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Meter and billing auditing of commercial and industrial electricity customers in a Metro Municipal Electricity Utility

Kobus van den Berg (Pr Eng)
Principal Engineer
NETGroup

SARPA Conference: Johannesburg 2010



Earth

Distance: 1,150,800 km
Radius: 6,378.1 km
Apparent diameter: 37' 53.7"
Phase angle: 126.8°

2010 Jul 29 21:57:38 STD
Real time

Speed: 0.00000 m/s

Follow Earth
FOV: 22° 42' 10.0" (1.00x)



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utilities and industries*

From a distance....



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From a distance the world looks blue and green,

And the snow-capped mountains white.

From a distance the ocean meets the stream,

And the eagle takes to flight.

From a distance, there is harmony,



2010 Jul 29 21:55:13 STD
Real time

Earth

Distance: 31,112 km
Radius: 6,378.1 km
Apparent diameter: 19° 35' 25.7"
Phase angle: 147.8°



Speed: 0.00000 m/s

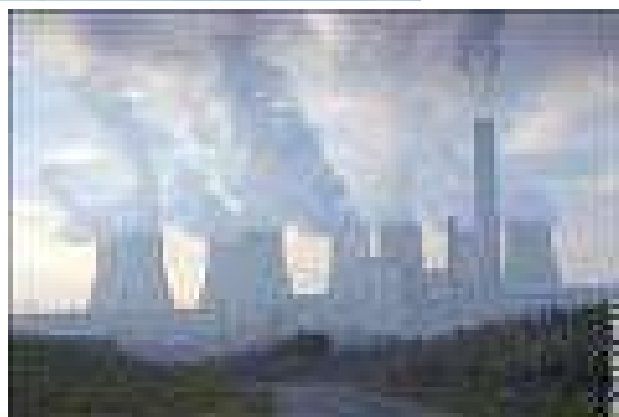
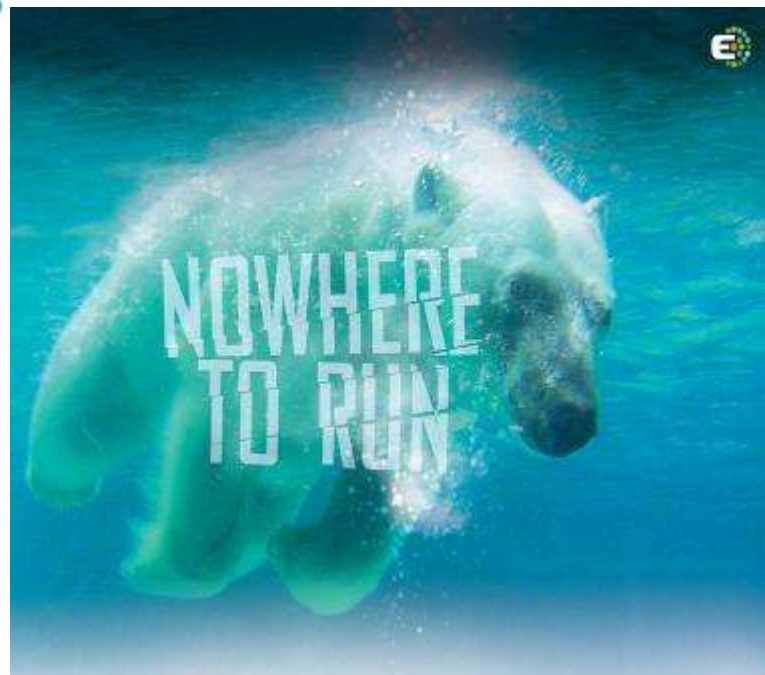
Follow Earth
FOV: 22° 42' 10.0" (1.00x)



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Overview



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- Introduction
- AMR the solution to all reading problems?
- Problem Statement
- Correction strategy
- Errors encountered in meter reading and billing
- Monitoring triggers
- Reading correction methods and process
- Codes of practices regarding correction methods
- Summary

Introduction



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- Revenue protection processes – reduce losses
- Quality control processes
- Loopholes in the processes
- Large power users a small error – major loss
- Highlight some of these problem areas
- Necessity to combine technical, financial and operational processes and skills.
- Silent killer from within was discovered
- Customers find it very difficult to obtain information

AMR the solution to all reading problems?



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- Solve all your metering and billing problems
- Timeous, 100% correct bills to all customers
- Very little human intervention
- Less chance for errors to creep in
- Customers pay their bills with a smile
- Right ???
- **WRONG !!!!**

Problem Statement



- AMR electronic metering systems are not infallible
- Data bases are not necessarily reliable
- Billing systems bill what ever readings are submitted
- Electricity tariffs are not applied correctly
- Meters are not installed and maintained effectively
- Takes too much time before faults are corrected
- Very few overall quality management processes
- Metering and billing errors are costing utilities dearly in the bulk supply sector
- Customers are at the mercy of utilities

Correction strategy

- Identify the sources of possible revenue collection losses
- Design monitoring triggers to flag a problem
- Use appropriate analysis methodologies
- Use appropriated reading/ data correction methods
- Establish bill correction process.
- Effective quality control system in place
- Processes from the application to the monthly billing are effectively linked and data integrity maintained.
- Communicate with the customer to obtain his inputs and consent
- Ensure that a comprehensive over-all meter management process is in place
- Integrate technical, tariff and financial skills in the management team to ensure that the total problem is analyzed and corrected



Errors encountered in meter reading and billing processes



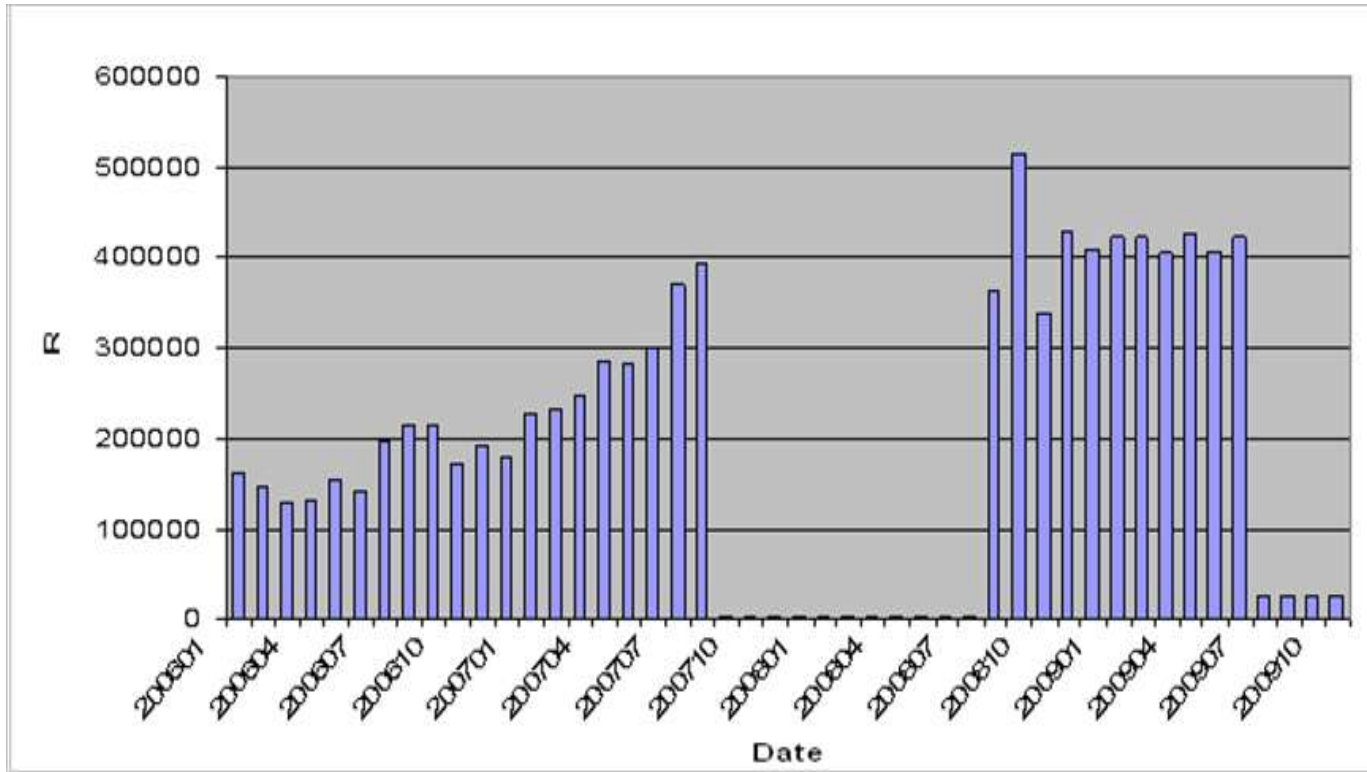
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- Metering or reading errors
- Gaps in data and bills
- Meter time change spikes
- Communication errors
- Tariffs incorrect
- Meter installation incorrect
- VT/CT failures
- Billing components incorrect

Gaps in Billing / Transactions missing



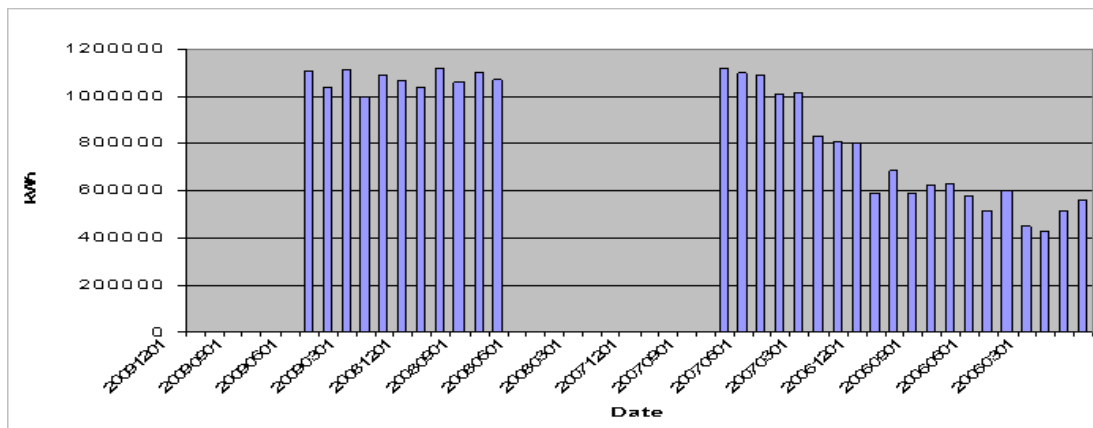
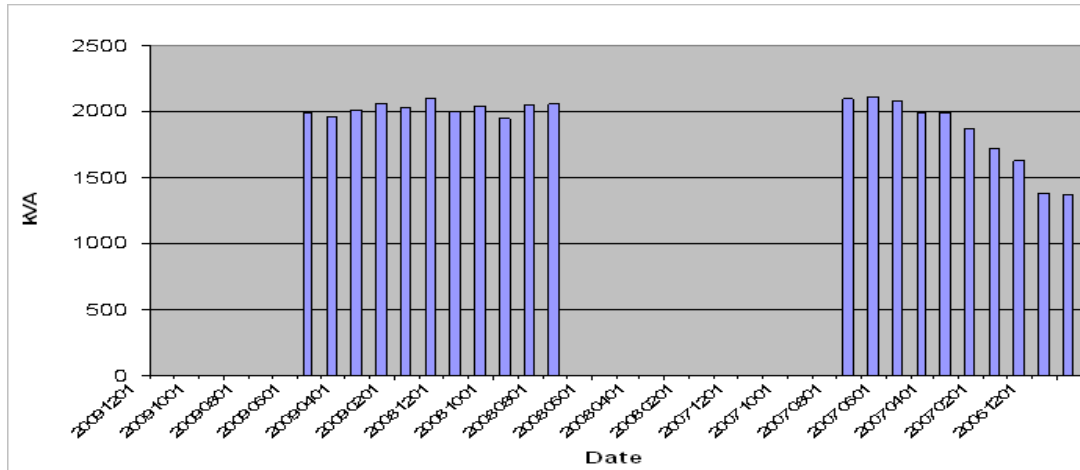
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Missing readings/ meter failure



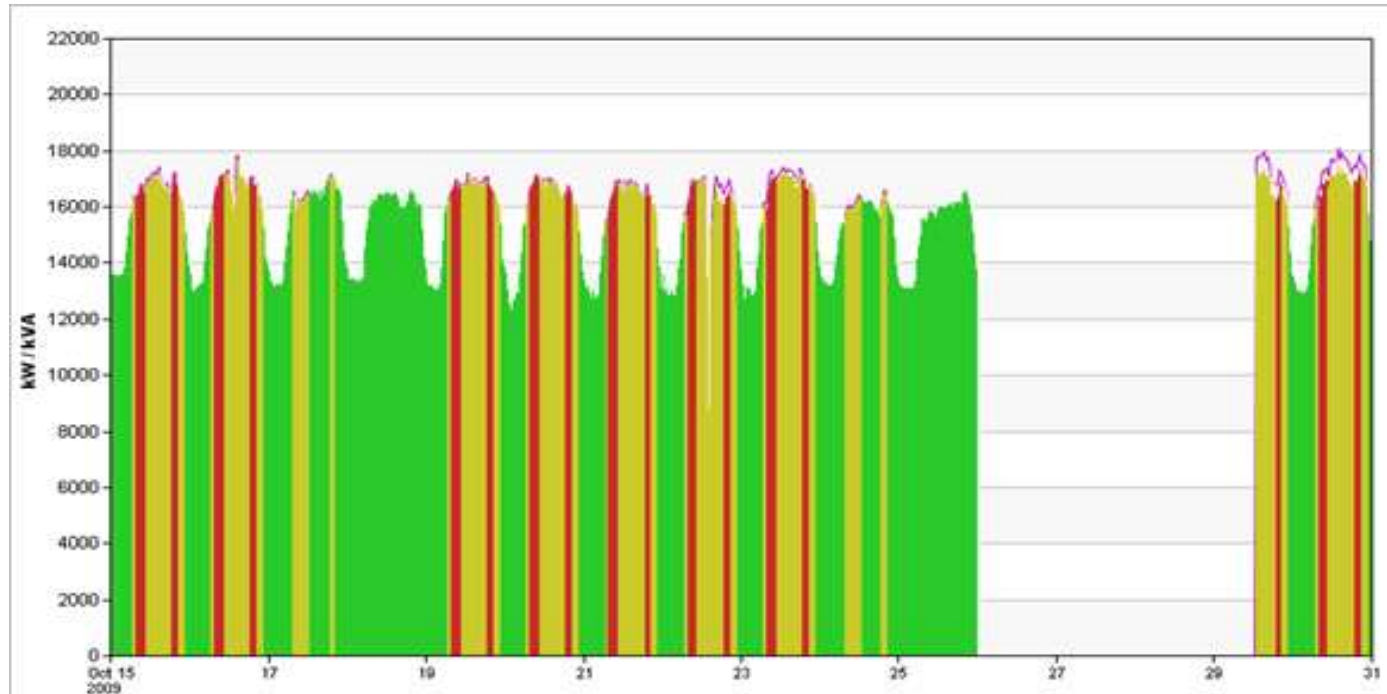
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Gap in readings for 3,5 days



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Monitoring triggers

- Customer complaints
- Bill transaction trend anomalies
- Reading trend anomalies
- Profile disturbances
- Missing 1/2h data, gaps in data
- Power factor
- Load factor
- Incorrect phasor diagram
- Meter is changed
- Tariff changes
- Peer group comparisons

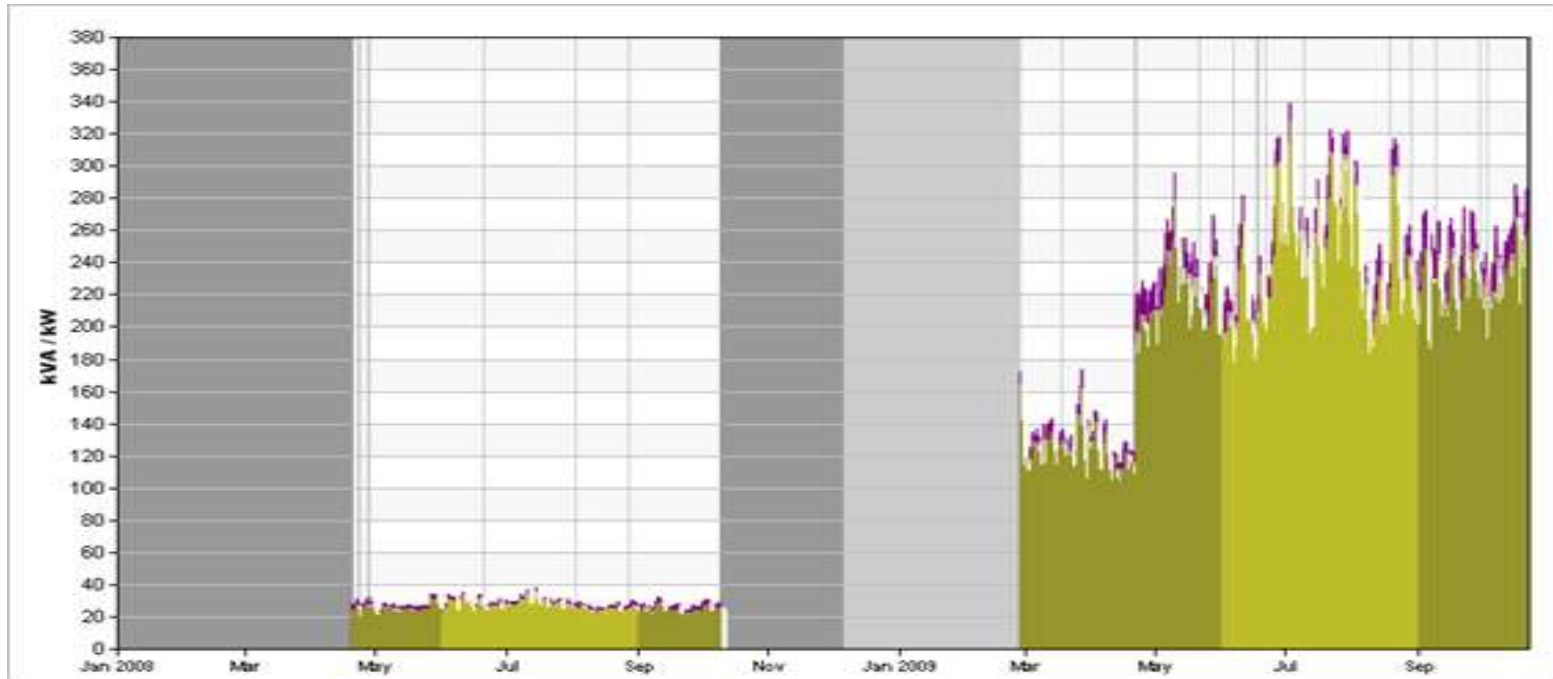


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VT/ CT Ratio Errors



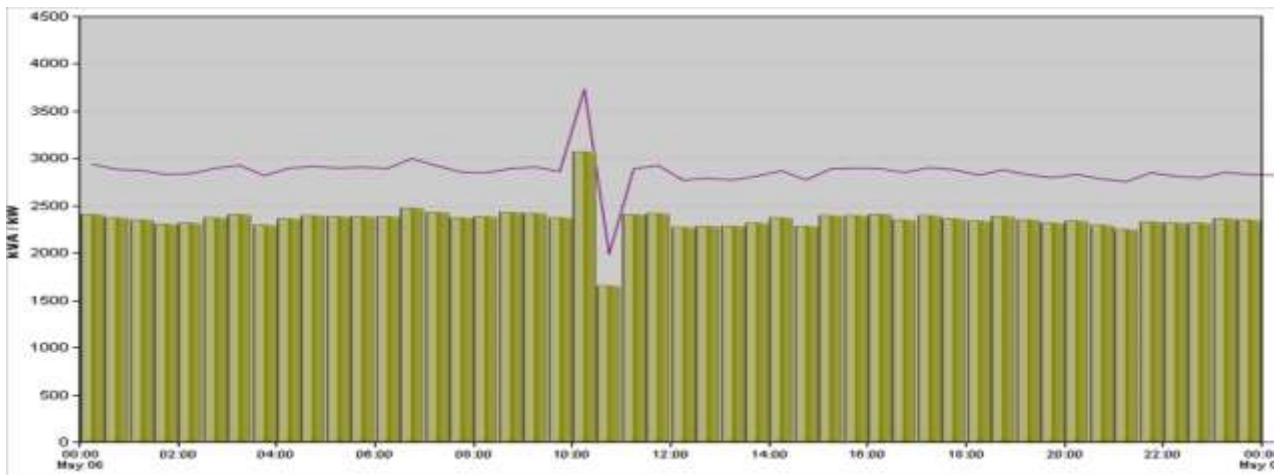
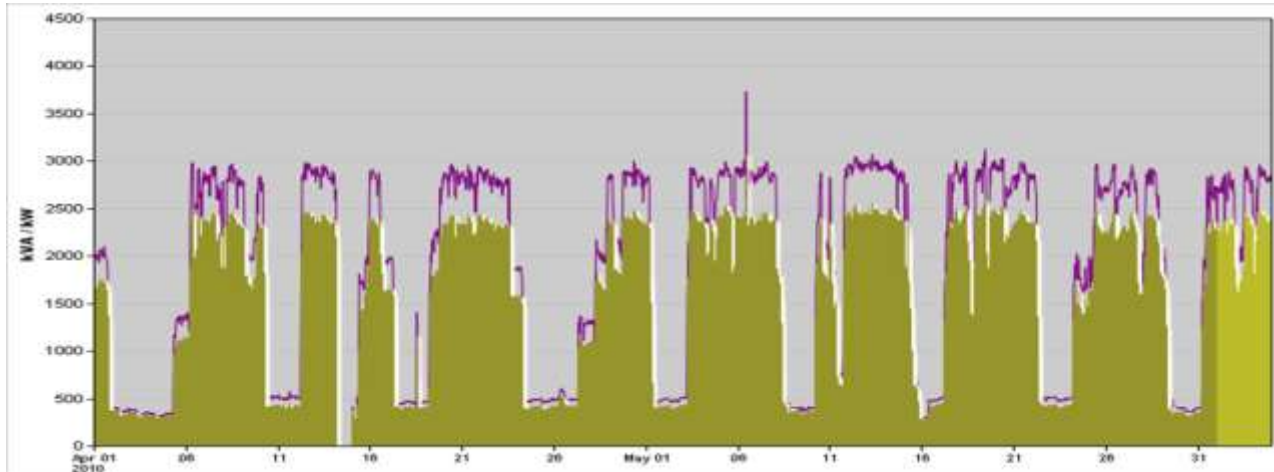
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Reading anomalies



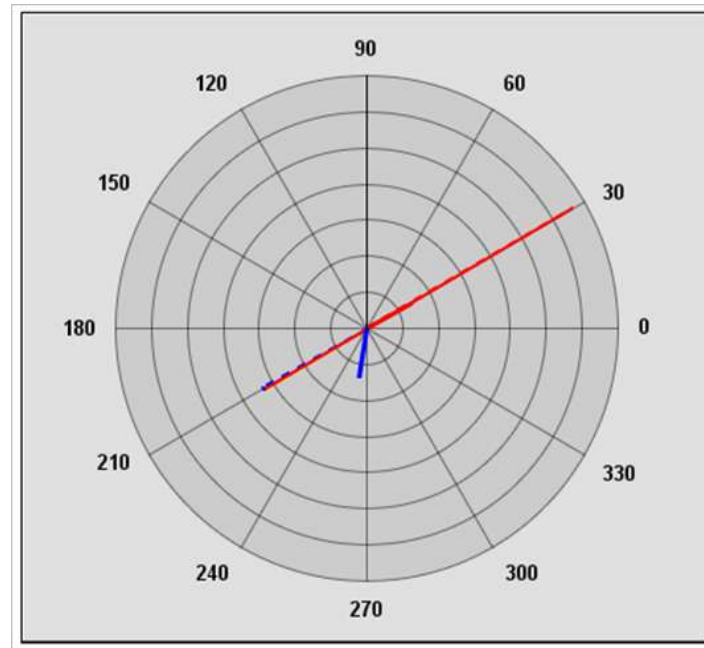
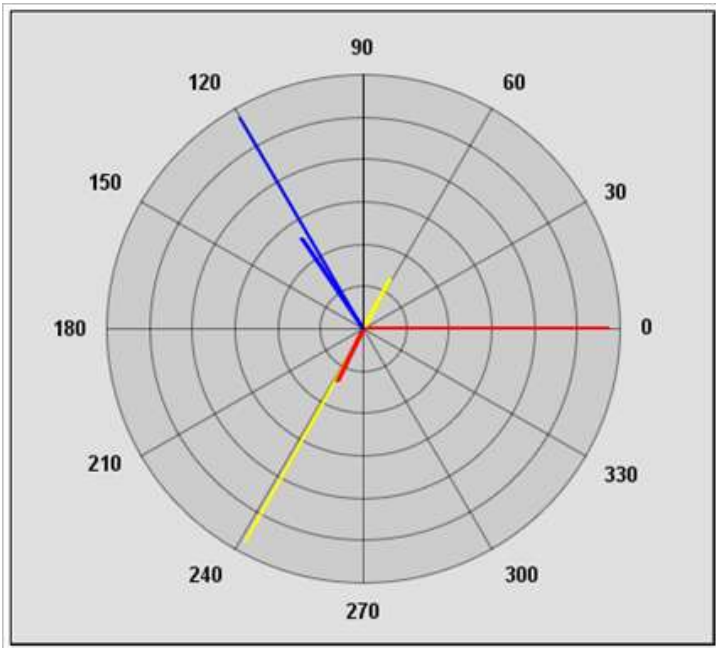
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Phasor diagram problems



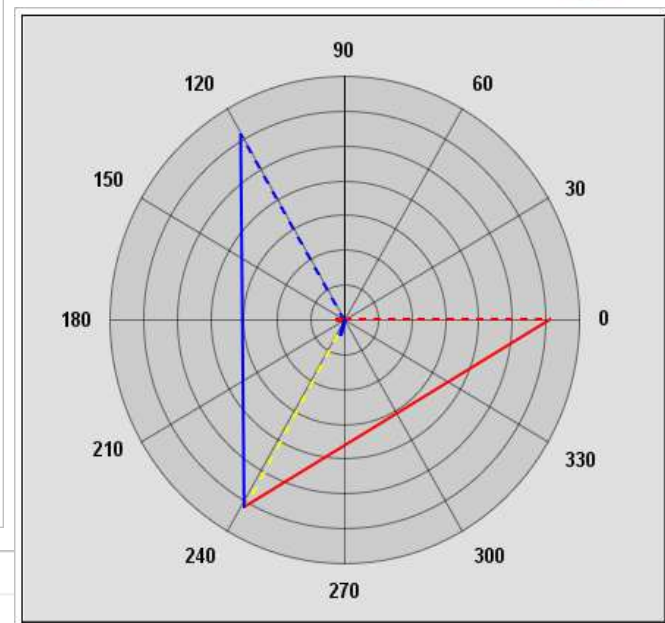
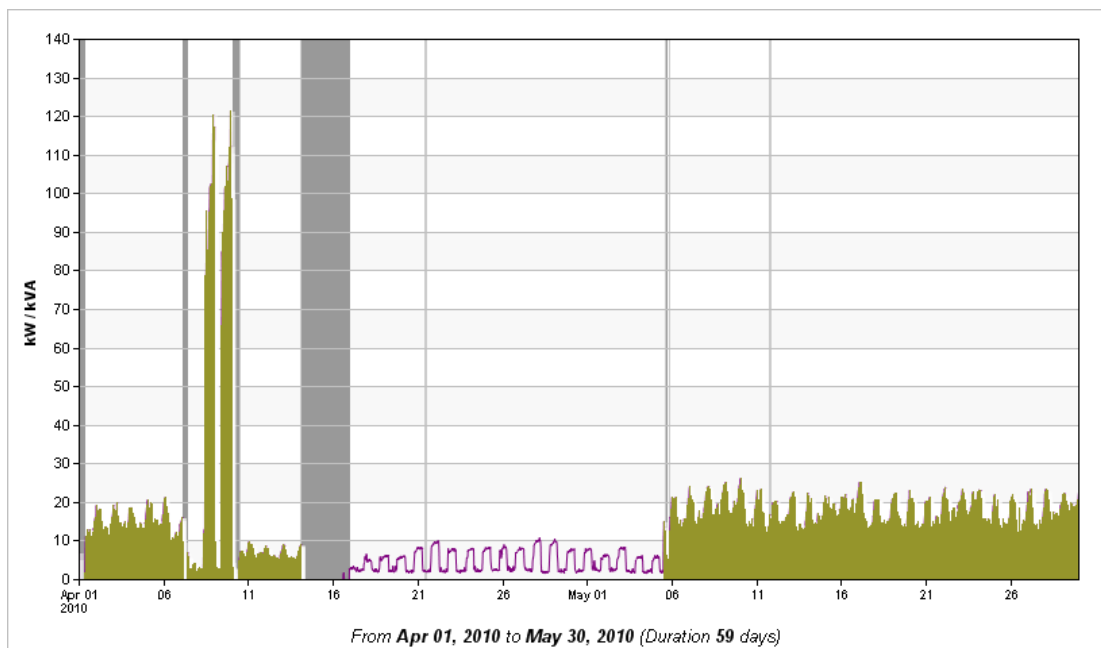
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Warning signs by AMR system



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2010-04-21 11:49:00	2010-04-21 11:49:00	Power Loss & Return	Power Loss		
2010-05-05 15:03:00	2010-05-05 16:49:00	Power Loss & Return	Power Loss		
2010-05-05 20:37:00	2010-05-05 20:37:00	Power Loss & Return	Power Loss		
2010-05-11 18:41:00	2010-05-11 18:41:00	Power Loss & Return	Power Loss		
2010-04-17 00:26:38	2010-04-17 00:26:38	Current Anomaly	Reverse Run	A	3wire, V/I: 0Deg/162Deg
2010-04-17 00:26:38	2010-04-17 00:26:38	Current Anomaly	Reverse Run	C	3wire, V/I: 60Deg/243Deg
2010-04-18 02:22:03	2010-04-18 02:22:03	Current Anomaly	Reverse Run	C	3wire, V/I: 60Deg/226Deg

Reading correction methods and processes



- Legislation, standards and code of practices in South Africa is fairly silent on corrective processes and algorithms
- In typical municipal bylaws historical data of three months before, three months after the problem period as well as the same period in the previous year is recommended
- Above-mentioned process not always fair

Overriding rules



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- Be fair in the process
- Involve the customer and the utility in the process
- Allow customer to involve an external consultant if required
- Compile a detailed report (technical as well as financial)

Sources of data for correction

- Historic billing system data
- Historic data from AMR system
- Meter commissioning sheets
- Feedback from Metering section
- Feedback from AMR operator
- Feedback from financial sections
- Meter reading management database
- Data from fault logging system
- Information from customer



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Correction techniques used



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- Averages of long term consumption as well as three month consumption data as prescribed in bylaws
- Averages over a few years for example for December
- Raw data to correct short term gaps and recalculation of trends and hourly consumption
- Regression methods
- Multiplication factor (VT and CT errors)
- Cost and reading correction graphs
- Compile a detailed report to explain the interaction between technical financial and customer related issues

Codes of practices regarding correction methods



- Electricity Regulation Act 4 of 2006 - silent
- Municipal Bylaws
- NRS 057 (Code of Practice for Metering)
- NRS 047 (Code of Practice for Quality of Service)
- NRS 055 (Code of practice for Revenue Protection) is currently silent on data correction methods
- NRS 071 (AMR systems)

NRS 057



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- **Data checks:**
- *All raw meter data shall be checked for validity at regular intervals or at a frequency that will allow a further interrogation of the meter (or both) before the data is overwritten within the meter and before this data can be used for any purpose.*
- *Validity checks shall include the following, as a minimum:*
 - *a) checks for missing data;*
 - *b) checks for invalid dates and times;*
 - *c) checks of zero consumption levels;*
 - *d) comparisons with standard or previous consumption patterns;*
 - *e) checks of the sum of demand values against the register advance; and*
 - *f) investigations of any meter error codes.*

NRS 047 Quality of Service

- ***Estimated energy consumption***
- *In cases where it is necessary to estimate electricity consumption for a particular period, the method of estimation shall be based on historical data or, in the absence of such data, on a method agreed upon between the customer and the licensee.*



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Summary



- **Technology can be of great assistance but good management practices are required**
- **Loss of skills is costing utilities and customer**
- **Appoint a dedicated team (internal or contractual) to supervise and manage all metering related activities**
- **Supporting quality and supporting processes are essential**
- **Set up trigger mechanisms to identify and report any failure in the metering and billing system**
- **Correct the incorrect readings and bills as swiftly as possible**

Summary

- **Involve the customer throughout the process**
- **Be fair towards the customer and utility.**
- **Ensure that the AMR system used, collect all relevant meter reading and technical information from meters to assist with meter management and use this information effectively**





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- Wise people know that they don't know
- So let us in our wisdom learn from one another and make a difference

Contact Details



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- Kobus van den Berg (Pr Eng)
- Principal Engineer
- NETGroup South Africa (Pty) Ltd.
- Tel no: +27 11 845 3734
- Fax no: +27 11 845 3753
- Mobile: +27 82 427 3428
- e-mail: k.vdberg@netgroup.co.za