Revenue Protection in Emnambithi/Ladysmith Municipality – Let's Start with a Meter Sweep

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Synopsis

Emnambithi/Ladysmith Municipality, like most municipalities is faced with the growing problem of non-technical losses. It is difficult enough in the current electricity climate to manage a small scale utility and having the additional problem of electricity theft is certainly unwelcome. This paper discusses Emnambithi/Ladysmith Municipality's approach to dealing with this growing problem. The paper will deal mostly with the development of a structured process of meter sweeping as well as the implementation of further control measures to minimize future losses.

1. Context

Emnambithi/Ladysmith Municipality, although a relatively small utility, is the sixth biggest municipal electricity distributor in Kwazulu-Natal. The municipality includes the townships of Ladysmith, Steadville and Colenso. Electricity is purchased from Eskom at 132kV in Ladysmith and 6.6kV in Colenso. The municipality has 14 061 electricity customers with an annual turnover from electricity sales of approximately R 87m (2007/2008). A breakdown of the customers and the respective income from each customer group is shown in table 1 below.

Customer Category	Customers	Energy/kWh	Income (Incl VAT)
Temporary Supply	22	162,627	R 2,051,728
Residential - Credit	6084	68,163,504	R 25,848,392
Commercial	1142	30,903,403	R 17,159,545
Prepaid - Indigent	2500	4,500,000	R 1,339,000
Prepaid - Domestic	4200	17,136,000	R 7,651,224
Prepaid - Commercial	30	720,000	R 388,800
Industrial - LT	52	16,603,623	R 7,181,453
Industrial - HT	31	91,083,534	R 25,173,868
TOTAL	**14061**	**229,272,691**	**R 86,794,011**

Table 1: Customer Classification and 2007/2008 Income

2. Loss Calculations

The annual losses (both technical and non-technical) are detailed in Table 2. Losses amount to approximately 15% of the total electricity purchased from Eskom. If one considers a 6% technical loss (assumed and includes streetlight losses of approximately 1 GWh per annum) then theft accounts for a 9% loss. The direct cost to the municipality is approximately R 4.264m per annum with a loss of income to the municipality of approximately R 10m.

Category	kWh	Percent
Electricity Purchased	268,215,312	100%
Electricity Sales	229,272,691	85%
Losses	38,942,621	15%
Technical (Assumed)	16,092,919	6%
Theft	22,849,703	9%
Cost at R 0.1866	R 4,263,755	
Income Lost at R 0.44	R 10,053,869	

Table 2: Loss Calculation

3. Distribution of Losses

Paragraph 2 above shows theft to be approximately 9%. It is however interesting to take a more detailed look at this figure as it may be misleading. Table 1 shows that approximately 47% of the total energy sales are to industrial customers. Due to the small number of industrial customers and their regular inspection (monthly) one can assume that very little losses occur here. It therefore implies that losses are actually in the order of approximately 17% if one eliminates the sales to industrial customers. Stretching this point even further to by apportioning say 50% of the losses to credit meter customers (both residential and commercial) implies that the losses from prepaid customers could be as high as 51% based on units sold. See Table 3.

Total Theft	22,849,703

Customer Category	Sales	Loss Distribution	Loss Amount	Percent
Temporary	162,627	0%	0	0%
Residential - Credit	68,163,504	25%	5,712,426	8%
Commercial	30,903,403	25%	5,712,426	18%
Prepaid	22,356,000	50%	11,424,852	51%
Industrial	107,687,157	0%	0	0%
Total	229,272,691	100%	22,849,703	10%

Table 3: Distribution of Losses

It is clear from the above analysis that Emnambithi/Ladysmith municipality has a major problem with losses especially in respect of prepaid meters. A meter sweep is therefore clearly required to eliminate these losses.

4. Meter Sweep

4.1 Aim

The major aim of the meter sweep will be to minimize the loss of revenue from meter tampering. There is however a secondary aim which is just as important. This revolves around the data clean up. As with most electricity utilities in South Africa, the Emnambithi/Ladysmith municipality customer database is not that reliable. This clean up essentially aims to;

- Ensure all electricity connections are accurately recorded in the customer database.
- Verify and record the electrical address[1] for each meter for future loss monitoring.

4.2 Out Source or In House

A decision whether to out source the meter sweep to an external service provider or undertake the project in house had to be made. The previous meter sweep, undertaken in 2004, was out sourced. Whilst the results were most certainly satisfactory, the professionalism of the service provider was brought into question. Furthermore, it is pertinent to note that the main labour force used in a meter sweep is semi-skilled. These persons can be readily sourced within local communities and this fits with the municipality's job creation programme.

Due to previous experiences with out sourcing and the fact the municipality had the necessary expertise internally it was decided to undertake the meter sweep in house. It is however noted that service removals will still be outsourced due to the municipality's shortage of electricians.

4.3 Basic Process

As defined in the meter sweep aims, it is critical that the meter sweep strengthens the customer database specifically to ensure all meters are registered and have an electrical address. Since the municipality operates a lot based management system, the meter sweep is also done using lots as the chief control measure.

4.3.1 Customer Awareness/Education

Customer awareness and education is critical. It is the opinion of the author that this is the biggest problem facing the revenue protection practitioner. There is major denial as to the level and impact of this problem. We have created the euphemism "non-technical losses" to describe theft. The CEO of Eskom, Jacob Maroga, describes the theft of electricity as "very low"[2] and politicians skirt the topic as if it were the plague. Utility engineers are scared to act, as they fear their political masters.

In Ladysmith, an extensive awareness campaign was done through local media, ward committees and distribution of pamphlets within the community. This however still proved to be insufficient as once the disconnections started in earnest amnesia set in.

4.3.2 Staff Integrity

In-house staff are just as prone to bribery as any other person. The temptation is massive and this must be considered when developing the meter sweep process. Since it is noted that bribery of sweep inspectors is likely to occur, systems must be put in place to cater for this potential dilemma. Let us consider how a sweep inspector can falsify records in order to receive a bribe and how this can be combated.

4.3.2.1 Vacant Land

Report the stand as being vacant land and hence no meter exists. This can be verified by checking the valuation roll to ensure that the stand is in fact vacant.

[1] Electrical Address: Transformer Number and Circuit Number

[2] Response to a question by Chris Yelland at Eskom Media briefing - http://www.eepublishers.co.za/view.php?sid=12745

4.3.2.2 No Supply/Supply Removed

Report stand as having either no supply or the supply has been removed. This will be checked against information available but ultimately require a follow up visit.

4.3.2.3 All Okay

The inspector reports the meter as all okay. In this instance the customer's purchasing (in the case of prepaid meters) or consumption (in the case of credit meters) must be checked. Any potential problem must be flagged as either;

- **Query** – revisit is required.
- **Potential Tamper** – installation is to be monitored.

4.3.2.4 Damaged/Faulty

The meter inspector reports the meter as damaged or faulty. In these instances, the meter will be re-inspected by the electrician dispatched to do the meter replacement.

4.3.2.5 No Inspection Sheet Completed

The inspector fails to complete an inspection sheet at all. This will be detected by GIS verification.

4.3.3 Cadastral Information

Emnambithi/Ladysmith municipality has very few customers (approximately 100) that do not live in formal housing. For this reason meter sweeps are based on the latest cadastral information available. Every inspection must be linked to an erf number.

4.3.4 Electrical Infrastructure – Electronic Data

The bulk of the electrical infrastructure in Emnambithi/Ladysmith municipality has not been captured onto a GIS system. For this reason, the first phase of the sweep process is to add transformers and LV circuits to the GIS database.

4.3.5 Transformer/Circuit Control

Sweeping will be done by transformer and LV circuit. Essentially meter inspectors are provided with a drawing showing the transformer location and LV circuit layout along with the cadastral information. They are then to sweep properties fed from the LV circuit.

4.3.6 Data Capture

Using an internally developed management system, data capture is done in a structured and controlled manner. This management system only allows data to be entered in a specified manner. It furthermore ensures that all the necessary checks and balances are put in place.

4.3.7 No Access

Inability to gain access to inspect the meter is a major problem. In many instances, residents see the inspectors coming and they lock their houses. The sweep policy is to leave a notice requesting that the consumer contact the municipality to arrange an inspection. If they fail to respond the service will be terminated.

4.3.8 Sealing

Part of the sweep process is to reseal all meters.

4.3.9 Job Cards

The meter sweep process generates numerous job cards that need to be controlled from inception to completion. Job cards generated include:

4.3.9.1 Hard Disconnect – Tamper

Meter was found tampered so hard disconnect is to be done.

4.3.9.2 Meter Change (Damaged/Faulty)

Meter was found to be faulty or damaged and must therefore be replaced.

4.3.9.3 Revisit – Query

There is a potential problem with the inspection and therefore it needs to be re-inspected by a senior official.

4.3.9.4 Soft Disconnect – No Access

No access was possible when the inspector visited. The customer has not called to schedule an inspection and 14 days has elapsed so the service will be terminated.

4.3.9.5 Soft Disconnect – Refused Access

The customer refused access when the inspector visited hence the service will be terminated.

4.3.9.6 Hard Disconnect – No Response to Soft

If a soft disconnection has been done due to failure to inspect and the customer still fails to respond then a hard disconnection is scheduled after 14 days.

5 Management System

In order to ensure a successful meter sweep the municipality required an effective electronic management system to manage the project. Since this sort of software is not readily available commercially, it was developed in-house. This system provides all the necessary control defined in section 4 above. Additional reporting is provided to ensure up to date management information is available for continued supervision.

Staff can, at the press of a button retrieve reports on inspection progress, area progress, job cards outstanding, daily productivity (both inspectors and data capture clerks), job cards completed etc.

6 Results

Some of the results achieved to date are detailed below:

6.1 Inspection Status

Every inspection has an assigned status. As an inspection flows through the system it will go from its initial status to ultimately *Complete* or *Hard Disconnect Done*. Table 4 shows the current status.

Status	Initial Status		Current Status	
	Quantity	Percent	Quantity	Percent
Complete	2509	66.8%	2534	67.4%
Customer to Call	496	13.2%	28	0.7%
Hard Disconnect Done	0	0.0%	57	1.5%
Hard Disconnect Pending	205	5.5%	302	8.0%
Meter Change Pending	60	1.6%	59	1.6%
Query	333	8.9%	329	8.8%
Query - Meter Error	124	3.3%	124	3.3%
Revisit Pending	28	0.7%	28	0.7%
Soft Disconnect Pending	2	0.1%	296	7.9%
TOTAL	3757	100.0%	3757	100.0%

Table 4: Meter Inspection Status Migration

What is pertinent to note is that there is very little increase in the number of inspections completed. This is concerning. It is largely attributed to the fact that there are numerous disconnections outstanding. The current staff shortages have made it impossible to undertake this work in house. An attempt to source an external service provider to undertake this work initially failed. When a private contractor was eventually found a major backlog had developed.

Furthermore, whilst tampering is only shown to be 9.5%, if one considers the number of soft disconnections outstanding due to no access, the total potential tamper rate is 17.4%. Add a further 8.8% for queries and the numbers start to get frightening.

Table 5 below shows some additional information in respect of the tampering detected. This analysis shows the statistics based on the meter type.

Status	Prepaid		Credit	
	Qty	%	Qty	%
Complete	954	74.01%	1026	97.99%
Hard Disconnect Done	49	3.80%	1	0.10%
Hard Disconnect Pending	112	8.69%	8	0.76%
Meter Change Pending	27	2.09%	2	0.19%
Query	130	10.09%	5	0.48%
Revisit Pending	16	1.24%	3	0.29%
Soft Disconnect Pending	1	0.08%	2	0.19%
TOTAL	**1289**	**100.00%**	**1047**	**100.00%**
Tamper	161	12.49%	9	0.86%
Potential Tamper	147	11.40%	10	0.96%
Total	**308**	**23.89%**	**19**	**1.81%**

Table 5: Meter Inspection Status By Meter Type

The statistics show a tamper rate of 12.49% for prepaid meters plus an additional 11.40% for potential tampers making the tamper rate on prepaid meters approximately 23.89%. A similar analysis on credit meters shows a tamper rate of 1.81%. It should be further noted that there are 296 soft disconnections pending (table 4) of which the majority are in prepaid areas. If we assume 200 of these are in fact prepaid meters and 80% are tampered hence the reluctance of customers to call this means an additional 160 prepaid meters are tampered. This would now mean prepaid tampering is close to 31%.

6.2 Transformer Status

Tracking inspections by transformer zone is critical. The tool used here is GIS based giving the supervisors a simple graphical view of the status of a selected transformer. Figure 1 below shows the status of transformer E390, LV Circuit 3.

Issues highlighted here are:

- Erf 1609 has the incorrect electrical address
- Erf 1459 and 1631 have no inspection record.

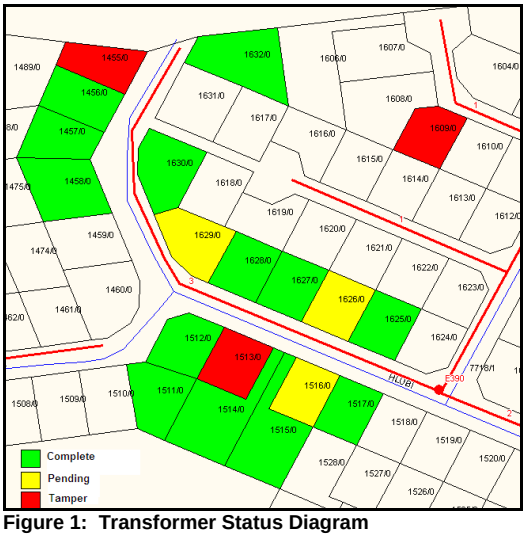

Figure 1: Transformer Status Diagram

7 Targeted Sweeps

The principle of meter sweeps and the need thereof is well documented. The cost of undertaking these sweeps must however be considered. Emnambithi/Ladysmith municipality intend to implement a policy of targeted sweeps. The issue is however; where to target? In this regard check metering will be installed throughout the municipality. This metering will monitor either individual or groups of transformers as transformer zones (approximately 200 customers). The total energy dispensed into these zones will then be compared to the energy consumed by the meters connected within that zone. As soon as the losses start to rise the transformer zone will be targeted. Results from this principle will be reported when available.

8 Challenges

There are some challenges facing the municipality. These specifically include:

8.1 Supply Chain

The Supply Chain Management policy as required by national treasury has caused many delays in the project. As the project gains momentum, this has become less prevalent.

8.2 Resources

Probably the biggest single challenge. Emnambithi/Ladysmith has a shortage of electricians. An attempt to out source disconnections originally proved fruitless – no companies responded to the tender invitation. A private company was eventually found to undertake disconnections.

8.3 Legal Issues

The Emnambithi/Ladysmith municipality was challenged in court over the legality of removing an electricity meter without a court order. The court ruled that the electricity meter was effectively the property of the house owner and therefore the municipality needed a court order to remove it. The department was ordered to restore the original meter and supply even though the Engineer argued that it was a hazardous situation. A court order was subsequently sought and the meter removed. Whilst the disconnection was ultimately carried out the local Rate Payers Association used this as a tool to drum up support against the council.

9 Conclusion

Electricity losses have a damaging effect on municipalities' viability and, considering the generation constraints facing South Africa, a major impact on our economy. The need to sweep electricity meters specifically prepaid meters is paramount.

Political support is also very important. Politicians should stop paying lip service to this problem and tackle it head on. Customer education must be tackled at all levels and must be driven by the political leaders.

Any meter sweep must be well planned and carried out. Comprehensive management software is needed. Such software should integrate with current management systems used specifically GIS, prepaid vending systems and credit meter management systems.

About the Author: Rolf Niemand graduated from The University of Natal as an Electrical Engineer in 1991. He started his career at Durban Electricity as part of his bursary commitments. Thereafter he operated as a consulting engineer specialising in municipal services specifically revenue protection and meter sweeps. After a few years in the off-grid utility sector, Rolf has returned to the

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