TARIFF

Definition

- The rate at which electrical energy is supplied to a consumer is known as tariff.
- Although tariff should include the total cost of producing and supplying electrical energy plus the profit , yet it cannot be the same for all types of consumer.

Objective

- Recovery of cost of producing electrical energy at the power station.
- Recovery of cost on the capital investment in transmission and distribution system.
- Recovery of cost of operation and maintenance of supply of electrical energy e.g. metering equipment, billing etc.
- A suitable profit on the capital investment.

Factors Affecting the Tariffs

The following factors are taken into accounts to decide the electricity tariff:

- Types of Load
- Maximum demand
- The time at which load is required
- The power factor of load
- The amount of energy used

Desirable Characteristics of a Tariff

The tariff must the following desirable characteristics

- **Proper return**
- **Fairness**
- **Simplicity**
- **Reasonable profit**
- **Attractive**

Types of Tariff

- Simple tariff
- Flat rate tariff
- Block rate tariff
- Two part tariff
- Maximum demand tariff
- Power factor tariff
- Three part tariff

Simple Tariff

When there is a fixed rate per unit of energy consumed, it is called a simple tariff or uniform rate tariff.

In this type of tariff, the price charged per unit is constant i.e., it does not vary with increase or decrease in number of units consumed. The consumption of electrical energy at the consumer's terminals is recorded by means of an energy meter.

Advantages:

- Simplest method
- Easily understandable and easy to apply
- Each consumer has to pay according to his utilization

Disadvantages

- There is no discrimination according to the different types of consumers.
- The cost per unit is high.
- There are no incentives (an attractive feature that makes the consumers use more electricity.)
- If a consumer does not consume any energy in a particular month, the supplier cannot charge any money even though the connection provided to the consumer has its own costs.

Application

Generally applied to tube wells used for irrigation purposes.

Flat Rate Tariff

- In this tariff, different types of consumers are charged at different rates of cost per unit (1kWh) of electrical energy consumed. Different consumers are grouped under different categories. Then, each category is charged money at a fixed rate similar to Simple Tariff. The different rates are decided according to the consumers, their loads and load factors.

Advantages:

- More fair to different consumers.
- Simple calculations.

Disadvantages

- A particular consumer is charged at a particular rate. But there are no incentives for the consumer.
- Since different rates are decided according to different loads, separate meters need to be installed for different loads such as light loads, power loads, etc. This makes the whole arrangement complicated and expensive.
- All the consumers in a particular "category" are charged at the same rates. However, it is fairer if the consumers that utilize more energy be charged at lower fixed rates.

Block Rate Tariff

- In this tariff, the first block of the energy consumed (consisting of a fixed number of units) is charged at a given rate and the succeeding blocks of energy (each with a predetermined number of units) are charged at progressively reduced or increased rates. The rate per unit in each block is fixed. **OR**
- Energy consumption is divided into fixed price per unit blocks. The price per unit in the first block is the highest (or lowest) according to the provider's necessities and priorities; accordingly, it is progressively reduced (or increased) for the succeeding blocks of energy.

Block Rate Tariff

- For example, the first 50 units (1st block) may be charged at 3 rupees per unit; the next 30 units (2nd block) at 2.50 rupees per unit and the next 30 units (3rd block) at 2 rupees per unit.
- Example

Advantages:

- Only one energy meter is required.
- Incentives are provided for the consumers due to reduced rates. Hence consumers use more energy. This improves load factor and reduces cost of generation.

Application

Generally applied to domestic consumers and small commercial consumers.

Two Part Tariff

- When the rate of electrical energy is charged on the basis of maximum demand of the consumer and the units consumed, it is called a two-part tariff.
- The total costs charged to the consumers consist of two components: fixed charges and running charges.
- The fixed charges will depend upon maximum demand of the consumer and the running charge will depend upon the energy (units) consumed.

It can be expressed as

Total Cost = [A (kW) + B (kWh)] Rs.
Where,

A = charge per kW of max demand (i.e. A is a constant which when multiplied with max demand (kW) gives the total fixed costs.)

B = charge per kWh of energy consumed (i.e. B is a constant which when multiplied with units consumed (kWh), gives total running charges.)

This type of tariff is mostly applicable to industrial consumers who have appreciable maximum demand

Advantages

(i) It is easily understood by the consumers.

(ii) It recovers the fixed charges which depend upon the maximum demand of the consumer but are independent of the units consumed.

Disadvantages

(i) The consumer has to pay the fixed charges irrespective of the fact whether he has consumed or not consumed the electrical energy.

(ii) There is always error in assessing the maximum demand of the consumer.

Maximum Demand Tariff

It is similar to two-part tariff with the only difference that the maximum demand is actually measured by installing maximum demand meter in the premises of the consumer. This removes the objection of two-part tariff where the maximum demand is assessed merely on the basis of the rateable value. 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

The tariff in which power factor of the consumer's load is taken into consideration is known as **power factor tariff**.

- kVA maximum demand tariff
- Sliding scale tariff
- kW and kVAR tariff

- **kVA maximum demand tariff**

It is modified form of two part tariff. 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 toward the fixed charges.

It encourage the consumer to operate their appliances at improved power factor.

- ***Sliding Scale Tariff***

In this type of tariff scheme, an average power factor (generally 0.8 lagging) is taken as reference. Now, if the power factor of the consumer's loads is lower than the reference, he is penalized accordingly. Hence, a consumer having low power factor load will have to pay more fixed charges. Also, if the pf of the consumer's load is greater than the reference, he is awarded with a discount. This gives incentives to the consumers. It is usually applied to large industrial consumers.

- ***kW And kVAR Tariff***

In this type, both active power (kW) and reactive power (kVAR) supplied are charged separately. A consumer having low power factor will draw more reactive power and hence shall have to pay more charges.

Three-part tariff

When the total charge to be made from the consumer is split into three parts viz., fixed charge, semi-fixed charge and running charge, it is known as a three-part tariff.

i.e.,

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

Where,

a = fixed charge made during each billing period. It includes interest and depreciation on the cost of secondary distribution and labor cost of collecting revenues,

b = charge per kW of maximum demand,

c = charge per kWh of energy consumed.

Q-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.

Q-2. The maximum demand of a consumer is 20 A at 220 V and his total energy consumption is 8760 kWh. If the energy is charged at the rate of 20 paise per unit for 500 hours use of the maximum demand per annum plus 10 paise per unit for additional units, calculate : (i)annual bill (ii) equivalent flat rate.

Solution-1

$$\text{Units consumed/year} = \text{Max. demand} \times \text{L.F.} \times \text{Hours in a year}$$

$$= (200) \times (0{\cdot}4) \times 8760 = 7{,}00{,}800 \text{ kWh}$$

$$\text{Annual charges} = \text{Annual M.D. charges} + \text{Annual energy charges}$$

$$= \text{Rs}\,(100 \times 200 + 0{\cdot}1 \times 7{,}00{,}800)$$

$$= \text{Rs}\,90{,}080$$

$$\text{Overall cost/kWh} = \text{Rs}\,\frac{90{,}080}{7{,}00{,}800} = \text{Re}\,0{\cdot}1285 = \mathbf{12{\cdot}85\ paise}$$

Solution-2

Assume the load factor and power factor to be unity.

$$\therefore \quad \text{Maximum demand} = \frac{220 \times 20 \times 1}{1000} = 4 \cdot 4\,\text{kW}$$

$$(i) \quad \text{Units consumed in 500 hrs} = 4 \cdot 4 \times 500 = 2200\,\text{kWh}$$

$$\text{Charges for 2200 kWh} = \text{Rs}\ 0 \cdot 2 \times 2200 = \text{Rs}\ 440$$

$$\text{Remaining units} = 8760 - 2200 = 6560\,\text{kWh}$$

$$\text{Charges for 6560 kWh} = \text{Rs}\ 0 \cdot 1 \times 6560 = \text{Rs}\ 656$$

$$\text{Total annual bill} = \text{Rs}\ (440 + 656) = \textbf{Rs. 1096}$$

$$\text{Equivalent flat rate} = \text{Rs}\ \frac{1096}{8760} = \text{Re}\ 0 \cdot 125 = \textbf{12.5 paise}$$