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The impact of inaccurate process variables on the Energy Balancing Process

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Abstract

There are a number of process variables affecting the accuracy of reported the Energy Balancing Process, which positively or negatively affect the interventions that Revenue Protection departments can use to manage losses to acceptable levels. This paper will address the salient points of these factors and how utilities can use the lessons learnt from a project initiated in Eskom Distribution in partnership with EON Solutions to better manage Energy Losses and hence improve financial performance.

The Eskom Distribution Business Challenge

The Eskom Distribution Business is an integrated business that provides creative and customer-oriented electricity solutions to South Africa. The Distribution Division is responsible for the transportation of electricity from the national Transmission Grid to end-users at the required voltages and provision of customer services. Eskom Distribution Division is divided into six regions, which are spread throughout South Africa.

The challenge for Eskom Distribution is to ensure that they have *visibility* of ALL their more than 3,7 million customers connected to the grid throughout the country. That means knowing what is happening with all these customers from a quality of supply and related customer services perspective. Taking into consideration the different terrains and bearing in mind that Eskom's customers are spread throughout the country, one can start to appreciate the challenge. Mind you Eskom's customers consist of residential, commercial, industrial and mining customers, as well as re-distributors.

From Revenue Protection perspective, the challenge is made worse by the fact that some electricity consumers deliberately ensures that they are not visible to Eskom, even when they are consuming Eskom's electricity. These illegal consumers of electricity come in different forms, which if not properly managed through the various process controls, can have a huge negative impact on Eskom's bottom line and safety performance.

Eskom Distribution uses the process of energy balancing to identify areas of possible illegal electricity consumption. However, it was found that some process variables inaccuracies in the business make the use of energy balancing ineffective. This paper highlights some of the key process variables identified and tested in Eskom over the past few years.

The Complex Process of Energy Balancing

The process of Energy Balancing essentially seeks to solve the following equation:

Energy Delivered – Energy Sales = Total Energy Losses

Total Energy Losses can be further broken down into the two components, technical and non-technical energy losses. The causes of non-technical losses vary from incorrect data and processing to illegal network connections and meter bypasses where-as technical losses are caused by thermal heating of the line during the energy transfer process.

Total Energy Losses = Technical Losses + Non-Technical Losses

This process is used to gauge the "health" of the business at different levels of the network. For the Energy Balancing Process to be completed, one needs to know how much energy was delivered into a specific area, how much energy sales are recorded for that area and what are the technical losses experienced in that network for that specific period.

Generally technical losses can be calculated using well proven methods (e.g. load flow studies) that yield very high levels of accuracy if the network configurations are known and measurements at different points of the network are available.

The energy balancing process can be depicted by the process flow diagram below.

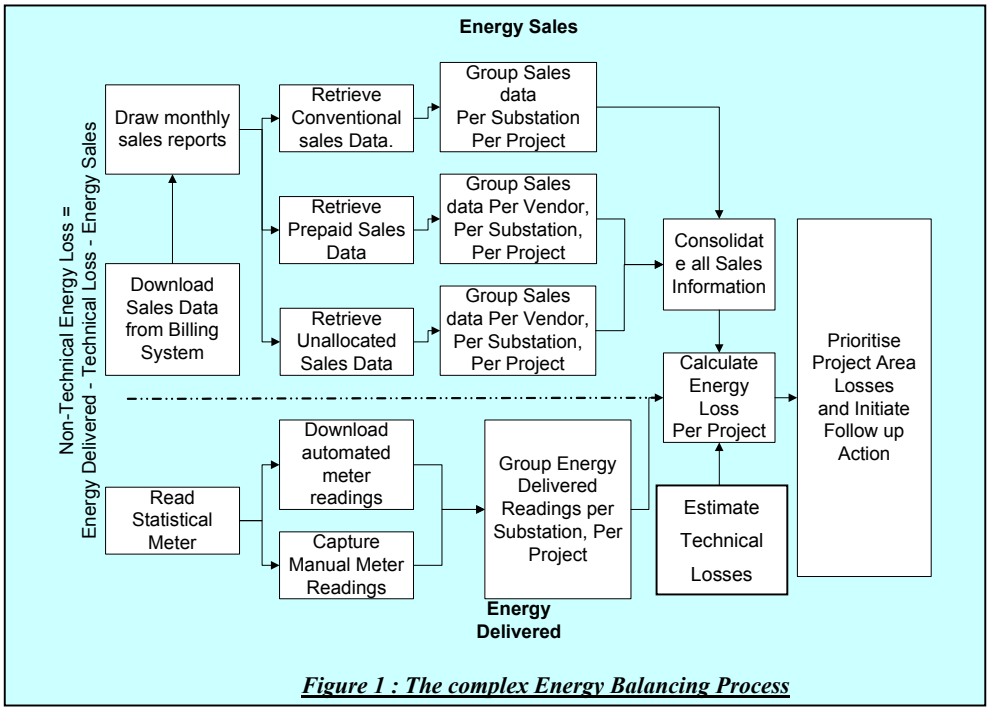

Figure 1 : The complex Energy Balancing Process

The critical output of the Energy Balancing Process is the Energy balancing Report, which lists energy losses volumes and percentages at the different levels of the network (e.g. areas; projects; feeders; etc). This Energy balancing Report is a critical input to the Energy Losses Management Process.

The drive to reducing losses, and the ability to succeed, is based on the premise that the causes of energy losses can be identified. The identification of energy losses can be approached in a number of ways, i.e. geographically, network based, audit based, customer-report based, etc. In Eskom Distribution we used Energy Balancing Report to locate where losses are occurring before looking at the causes.

The Energy Losses Management Program

A well designed energy loss management program will help utilities in making decisions about the allocation of funds and resources to minimise losses. However, if the process variables used in arriving at the decision are inaccurate, the utility could end up misallocating resources. This unfortunately will yield very poor results.

The diagram below illustrates how the losses figures for the different networks are used in the Loss Reduction Action Plan.

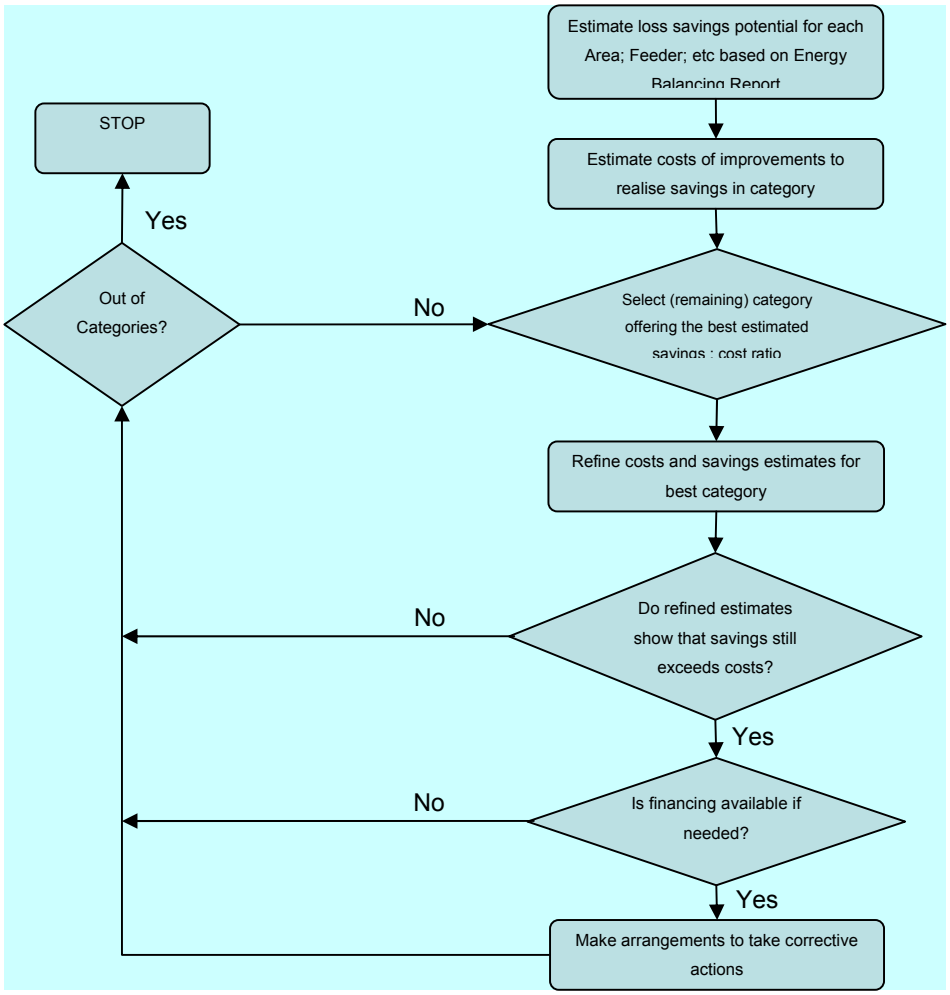

Figure 2 : Loss Reduction Action Plan

As already mentioned, the critical input into the Loss Reduction Action Plan is the Energy Balancing Report, an output from the Energy Balancing Process. Identifying and prioritising loss making areas for remedial actions will only be accurate and efficient if the inputs are accurate. Unfortunately the accuracy of the input (Energy Balancing Report) depends on a number of process variables. In a paper presented at the SARPA Convention in Durban in 2004, these variables were tabled. The variables tabled then were:

- ✓ Accurate and working meters
- ✓ Accurate and timeous statistical and customer meter readings
- ✓ Accurate and timeous Credit Dispensing Units (CDUs) uploads
- ✓ Accurate linking of customer to the network
- ✓ Accurate knowledge of network configuration during normal and abnormal conditions

These variables affect the Energy Balancing Process in different ways, but the bottom line is that the outcome thereof is the misallocation of resources during the last phase of the Energy Losses Management Process.

Over the past few years Eskom Distribution experienced the negative impact of the inaccurate process variables.

In certain areas of the business the variables like customer–to–network links; customers disconnected in the Billing system but still connected in the field; sales estimations; etc resulted in the business not being able to effectively use the Energy Balancing Report to target the loss areas. This rendered the utility's loss reduction program ineffective, and as a result the losses escalated whereas the costs associated with Revenue Protection Audits continued to escalate. In this case money spent on the Loss Reduction Plan did not necessarily result in positive movement (reduction) on losses.

Lessons learnt

1. Utilities should have robust systems to keep accurate records to facilitate effective loss management programs
2. The systems should be integrated to ensure smooth flow of information from one to the next
3. Input data into the systems should be tightly managed
4. Perform desk top audits before going out in the field – this could save you a fruitless field visit
5. Avoid using one month's information for decision making, especially in areas where estimations are high – in this case trends are more reliable than monthly figures
6. GIS linked systems have an advantage over most traditional systems when coming to locating losses