of Manual Meters to Remote System Updates and Monitoring |
| Shopping          |                         | ✓ Remote Availability |
| Shopping          |                         | ✓ Meter Reading Performance |
| Shopping          |                         | ✓ Reduced Estimations |

| Upload Fails | System Mismatches | Re-alignment of MDMS & Billing System Mismatches | ✓ System Updates |
|              | Offline Meters    | Monitor and Rectify functionality aspects of remote metering base | ✓ Improved Meter Performance |
|              | Data Upload Fails | Resolve data upload fails via investigations | ✓ System Updates |
|              |                   | Field Data Downloads and system updates | ✓ Data Accuracy |
|              |                   |                                              | ✓ Reduced Estimations |

| Losses Prevention | Manual Meter Conversions | Conversion of Manual Meters to Remote System Updates and Monitoring |
| Shopping          |                         | ✓ Remote Availability |
| Shopping          |                         | ✓ Meter Reading Performance |
| Shopping          |                         | ✓ Reduced Estimations |
RRP – Project Structure

ENGINEERING SERVICES DIRECTOR

LPU, DOMESTIC & PREPAID SMART METERING PROJECT MANAGERS

PMO SUPPORT LEADS

PLANNING/PRE-AUDIT
SMART METER EXECUTION
PROTECTIVE BOX EXECUTION
REMOTE & FIELD QC

PROJECT SUPPORT AND REPORTING OFFICE

Legal & Investigations
City Power Depots
Metering SPs Back Office
Supply Chain
Field QC Strategic Partners

JMPD
Meter Contractors
Box Contractors
Stores

System, Data, Customer Engagements

System, Billing, Work Portals (Alarm monitoring)
RRP Project Progress Made

- **LPU LOSSES PREVENTION**: 61%
  - LPU Conversions
  - LPU Ghosts
  - LPU Focussed
  - LPU Mining
  - Feed-In Recovery

- **LPU LOSSES RECOVERY**: 78%
  - LPU Upload Fails
    - LPU Upload Fails
    - LPU Mismatches
    - LPU Unconfirmed
    - Portion Clean-up

- **LPU UPLOAD FAILS**: 33%

- **REVENUE RECOVERED**
  - LPU Upload Fails: R 145 Mn
  - LPU Ghosts: R 162 Mn
  - LPU Focus & Mining: R 160 Mn
  - Feed-In Recovery: R 229 Mn
  - Total = R 696 Mn

LPU Initiatives Completion Progress
RRP – Impact on Non-Technical Losses Trend & Meter Reading Performance

### Non-Technical Losses Trend Impact
- Roll Out of Initiatives in LPU sector shows impact
- Arrest in Increasing Trend
- Revenue Recovery Initiatives to provide further impact on overall losses trends

### Maintain Gains Realised
- Roll Out of initiatives in Domestic & Prepaid Base
- Proactively monitor & identify anomalies
- Protective Structure Roll Outs
Summary of Lessons Learnt

1. **Data Quality**
   - Manage data quality during planning of strategy and ongoing.

2. **Integration**
   - Closely manage integration points at various levels and across value chain to avoid gaps.

3. **Processes & Controls**
   - Define and control processes and sub-processes at a programme and project level.

4. **Performance Monitoring**
   - Daily monitoring and response to anomalies through Dashboards & KPIs tracking.

5. **Contractor Competence**
   - Verify formal competencies and ensure the right skill level.

6. **Protective Enclosures**
   - Installation of boxes must be done in parallel with meter installations.

7. **People**
   - Enable resources with capability, competency & commitment to ensure delivery.

8. **Change Management**
   - Change takes time and new projects need to gain momentum before results are seen.