Revenue Protection success story: The case study of River Park (Alexandra)

Xolani Lembede, GM: Infrastructure Planning, **City Power**

Johannesburg

Abstract

Due to low level of payments in low income areas, City Power has been experiencing high levels of electricity theft, network overload and high rate of repeated failures. The ultimate solution to the problem is to educate the customers about the benefits of paying for services and the consequences of abuse and theft of electricity. The experience has however proven that it's in the human nature that once you have experienced free services, you develop a sense of entitlement and it becomes difficult to adapt to paying for those similar services.

Authorities have to strike a balance between the electricity usage and bylaw enforcement. The utility has to recoup the consumption related costs, protect the infrastructure from vandalism and monitor the consumption patterns for the purpose of detecting theft; however all the efforts will only succeed with the community's buy in, hence the importance of vigorous community awareness initiatives.

1 Background

Alexandra is one of the oldest townships in Johannesburg. The development of this Township dates back to 1912 and has got a very rich South Africa history, (*SA History Online).*

Alexandra is divided into a number of townships mostly with ancient types of dwellings but the Alexandra Renewal Project (ARP) has introduced new townships with clearly demarcated stands. The article will discuss on River Park Township portion of the project.

1.1 River Park Housing Project, Johannesburg, South Africa

As a consequence of the new political dispensation in 1994, the Johannesburg City Council embarked on a project to construct "top structures" (buildings) on already proclaimed and serviced land designated for housing.

This particular development was called River Park and was located just across a tributary of the Jukskei River from the "established" suburban area of Lombardy East and on the east bank of the river opposite traditional Alexandra Township. In the first phase of the proposed 700 family scheme, 150 units were built and occupied. Figure 1 and 2 indicates the serviced dwellings of phase 1.

Figure 1: Serviced River Park Houses, (Rich, 2000)

Figure 2: Typical Houses in River Park, (Rich, 2000)

The houses are a combination RDP and the walk ups type dwellings, well orientated and provided good quality exterior space in the landscape whilst contributing to an active streetscape. Maximum internal volume was achieved within the limited budget constraints, giving a sense of lightness and scale. The proposal demonstrates that low-cost, high-density housing can be built with sensitivity to good design (Rich, 2000).

2 Introduction

City Power recently embarked on an extensive revenue enhancement project in Alexandra Township. This report focuses on River Park Section, where the vast majority of electricity meters were tampered with and bypassed resulting in extensive revenue losses and frequent power outages for City Power.

The original metering system was not STS compliant leading to the residents protest on the devices usage to meter their consumption. The infrastructure was vandalised giving access to rouge elements resulting in collapse of some revenue collection mechanisms.

3 Interventions

3.1 Solution

The solution talks to the number of interventions to prevent theft and estimations. Figure 3 indicate the process flow of the solution.

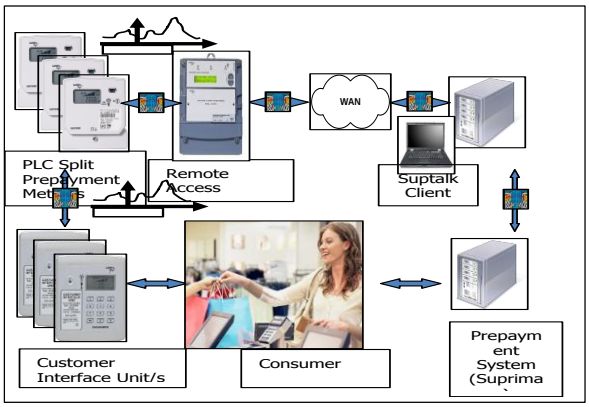


Figure 3: Pre-Paid System Process Flow (L &G, 2013)

3.1.1 Meters

All residential electricity meters in this area were replaced with Power Line Carrier (PLC) prepaid meters, which are housed and secured in protective meter enclosures.

These are simple PLC2 meters with proven FSK technology (IEC 61334-5-2) for cost sensitive split prepayment metering solutions (IEC 62055-32). The meters are made according to Cenelec A band frequencies and CISPR 22 maximum signal levels with protocol using a single carrier frequency of 66.0kHz as indicated in Figure 4, this A band frequency is reserved solely for use by utility equipment, and it is ideal for low cost communication, (L&G, 2013).

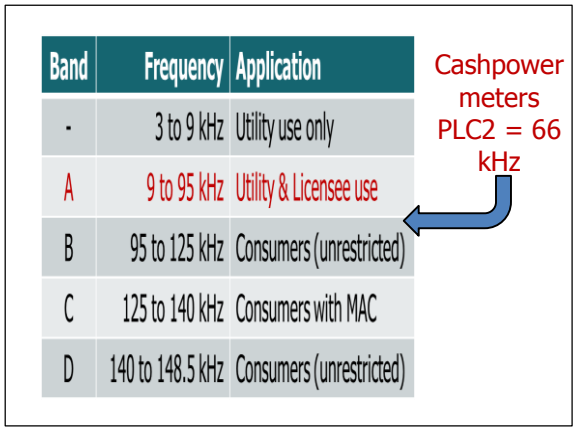


Figure 4: PLC Meter operating Frequency Band

3.1.1.1 Current Challenges with the meter

+ Compliance with Cenelec EN50065-1 limits the transmitted signal strength
+ The technology relies on good line conditions to avoid blocking from narrowband sources emitting at the same frequency

+ Interference from appliances can however swamp the Cenelec compliant signals.

+ Such interference sources are managed via the application of narrowband PLC filters and/or by enforcement of bylaws insisting on consumer appliance compliance with the Cenelec norm.

3.1.2 Data Concentrator/Remote Access Terminal (RAT) unit

PLC Data Concentrators were installed at each mini-substation or adjacent to each pole mounted transformers, which remotely monitor the prepaid meters and provide City Power with a wealth of meter data information, including events such as tamper, mini-sub power failure, as well as a host of additional data to assist the utility in managing the prepaid meter park.

The PLC Data Concentrator constantly monitors the PLC communication between the PLC prepaid meters and their keypads, collecting profile data, such as meter consumption, and immediately reporting critical pre-configured meter events such as tamper.

Using this innovative solution, the prepaid meters are remotely monitored by skilled staff at the City Power Nerve Centre and should a meter be reported as tampered, personnel are immediately dispatched to investigate and rectify the situation.

Figure 4 below shows the Data Concentrator reading showing healthy meter consumption pattern and Figure 5 shows the graph with an indication of a tampered meter mode.

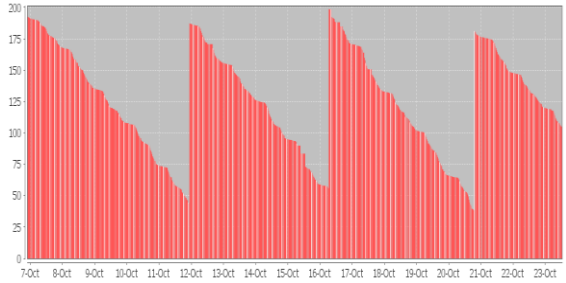


Figure 4: Data Concentrator reading with healthy meter consumption pattern

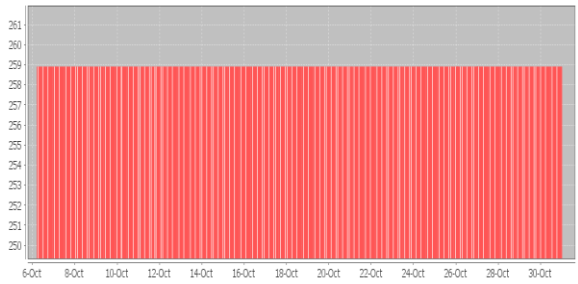


Figure 5: Meter in a tamper mode

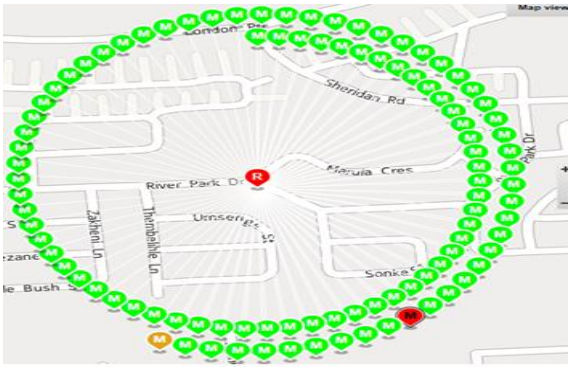


Figure 5: Data Concentrator Indicating one faulty meter

Figure 5 shows the Data Concentrator at the centre of the circle and the meters monitored shown at the outer circle around. The Red meter icon helps the utility to easily identify the tampered meter(s) that require further investigation.

Figure 6 is the Data Concentrator indicating all healthy meters.

Figure 6: *Data Concentrator Indicating all meters*

3.1.3 Metering Protective Enclosures

To avoid electricity theft and tampering with meters, City Power has resorted to measures to prevent public access to the meters. The protective structures are a method becoming more popular in utilities because of its effectiveness in preventing access to electrical installations and specifically energy meters and LV Circuit breakers. These enclosures have strict access control features, to prevent unauthorized entry.

Figure 7: Protective Enclosure Unit

Figure 8: Protective Enclosure Unit with Meters

The structure is made out of a thick mild steel material with a special electronic locking mechanism. It is manufactured with built in sensors that will sense vibration and forced entry which will trigger alarms to a remote manned system enabling the utility to take appropriate action. Figure 7 and 8 shows the closed and opened enclosures with pre-assembled meters.

Due to the success of this solution, City Power is rolling out this solution to additional sites.

3.1.4 Community engagement

The utility had to use the local communication service provider who understands the dynamics of the area and people behaviour. The service provider had to go door to door to assess the status and advise the residents accordingly. This helped a big deal in project acceptance as community saw themselves as part of the project and understood the benefits. Mass communication bare minimal results compared to the door to door strategy. Residents feel that personal touch and are able to share their personal experiences and challenges.

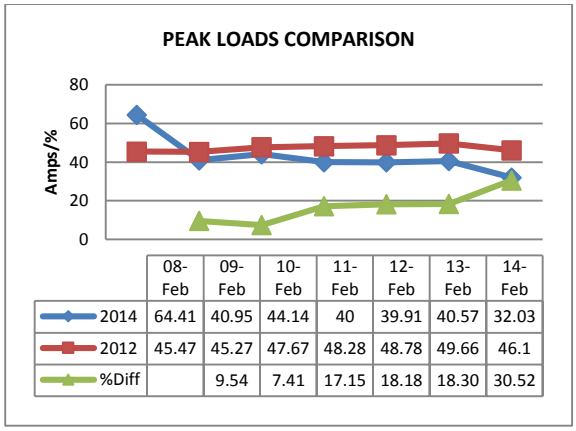
4 Experience

The project experienced huge resistance from the community. Residents have not been paying for electricity for a long time.

5 Impact of the solution

5.1 Loading impact

Assuming standard network configuration, City Power has seen significant decrease in loading which can be attributed the user's reaction to electricity cost. Figure 9 indicate an average of 16% load reduction between February 2012 and February 2014. This is also evident on the significant reduction on the number of outages in the area.



	08-Feb	09-Feb	10-Feb	11-Feb	12-Feb	13-Feb	14-Feb
2014	64.41	40.95	44.14	40	39.91	40.57	32.03
2012	45.47	45.27	47.67	48.28	48.78	49.66	46.1
%Diff		9.54	7.41	17.15	18.18	18.30	30.52

Figure 9: River Park Load Patterns before and after intervention

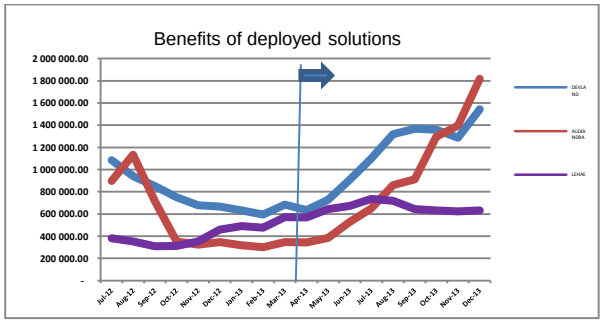
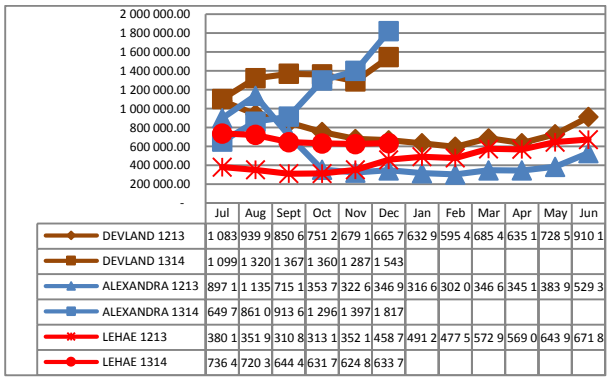


Figure 10: Continuous revenue growth after intervention



	Jul	Aug	Sept	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun
DEVLAND 1213	1 083	939 9	850 6	751 2	679 1	665 7	632 9	595 4	685 4	635 1	728 5	910 1
DEVLAND 1314	1 099	1 320	1 367	1 360	1 287	1 543						
ALEXANDRA 1213	897 1	1 135	715 1	353 7	322 6	346 9	316 6	302 0	346 6	345 1	383 9	529 3
ALEXANDRA 1314	649 7	861 0	913 6	1 296	1 397	1 817						
LEHAE 1213	380 1	351 9	310 8	313 1	352 1	458 7	491 2	477 5	572 9	569 0	643 9	671 8
LEHAE 1314	736 4	720 3	644 4	631 7	624 8	633 7						

Figure 11: Year on revenue growth after intervention

5.2 Financial Impact

City Power has seen positive spin offs on the electricity revenue. Again this shows the effectiveness of the system as it becoming more and more difficult to temper with the system. Figures 10, 11and 12 indicate the revenue step change after the intervention in different areas.

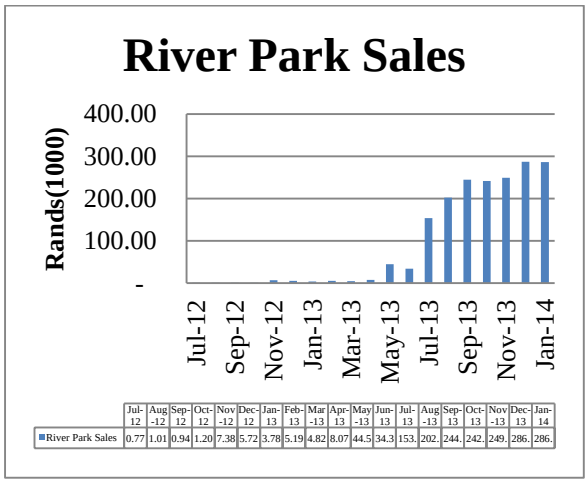


Figure 10: Revenue Impact

6 Lessons learnt

7 Conclusion

The culture of non-payment attracts some strange electricity consumption behaviour, not because the house hold dwellers have lots of appliances. The dwellers start seeing business opportunities because of free services. Most of these individuals are not the real business owners within their premises but they use electricity as a tool to attract tenants who end up using rented premises as business space. The simplest solution in these problems is to enforce the bylaws and implement theft monitoring systems with strong back office energy management. Public awareness through community engagements play a big role on infrastructure safeguard and ownwership.

8 References

Musiker, N. & Musiker, R. (2000). *A Concise Historical Dictionary of Greater Johannesburg*. Cape Town: Francolin, pp. 46-7.

SA History Online: www.alexandra.co.za/about/history.htm - a good, brief history using a chronological approach to the township. Accessed July 30, 2014

Rich, P: 2000, http://www.peterricharchitects.co.za/riverpark.php. Accessed July 30, 2014

Landis & Gyr, 2013: Landis+Gyr PLC Technology