How to undertake a simplified municipal cost of supply study

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Abstract

Understanding costs is a foundation of distribution business sustainability and customer-centricity. In this era, distributors are becoming more than just suppliers of energy, but providers of network services such as wheeling and distributed generation. These services, or "new business models", require a sound understanding of network costs and the associated cost drivers, which is the primary purpose of a cost of supply (COS) study. Despite national government policy (Electricity Pricing Policy, 2008) requiring licensees to perform a COS study every 5 years, uniform COS studies and tariff setting remain a challenge for most municipalities. This renders it difficult to compare costs across municipalities and extremely challenging to regulate. In an attempt to standardise COS approaches, this paper provides a practical step-by-step guide to performing a COS study, using the National Energy Regulator of South Africa (NERSA)-endorsed simplified COS tool. The methodology described is based on NERSA's COS Framework and draws on the NRS 058 where needed. The input data is kept as simple as reasonably possible, and assumptions are explicitly described. These assumptions are the crux of where COS approaches differ vastly, and this paper brings these assumptions to light for others to replicate and build on.

The importance of cost of supply studies

Electricity tariffs are the means by which municipal distribution utilities recover their operating costs and make a return on capital investments to ensure a viable electricity industry. A Cost of Supply (COS) study is one of the most important considerations in establishing and designing electricity rates. These rates should provide the service required by customers and recover costs incurred by licensees. The objective of a COS study is to apportion all costs required to service each customer category in a fair and equitable manner. The National Energy Regulator of South Africa (NERSA) has developed the COS Framework to promote sustainability of the electricity supply industry, while protecting customers against unduly high prices.

Significant challenges have emerged in the municipal electricity distribution industry, and it has become a high-risk and unsustainable business. Despite some pockets of good performance, the electricity distribution industry is not effectively managed as illustrated by the very high technical and non-technical losses. In addition, the inability of the industry to do effective revenue collection and revenue management are matters of major concern. A COS study is a critical first step to understanding the operational performance of an electricity distributor, and NERSA has therefore started enforcing this requirement by refusing to approve new tariff applications without a COS study. As such, the urgency for municipalities to develop their COS studies has increased significantly. This paper offers an overview of the process of undertaking a COS study and seeks to simplify the process to become a feasible task for any keen municipal official.

Sustainable Energy Africa has been working with NERSA, SALGA, Eskom, GIZ and other key stakeholders to develop a COS tool for municipalities to use when undertaking a COS study. This tool is freely available for use by municipalities.

Overview of NERSA's COS Framework

The 5 steps of the COS process are show in Figure 1 and these will be unpacked in this paper.

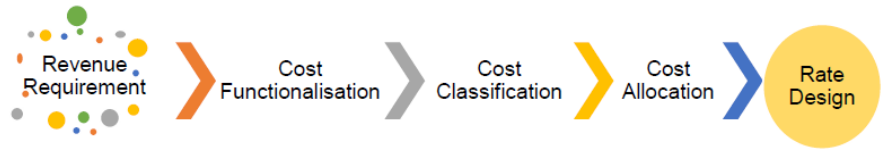


Figure 1: 5 steps of the Cost of Supply Process

Step 1: Revenue Requirement

The revenue requirement is the total cost of running your electricity business for the next year and it determines the total amount of revenue that should be recovered by tariffs. In practice, determining a municipality's revenue requirement is done by using two key data sources:

1. **D-form financial statement** (non-purchase costs)
2. **Eskom bills** (energy purchase costs)

Obtaining this data and ensuring its accuracy is often the most challenging step of the entire COS study process.

Non-purchase costs

The primary source of data for non-purchasing costs is the municipal D-Forms (distribution forms)[1]. The cost information is available in the Income Statement section (D-1 tab) of these forms. Municipalities are required to capture all expenses in the D-form, broken into the following line items:

- Repairs and Maintenance,
- Operating Expenditure,
- Interest on Loans,
- Purchases,
- Depreciation, and
- Shared costs.

As such, maintaining accurate and up-to-date D-forms is a critical function of municipal electricity departments. The task of completing D-forms is often left to municipal finance departments, but **the importance of collaboration between finance and electricity departments in agreeing on the expenses captured in the D-form cannot be understated.**

A noteworthy challenge many municipalities have in completing their D-forms is determining the depreciation expense value. Determining the electricity business' depreciation requires an up-to-date asset register which is often not available. Municipalities must therefore dedicate time and resources to developing and maintaining their asset registers. An interim approach is to benchmark

[1] Questions have been raised around the quality of the data in the D-forms. However, it has emerged that the D-forms contain the best data available, and NERSA is actively working to improve these.

the network depreciation value from similar electricity networks – and we are working on developing such a benchmarking approach – but up-to-date asset registers are the most reliable way to justify your costs in a tariff application to the Regulator.

Purchase costs

Most municipalities purchase all their electricity from Eskom. As such, determining purchase costs usually only requires the last 12 months Eskom bills. This process can be significantly streamlined if municipalities request that Eskom share their last 12 months of bills consolidated into a single spreadsheet.

Revenue requirement tips

The importance of accurate D-forms cannot be overstated, and municipalities must dedicate time and capacity to this task. When assessing COS study submissions, NERSA will evaluate the prudency of the expenses included in the D-form, so a justification may be required when a municipality's cost differ significantly from the benchmarks.

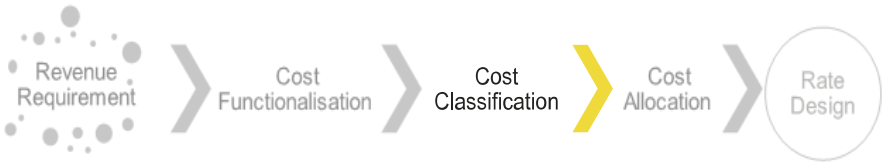
Some useful benchmarks to keep in mind are the following:

- **Percentage Power Cost = 75%** i.e., Eskom bills should account for 75% of the total electricity department costs (the acceptable range is between 58% and 78%).
- **Repairs & Maintenance = 6% of revenue** i.e., repairs and maintenance expenditure should be between 6 and 15% of the total revenue billed. Repairs & maintenance underspend can degrade network infrastructure. On the other hand, some municipalities have the capacity to perform inhouse repairs and maintenance meaning their costs are lower.
- **Energy losses = 10%** i.e., the difference between kWh purchased and sold should not exceed 10%. High network losses increase the cost of electricity for all customers and interventions to reduce losses are required in many municipalities.

Step 2: Cost Functionalisation

This step divides the revenue requirement into the functions of the licensee – generation, transmission, or distribution. Since most municipalities are purely distribution utilities, all costs are typically functionalised as distribution related. This step is very straightforward but remains an important placeholder for when municipalities engage in the function of electricity generation.

Step 3: Cost Classification



Cost classification is a two-step process. The first step is to decide whether cost items are fixed or variable. Fixed costs are costs that remain constant regardless of the volume of sales; an example of a fixed cost is billing and metering labour – regardless of how much a customer consumes, you still need to go read their meter. Conversely, variable costs change with the volume of sales. An example of this is your Eskom purchase costs – the less you sell, the less this cost is. Executing this step is simple, you decide whether each cost item (on your D-forms and Eskom bill) is fixed or variable.

Once classified as fixed or variable, the second step involves grouping costs into the cost drivers. Costs are either driven by energy (kWh), demand (kVA) or the number and type of customers:

- An example of an energy-driven cost is the Eskom energy purchase cost: the more kWh consumed on the network, the more Eskom energy purchase cost you will incur.
- An example of a demand-driven cost is the network capital cost: the higher the maximum demand on your network, the more costly the network infrastructure will be.
- An example of a customer-driven cost is the retail cost of billing and metering: the more customers on your network, the higher the cost of billing and metering for all those customers.

Executing this step of the COS study entails classifying each line item in the D-form or Eskom bill according to their cost driver: energy, network, or customer.

Functionalisation and Classification tips

Executing steps 2 and 3 of the COS process is relatively straightforward once the concept is understood. Each cost item in the D-form is categorised according to function, fixed/variable, and the cost driver (energy/demand/customer). Figure 2 shows how this is performed using drop-down menus in the simplified COS tool.

D-form Cost Item		Cost Function	Fixed/Variable	Cost driver
Repairs, Maintenance and Salaries				
Repairs and Maintenance:	R 176 936 506			
1. Salaries and allowances	R 128 510 420	Distribution	Fixed	Customer
2. Materials and supplies	R 14 584 309	Distribution	Variable	Demand
3. Contracted Services	R 33 841 777	Distribution	Variable	Customer

Demand
Energy
Customer

Figure 2: Executing Cost Functionalisation and Cost Classification in the simplified COS tool

The challenge here remains understanding the cost drivers. Deciding on whether a cost is customer-driven or demand-driven can be difficult to understand. A simple rule of thumb is that costs related to network infrastructure (depreciation, repairs and maintenance etc) are demand driven, while costs related to municipal services (salaries, shared costs or charges from other municipal departments, bad debts etc) are customer driven.

Once costs have been classified, they can be grouped and presented according to their cost drivers, as illustrated in Figure 3.

Non-purchasing costs

These are drawn from the D-form Financial Statement

	Demand-related costs		Energy-related costs		Customer-related costs	
	Fixed	Variable	Fixed	Variable	Fixed	Variable
Non-purchasing costs	R 95 740 565	R 15 905 553	R -	R -	R 231 039 931	R 34 086 232

Purchase costs

These are drawn from the Energy Purchase Costs

	Demand-related costs		Energy-related costs		Customer-related costs	
	Fixed	Variable	Fixed	Variable	Fixed	Variable
Purchasing costs	R 144 566 400	R 42 717 344	R -	R 1 796 089 037	R -	R -

Figure 3: Table showing classified costs

Step 4: Cost Allocation

The final step of the costing process before moving into rate design is cost allocation. This is where the classified cost groups are allocated to your different customers reflecting the cost they cause. Ultimately, the cost allocation step provides you with the cost of supplying each customer group in R/kWh, R/kVA and R/customer. Each of the classified cost groups – shown in Figure 3 – is allocated using each customer group's contribution to that cost.

- **Energy-related costs:** allocated using each customer group's share of energy consumption in each time-of-use period.
- **Demand-related costs**: allocated using each customer group's contribution to the network's peak demand.
- **Customer-related costs:** allocated using a weighting for based on how much more expensive large customers are to service relative to small customers.

Once these costs have been allocated to each customer group, they should be divided by a measurable unit (e.g. kWh) in order to provide a per unit cost of supply. As a start it is always useful to understand the average c/kWh cost for each customer, but it is important to note that this is not a cost-reflective way of presenting costs. An example of the per-unit average c/kWh cost of supply is presented in Figure 4 below.

	Average R/kWh cost
Free Basic Electricity	**2,20**
Domestic (pre-paid)	**2,37**
Domestic (conventional)	**2,08**
Manufacturing / Industrial	**1,71**
Commercial (conventional)	**3,01**

Figure 4: Example of the per-unit average c/kWh cost of supply

To better inform rate design, allocated costs should be divided by their cost driver to determine the cost of supply in cost-reflective units. An example of the cost of supply in cost-reflective units is presented in Figure 5.

	Total Variable Costs	Total Fixed Costs
	R/kWh	R/customer/month
Free Basic Electricity	**1,66**	**R 80**
Domestic (pre-paid)	**1,66**	**R 207**
Domestic (conventional)	**1,66**	**R 251**
Manufacturing / Industrial	**1,56**	**R 5 842**
Commercial (conventional)	**1,56**	**R 255**

Figure 5: Cost-reflective cost of supply

This cost of supply should then form the basis of the rate design step.

Step 5: Rate Design

Once the costs of supply have been determined, the final step is to design appropriate electricity tariffs for submission to NERSA. Many municipal tariffs are far from cost-reflective and transitioning

these tariffs towards cost reflectivity should be done incrementally over a few years. Key considerations when designing electricity tariffs include:

- **Cross subsidies:** deviating from cost reflectivity to improve the affordability of electricity to indigent customers is highly effective, but this subsidy cost needs to be collected from other customers.
- **Understandability:** tariffs must consider the level of understanding a customer may have to certain tariff elements. As an example, demand charges are inappropriate for residential customers because they tend not to understand the concept of maximum demand.
- **Ability to respond**: tariffs should send signals to customers that enable them to respond. Customers with flexible load should receive time-of-use signals to shift their load away from peak times.
- **Metering infrastructure**: tariffs must be measured, and metering infrastructure often limits the tariff options a municipality has for a certain customer group.

Tariff setting tips

Some broad tariff setting tips are provided from our experience working with municipal tariffs:

- Domestic tariffs should include a fixed/basic charge in R/month. Based on available COS studies, a sensible fixed charge is between R100-R400 per month. However, it is critical that these fixed charges are introduced incrementally as to not shock customers.
- Indigent tariffs should not include basic charges. These tariffs should be purely volumetric energy charges. Many municipalities utilise inclining block tariffs to provide cheaper electricity to indigent customers.
- It is important that commercial customers pay a fixed charge component, and this can be complemented by a demand charge component. Commercial fixed charges ensure that sufficient revenue is recovered when customers reduce their demand through energy efficiency or embedded generation.
- Industrial customers should pay both fixed and demand charges, and energy charges should be on a time-of-use basis.

NERSA Submissions

When submitting a COS study to NERSA, it is important that all data, assumptions, and models are shared. The entire process should be described in a COS report. The submission process is lengthy and COS studies should be submitted before the end of the calendar year to be approved by the start of the municipal financial year in July.

Conclusion

The sustainability of South Africa's electricity distribution industry relies on a transition towards cost-reflective electricity tariffs and sufficient investment in infrastructure maintenance. This requires a radical improvement in costing methodologies, hence the critical need for COS studies. This paper has presented a simplified COS methodology along with a freely available COS spreadsheet tool. This simplified COS tool is intended to improve the situation of electricity pricing in South African municipalities. Municipalities can undertake a COS study internally or they can partner with consultants to use this tool. The COS tool will continue to be modified as our understanding of the COS methodology improves and as data availability improves. The tool can be found at www.SSEG.org.za/COS