

FAULT FREE ELECTRICAL UTILITY: REALITY OR DREAM?

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INTRODUCTION

Intention of this paper (case study) is to analyze number of factors which influence performance of average electrical utility in present South African condition.

We are constantly hearing about problems with regards to the quality of electrical supply. These include regular interruptions, lack of maintenance etc. Prof. Anton Eberhard, a member of the NER board, in a recent issue of ENERGIZE Journal quoted the following:

“Some areas in South Africa are already experiencing not infrequent interruptions in supply. This is mainly the consequence of municipalities not investing in adequate maintenance or strengthening of their distribution network”.

But there is also another side to this story, which we want to share with you.

What would you think if you were told that a Municipality exists which does not have the above problems? Where there are no backlogs in new connections; Where upgrades, refurbishment and preventative maintenance are fully in place; Where there are no rotten poles with dirty or broken street light shades, etc,etc.

Why is the Electricity set-up in Umtshezi Municipality different and why is it appropriate for it to be described here?

Firstly, Umtshezi represents average electrical utility in almost every aspect. Estcourt is a typical industrial average-size town, with a ratio of 67 % industrial load, 13 % commercial and 20 % domestic load which is probably very close to the ratio of the categories of load profile in the country. Secondly, we are the 37-th load size Municipality in the country, not big but also not small, with an average load close to 40 MVA.

And the last very important matter, is that we are part of a Municipality with all the many problems which every Municipality faces, in regards to budgetary constraints, staffing, bureaucracy etc.

What makes probably interesting is the fact how we manage to have successful electrical utility while being average in almost every aspect. Therefore, I would like to initiate some interaction and share experiences of what we are doing on a regular basis to provide a reliable electrical supply. I hope this information will prove to be beneficial for others.

LESSONS LEARNT

The electricity system in Umtshezi Municipality consists of Estcourt’s Urban area and the Wembezi Township which is approximately 8 km from Estcourt. Estcourt is mostly an industrial town while Wembezi township has 3 500 households and 30 000 people, using approximately 2 to 2,5 MVA in summer and winter respectively. The electricity system in Estcourt town is almost fully cabled while Wembezi is mostly done by means of Overhead lines.

Every utility has a history with a lesson to be learnt. So do we. Becoming a Transitional Local Council in around 1995, we have taken over Wembezi town. Due to the fact that

no maintenance was done on the electrical system during the period of years of political violence, no one wanted to take over the electricity service at this township. However, we were consistently paying an Eskom bill, which at that time was averaging over R250 000 for slightly over 1 000 connections on a flat rate.

The main challenges at that time were the resistance of the staff to tackle the new problems and Council not being flexible enough to address the problems. Electricity service was the last one to be taken over by Council from Kwazulu Natal Provincial Administration which took place in 1998. My first task after appointment was to undertake the refurbishment of the network including an electrification project during 1998-1999. The total cost of the project was 6,3 million Rand and was funded mostly by Council and partly by NER via their electrification programme. The project included the installation of prepaid meters for old and the new installation and total refurbishment of the network.

So, what are the results? Since then the system has been operating well with regular maintenance in place and no occurrences of tampering etc. The present Eskom bill is still after six years by far lower than the one prior to the refurbishment, although we have now three times more new connections and have had five annual Eskom increases.

Although we inherited problems in Wembezi, we needed to realize that it was still our problem and the more we delayed rectifying it, the more costly it would become to do so, besides all the other negative effects. The lesson learnt here is universal and past mistakes must not be repeated.

The system at Wembezi is operating well but how much money could we afford to spend if places like Wembezi, as typical residential areas, needed millions of Rand?

I can tell you that this place is still experiencing major nonpayment problems in all other services: water, sewage, refuse, as well as rates.

Therefore, there are two ways to upgrade an electrical system to a good functional operating level. Firstly, as in the previous example, to use large capital funding or secondly, to do it systematically over a period of years. In some instances, we can manage to access funding to completely refurbish the system, but often this is not possible.

PLANNING

To achieve the best results it is necessary to systematically address problems in the system. One needs to have a good plan and the best way is to have a good long term plan, for example a five year Master or Electricity plan. This is normally done by Consultants. I have done a couple of presentations a few years back showing how a relatively small Municipality can solve this problem in-house, by having the right tools (a number of software programs), and the ability to do full planning, basically on their own. One needs to acknowledge that no one knows our systems better than we do. Having the correct tools, the Engineer is able to simulate IF scenarios and make the most appropriate and cost-wise viable decisions and ultimately prioritize projects. Knowing each year what we need to do with available funds makes work easier. Master plans need to be part of the Municipal IDP as this covers capital projects, strengthening of the network and future upgrades etc.

What we have done is measured in years. There has been no quick fix. Buying new equipment as part of Capital projects, is actually the first step to excellence. We opted for new technology a number of years back as besides a number of other benefits, it reduces or completely eliminates maintenance. A few years back, we started an upgrade of Ring Main Units in the Industrial area as part of our

secondary Medium Voltage system in town using new SF6 Ring Main Units, but we had to halt this for a while, as the Rate of Exchange at one time was not favorable. But things have changed recently and we have completed the project and our whole industrial area is now covered by new equipment. We also replaced numbers of Medium Voltage panels in our main substations where in some instances equipment was more than 50 years old and, although well maintained, we had no option but to replace it to ensure a good quality supply.

Do you have a detailed Master or long term Electricity plan? How are your capital projects are executed? What standards are used when new equipment is acquired?

PREVENTATIVE MAINTENANCE

Having worked in industry for a numbers of years where preventative maintenance is a necessity, it was natural for me that such principles should also be applied in regards to Municipal Utilities. We all have programs of that nature but often these seem to not work well. And so, we need to ask why? We used to patrol lines only when the Circuit Breaker trips. Now we do it every month as part of our programme.

Regular inspection of equipment, even visually, can prevent the occurrence of serious problems. It is amazing that even staff on lower levels, adequately trained, are able to come forward with valuable information about possible problems in the system. We have about 30 regular inspection schedules which are very simple. These cover most of the equipment, starting from patrolling the line, substation inspections, substation battery checks etc.

The higher the level of equipment, the higher the level of staff is involved and for example, certain senior staff in Department are personally responsible for main substations in the system. The frequency of these inspections is the crucial link to the prevention of faults.

Besides visual checks, we have introduced a number of other tests such as:

- ◆ Pressure tests of equipment (Biannually)
- ◆ Circuit breaker and Protection tests (Biannually)
- ◆ Transformer oil tests (Annually and on Main Transformers 6-monthly)
- ◆ Load and voltage tests (Annually)
- ◆ Infrared tests (Annually)
- ◆ Poles for rottenness (Biannually)
- ◆ Meter tests (Biannually) etc

It is essential to do all available tests, which your Department is able to perform, regularly. Those which you cannot manage can be outsourced to specialists. Pressure testing of equipment takes time and lots of switching. Last year we tested all Medium Voltage cables in our system and it is amazing what we found. We have redone many cable joints to prevent future problems. We are confident that cables are in order now and have also identified which ones we need to look at carefully and possibly replace in the future.

We prefer Protection tests to be done by specialists in conjunction with Circuit Breaker testing. Everyone who has done this exercise will be surprised how much is involved to ensure that you have a well-protected system in place. Infrared tests are a typical preventative maintenance tool. We do these annually on the full Medium Voltage system including also Low Voltage panels in substations; this takes days but it is worthwhile and tremendously helpful.

We prefer to perform transformer oil tests, rather than just regularly purifying the transformers.

Load and voltage tests are done by means of ammeter reading or preferably using loggers. We have over a period of years obtained an amount of loggers which we installed in substations where we have a full load profile. The result is that in the winter period we have a balanced load and we have practically no call outs during winter. And some of you know how cold Estcourt can be.

Do you have a maintenance program in place and is it implemented fully (frequency of inspection and test)?

REFURBISHMENT PLAN

We found that in order to save money, there are lots of ways to replace essential parts of equipment and basically increase the age of our equipment. Everywhere we were able to, we replaced:

- ◆ Medium Voltage Circuit Breakers with upgraded ones
- ◆ Every electromechanical relay with an electronic one,
- ◆ Amount of Medium Voltage Circuit Transformers,
- ◆ Old with reliable Battery tripping units,
- ◆ Every bare low voltage Overhead line in town with Aerial Bundle Conductor,
- ◆ Every box in the CBD area with a concrete one,
- ◆ Street lighting in town has been completely refurbished etc.

The refurbishment of equipment is probably where the Municipal Engineer is most challenged, as funding is always limited. All of above are done in a well-planned manner, taking into consideration future requirements, increased demand etc.

Do you have a refurbishment plan in place and is it fully implemented?

Common to any of the plans above, is that funding and staff are needed. Being a Municipality we never expected to have a significant allocation of funds to the Electricity Department but it has always been steady over the years .

Altogether what are the results?

- ◆ No problems in the system]
- ◆ The amount of breakdowns minimized to almost non-existent
- ◆ Planned work is our main objective which in turn will reduce the amount of breakdowns in the future.

These are all the relevant events which occurred from 01 January 2002 which covers a time span of almost 3 years:

1. 3x100 KVA transformers, 2 at the township and another at a rural line blown by lightning. In all cases protection operated correctly. Transformers replaced on the same day.
2. MV cable in residential area of town damaged by contractor. Protection operated correctly. Power restored in 45 minutes. SMS system which we have introduced a few years ago facilitated a quick response as all senior staff attended to this fault.
3. 2 MV cables supplying main Water Works simultaneously hit by lightning strike. Protection operated correctly. Power to Water Works restored on the same day.
4. ESKOM power failure causing 3 hours interruption of whole town, blown VT's on their 88 KV substation.

5. Rural line Mimosadale tripped on two occasions due to the weather conditions. Protection operated correctly. Power restored on the same day.

As you are able to see all of the above events (besides ESKOM failure) are minor incident affected limited areas for short period of time.

The main achievements of all our programmes and efforts are that:

- ◆ Every fault was beyond our power to prevent
- ◆ Protection in all occasions operated correctly
- ◆ Business and industry have not been affected except in the case of the ESKOM fault
- ◆ No other failures of equipment

ENGINEER'S ROLE

This is just one side of the story, the other side relates to the humanistic aspect: how committed your staff are, how far everyone is prepared to go, how enthusiastic we are and the pride we take in our work and achievements.

The Engineer's role in this whole process is probably one of the most important as he is the driver of the entire process. This is particularly important for the Engineer in a medium sized Municipality as he is the person involved in management, planning, technical aspects, administration, operations etc. Municipal Engineers must not forget that we are in the first instance Engineers, and that maintaining and upgrading our system is priority number one.

The Municipal Engineer has to be resourceful and undeterred by bureaucratic problems and blockages in his day to day workings. Creative ways are needed to resolve problems and overcome obstacles. The Engineer must continually be finding ways to fund projects and must source every avenue to make things happen in his department. He should always be adaptable and willing to prove to Council and his community that he is doing all he can to improve their lives by providing for their energy needs. Always strive towards perfection and do not settle for mediocrity. Electricity is the life-blood of both the economic and residential communities within a Municipality and it must be afforded the importance it deserves.

The same will apply to senior staff of the Department. The experience of your senior staff is essential to the staff on the site. Make sure that your senior staff spend a considerable amount of time on site. A good management team is the formula for success; a team which is willing and able to go the extra mile. They are all willing to be immediately available for any problem, even if not on stand-by duty. All it takes is one phone call.

Assisting Council by going out of our way is another aspect of our work. Being able to deliver your service quickly and effectively is highly appreciated by the Council. This is particularly important in remote rural areas where access to electricity completely changes the life of the communities. Making sure that there is no backlog, and being proactive are some of the reasons why we always have support from our Council.

Prof . Anton Eberhard continues quoting:

“And one of the reasons they have not done so has been the uncertainty regarding the transfer of their assets into the envisaged six regional electricity distributor (RED) companies.”

Years ago we convinced Council that it is in their best interest not to stop spending in the electrical system for two reasons:

- a) If everything goes well during the take-over period, the value of their shares in the new company will be increased,
- b) In all instances even if something goes wrong, the Municipal system will still be in such a condition to last for a number of years and provide quality supply to community.

This approach, after a number of years of uncertainty in regards to the restructuring of ESI, has shown great results.

Our aim is not to join Regional Electricity Distributor to solve our problems, but simply to bring one problem less.

Conclusion:

It is probably not possible to have an entirely fault free electrical utility as we depend on a number of factors which are sometimes beyond our influence, but a combined systematic and holistic approach backed with technical knowledge and extra effort can make a significant difference.

Thanks to my dedicated staff and to Council for continued support.