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Distribution Eastern Region



Easter Region Engineering

Title: *Case study of the Split metering Pilot at Edendale-Imbali*

**SARP CONVENTION PRESENTATION
CSIR Convention Centre
CITY OF TSHWANE
17 & 18 JULY 2008**

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Date : June 2008

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ACKNOWLEDGEMENTS

I would like to thank the following people for their assistance and support to ensure that this project was initiated.

- Eastern Regions Engineering manager, Mr Prince Moyo, for his support and patients
- The Eastern Region management team, Mr Riaz Asmal, Glynn Sprunt and Veer Ramnarain for their support.
- The Edendale Technical Support Centre supervisor, Mr Veeren Reddy for his role in ensuring that the technology is maintained and audited

ABSTRACT

An initiative started late 2003 resulted in a research probe into the high number of transformer failures. The probe revealed that the root cause of failure was due to theft of electricity within the peri-urban community. Further investigation revealed that bypassing of meters consisted of 60% and illegal connections 5%.

Eskom Eastern Region like all other Eskom Regional Distributors did not have a standard Split Meter solution as part of the design pack hence it was decided to conduct a pilot study in a township within the Pietermaritzburg Field Services Area. The technology solution chosen for the Eastern Region was the Split Meter. The purpose was to alleviate revenue losses due to theft of electricity by reducing theft from 60% to 3-5% on implementing the Technology. A presentation of a case study of the solution and results of the split meter technology piloted within the Edendale-Imbali townships on 3000 customers' meters is presented.

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1. Introduction

The increase in theft of electricity in the prepaid customer environment is on the increase and is resulting in mass scale theft within the peri-urban squatter and low cost housing settlements. The economic climate and the intensive marketing of products like telephone airtime, lotto and gambling have all changed budgeting mindsets and priorities. The reduced disposable income of the lower LSM customers are now lost to the above vices, resulting in little money being left to dedicate towards the essential purchasing of prepaid electricity.

Customers with conventional meters have run up debt into thousands of rands and are now faced with the burden of hefty fines. These customers are being disconnected and thus increased their debt and have opted to steal power instead. Those that usually don't steal see the unfairness and have lost all sight of ethical behaviour and are now joining the masses and stealing as well. Accumulatively, these previously insignificantly small power consumers are now collectively resulting in large revenue loses.

2. Historical Background

In the early 90's Eskom Distribution as a whole considered the prepaid market as a small sector in the Distribution business. The technology mandate was then to provide a technology which will be cheap to implement, but provide a quality infrastructure that with a life expected to span 15 - 20 years and then consider replacement. Thus from the mandate only semi urban communities and those closest to major power routes benefited power. The recent mandate for universal access has now resulted in the extension of the LV distribution lines into deep rural customers.

The above economic and market changes has happened in such a short time span that the design philosophy and the demand for connections have inundated the Distribution Business and hence the lack of appropriate technology to curb customer behaviour. In 2003 the Eastern Region initiated a study to consider Split meters as a solution to reduce theft.

3. The Research that was conducted for this significant Decision

3.1 Project Trigger

Transformer failures during 2001 cost the Eastern Region a R13 million loss for Distributions transformer failures. In an effort to reduce transformer failures a request was made to investigate the overload conditions and establish the root cause and an appropriate solution. There was also a need to delay the upgrading of transformers as networks became progressively overloaded and unbalanced over a period of time as the increased demand did not stem from increased customer ADMD.

A significant percentage of the loss was due to transformers that fail due to overloading and this was prevalent during the winter months.

3.2 Sample of customer taken to conduct the research

- The total customers that were audited is 1650
- The focus was on illegal connections on aerial bundle conductor (ABC)
- It was then discovered that meter bypassing (tampering) was also an issue and the scope was extended to meter bypassing as well
- It was then discovered that meter bypassing was a significant portion of the overloading problem and focus was provided in this aspect as well.

3.3 Calculation of Electricity losses

The losses have been calculated as shown in table 1 below. The average loss per 100 kVA supply is just about a R1 million per year. On 5000 customers this figure is approximately R15.5 million. Thus the payback period for the 5000 customers on the R16 million project at Edendale/Imbali would be just over 1 year. Technically this pushes the ADMD up to approximately 1.92!

Table 1.: Cost Comparison between Usual Prepaid Meters and the Split prepaid meters

	Meter type	Usual Prepaid Meter		Split Prepaid Meter		Business Impact	
	Current Rate of Theft in %	32%		0	%		
	Cost of electricity/kWh	R 0.52		0.52			
	Field Services Cost/income ratio	0.60		0.6			
	Cost to re-seal /meter	R 10.00		R 0.00			
	Cost to fine	R 10.00		R 5.00			
	Ratio of Houses per Pole top box	1		8			
	Revenue protection Ave Cost/meter visit	R 20.00		R 20.00			
		Normal	Theft	Normal	Theft		
	Transformer size in kVA	200	200	200	200		
	ADMD (peri-urban customers)	0.75	1.1	0.75	0.78		
	Hours of consumption per day	24	24	24	24		
	Days in a year	365	365	365	365		
	Total Power Consumption - kVA/year	1314000	1927200	1314000	1366560		
REV	Prospective revenue rands/year	R 685,514	R 1,005,420	R 683,280			
	Revenue losses due to theft rands		R 319,906		R 27,331	292575.2	Revenue loss or Money Saved if split meters are implemented!!
	% Revenue collected		53		96		
	% Revenue lost		47		4		
	Total		100		100		
ENG	At normal consumption we can connect	267		267			
	When we have theft we need to reduce the number of Customers to	182		256			
	Lost potential to connect	85		10		75	More houses conected!!
MARKG	Customers that do not steal (unhappy)	182		256			If 30 % of people steel and only 25 % of people do nothing, this means that we can expect the bal of 45 % to steel soon.
	Happy customers (because they indulged)	85		10		246	The number of Increased happy customers and just 10 in jail
REV PROT	The Average Rate of Theft	32%		4%		75	Reduced the number of customers that steel by 75, only 10 continue to steel
	The cost to reseal tampered meters	R 848		R 0		R 848	This will be the cost associated with re-sealing the meters that were tampered
	The cost to issue a fine	R 848		R 51		R 797	This will be the cost to issue fines to the house holds
	Cost of Audits	R 5,333		R 667		R 4,667	The saving in Revenue protection Audit costs
	Total Costs for Revenue protection					R 6,312	Total cost saved due to reduced auditing and inspections!!
FIELD	The percentage increase in the cost of OPS and maintenance in the transformer zone due to theft and failing transformers	28%		2%		26%	Reduction in OPS cost in these areas ie 1 day per week here to solve problems
	The percentage overload	147%		104%		43%	This will definitely result in zero failures due to no overload

3.4 Recommendations and Conclusion on the report completed in 2004

Findings

Most critical findings of the audits carried out at the various transformer hot spots were as follows

- a) The number of customer meters that were found Bypassed on average was reported to be in the region of **32 % on averaged**. This figure was conservative and expected to increase at a rate of 5 % per year. It was also found that after each successive audit and clean up that 25 % offenders bypassed newly sealed meters only after a month.
- b) The number of community house holds that will illegally connect up onto the ABC will be at the rate of **4 %**. The number that re-connected after the audit was found to be 100 %. This figure is expected to remain fairly steady and increase at a rate of 0.25% per year. If the audit savings from the door to door audits after split meters are introduced are utilised for illegals, the expected increase will stabilize at 4 – 6 %.

Recommendations

- a) It was recommended that a Split meter pilot be introduced in the region's worst hot spot Edendale/Imbali and the pilot be monitored for a year. To implement the technology to all semi urban prepaid customers if the pilot proves to be successful.

3.5 How did the pilot turn out to be a regional wide design default?

- a) The Eastern Region took the initiative to the Distribution director with the request to make the technology widely available as a design default within the region and recommend the technology philosophy to the rest of Distribution.
- b) The region is now in the process of adopting the Split metering philosophy as the first design default option with the intension to phase out the standard conventional meter.

4. The Research that was conducted for this significant Decision

4.1 What is aggravating the theft of electricity?

- a) Community resistance
- b) The slow delivery of connections
- c) The lack of customer knowledge
- d) The growth rate of technology for rural communities
- e) The lack of frequent monitoring
- f) The delay in issuing taper notices to offenders
- g) Staff ethics
- h) Loss of meters that are lost in the system
- i) Not collaborating effectively with community stakeholder to resolve theft
- j) To place a strong stance on community leader and set high standards to power cuts when defaults are noticed
- k) The slow release of vending available for customers that are in distant communities

4.2 Mitigation strategies

- a) Enclosure Robustness
- b) The implementation of stakeholder technical and customer forum that is represented by community groups to take accountability for theft offenders and cut-off.
- c) Ensuring the full role out of “ON LINE VENDING” to reach the masses and the deep rural communities
- d) Ensure that all customers are planned and prioritised for the government Universal Access implementation
- e) Ensuring controlled rollout of Free Basic Electricity FBE.
- f) Ensuring that customers that transgress the LSM groups have readily available network capacity to be upgraded without network strengthening.

4.3 Highlights

The research that was conducted on the project shows that the figures quoted are fairly accurate and that the saving projected in term of ROI are possible and will save the regions millions in lost revenue in the medium to long term

The technology still leaves a 4 % gap for theft that will now result in the theft being exposure to public. The illegal wiring that usually would have taken place behind closed doors will now come out of the household on to the line or pole top box and thus expose perpetrators. Also these will be high up of the ground protecting innocent by passers and children from dangerous illegal connections

4.4 Lowlights

The power quotas and dimensioning core skills will have a slowing down effect on the Universal access initiative; this will impact the pace of electrification and infill resulting in an upward trend in theft.

4.5 Challenges for the future

To ensure that PTB and ABC are such that tampering is easily noticeable and easily disconnected

To ensure that the industry not only focus on the technical aspects but consider that customers need to be at the forefront of solutions and be a part of the implementation team.

5. Results of the 3000 customers installed

Revenue snapshot - collected from the 584 customers audited on the 12 June 2008.

Area Description	No of Customer	Amount	Ave Amt
Unit 13 NE 08	8		
		510	64
Hlokohloko Stage 2	33		
		1300	39
NE 08 - Phase 4	46		
		2040	44
IO 07	24		
		0	0
Unit BB - BE 04	43		
		2860	67
Unit BE 04403	43		
		3065	71
Unit BB	14		
		930	66
IO 09	25		
		640	26
IO 13	18		
		590	33
IO 14	8		
		240	30
NE 08	49		
		1760	36
Stage 1	23		
		1202	52
Stage 2	32		
		1925	60
TJ 05	38		
		2200	58
Imbali Stage 2	30		
		2070	69
IO 05	23		
		550	24
TL 2&3	38		
		660	17
IO 03	32		
		1140	36
Sakabula stage 2	57		
	584	1665	29
Total for 1 month	584	R 25347	R 46

A sample of 609 customers was randomly audited in a population of 3100 customers. Of the 609 audited, 584 customers had purchased a total of R25347 prepaid electricity for the month with an average of R46 credit per customer per month. Extrapolated over the 3100 customers the figure would be R129 000 or R1.5 million for the year. The 25 customer meters that were bypassed represents four percent **4% of the total random audit sample.**

Of the 25 customers that were illegally connected, 25 customers were easily issued a tamper notice and 20 of the customers paid the tamper fee without any reservation ie 75 %.

6. Conclusions

The implementation of the pilot project produced the results expected ie the reduction of bypassing within the households to 0% and illegal bypass to between 3 - 5 %.

The 3-5 % bypass occurred in the PTB because of the ease of accessing the unlocked boxes. It is still however postulated that even if the boxes are well secured that limited theft will take place directly from the ABC. This type of illegal connections is easily eradicated in a sustainable manner as it is easily identified and controlled.

The decision made for the Eastern Region to expand the split meter technology for all future installations is plausible and strongly supported.

Annexure

Example of the Split meter

Prepayment Electricity Meter

DOMESTIC

Landis+Gyr

CASHPOWER

POWER-RAIL

SPECIFICATION SHEET



The new generation Cashpower Power-Rail is a single-phase, keypad based, split prepayment meter in a DIN rail-mount housing.



Fig 1 Power-Rail Energy Management Unit (EMU)

Features

- ** Compact meter (EMU) design, with DIN rail-mount layout
- ** Easy to install and ideal for new reticulation in areas where low installation cost is a primary concern
- ** Proven Cashpower keypad technology

- ** Meter CIU provides valuable information to help consumers effectively manage and budget their electricity consumption
- ** Galvanically isolated communication to CIU for consumer safety
- ** Significant Reverse Energy (SRE) detection
- ** Programmable software power limit
- ** Advanced commissioning/decommissioning feature
- ** Available in 16-digit (CTS) and 20-digit STS encryption algorithms
- ** Language independent user interface
- ** Meter state indication LED and COMMS diagnostic LED at EMU
- ** High surge withstand capability for areas prone to lightning or other line surges
- ** High temperature withstand capacity
- ** SABS 1524 and IEC 62052-11, IEC 62053-21 compliant

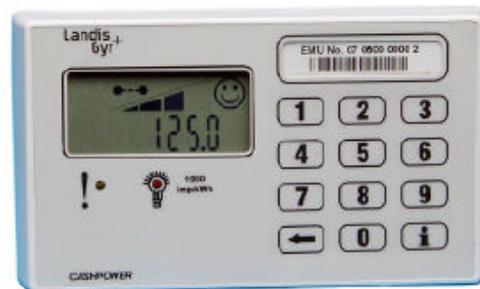


Fig 2 Customer Interface Unit (CIU)

Bypassing of a meter within the house



Theft directly off Ground mounted Customer Distribution Boxes

