# **Optimum tariff for sustainable electricity distribution system**

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**Abstract:** Electricity supply is a service required round the clock and 365 days a year. Utilities should run on "No-Loss-No-Profit and again on Sound financial basis". This requires proper Tariff, as revenue from consumers is the main source of income for any Utility. Investments should be on revenue criteria. Again all areas of the Utility are to be brought under electrification, i.e. "Area coverage electrification program" irrespective of revenue. The two concepts are contradictory. Politicians sometimes commit to provide electricity free of cost or at highly subsidized rates to its Consumers (voters), but who will actually pay for this free electricity.

The Tariff is not rationale. Rich countries provide subsidy whereas developing countries are discouraged because of mismanagement.

Electricity is sometimes considered as Goods and by some as Service. It is a product whose quality cannot be ascertained before its delivery. Provide best quality electricity. For Off Grid areas we need renewable energy. Provide one time subsidy to them. Often we have to go for privatization mainly due to inefficient management of state owned Utilities. The Tariff should minimum and able to recover Total cost of providing electricity from total sale of electricity.

Key words: Tariff, Price cap, Subsidy, Infrastructure, Master Plan

### 1. Objective of paper

To have an idea about how the Electric Utilities function. Tariff is most vital for efficient functioning of the Utilities, so we should have an idea about tariffs, its type etc. What is viable tariff? How to lower electricity cost, how to provide quality electricity at lowest possible cost etc. Should we have cost effective tariff or go for economic costing?

## 2. How Utilities should operate?

The Electric Utilities should run at least on the concept "No-Loss-No-Profit" and also on "Sound financial basis at lowest possible cost". This is essential for the sustainability of Power sector. Power sector need proper Tariff to achieve it. Revenue from consumers is the main source of income for any Utility. This requires all new extension of electric system be based on "Revenue criteria", i.e. electric line should be constructed first where we expect maximum revenue. Again these new lines should have reasonable consumer to recover the capital, operational, maintenance and other costs in due time. But this may not be the condition for remote off-grid cases, where we need renewable energy (electricity), which is costlier than fossil fuel grid connected electricity.

Again Electricity is a basic requirement or right; all consumers are to be connected with electricity connection in phases. i.e. All areas will come under Electrification programme irrespective of revenue.

In Bangladesh it was found that "Cost of providing electricity 1 KWHr of electricity is  $\in$  0.058 / \$ 0.084. The Cost of not providing equivalent electricity  $\in$  0.291 / \$ 0.422.

# 3. Is our Tariff rational or cost effective?

The concept "No-Loss-No-Profit and Sound financial basis at lowest possible cost" and "Electrification for all in phases" are conflicting criteria.

In some countries, Politicians commit to provide electricity free of cost or at highly subsidized rates to its Consumers (voters) in irrigation areas or to the poor! Sound very interesting, but who will actually pay for this free electricity. Result Utilities losses increases.

# 3.1. CROSS SUBSIDY

In any business the retail price is always more than wholesale or bulk sale price. But in case of electricity, there are many countries where the tariffs of Industrial consumers are more than that of Domestic consumers. The reason being that any Political Government is afraid to increase Domestic consumers' tariff for political gains. The domestic consumer's rate is subsidized. But who pays for this subsidy? It is the Industrial consumers who actually pay the subsidy. What happens for charging higher tariff for Industrial consumers?

The Utilities having more Industrial consumers earn more, as there is less operational cost with Industrial consumers. So those Utilities become financially viable. **But what happens to the Industries?** There cost of production is more. As a result there is uneven competition with imported products in free trade environment. So Industries loss financially.

## 3.1.1 What happens then?

Industries try to adopt any means to minimize the losses. **Necessity knows no law**. One of the means may be through electricity pilferage. As a result Electric Utilities losses increase.

In some countries the Industrial tariff are less than that of Domestic tariff. Result reasonable production cost.

In today's competitive market, certain highly populated countries like often charge the Overhead cost of Exportable products to their internal market, and as a result their production cost is highly competitive.

## 4. Subsidies

The rich countries often provide subsidy to its Utilities, whereas developing or poor countries are discouraged to provide any direct or indirect subsidy because of mismanagement of their Power sector.

Subsidies in the form of Lower bill for less electricity users say 50-100 KWH per month. Irrigation consumers are given subsidy and often Utilities are provided with subsidy. **Question is how long the subsidies will be provided and who will bear the subsidy**?

## 5. The Regulators and the Price cap

The Energy Regulators are entrusted with the task of working with utility providers to determine a Price cap for services rendered that is equitable to the consumer as well as to the supplier. Any increases in rates have to be approved by this agency before the utility can implement any price changes that exceed the agreed upon price cap. Often the Price cap doesn't fully compensate the cost of electricity as such a bargain develops. In case the Energy Regulators doesn't agree to enhance the Price cap, the Power producers/distributors may not

go for new Generation. This impractical situation has led to electricity shortage in many countries. Again there may be a situation where the Government fixes a price for IPPs (Independent Power Producers) which is more than the prevailing market rate price, result Investors both foreign and local will invest in Power generation taking out the public money, the Industrial production and all other electricity dependent cost goes high, but it's the consumer who pays for such high price. This situation happened in many countries resulting in mess in electricity sector and its economy.

# 6. Cost of Electricity

Often it is found that Cost of electricity and Tariffs are not in harmony. Why?

The cost of electricity up to Consumer point may be higher for following reasons.

- a. Higher cost of Plants, equipments etc.
- b. Lack of Technical knowledge, as a result, inefficient or non-standard equipment procurement.
- c. Improper planning. No Master plan for electricity system.
- d. Inadequate remuneration to local staffs.
- e. Inefficient management. Again lack of commitment
- f. High losses including pilferage.
- g. Political interference leading to less freedom.
- h. Lack of motivation, consumer awareness etc.
- i. Lack of transparency or accountability.

### 7. How to lower the cost of electricity?

As electricity is an expensive service, best way to apply minimum tariff to attain No-loss-noprofit condition is to keep the Total cost of electricity supply at the lowest.

This is possible through the following.

- a. Energy Efficiency through Energy audit and its implementation.
- b. Lowering the Generation cost.
- c. Improvement of Transmission and Grid system including sub stations.
- d. Improvement of Plant factor.
- e. Improvement of Load factor.
- f. Improvement of Power factor from consumer level up to generation.
- g. Improvement of Load management to minimize or reduce Peak demand.
- h. Minimizing administrative and other costs.
- i. Improvement of technical & managerial skills of the staffs.
- j. Reduction of technical and non technical losses.
- k. Introduction of reward & punishment system.
- 1. Transparency and accountability.
- m. Minimum political interference.
- n. Consumer awareness on EE and reducing misuse of electricity.
- o. Ensure minimum disconnected consumers. Its loss of revenue.
- p. Maximum new connections under existing facilities created.

These will ultimately reduce our energy cost.

Another important aspect is to always procure or install best quality electrical products for Generation, Transmission and Distribution side.

## 8. Electricity quality improvement

Electricity is sometimes considered as **Goods** and by some as **Service**. In any case it is such a product whose quality cannot be ascertained before its delivery to its consumers. It's like "**Just-in-time**" service.

- a. Improve Power factor. Keep it minimum 95%. Use Intelligent Power Factor controller or Automatic Power factor Improvement devices, which keep the Power Factor to almost 1 (unity). Additionally incentive may be given to the consumers for power factor above 95%.
- b. Minimize harmonics. The higher the Total Harmonics, the lower is power quality. This also reduces the electrical items life.
- c. The consumer electrical products must be standardized to ensure minimum harmonics, better power factor and less GHG emission.
- d. Other improvement of Power quality is through keeping electric lines clear of any trees etc, Phase balancing, adequate grounding etc.
- e. Proper Voltage by using voltage regulators.

### 9. Power supply reliability

Electricity is a service, which is required 24 hours a day, 365 days (or 365.25 days) a year. Consumers never understand how much time electricity was supplied, but they remember the interruption time.

Countries in Europe with 99.95+% electricity supply reliability are not satisfied. For losses due to discontinuity in electricity supply is immense. They actually do economic analysis of interruption.

The Plant factor must be as high as possible to minimize the idle Plant cost. The Peak and Off-Peak demand should be as close as possible. Again day/month wise demand should be made uniform. Here comes.

#### 9.1 Load management

To shift the expensive Peak. Some examples are:

- a. Market closure after evening.
- b. Industrial holiday staggering.
- c. Industry & Irrigation- No use during Peak hours.
- d. Air conditioner, Heaters, Pumps, Ovens etc use in Peak hour minimizes.
- e. Use of multiple tariff meters.
- f. Use of Prepaid meters for more power-consuming consumers.
- g. Day Light Saving.

#### **9.2** Demand side management

Use of Energy saving devices. It actually reduces consumption of electricity, but simultaneously the Peak Demand is also reduced. Though critics urge Consumers may increase usage but practically the situation is reverse. Examples of Demand side management.

- a. Energy Saving Lamps, Eco bulbs, LED, Electronic ballasts use.
- b. Use of Energy efficient equipments, Variable speed motors.
- c. Industrial cooling, Voltage regulators installation etc.
- d. Reduction of Technical & Non technical losses.
- e. Consumer education & motivation to minimize misuse (important).

Bangladesh experienced huge power shortage in 2006 (40%). Then with extensive drive, Load management, Demand side management, the Peak hour shortage came down to 20%. This was possible due to sincere efforts, strict implementation of programme and monitoring.

# **10. Metering**

Meters are Cash Box for any Utility. Remember always buy best quality meters especially Electronic Meters which can read any minimum consumption. Today's Compact Fluorescent Lamps, Eco Lamps, LED etc consume very less electricity, so meters must be effective in reading such low wattage. For 3 phase meters, it should be 3-element meter and be adequately grounded.

Meters with multiple tariff provision may be used to discourage excess use of electricity during Peak hours and encourage the use during Off-Peak period. Prepaid Meters will make consumer more aware of electricity use & minimize consumption. But they are relatively expensive. Prepaid meters are expensive, but have many advantages like No botheration of bill collection rather advance payment, Consumer awareness about electricity use leading to minimum misuse or demand side management etc.

### 11. Do we need uniform Tariff for the whole country?

The Utilities should have their tariffs based on its geo-economic condition. In Bangladesh, Cooperatives making profit lower their tariffs and those running on loss need to increase their tariff to reach to Break-even point.

Bangladesh had the experience of reducing the domestic tariffs of financially viable electric cooperatives, which is very rare in many countries. As the concept is "No-loss-no-profit" so in case of loss, the tariff increase is the last remedy. In case of profit, either tariff is to be reduced or new extension work with the profit can be implemented.

## 12. Renewable energy

The renewable energy like solar energy, wind etc is very expensive. They require close monitoring with quality of products and price. Their Tariff will be complex and Relatively high. Best thing will be to provide One time subsidy to user of Renewable energy. We do not have alternate to renewable energy. It use should be increased.

Introduction of Solar water heater/solar geyser can save significant amount of electricity in morning/evening and specially in winter. Again solar panel may be placed on roof. This will minimize pressure on Grid. In case of excess solar electricity, it can be transferred to the grid through 2-way meters.

Initial investment with Renewable Energy is higher.

Experience shows cost of saving 1 megawatt of electricity is almost half required to generate the same.

# **13. Remuneration to employees**

One of the obstacles in transparency, accountability or commitment is inadequate salary structure for (local) staffs. There is huge shortage of skilled manpower. Again due to insufficient salary, there may be brain drain.

# 14. Privatization of electricity system

Privatization or unbundling is mainly due to inefficient management of Government machinery to run the state owned Utilities. We should be careful with full privatization of electricity distribution system. Our dependence on them is increasing but it's not wise at least with Energy and Electricity. Enough control should be there so that the Private Companies are not in a position to dictate the Government. Worst case with full privatization is the Generation Company if interrupts or stops electricity supply to such an extent that water supply is collapsed, then people will simply come out and can collapse a government. Water requirement is much more than electricity. We should have Privatization but with sufficient control.

In many cases unbundling did not yield fruitful result mainly due to lack of commitment, transparency, too much commercial way of thinking etc. It was just shifting the losses from Government's shoulder to the private entity, but in fact there was no improvement.

# **15.** Tariff and cost of electricity

The Tariff structure of a Utility (PBS) of Bangladesh and its comparison with average cost of electricity is given below. Tariff lower than cost of electricity is marked **red**.

Sl.	Category	KWHr Slab	<b>US Cents</b>	Euro cent	Remark
1	Domestic	000-100	4.00	2.78	Less than cost of electricity
2	Domestic	000-100	4.10	2.85	Less than cost of electricity
3	Irrigation	-	4.10	2.85	Less than cost of electricity
4	Others		4.70	3.26	Less than cost of electricity
	Cost of Electricity		5.50	3.83	
5	Domestic	301-500	5.80	4.04	
6	Domestic	above 500	8.40	5.85	
7	Commercial	-	7.30	5.08	
8	Industry	-	5.70	3.97	
9	Large Industry	-	5.60	3.90	

Table 1. Category wise Tariff and its comparison with average cost of electricity

In many developing countries Tariff structure and consumer mix is poor and unable to realize cost of electricity supply.



# 16. A Typical Utility's expenses (%) in Bangladesh

Fig 1: Percentage of expenditure incurred against various head of accounts

17. A Typical Utility's Consumers category wise consumption (%)



Fig 2: Percentage of electricity consumption for each Consumer category.

The Tariff should be such that Total expenses = Sum of Category wise Total consumers electricity consumption x its tariff

# 18. Challenges to today's Tariff

The Tariff should be cost based or based on economic analysis is one of the challenges faced by the Utilities. Should Utilities charge customers varied rate based on varying difference cost?

A summer day more costly than a fall night, so how tariff be fixed? Will Consumer accept mandatory TOU price? Are Customers willing to pay additional cost for Smart meters and smart grid?

These are some of the challenges to the Utilities.

## **19. COST OF POWER AFTER MANAGEMENT**

- a. Analyze cost of power up to consumer point.
- b. Consider Consumer mix and their consumption.
- c. Formulate tariff on the basis of "No-loss-no-profit "basis.
- d. Even after reforms, if Losses exist, then we may go to enhance the Tariff.
- e. The economic effect due to electricity supply must be analyzed. Well if the losses there, then we have no other choice.

# **20. CONCLUSION**

- a. Cost of electricity generation, transmission and distribution up to consumer point should be kept to minimum.
- b. Only superior quality products to be used.
- c. For renewable, One time subsidy may be provided.
- d. Use of Renewable to compensate Peak demand.
- e. Human resources development.
- f. Adequate remuneration.
- g. Reward and punishment
- h. Power factor improvement from consumer point up to generation.
- i. Load management & Demand side management.
- j. Energy Efficiency & Energy audit.
- k. Reduction of technical and non-technical losses.
- 1. Extensive motivation to consumers.
- m. No unnecessary interference or influence.
- n. Consumer education for economical use of electricity.
- o. Use pilferage proof good quality meters.
- p. Accountability and transparency of the Power sector.
- q. Cost analysis for tariff fixation.
- r. Provide subsidy as required.