ANALYSIS OF BULK CONSUMER DEMAND FOR TARIFF DESIGN

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DECLARATION

The work submitted in this dissertation is the result of my own investigation, except where otherwise stated.

It has not already been accepted for any degree, and is also not being concurrently submitted for any other degree.

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Abstract

Bulk consumers are the main revenue generating category of the electricity consumer mix in Sri Lanka. Their contribution has a large impact on demand in the power distribution network. The tariff applied, the metering system and the analysis of their consumption is very important to the utility and to the consumer.

Optimizing the resources in the power distribution network is very important to the utility. The utility has to encourage the consumer to manage the load scientifically. The energy consumed should be charged in a fair manner. Paying a reasonable bill is appreciated by any consumer. In this context, application of a 'cost reflective' tariff is fair by the consumer and the utility. As a country on the whole, it is an important attempt to utilize the energy in the most cost effective manner. This would help the country facing the energy crisis, sustain the industries and employment, and enhance the power quality and reliability.

The objective of this research is to investigate individual and collective demand profiles of bulk consumers, and to encourage them to implement demand management measures. This is done by introducing a better cost reflective tariff. Thereby, both the consumer and the utility would be benefited.

Electronic digital meters, with remote meter reading facility, were introduced very recently. These meters provide detailed information about the consumer's demand profile and give an in-depth view of their electricity consumption. Studying these demand profiles show that there are many consumers with a poor power factor, consuming a large amount of reactive power from the system, transmitted all the way from the point of generation. This causes excessive burdens on the network for handling extra current and causing excessive power and energy losses.

In this research, an effective sample of bulk consumers who consume a large amount of reactive power is considered. In order to encourage them to improve their power factor, it is suggested to introduce a charge for reactive power consumption (in Rs/kvarh). Considering a sample, the price of a unit of reactive energy is calculated

based on, if the utility does the power factor correction and if the consumer does the correction. It will be shown that, it is more appropriate for the consumer to do the power factor correction on their own. This suggested charge is much reasonable to both the utility and the consumer. A charge for the consumption of reactive power would be cost reflective and would reward high power factor consumers by giving a lower maximum demand charge. Thereby, the consumers with a poor power factor are encouraged to improve their power factor. With this enhancement to the tariff, both the utility and the consumer will be benefited.

The maximum demand charge is imposed to reduce the demand of system in general. However, it does not deal the issues of low power factor, in a cost reflective manner. It is also imposed, to compel the consumer to manage his demand-peaks as much as possible. Both these components contribute to the maximum demand charge. By removing the power factor contribution from the presently applied 'Maximum Demand' charge, the demand-peak component can be isolated. Thus, the new maximum demand charge would inevitably become a lesser charge.

The demand-peak component is a burden to the utility during the system peak period. During the off peak period, these individual demand-peaks will not cause much difficulty to the utility to cope up with. Therefore, it should be applied on a time of day basis. It is reasonable to apply a lesser charge (as an incentive) during off-peak, and a higher charge during peak load time period. Thereby, the bulk consumers are encouraged to shift on to off peak time. This enhanced tariff structure would benefit both the consumer and the utility.

The study concludes by suggesting a charge for the monthly reactive energy consumption, while recommending a reduction in the present maximum demand charge. Further, the bulk consumers are categorized into five types, based on their demand profile. These may be used in extending the study to design a maximum demand charge base on time of day.

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RMR	Remote Meter Reading
PPM	Programmable Poly Phase Meters
BSC	Bulk Supply Consumers
MD	Maximum Demand