How the Newly Restructured Eskom Tariffs were Developed

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1. Introduction:

This paper describes the major steps taken in the development of tariff structures and tariff methodologies for Eskom. With the publishing of the White paper on Energy Policy in 1998 and several other driving forces such as the unbundling of Eskom into separate divisions it has become possible to restructure legacy rates. Eskom has a long standing tariff history and some tariffs were developed decades ago. The current tariff methodology is a response to the current utility environment where cost based tariffs, effective customer behaviour and the efficient investment are of the utmost importance. In the light of restructuring it has also become necessary to restructure tariffs into new sets of tariff that could weather the "storm" and will form a foundation for the tariff structures of future Distribution companies.

The steps taken in the tariff design methodology are described as well as the overall outcomes at different stages of the design process. There are two conflicting concepts in tariff design that make this process one that is often described as art rather than science: On one hand is the desire of the utility to reach its financial objective and earn a fair return and on the other hand, is the desire of the end-user or customer to receive fair tariffs at the lowest possible level. The major thrust of the tariff design philosophy is to achieve a realistic balance between these two often conflicting concepts within the realm of a regulated environment.

2. Attributes of Rate Structures:

There are several attributes that sound rate structures should adhere to. These attributes can be separated into revenue-related attributes, cost-related attributes and implementation-related attributes.

2.1 Revenue-Related Attributes

The tariffs should yield the total revenue requirement including a fair return. This would require that all designed tariff structures should be tested for adequate recovery of revenue and scaled to levels that would ensure recovery.

The revenue should be stable and predictable with minimal unexpected changes to the utility. This should allow the utility to gradually grow its base of customers and revenue. There could be no revenue shocks (i.e. losses in revenue) that would

jeopardize the sustainability of utilities.

The tariff structures should be stable and predictable with minimal unexpected changes and with some sense of historical continuity. This might sound conflicting in the light of restructuring tariffs but major changes towards future tariff structures should be brought about to ensure as small an impact as possible on customers. The fact that several utilities are still marred by legacy tariff structures will make this attribute difficult to adhere to in the time leading into the future RED dispensation.

2.2 Cost-Related Attributes

Tariff structures and tariff groupings should be designed to discourage wasteful use of the service while promoting efficient use:

- Increased overall usage for existing infrastructure should be encouraged and
- Time variant or relative usage should be encouraged (Off peak usage vs. peak usage or summer usage vs. winter usage).

Tariffs should reflect all present costs and portray the structure of costs to the utility.

There should be fairness in the apportionment of total costs of service among the different customer classes so as to avoid arbitrariness. This would imply the adoption of accepted cost of service methodologies that is used to allocate cost to defined customer classes.

Undue discrimination in tariff levels should be avoided and where possible subsidies should be shown and phased out in accordance with government objectives. In this are Eskom has engaged government to provide direction as this issue touches on the distribution of resources in the larger economy and the effects should be known to government.

2.3Implementation-related Attributes

The tariffs should be kept as simple as possible while providing adequate information to the customer. The introduction of additional tariff components might be seen as contradictory to this statement. There is however an element of being able to clearly express the services that the customer is paying for by having tariff components for the most significant services such as energy and networks.

Tariff structures should be implementable and free from controversies. The interpretation of tariff structures should be clear. Inconsistencies should therefore be eradicated as to promote understanding. The elimination of the consumption based rebate is one such inconsistency that Eskom will eliminate by introducing more consistent pricing signals across all tariffs in the form of the network charge.

3. Recent tariff structure changes

Eskom has made significant progress over the past few years to implement rate structures that are in

coherence with principles laid down in the White paper on Energy Policy published by Government in 1998. There has also been several changes that was brought about to ensure that Eskom tariffs have attributes that are acceptable for utility tariffs as discussed in paragraph 2.

The most significant changes that have been brought about can be summarized as follows:

The introduction of unbundled network charges started with rural customers in 2002 and will also be extended to urban customers in 2004. The attribute of reflecting the cost structure and ensuring adequate revenue for the utility is satisfied by the introduction of these charges. This also provides for efficient usage of resources by customers and Eskom being able to provide additional service on existing networks. As mentioned before the necessity for providing consumption based incentives for utilizing supplies optimally through the connection charge rebates have been done away with. This has been replaced by a more significant incentive by charging for network costs based on the utilized capacity of a customer that is the higher of the actual for the previous 12 months and the Notified Demand.

The introduction of a shorter high demand season and more pronounced price differentiation in the time of use periods. This satisfies the attribute of encouraging overall usage of infrastructure and encouraging time-variant usage.

4. The Tariff Design Process

The process of calculating tariff structures for electricity can be broadly broken into 3 steps:

- Identifying and calculating costs
- Allocation of the costs to defined tariff classes and
- Tariff structure and rate determination

Identifying and allocating costs is done based on the cost of supply methodology as set out in NRS 058. This methodology has been accepted by the industry. Eskom has implemented this method to allocate cost to its existing tariffs classes. It is envisaged that tariff classes in future will reflect usage patterns. Thereafter the calculation and logic used to determine the structure and rates of the tariffs is described.

There is often confusion around the words “price and cost”, price is not cost. Cost is the amount incurred to obtain or deliver a specific service whereas price is an amount charged to a customer for that service.

In a regulated and monopoly environment, the price paid is regulated based on certain criteria, such as cost which includes an allowed return on investment, or even on affordability levels as judged by the regulatory authorities.

Irrespective of what type of market environment there might be, the basis (or the floor) for determining the price to be charged is the costs. The market or regulator determines the price ceiling. Costing information

is a vital element of management information and is a useful tool in the following areas:

- Product Pricing
- Make/buy decision making
- Breakeven and investment analysis
- Transfer pricing
- Scenario planning
- Process optimisation

All of the above are important for Eskom. The basis for Eskom's tariffs is cost; a good understanding of what these costs are and how they are allocated to customers is required in order to set tariff levels, and subsequently to determine project viabilities, investment decisions, technology strategies and, ultimately, how to keep prices low and profitability up.

Once the costs have been determined and adjusted to ensure that revenue requirement is met, the tariff design process moves to the allocation of costs amongst various customer categories. The allocation process is based on the customer categories' degree of association with the energy, demand and customer related functions. Eskom's customer categories used for this tariff design process are based on the existing tariff classes.

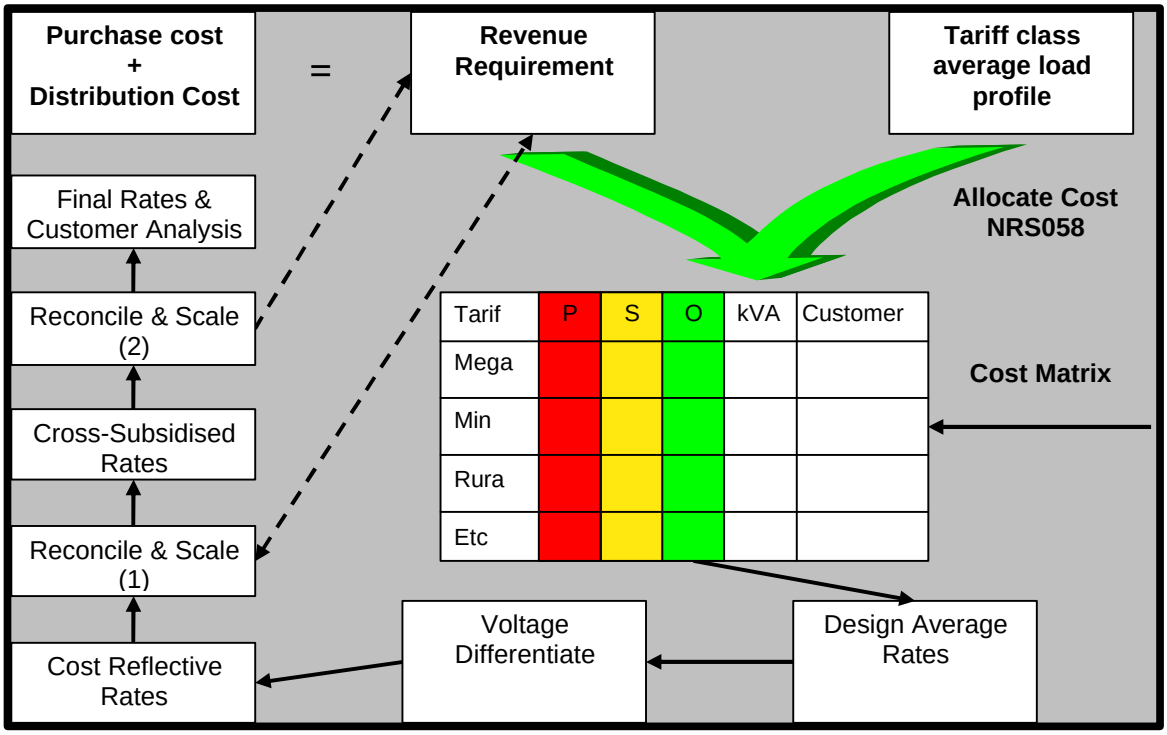
Once the cost of energy, demand and customer-related functions are allocated, these costs are used to determine the initial average cost reflective price, and do not take adjustments (e.g. voltage surcharge and subsidies) into account.

There is a cost differentiation from higher voltages to lower voltages that should be reflected in the tariff structures. Eskom is currently operating with a specific set of pre-defined voltage differentiation factors. These factors will be under scrutiny in future but will only be changed or increased as more data is available to model all voltage levels. In the next step the adjustments are included, which is a reconciliation and scaling process to ensure that revenue requirement is met.

There are inherent subsidies in the current Eskom tariffs that should be rationalized and phased out as Government gives direction to re-balance tariffs to those customers that receive the subsidies. In the next step of the design process the subsidies are clearly identified and levies are added to the costs of those customers contributing to the subsidy pool and given to customers that receive the subsidies. These levies and subsidies impact the tariff structures and once again the tariffs should be applied to the customer data to ensure that revenue requirement is met.

The final tariff structures and rates are applied to customer data and analysis is done on each point of deliver of large customers and groups of small customers to determine the impact of the changes in tariff structure. This analysis is then used to make further adjustments to the tariff structures if the impact of the proposed changes is too severe such as phasing-in of fixed charges.

Figure 1 - Rate Design Process Overview



Each step of figure 1 is described in more detail as follows:

4.1 Revenue Requirements

Eskom's revenue requirement consists of Distribution purchase costs (energy and transmission network services) and other distribution costs such as the cost of Distribution networks and customer service. A tariff design exercise should always use a test year as close as possible to the present financial year to ensure that rates reflect as far as possible the current level of service and mix of customers. The tariffs are therefore designed using the budgeted revenue requirement for the year when the design is done and using the forecasted customer data for the same year. The tariff structures for 2004 are therefore designed by using the 2003 budgeted revenue requirement and the 2003 customer forecasts. This would result in tariff structures with rates in 2003 rand value. Once the overall price increase is determined these rates are increased by a percentage to reflect the revenue requirement for 2004. The revenue requirement is broken down into the major cost categories according to the NRS 058 cost of supply methodology whereafter each component will be allocated.

The tariff design process has, as one of its main objectives, to recover the revenue requirement. All rates applied to the customers' forecasted

profiles should therefore balance to the revenue requirement. The

4.2 Tariff Class Average Load Profiles

The load profiles of the defined customer categories should be determined to allocate costs based on the way a customer or customer category uses electricity in the hours of the day and in the seasons of the year. This information is used to determine the costs of purchasing energy and the capacity required on the networks. Eskom currently uses the defined tariffs as customer classes as these categories are well established and a migration to new classes that are more load factor related for larger customers will probably only occur after the formation of REDs. For many of the existing tariffs this categorisation is adequate as it reflects 3 levels of pooling: urban and rural is separated, residential customers are treated separately from other urban customers and customers are pooled according to size.

The tariff class average load profiles are determined at the 275kV level per tariff class.

4.3 Allocate costs NRS 058

One of the fundamental criteria in allocating costs is to classify costs according to their nature. Costs can be broadly classified into the natures of:

- fixed or variable costs, and
- direct and indirect costs.

Fixed costs are costs that are fixed regardless of consumption and relate in particular to capital investments for infrastructure development. An example would be the cost incurred in building an electricity network to supply a customer.

Variable costs are those that vary directly related to output or consumption, such as the cost of raw material. An example for an electrical utility would be the cost of the coal or the water, which is used to generate the electricity consumed.

Direct costs are those costs are costs that are directly associated with providing service related to a product or service. An example would be the cost of metering or billing a customer and providing customer service.

Indirect costs are shared or common costs that are allocated to a number of different products or customer categories as there is no direct cost causation responsibility. An example is overheads related to building rentals or head office staff costs.

The costs are allocated to the defined customer categories according to the NRS 058 methodology. Each tariff class (subdivided by size) becomes virtual customer groupings that share in the allocated costs. The costs allocated to each of the virtual customers is captured in a cost matrix reflecting each major cost category that can be used in a tariff structure ie. kVA related costs, kWh related costs and customer or account related costs.

Once these costs categories have been determined average tariff rates will be designed for each tariff.

The energy costs (for peak, standard and off-peak time periods in both the high and low seasons) are allocated directly, with an addition for losses, while network costs are allocated using the Average and Excess methodology, as described in NRS 058. Energy costs are allocated on the basis of volume (c/kWh) whereas network costs are allocated based on capacity (R/kVA).

Other distribution costs are categorized with cost drivers being volumetric (kWh), capacity (kVA) and number of customers (Customer; Account; POD). Customers are differentiated on size and the costs are allocated accordingly.

The above steps yield a cost matrix, reflecting per unit and total costs, for each tariff class for energy, capacity and customer costs. This matrix can be seen in figure 1.

4.4 Design average rates

The cost matrix contains a cost component for each identified cost, for each tariff. The tariff structures are limited by the ability to meter certain cost drivers and by simplicity. As an example the Homelight tariff cannot have separate network costs and customer costs reflected in the tariff, as the capacity is not measured and the meter is not capable of raising a fixed charge. In this case certain cost components of the cost matrix should be added together (bundled) to determine average rates.

The purpose of this step in the tariff design process is therefore to add different cost components together to match appropriate rate structures and to convert those bundled costs into unit rates (c/kWh, R/kVA, R/Customer; R/Account; R/POD).

The costs are put together in accordance to the unbundling of energy and wires costs. Therefore all tariffs that allow for the separation of these costs see separate energy costs and separate network costs. The energy costs can be reflected on a time of use basis exactly like the input costs or converted to more equalized energy charges for the small customer tariffs. The network costs are charged based on utilized capacity where possible as the network costs are not caused by the variant demand of a customer but the maximum required by the customer for a specific year.

Figure 2 expains the relationship between costs and tariff structure components for the Nightsave tariff. This tariff re-packages the costs into tariff components that are more suitable to customers that manage their load on a daily and seasonal cycle rather that an hourly cycle. This tariff design converts standard and off-peak energy costs into a non time-variant energy price and converts some of the energy costs into a demand charge to ensure demand side management when energy rates are flat. Network costs are recovered as a demand related charge (R/kVA).

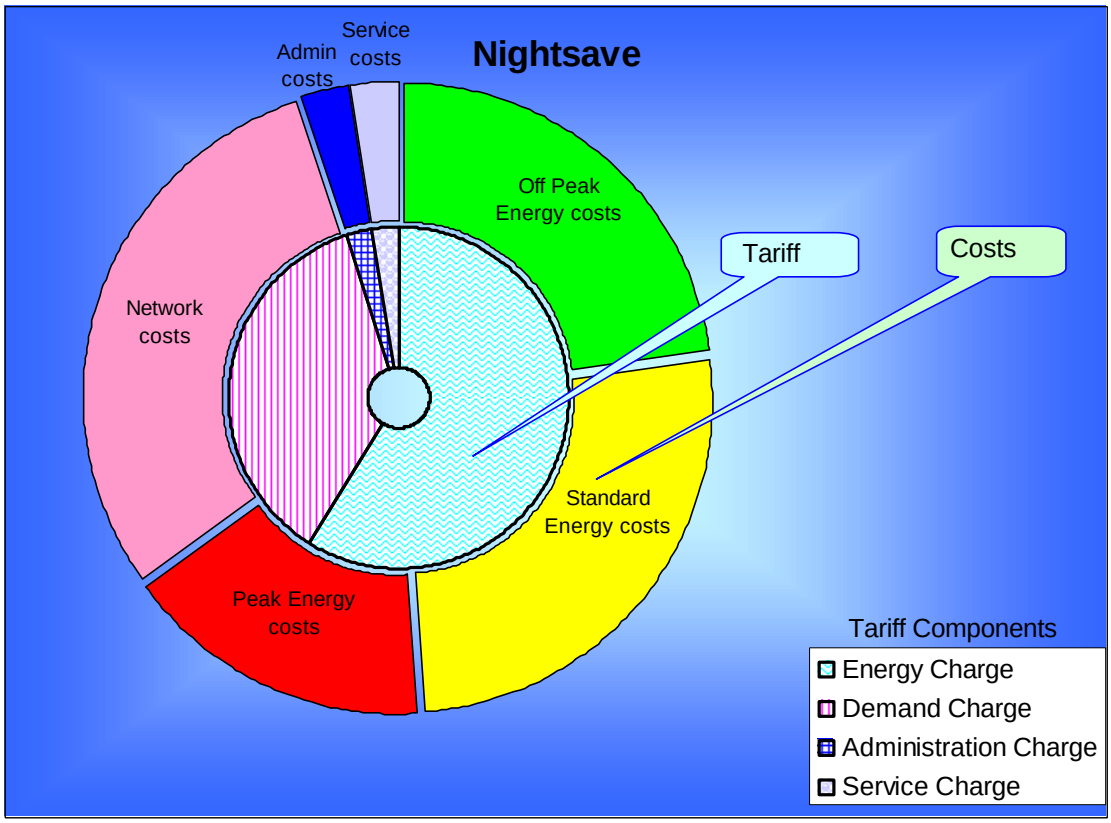


Figure 2 – Difference between cost components and tariff components for Nightsave (Urban) tariff.

4.5 Voltage Differentiation

The rates at this point are average rates designed by using the average profile of a tariff class as seen at the purchasing point of Distribution. These rates still require differentiation for voltage to reflect the true cost of supplying different customers at the various voltage levels. This is achieved by calculating the volume weighted differentiated rates for each component per tariff class and per voltage level. The resultant rates will reflect cost differences between higher and lower voltages. The existing voltage differentials will be applied.

4.6 Reconcile and Scale (1)

Once the voltage differentials have been applied the rates are deemed to be close to cost reflective. These rates are applied to customers' profiles to determine Eskom's total revenue.

A difference between the calculated revenue and Eskom's total revenue requirement occurs due to a combination of the following reasons:

- Certain assumptions are made regarding load profile where no actual data exists.
- Adjustments due to Transmission surcharge.

This difference is eliminated by scaling the cost reflective rates to ensure revenue requirement within an accepted margin of error (0,1%).

4.7 Cross subsidised Rates

The cost reflective rates for some tariffs are significantly different from the existing rates which may require huge increases/decreases to the rates, which may be unaffordable for some customer classes. These rates are adjusted based on tariff rebalancing direction approved by the regulator. The cross-subsidisation is based on reducing the capacity related (network) costs allocated to the subsidised tariffs, and recovering this cost on a volumetric (c/kWh) basis from customers contributing to the subsidies.

4.8 Reconcile and Scale (2)

Once the subsidies have been included the rates it is necessary to ensure that revenue requirement is obtained from these subsidised rates. The subsidised rates are applied to customers' profiles to determine Eskom's total revenue.

A difference between the calculated revenue and Eskom's total revenue requirement occurs due to a combination of the following reasons:

- Adding a flat c/kWh subsidy rate to rates and then applying voltage and geographical differentials.

This difference is again eliminated by scaling the subsidised rates to ensure revenue requirement within an accepted margin of error (0,1%).

4.9 Final Rates and Customer Analysis

The re-designed tariffs are now structurally different and have different tariff rates from existing tariffs. Due to these changes, individual customer bills will be impacted differently, depending on their load profile and tariff. The impact can range from significant savings for the customer to substantial increases in the customer's bill. Such impact is unavoidable when there is a re-design of tariffs, however due to affordability constraints, there should be a minimum negative impact to the majority of customers. The quantification of "minimum" and "majority" is at the discretion of the National Electricity Regulator.

To be able to quantify the revenue impact on each individual customer, the customer's bill needs to be modeled on the existing tariff and the new re-designed tariff.

Comparisons between existing and new tariff revenue is compiled for each customer (LPU) or customer grouping (SPU) by tariff and portrayed in the form of histograms.

Automatic savings made by customers without shifting any load, is regarded as a loss to Eskom. This places risk of not meeting the revenue requirement. Further analysis based on new rates is very important to quantify the risk of automatic savings.

5. Conclusion

There is a need within the Electricity Supply Industry (ESI) to have substantiated tariff structures that are based on costs with some changes to allow for socio-economic subsidies. A prerequisite of this is a standard procedure of allocating and deriving costs, which is considered to be fair and equitable which is as broadly acceptable as possible to all stakeholders. In the costing process the unit costs for all functions of electricity supply to customers (purchase, network and support costs) are calculated as described. The cost-of-supply methodology on its own is not enough to allow for the restructuring of retail tariffs towards sound cost-reflective tariffs. It is necessary to have a tariff design methodology that guides the process of moving from costs to tariffs.

Eskom has followed such a tariff design methodology and has brought about significant changes in the legacy tariff structures to reflect more accurately, current-day pricing objectives and cost structures.

These structural changes have brought about a certain level of instability in tariff structures. This is however a transitional phase that will stabilise as the tariff structures are founded on the longer term cost structure. If these changes are implemented there will be longer term tariff structure stability.

The tariff restructuring has brought about several of the objectives for sound pricing. Eskom has seen better usage of infrastructure due to the introduction of network charges and the charging of required capacity as opposed to actual variant demand. There is also a close reflection of the purchase cost time of use ratios in the retail tariffs that has been followed by the rescheduling of electricity consumption to times and seasons that are most cost-effective to the customer. This will bring about longer term savings as it would postpone the requirement for new capacity if this signal is followed by customers.