Effect of Plant Type on Rates

(Tariffs or Energy Element):

Rates are the different methods of charging the consumers for the consumption of electricity. It is desirable to charge the consumer according to his maximum demand (kW) and the energy consumed (kWh). The tariff chosen should recover the fixed cost, operating cost and profit etc. incurred in generating the electrical energy.

Requirements of a Tariff:

Tariff should satisfy the following requirements:

(1) It should be easier to understand.

(2) It should provide low rates for high consumption.

(3) It should encourage the consumers having high load factors.

(4) It should take into account maximum demand charges and energy charges.

(5) It should provide fewer charges for power connections than for lighting.

(6) It should avoid the complication of separate wiring and metering connections.

Types of Tariffs

The various types of tariffs are as follows,

(1) Flat demand rate

(2) Straight line meter rate

(3) Step meter rate

(4) Block rate tariff

(5) Two part tariff

(6) Three part tariff.

The various types of tariffs can be derived from the following general equation:

$Y = DX + EZ + C$

Where

Y = Total amount of bill for the period considered.

D = Rate per kW of maximum demand.

X = Maximum demand in kW.

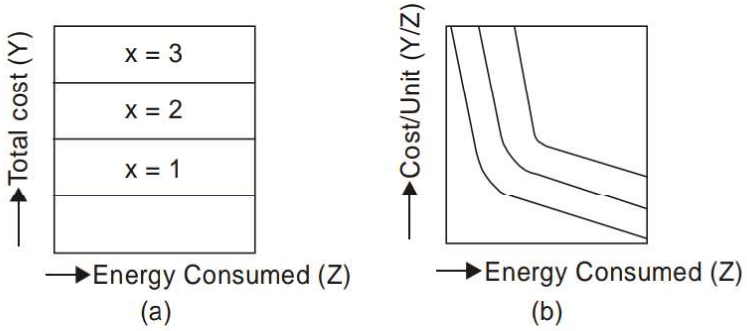
E = Energy rate per kW.

Z = Energy consumed in kWh during the given period.

C = Constant amount to be charged from the consumer during each billing period.

Various types of tariffs are as follows:

(1) Flat Demand Rate. It is based on the number of lamps installed and a fixed number of hours of use per month or per year. The rate is expressed as a certain price per lamp or per unit of demand (kW) of the consumer. This energy rate eliminates the use of metering equipment. It is expressed by the expression.



(2) Straight Line Meter Rate. According to this energy rate the amount to be charged from the consumer depends upon the energy consumed in kWh which is recorded by a means of a kilowatt hour meter. It is expressed in the form

$Y = EZ$

This rate suffers from a drawback that a consumer using no energy will not pay any amount although he has incurred some expense to the power station due to its readiness to serve him. Secondly since the rate per kWh is fixed, this tariff does not encourage the consumer to use more power.

(3) Step Meter Rate. According to this tariff the charge for energy consumption goes down as the energy consumption becomes more. This tariff is expressed as follows.

$Y = EZ$ If $0 \leq Z \leq A$

$Y = E_1Z_1$ If $A \leq Z_1 \leq B$

$Y = E_2Z_2$ If $B \leq Z_2 \leq C$

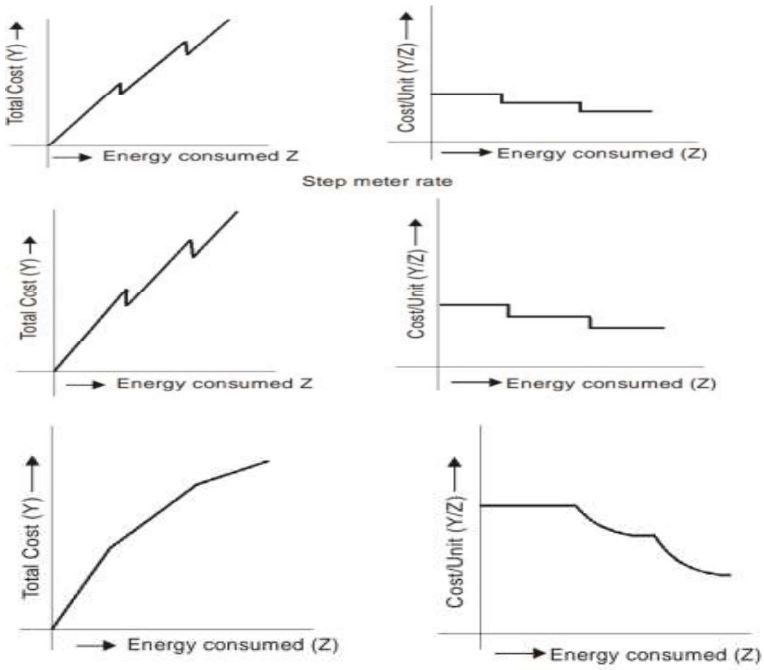
And so on. Where E, E_1, E_2 are the energy rate per kWh and A, B and C, are the limits of energy consumption.

(4) Block Rate Tariff. According to this tariff a certain price per units (kWh) is charged for all or any part of block of each unit and for succeeding blocks of energy the corresponding unit charges decrease.

It is expressed by the expression

$$Y = E_1Z_1 + E_2Z_2 + E_3Z_3 + E_4Z_4 + ...$$

Where E_1, E_2, E_3.... are unit energy charges for energy blocks of magnitude Z_1, Z_2, Z_3,.. respectively.



(5) Two Part Tariff (Hopkinson Demand Rate). In this tariff the total charges are based on the maximum demand and energy consumed. It is expressed as

$$Y = D \times X + EZ$$

A separate meter is required to record the maximum demand. This tariff is used for industrial loads.

(6) Three-Part Tariff (Doherty Rate). According to this tariff the customer pays some fixed amount in addition to the charges for maximum demand and energy consumed. The fixed amount to be charged depends upon the occasional increase in fuel price, rise in wages of labour etc. It is expressed by the expression

$$Y = DX + EZ + C.$$

Electricity Billing

The electricity billing by utilities for medium & large enterprises, in High Tension (HT) Category, is often done on two-part tariff structure, i.e. one part for capacity (or demand) drawn and the second part for actual energy drawn during the billing cycle. Capacity or demand is in kVA (apparent power) or kW terms. The reactive energy (i.e.) kVA-hr drawn by the service is also recorded and billed for in some utilities, because this would affect the load on the utility. Accordingly, utility charges for maximum demand, active energy and reactive power drawn (as reflected by the power factor) in its billing structure. In addition, other fixed and variable expenses are also levied.

The tariff structure generally includes the following components:

a) Maximum demand Charges

These charges relate to maximum demand registered during month/billing period and corresponding rate of utility.

b) Energy Charges

These charges relate to energy (kilowatt hours) consumed during month / billing period and corresponding rates, often levied in slabs of use rates. Some utilities now charge on the basis of apparent energy (kVA-hr), which is a vector sum of kWh and kVA-hr.

c) Power factor penalty or bonus rates, as levied by most utilities, are to contain reactive power drawn from grid.

d) Fuel cost adjustment charges as levied by some utilities are to adjust the increasing fuel expenses over a base reference value.

e) Electricity duty charges levied w.r.t units consumed.

f) Meter rentals

g) Lighting and fan power consumption is often at higher rates, levied sometimes on slab basis or on actual metering basis.

h) Time of Day (TOD) rates like peak and non-peak hours are also prevalent in tariff structure provisions of some utilities.

i) Penalty for exceeding contract demand

j) **Surcharge if metering is at LT side in some of the utilities**