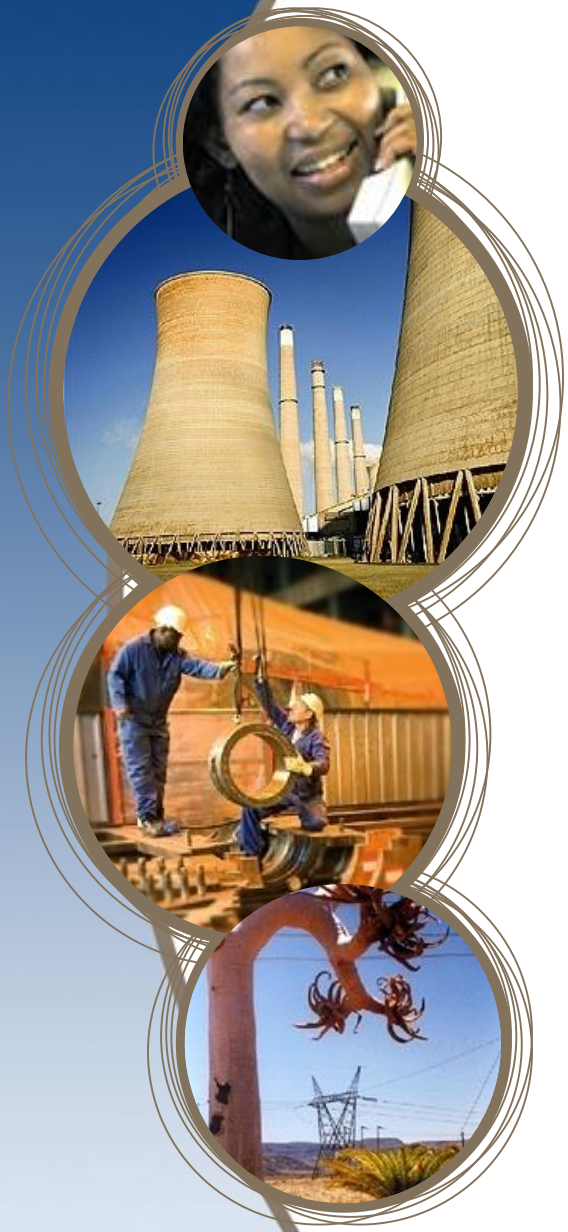

Loss Management at Customer Network Centre level with the focus on non-technical losses per feeder

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Authors: Rob W. Shongwe, Modise L. Mashishi and Dr. Louis van Antwerp

04 October 2016

LEADING THE ELECTRICITY DISTRIBUTION INDUSTRY

Points for discussion

- Energy losses management
- Energy flow
- Energy losses breakdown (Network Level)
- Simple network diagram
- Typical network scenario
- Feeder balancing overview
- Feeder Balancing Application data architecture
- Feeder balancing process
- Mapping of substations/switching stations, stats meters and feeders
- Typical Energy Balancing Calculation
- Conclusion

Energy Losses Management

Analyse Energy Losses

- Dx/OU Losses
- Energy Balancing
- LPU/SPU Demand/ Consumption
- CC&B Anomaly Reports
- Tip Off's
- Technical Losses Simulation

Plan & Execute Audits

- Plan & Prioritise Audits
- Source & Manage resources to perform audits
- Perform Audits & Capture required info
- Consolidate & Report on Audit Findings

Resolve Audit Findings

- Remove Illegal Connections
- Disconnect Tampers
- Issue/Manage Tamper Fines
- Revise Supply Group Codes
- Repair Faulty Meter Installations
- Correct Data Issues
- Recover Revenue

Evaluate Performance

- Losses performance reporting
- Evaluate ROI of losses management interventions
- Implement continuous improvement initiatives

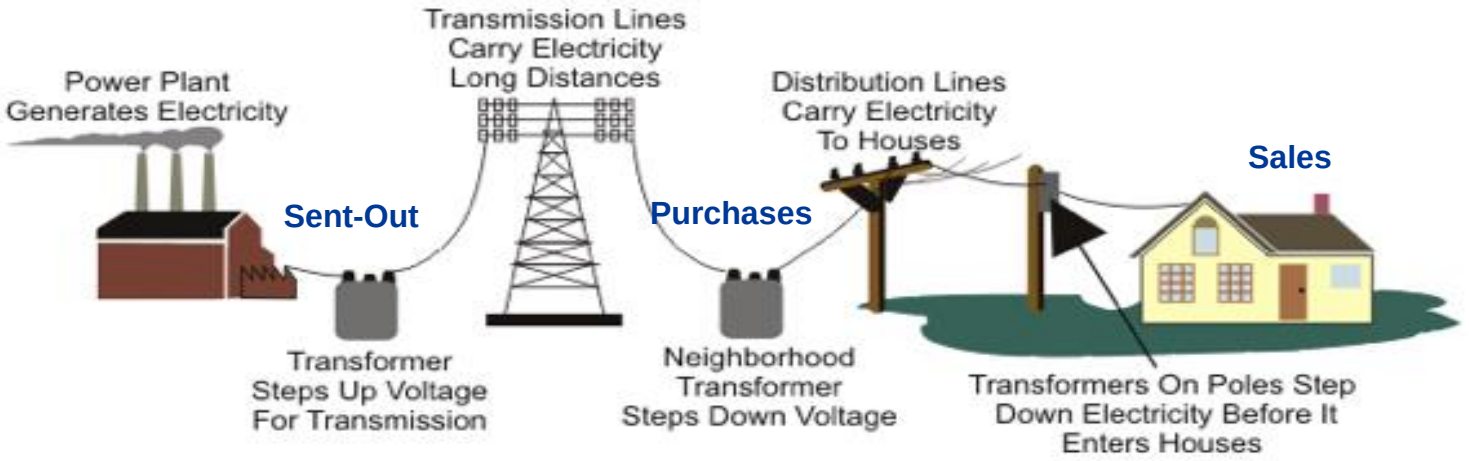
Social Marketing (Operation Khanyisa)

Investigations, Arrests, Prosecution

Systems – Risk Analysis, Energy Balancing, Audits, Data

- **Distribution**
- **Customer Services**
- **Corporate Affairs**
- **GroupSecurity**
- **Group IT**

Energy Flow

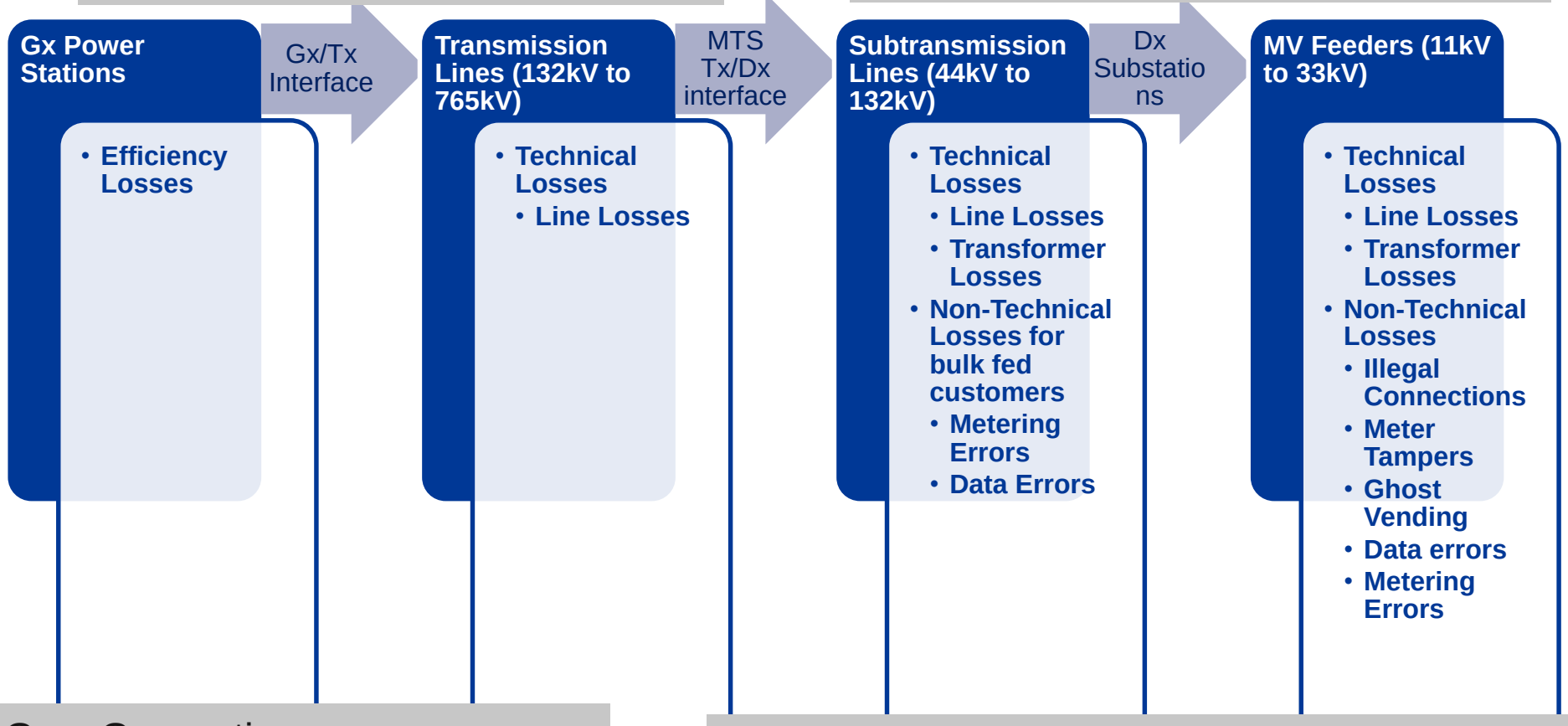

Power Plant
Generates Electricity
Transmission Lines
Carry Electricity
Long Distances
Distribution Lines
Carry Electricity
To Houses
Sales
Sent-Out
Purchases
Transformer
Steps Up Voltage
For Transmission
Neighborhood
Transformer
Steps Down Voltage
Transformers On Poles Step
Down Electricity Before It
Enters Houses


Tx Losses
Dx Losses
Sales
Tx
Dx

Energy Losses Breakdown (Network Level)

Tx Losses Measured as difference between energy metered at Gx/Tx interface and Tx/Dx interface

Dx Losses Measured as difference between total MTS purchases (from Tx) & total Dx Sales

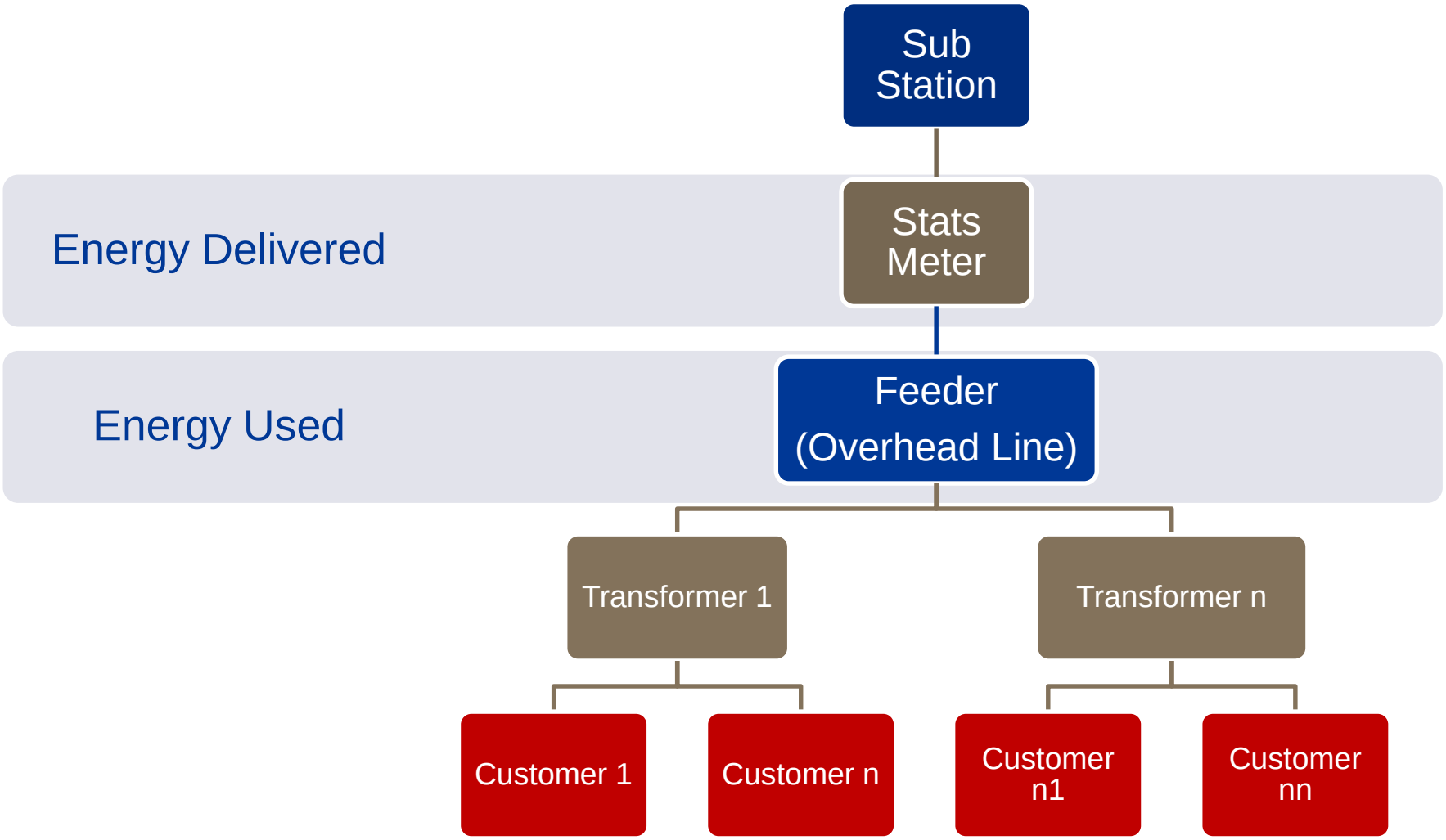


Gx – Generation
Tx – Transmission
Dx – Distribution
MTS – Main Transmission sub

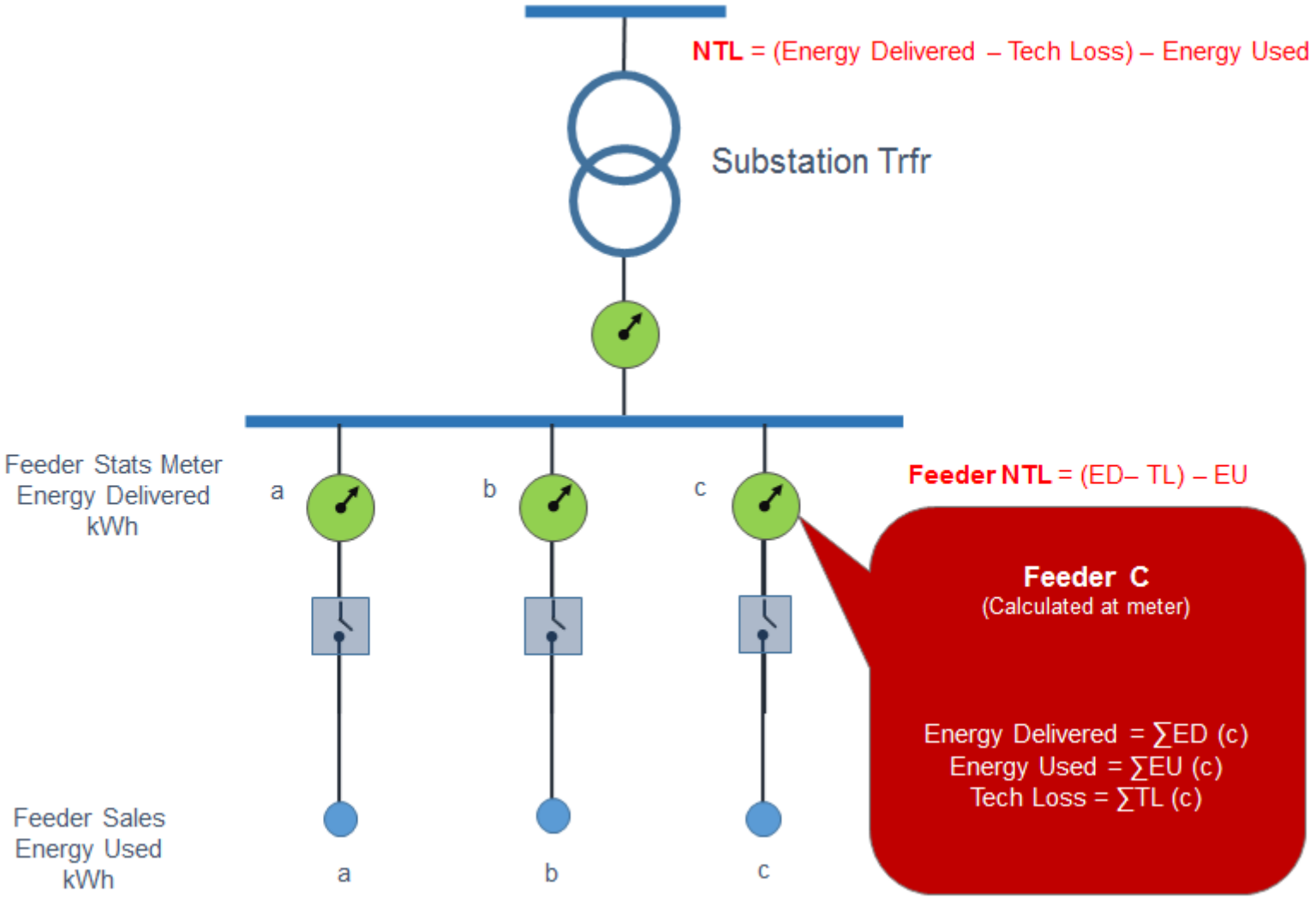
MV feeder level losses measured as difference between statistical meter energy inflow & total sales for customers linked to the feeder

*current coverage of MV feeders with stats meters is 90%

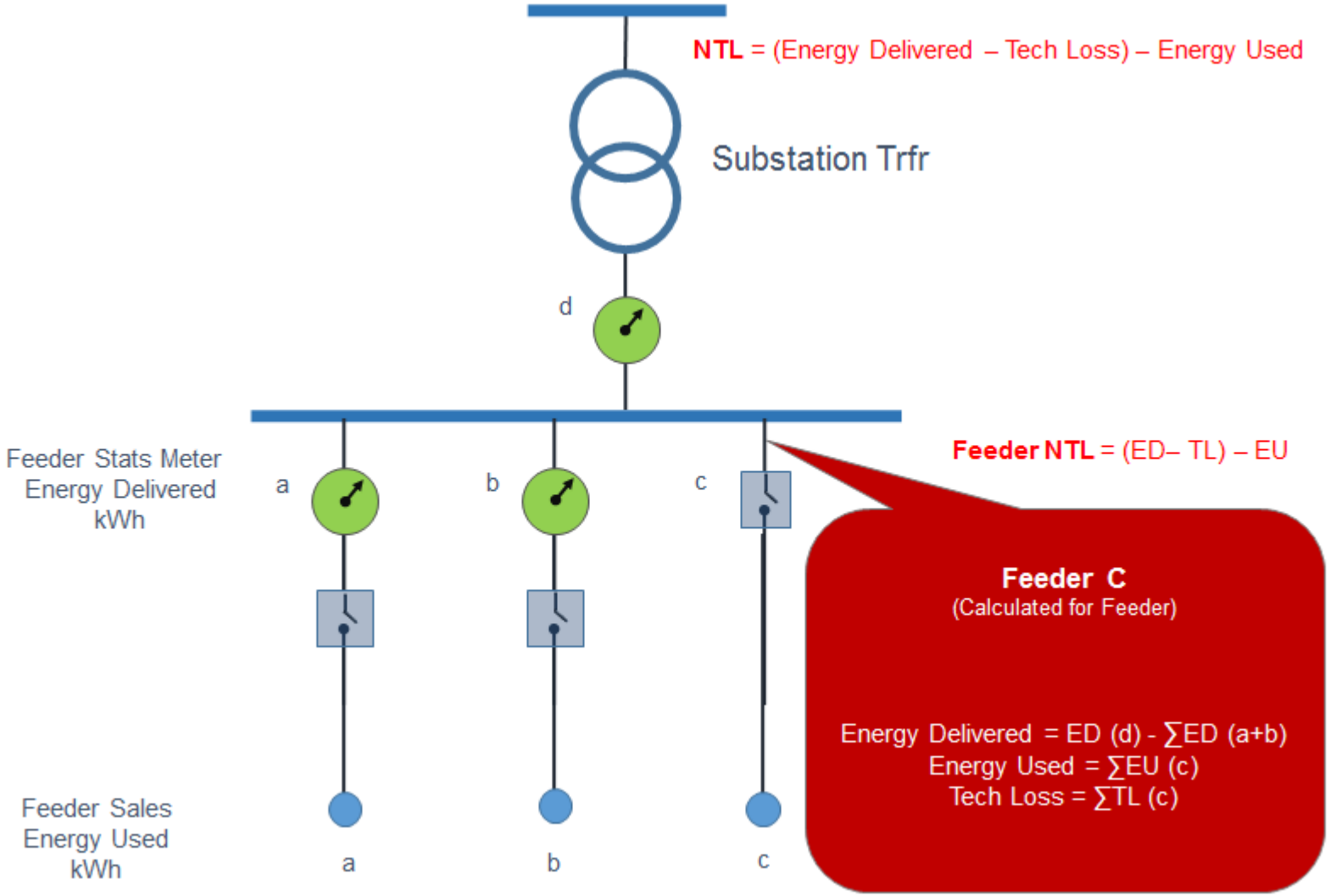
Simple network diagram



Typical scenario i/ii)



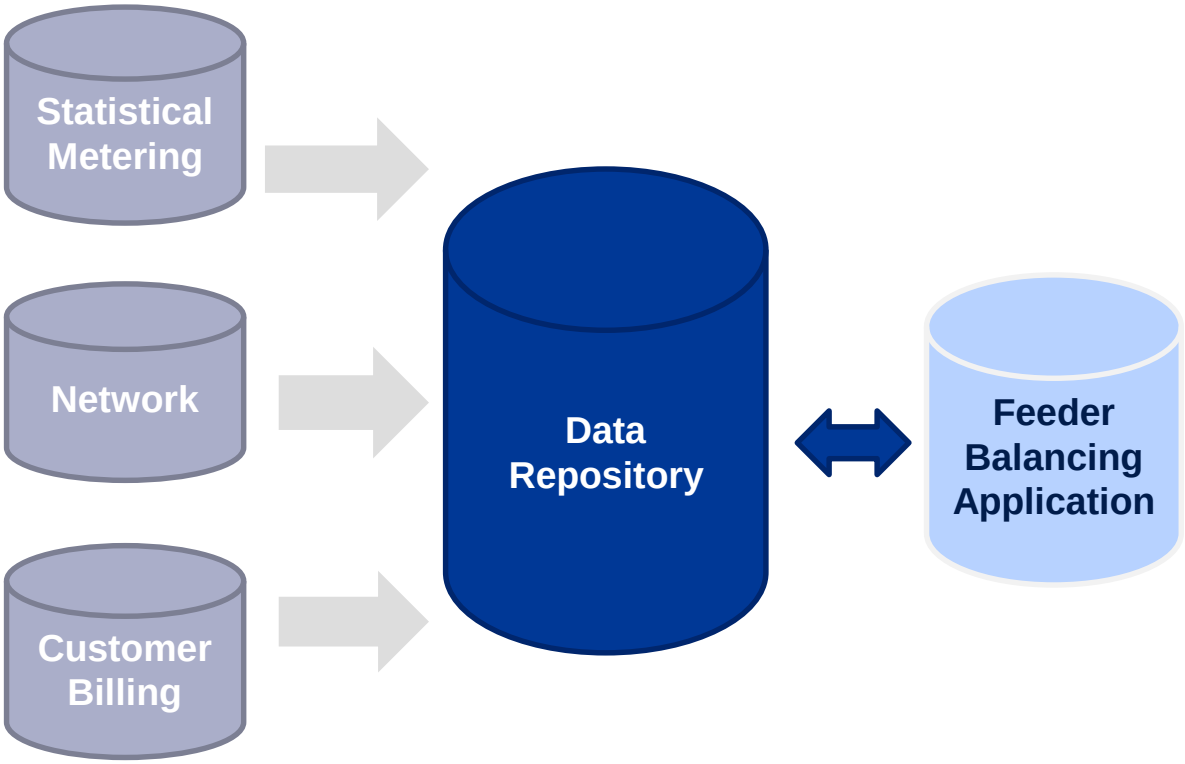
Typical scenario ii/ii)



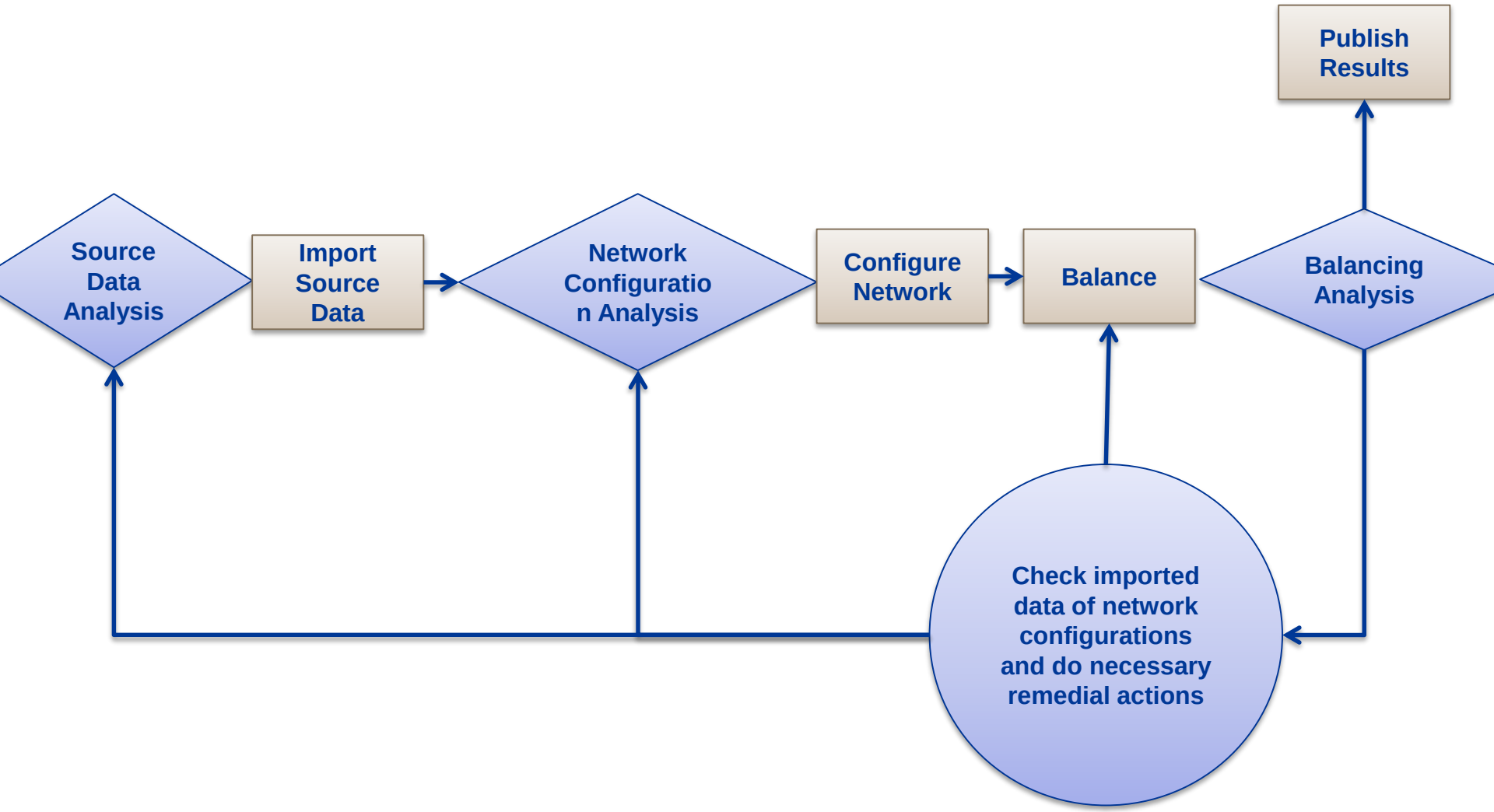
Feeder Balancing Overview

- The Feeder Balancing Application (**FBA**) purpose is to enable calculation and analysis of Technical Losses (TL) and Non-Technical Losses (NTL) by comparing energy delivered to energy used at **MV** feeder level.
- FBA enables the **mapping** of stats meters to feeders, mapping of **unallocated CDU sales** to feeders, **adjustment** on energy delivered and used, setting and changing various **statuses** and TL %.
- **Energy Delivered** readings are recorded and calculated on a **Stats Meter** from **meter management system.**
- **Energy Used** is customer consumption billed on **customer billing system**. This is linked to and summed up at a **Feeder (Overhead Line)**.
- Substation, Feeder and Transformer/Bulk details and mappings**.**
- **TL** is calculated on a Feeder (Overhead Line)**.**
- **NTL** = (Energy Delivered – TL) – Energy Used. This should be calculated on a Stats meter.

FBA Data Architecture



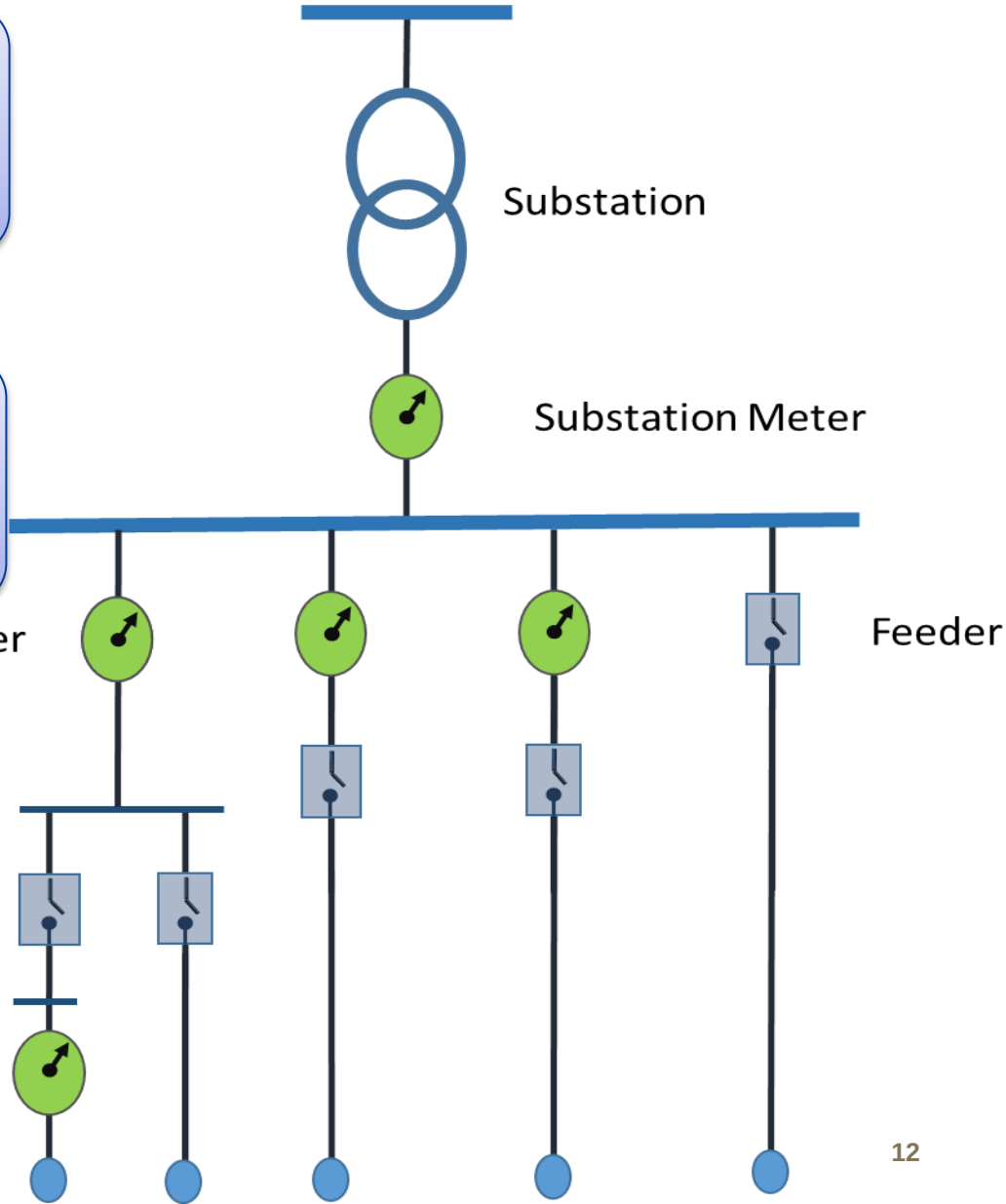
Feeder balancing process



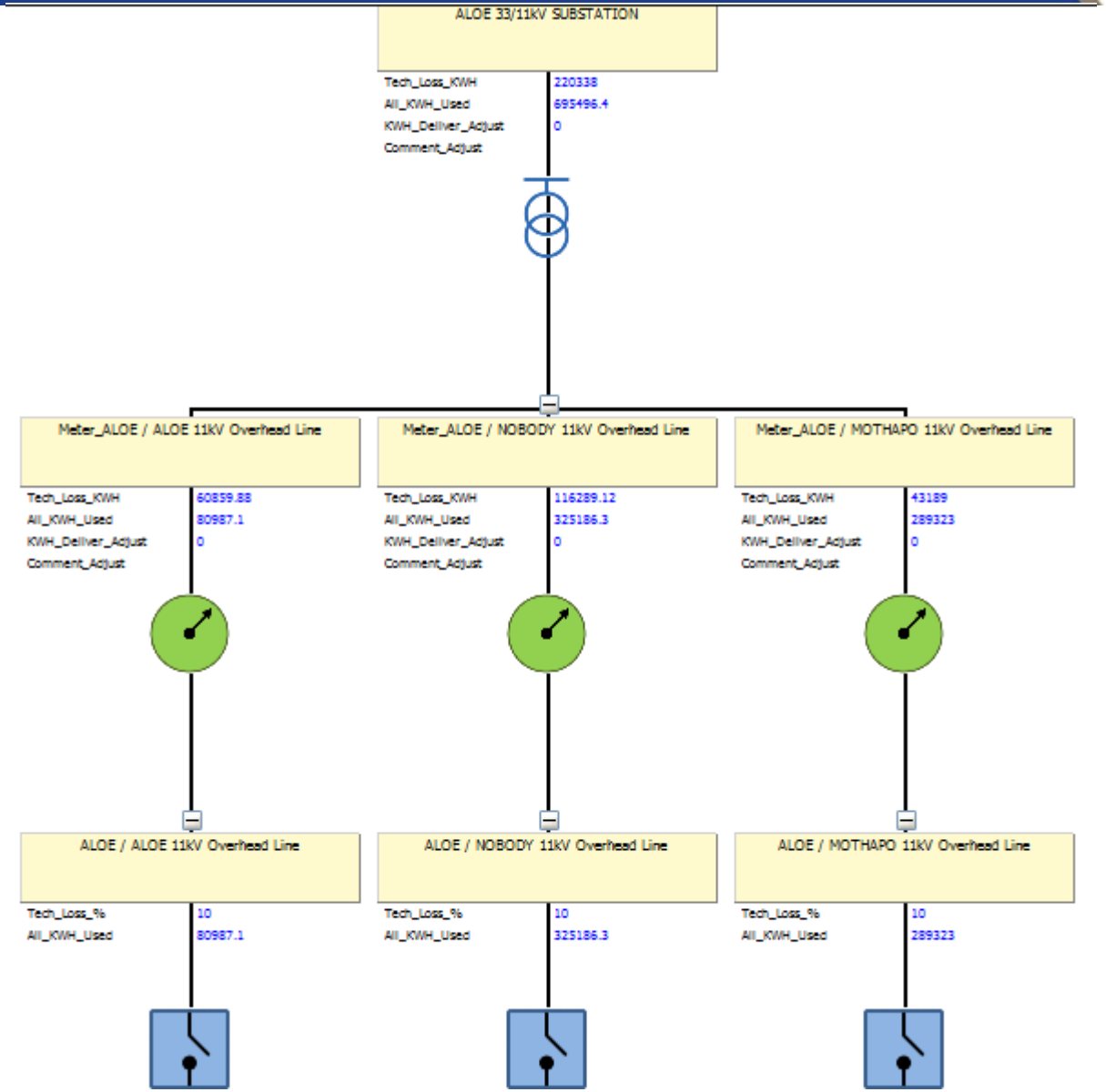
Mapping of substations/switching stations, stats meters and feeders

Statistical Meter → Maps to → Substation/ Switching Station

Overhead line/ Feeder → Maps to → Statistical Meter



Typical Energy Balancing Calculation (i/ii)



Typical Energy Balancing Calculation (ii/ii)

Eskom

Scenarios

Can not Balance	36	8.26%
Sub / Fdr Meter Combination	13	2.98%
Sub Metered -> 1 Fdr not Metered	2	0.46%
Sub Metered -> 2 or more Fdrs not Metered	4	0.92%
Sub not Metered -> All Fdrs Metered	189	43.35%
Substation not Mapped	192	44.04%
Total	436	

Feeder breakdown

Fdrs Metered		832	76.97%
	Metered via Sub meter	45	4.16%
	Metered via Fdr meter	787	72.8%
Fdrs Not Metered		3	0.28%
Fdrs Not Mapped		246	22.76%
Total		1081	

Balancing Non Tech Loss

	Fdrs	Meters	ED kWh	NTL kWh	NTL %	NTL % 12mma	Fdrs < 30%
KwaZulu-Natal Operating Unit	832	730	533787039	71014186	13.3%	17.44%	470
Empangeni Zone	196	163	188804732	24083369	12.76%	16.43%	94
Newcastle Zone	238	220	117964641	13138307	11.14%	16.11%	146
Pietermaritzburg Zone	398	347	227017666	33792510	14.89%	18.89%	230

Conclusion

- The case shows how the systemization of losses reduction in all business levels with the focus on the lowest level of the network at MV is done.
- For the systemisation and automisation of accurate loss calculations there are data requirements for energy delivery, energy consumption and network/configuration as well as predefined business rules adjustable to business needs.
- Network in a form of stats metering equipment and operating technology infrastructure needs to be integrated to enable the flow of the data required.
- FBA software is fed with business knowledge and experience to ensure automation of this energy balancing process in all business areas.
- Automating the calculation process gives allowance for more time to be invested in investigations and analysis.

Thank you