# Making Revenue Protection Units a Self-Funding Valuable Source of Revenue

## *Paper on revenue protection and generation through technological innovations in data management*

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**Abstract**

*The intent of this paper is to present a business case on how flawed meter reads can have a huge impact on the utility's revenue generation and collection. Most utilities in South Africa have been estimating consumer utility bills which has resulted in huge financial losses to the local and central governments. It is important to have speed, accuracy and quality in the meter data management process which forms an input to the billing and revenue collection process. The study will highlight how technological innovation can address each of the data quality issues and finally will illustrate how data completeness and collection can reduce the utility losses in provision and collection.*

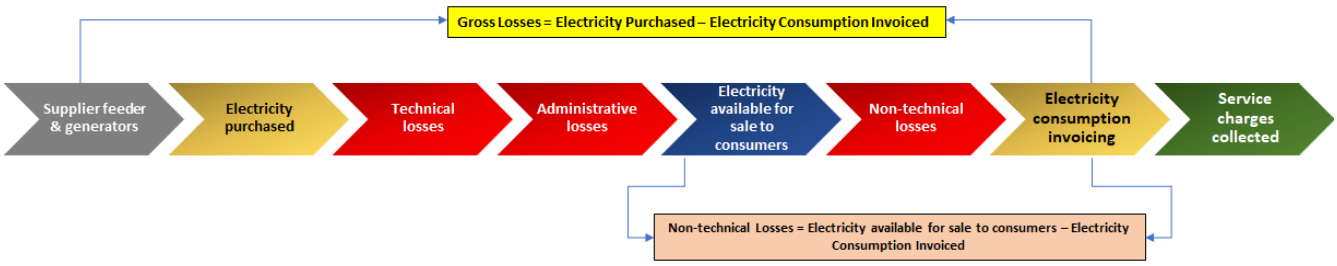
***Key Concepts***

Before getting into details about this problem, one must ensure that we all have the same understanding of what we are talking about. Key concepts used in this paper are;

a) ***Revenue losses*** for utilities is defined as a difference between energy purchased measured at the Transmission networks and energy sold to all Distribution customers (measured or estimated). This includes both technical energy losses (energy lost in the electrical networks due to the flow of current or energisation of the system) and non-technical energy losses (caused by various factors, amongst others; energy theft, incorrect or faulty metering, billing, etc). This excludes non-payment or debt management.
b) ***Revenue protection*** refers to prevention, detection and recovery of losses.
c) ***Revenue generation*** refers to income generation that commences once revenue has been protected.

## I. High level analysis of revenue losses in utilities

Non-technical losses for utilities can be depicted in the schematic below;




Electricity is purchased in bulk from energy suppliers. The total amount of electricity purchased is then distributed to the various customer market categories, i.e. industrial, business, agricultural and domestic. Technical losses are incurred in the distribution process (currently presumed to be 9%, although there is apparently an indication that it may be only 7%). Electricity is eventually delivered at various consumption points and measured.

Utilities across Africa are in a state of distress and failing to meet their financial obligations in the short term because of not achieving the targeted gross margin, negative cash flow and a deficit which is compromising business operations, delivery on the mandate. Changing market dynamics threaten the sustainability of their business model. **At the centre of the problem statement lies external macro challenges within the energy sector as well as internal inefficiencies embedded in the system.**

The City of Johannesburg has succeeded in reducing its total electricity losses to 11.2% in 2016/17, down from a staggering 13.44% in the 2015/16 financial year. Increasing trend in non-technical losses has been demonstrated by City of Tshwane, whose losses are up from R 858 million in the financial year 2015/16 to 1041.3 million in 2016/17. Even though the percentage of energy losses has reduced for City of Johannesburg it is still quite alarming to notice the level of non- technical losses incurred by utilities. ***Any increase in revenue from one year to another year is due to tariff increase and clawing back some units from non-technical losses.***

If energy losses are curbed, it would either reduce costs and ease demand on the system to be used by other customers or recover additional revenue the utility would have otherwise not recovered. This makes it imperative for the utilities **to manage energy losses tightly to avoid strain on the system and the profitability of utilities.**

## II. Where are the utilities going wrong?

Apart from the external macro factors such as illegal connections, meter tampering and theft, **internal inefficiencies such as data management** add-up to the non-technical losses.

a) Poor maintenance of customer data (Addresses, Account Number, etc.): Lack of customer data quality management and associated system updates leads to inconsistency in data sets giving rise to challenges as follows;

i. Un-located addresses for manual read meters: Inability to respond swiftly to detected energy theft, and inability to fast-track maintenance of meter change out for customers who logged queries

ii. Poor data capturing of meter readings: Meter readers often capture data that throws exception during the validation phase. Some of these errors are not resolve within the meter reading window and therefore impact on accurate billing of customers. Meter readers must face penalties for poor data capturing.

iii. Inaccurate billing of customers: Inaccurate billing tends to promote the culture of non-payment with disgruntled customers. Inefficient management of meters or not fulfilling work orders often leads to customers being billed on estimates rather than actual consumption. There are cases where customers on prepaid are still billed and invoiced for some time after they have been converted to prepaid. Inaccurate billing is a major contributor for customers having negative sentiments about the organisation.

## III. How can the utilities use technological interventions to address challenges relating to non-technical losses?

To mitigate the impact of non-technical losses on their revenue profile, utilities will have to initiate technological interventions in key focus areas of their business to curb the growing trend of energy losses. Business process management systems, mobility, cloud-based solutions, artificial intelligence will be the key components of the digital era which will assist utilities in enhancing consumer experiences, operational efficiencies and changing business models.

As improved data accuracy is critical to workflows implemented in curbing energy losses, it is inherent that the business segments processes be transformed using cloud computing tools. Key technological interventions can direct utilities on to the path of revenue protection. With the objective of curbing non-technical losses arising due to data mis-alignment, utilities can adopt a phased approach to resolving data quality issues.

### Key Technological Interventions

1. Phase I

**i. Data Cleaning**

It is necessary for all utilities to have an updated database, both for ensuring efficient contact with their customers and maintaining compliance standards. Data Cleansing or data scrubbing is the process of identifying and correcting inaccurate data from a data set. Procedure to cleanse data includes the following steps;

a) Data Auditing – Audit the entire database using statistical and database methods to detect anomalies and inaccuracies.

b) Consolidate Data – apart from removal of anomalies, define links between multiple data sets and consolidate multiple databases. For instance, consolidation of customer data, supplier data etc.

c) Feedback – establish control mechanism where inaccurate information can get reported and this gets updated into the database.

d) Repeat – process of data clean-up should not be a one-time process, instead it should be made a part of a regular workflow.

**ii. Overcome IT infrastructure inefficiencies**

To stay current with sophisticated technology, it is imperative to root out inefficiencies that can be extremely time-consuming and intimidating. Steps to manage IT infrastructure are;

**1. Computing Platform upgrade**

a) Data storage – move out of large in-house IT infrastructure consisting of hard drives and servers for data storage. Make use of cloud storage solutions and management.

b) Update technology – investigate and keep abreast with technology. Streamline the business requirements and make use of those software and applications which can efficiently drive the business processes.

**2. Network efficiencies**

a) Network upgrade - software-based methods and network architecture design to cater for a reliable network in place.

b) Network optimization – Be able to migrate IP address to multiple hardware. Build intelligence in wired and wi-fi connectivity network to reduce costs.

**3. Improve Data Analytics and control over IT systems**

a. Standard framework for data transfer - easy data transfer between different tools and layers.

b. Improved Analysis – Comprehensive data transfer would permit improved data analysis. These analytics would be used for industrial control systems and for network and IT monitoring.

**iii. Workflow and content automation & management (WCA)**

Workflow automation is an easy way to streamline manual and paper-based operational processes often comprised of unstructured tasks involving people, processes, and content. Workflow and Content Automation (WCA) represents the consolidation of traditional workflow and content generation into a new category to support the needs of a digital business.

**1. Define standard process**

a) Standardise processes – define standard business process and refrain from using multiple software applications for the same process.

b) Software upgrades - Infrequency or inconsistency in software upgrades greatly contributes to diminished output. Creating robust policies that govern the implementation and use of standardised software for specific business functions cuts out wasteful overlapping of technology.
c) Optimum utilization of resources - The more efficiently business applications are implemented and managed from the get-go, the more time IT managers have to innovate instead of focusing on troubleshooting and maintenance.

**2. Virtualisation**

a) Manage virtual operations- Virtualisation is ever expanding with more entry points into networks and the switches between devices and applications. Exercise greater control over physical servers, routers and firewalls, as well as virtual networks and security systems, which is crucial for the continuity of business operations.
b) End to end visibility - Being able to view and manage both physical IT infrastructure and the virtual environment from a single platform is the best way to simplify troubleshooting and minimise inefficiencies.

## 2. Phase II

### iv. Information Life cycle management (ILM)

In due course, the utilities must adopt an Information Life cycle management approach to curb external factors from harnessing to their non-technical losses.

Information life cycle management is the consistent management of information from creation to final disposition. It is comprised of strategy, process, and technology to effectively manage information which, when combined, drives improved control over information in the enterprise. It aligns existing information management disciplines, including: Enterprise Content Management, Archiving (application and information), Electronic Discovery (eDiscovery), Records Management, and good storage practices. Technology + processes = ILM

**Approach to implementing ILM**

a) Business interface - Service level management, understand your data growth trends, determine your success criteria
b) Business value integration - Storage policies and information classes, select a solution with pre-packaged business rules, customize the business rules, as needed, test the business rules, create user access policies, ensure restoration
c) Storage management integration - Resource and metadata management, establish a data retention policy
d) Information placement -Storage optimization, data protection and retention management.
e) Physical infrastructure - Data storage, movement and management
f) Follow a time-tested methodology

## 3. Cost-Benefit Analysis

| | **Benefit Areas** | **Average Costs** |
|---|---|---|
| **Tangible Quantifiable Benefits (Hard $) -** Reduces COSTS | Data Storage | Hosted server (fixed cost) = R1400 to R14000 a month. Cloud hosting = usage = R 98 a month for 1 TB of stored data. |
| | Data Cleansing | Average rate of R4000/hour ~ R 3 million (requiring 4 Data Analyst to work on any size of data). Cost is 0,2% of amount of non-technical losses accrued. |
| | Workflow & Content Automation | Basic project task management automation tools costs R 8400 a year as licensing fee. A cloud-based workforce management tool would cost between R 3,5 million to R 11 million a year. Costs of R 11 million would be saved by leveraging on tool benefits of process efficiency and improved customer services. Software companies today have a pay as you go model which is priced at approximately R6 per account per month including meter reading, billing, data management, CRM and the entire utility life-cycle with no costs for infrastructure and extra software licenses. |
| **Non- Tangible Quantifiable Benefits (Soft $)** | Findability | Reduces skilled worker searchability time required to locate information. |
| | Reuse | Reduces unnecessary document recreation and 'reinventing the wheel'. |
| | Data Security | Protection of personal information and ability to apply legal holds to data security. |
| | Quality | Improve information relevancy, applicability, dependability and visibility. Facilitates automated information tracking & monitoring. |
| | Enhances Productivity | Collaboration & process efficiency- visibility of processes and accountability can increase workplace collaboration immensely. |

| | Benefit Areas | Average Costs |
|---|---|---|
| | Enhances Productivity | Improved & informed decision making - Ability to view end to end processes enables improved and informed decision-making process. |

## IV. Illustration/ Business case

An illustration to depict how utilities can commence implementing Workflow and content automation & management (WCA).

### i. Business Challenge

Depicted below is utilities revenue management value chain


Utilities sale of electricity to customers begins with meter installations/ replacements and ends with invoicing customers for the electricity consumed and the final revenue collections. **Measurement of electricity consumed by customers forms a key input to the billing process.** Inaccuracy in consumption measurement would render inefficiency in the revenue collection process. An overstated consumer bill delays the revenue realisation process by a minimum of six to seven months. Apart from revenue realisation from customer, utility will have to deploy additional resources for dispute management and write off the overstated revenue from their financial statements once the sum has been realised from the customer.

### ii. Current state - where are the utilities going wrong with the revenue management process?

Most of the utilities in South Africa arrange with third party contractors for measuring consumer electricity consumption. Third party contractors are given meter read schedules and are directed to capture customer and meter technical data (including reads) using handheld devices. The utilities follow a conventional meter management to billing workflow which overlooks significant field validations. Challenges which go unidentified in the current process are;

a) Inconsistency in input and output data fields.
b) Variations in methodology of data transfer between utility and third-party contractors.
c) Manual data entry and absence of validations throughout the meter management process.
d) Multiple touch points leading to inconsistency in data.
e) Lack of end to end consumption data visibility curbing data forecasting.

***Under these circumstances, data analytics done as a thumb rule basis and acts as a disconnected module in the value chain.***

A sample meter reading data of one of the leading utility's in South Africa was analysed to re-instate the problem of inaccuracy of input meter reading data leading to revenue loss for the utility.

**Single Phase 60A Residential Conventional**

| Account Number | Meter Number | Meter Number Found | Reading Date | Reading (Kwh) | Comment | Note | Physical Address | QC Status | QC Reject Reason |
|---|---|---|---|---|---|---|---|---|---|
| 200200000 | CCCC60000 | CCCC60000 | 2018/01/20 | 61621,00 | | | XXX | Reading Confirmed & Accepted | |
| 200200000 | CCCC60000 | CCCC60000 | 2018/02/19 | 61814,00 | | | XXX | Reading Confirmed & Accepted | |
| 200200000 | CCCC60000 | CCCC60000 | 2018/03/11 | 619648,00 | | | XXX | Reading Confirmed & Accepted | |

**Based on 2017/18 tariff for Single phase 60A**

| Incorrect Usage (in kWh) | | | | 557834 |
|---|---|---|---|---|
| | Max. Size | Usage | Tariff(c/kwh) | Amount (ZAR) |
| Block 1 | 500 | 500 | 110,65 | 553,25 |
| Block 2 | 1000 | 500 | 126,98 | 634,9 |
| Block 3 | 2000 | 1000 | 136,35 | 681,75 |
| Block 4 | 3000 | 1000 | 143,86 | 719,3 |
| Block 5 | 300000 | 554834 | 150,91 | 754,55 |
| **Sub-total** | | | | 3343,75 |
| DSM Levy (c/kwh) | | | 2 | 11146,68 |
| Service Charge | | | | 114,57 |
| Capacity Charge | | | | 337,52 |
| **Total charge for the month** | | | | **R14 942,52** |
| Average Tariff (c/kwh) | | | | 0,03 |

**Based on 2017/18 tariff for Single phase 60A**

| Correct Usage (in kWh) | | | | 134 |
|---|---|---|---|---|
| | Max. Size | Usage | Tariff(c/kwh) | Amount (ZAR) |
| Block 1 | 500 | 134 | 110,65 | 148,271 |
| Block 2 | 1000 | | 126,98 | |
| Block 3 | 2000 | | 136,35 | |
| Block 4 | 3000 | | 143,86 | |
| Block 5 | 300000 | | 150,91 | |
| **Sub-total** | | | | 148,271 |
| DSM Levy (c/kwh) | | | 2 | |
| Service Charge | | | | 114,57 |
| Capacity Charge | | | | 337,52 |
| **Total charge for the month** | | | | **R600,36** |
| Average Tariff (c/kwh) | | | | 4,48 |

Note that under these circumstances the utility is unable to repay the power suppliers, which leads to further increase in costs of electricity for the consumer.

These anomalies can be circumvented by mandating the use of the work-force software guaranteeing data accuracy by all meter readers. The workforce applications for example, oblige each meter read to be accompanied with a photo of the meter. The meter photo contains encrypted hashes that guarantee that the image has not been tampered with and the image meta-data (location of the photo and the date time of the photo) is accurate.

### iii. Cloud based workflow and content management - How can revenue losses be curbed through meter management workflow automation?

By implementing a cloud-based **meter management to billing workflow**, utilities will be able to save costs on data storage, searchability, process efficiency. In addition, utilities will have a better control over the data and be able to provide end to end visibility.

a) **Data storage –** Study has shown that, storing data onto a hosted server would have a fixed cost of $100 to $ 1000 a month while cloud hosting is dependant on the usage. For example, a client would pay $7 a month for 1 TB of stored data.
b) **Searchability –** Decrease knowledge worker time required to locate needed information. Reduce search time due to multiple file copies or inadequate metadata.
c) **Process efficiency** - Manual process lead to inaccuracies and adds to an estimated 30 minutes in creation of new documents. Assuming employee is paid at ZAR100 an hour, it would accumulate to ZAR 1550 per month in resolving manual input data errors.
d) **Control** - Improve the precision of applying legal holds. Provide mechanisms that increase the security of information assets.
e) **Quality & Visibility**- Improve information timeliness, relevance, trustworthiness, and transparency. Facilitate automated information monitoring
f) **Invoicing Delay** – Invoicing and payment is currently after the month of meter read. With new software solutions, the invoice can be presented to the consumer immediately after the meter has been read.

| Business Process | Process Interventions | Benefits |
|---|---|---|
| **Billing** | • Web Portal billing<br>• Built in validations<br>• Exception handling | • Online monitoring and tracking of data<br>• Centralised data processing |
| **Consumer utility experience** | • Ability to measure consumption and make alterations | • Online monitoring and tracking of data |
| **Meter Management (Auditing, Reading, Installation)** | • Schedule Management<br>• Built in validations<br>• Image recognition data capturing<br>• Capture Images with imprinted GPS co-ordinates and date of capture<br>• On site meter read verification with historic reads.<br>• Improved Tracking via GPS co-ordinates.<br>• Meter Fault Reporting<br>• Meter exception handling | • Online monitoring and tracking of data<br>• End to end visibility of revenue value chain<br>• On-site validations supporting real time monitoring<br>• Efficiency in resource management leading to cost reductions |
| **Prepaid vending** | • Online prepaid vending management<br>• Tracking of historic purchases | • Online monitoring and tracking of data |
| **Database management** | • System reporting dashboards<br>• Data export in multiple formats | • Immediate corrective action |

## V. Summary

In the Utilities sector, there is an increasing urge in the adoption of mobile solutions for internal processes as well as customer facing applications and services. There is an increasing desire to serve field engineers with a mobile solutions to create efficiencies in the internal processes. According to the World Quality Report 2018-19, in utilities sector there are around **300 million smart meters installed world wide and these will increase by another 60% by 2020 – 2025.** The explosion in the roll out of these devices puts pressure on the utilities to effectivey serve each device as well as try and manage them remotely.
However, unlike other sectors, public sector funding are dependant upon political decisions which vary acccording to time and place. Hence, most solutions are implemented in isolations without proper quality checks at all touch points. This has resulted in huge revenue losses for the utilities and in turn for the government. Cloud based solutions are easy to implement, flexible, reliable and ensure data security. **Given the budgetary constraints, cloud-based solutions; represent a potential cost savings of 30%.** These are actual cost savings that go unnoticed in the bigger organisations. Majority of this cost savings is accounted for by storage costs, which are at least an order of magnitude less expensive in the cloud versus on-premises.

## VI. References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