EEE 411
Power Station Engineering

TARIFF OF ELECTRICITY

Introduction

The rate at which electrical energy is supplied to a consumer is known as tariff.

Objective of Tariff:

1. Recovery of cost
2. Suitable profit

Desirable Characteristics of a Tariff

1. Proper Return
2. Fairness
3. Simplicity
4. Reasonable Profit
5. Attractive

Types of Tariffs

1. Simple Tariff
2. Flat rate Tariff
3. Block Rate Tariff
4. Two-part Tariff
5. Maximum Demand Tariff
6. Power Factor Tariff
7. Three Part Tariff

Simple Tariff (Uniform Rate Tariff)

price charged per unit is constant i.e., it does not vary with increase or decrease in number of units consumed.

Disadvantages:

1. There is no discrimination between different types of consumers since every consumer has to pay equitably for the fixed charges.
2. The cost per unit delivered is high.
3. It does not encourage the use of electricity

Flat Rate Tariff

When **different types of consumers** are charged at **different uniform per unit rates.**

It depends on load

Disadvantages:

1. Since the flat rate tariff varies according to the way the supply is used, separate meters are required for lighting load, power load etc. This makes the application of such a tariff expensive and complicated.
2. A particular class of consumers is charged at the same rate irrespective of the magnitude of energy consumed.

Block Rate Tariff

When a given block of energy is charged at a specified rate and the succeeding blocks of energy are charged at **progressively** reduced rates.

Example:

First 30 units	60 paise per unit
Next 25 units	55 paise per unit
Remaining units	30 paise per unit

Disadvantages:

it lacks a measure of the consumer's demand. (maximum demand.)

Two-part Tariff

When the rate of electrical energy is charged on the basis of **maximum demand of the consumer** and **the units consumed**

$$Total\ charge = b \times kW + c \times kWh$$

Disadvantages:

1. The consumer has to pay the fixed charges irrespective of the fact whether he has consumed or not consumed the electrical energy.
2. There is always error in assessing the maximum demand of the consumer.

Maximum Demand Tariff

Similar to two-part tariff with the only difference is that the maximum demand is measured by installing maximum demand meter.

Disadvantages:

This type of tariff is mostly applied to big consumers. However, it is not suitable for a small consumer (e.g., residential consumer) as a separate maximum demand meter is required.

Power Factor Tariff

A low power factor increases the rating of station equipment and line losses. **Therefore, a consumer having low power factor must be penalized.**

(i) kVA maximum demand tariff : It is a modified form of two-part tariff. In this case, the fixed charges are made on the basis of **maximum demand in kVA** and not in kW. As **kVA is inversely proportional to power factor** , therefore, a consumer having low power factor has to contribute more towards the fixed charges.

Power Factor Tariff

(ii) **Sliding scale tariff :** This is also know as **average power factor tariff**. In this case, an average power factor, say 0.8 lagging, is taken as the reference. If the power factor of the consumer falls below this factor, suitable additional charges are made. On the other hand, if the power factor is above the reference, a discount is allowed to the consumer.

(iii) **kW and kVAR tariff :** In this type, **both active power (kW) and reactive power (kVAR)** supplied are charged separately.

Three Part Tariff

$$Total\ charge = a + b \times kW + c \times kWh$$

This type of tariff is generally applied to big consumers.

Numerical Example

Power Factor Improvement

Example 5.1. *A consumer has a maximum demand of 200 kW at 40% load factor. If the tariff is Rs. 100 per kW of maximum demand plus 10 paise per kWh, find the overall cost per kWh.*

Example 5.4. *A supply is offered on the basis of fixed charges of Rs 30 per annum plus 3 paise per unit or alternatively, at the rate of 6 paise per unit for the first 400 units per annum and 5 paise per unit for all the additional units. Find the number of units taken per annum for which the cost under the two tariffs becomes the same.*

Example 5.8. *Calculate annual bill of a consumer whose maximum demand is 100 kW, p. f. = 0·8 lagging and load factor = 60%. The tariff used is Rs 75 per kVA of maximum demand plus 15 paise per kWh consumed.*

Example 5.9. *A factory has a maximum load of 240 kW at 0·8 p.f. lagging with an annual consumption of 50,000 units. The tariff is Rs 50 per kVA of maximum demand plus 10 paise per unit. Calculate the flat rate of energy consumption. What will be annual saving if p. f. is raised to unity?*

Example 5.10. *The monthly readings of a consumer's meter are as follows :*

$$\text{Maximum demand} = 50\ kW$$

$$\text{Energy consumed} = 36{,}000\ kWh$$

$$\text{Reactive energy} = 23{,}400\ kVAR$$

If the tariff is Rs 80 per kW of maximum demand plus 8 paise per unit plus 0·5 paise per unit for each 1% of power factor below 86%, calculate the monthly bill of the consumer.