SAFIR Core Course
Infrastructure Regulation & Reforms

Tariff Setting

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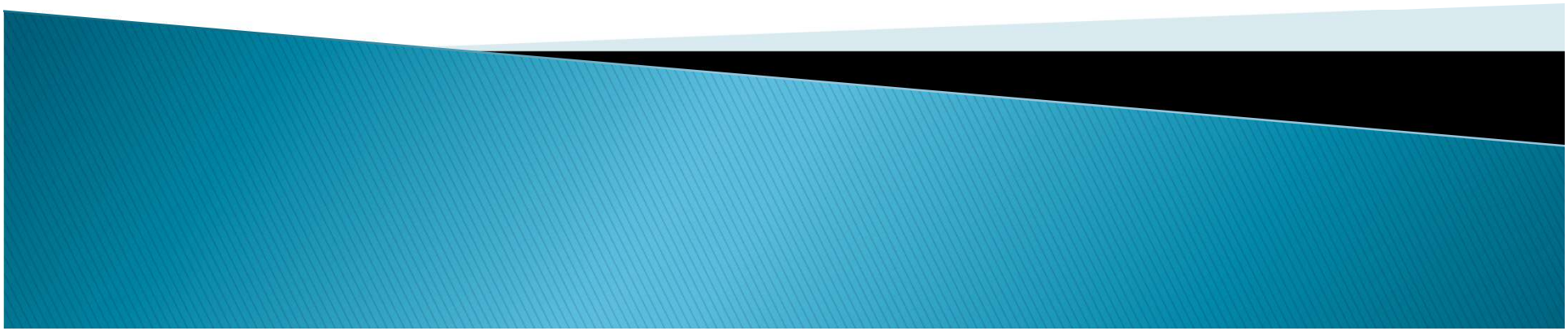
Session Overview

- Characteristics of Electricity Tariff
- Approach to Tariff Setting
  - Rate of Return,
  - Performance Based,
  - Hybrid methods
- Overview of Tariff Setting
  - Components of Tariff
  - MYT
- Rate Design
- Regulatory Process

Characteristics of Electricity Tariff

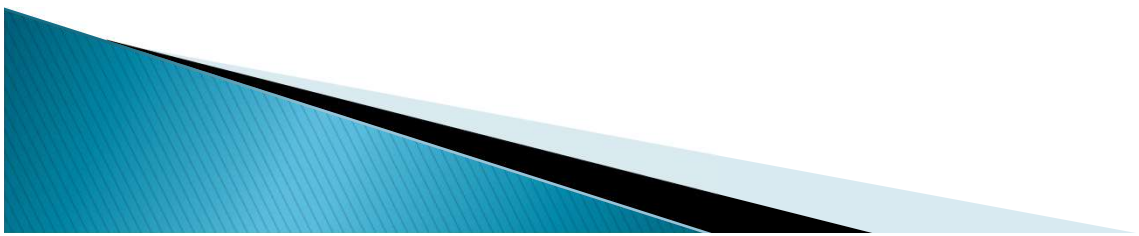


Characteristics of Electricity Tariffs

- Supply Side – cost of supply varies by the time of day and time of year (seasonal variations) depending on fuel mix of generation
- Demand Side – cost of supply to various consumer categories varies with voltage of supply, time of use (peak/ Off-peak), technical characteristic of last-mile
- Supply must match demand simultaneously in a reliable system – availability of network (T&D)

Pricing and Costing Principles

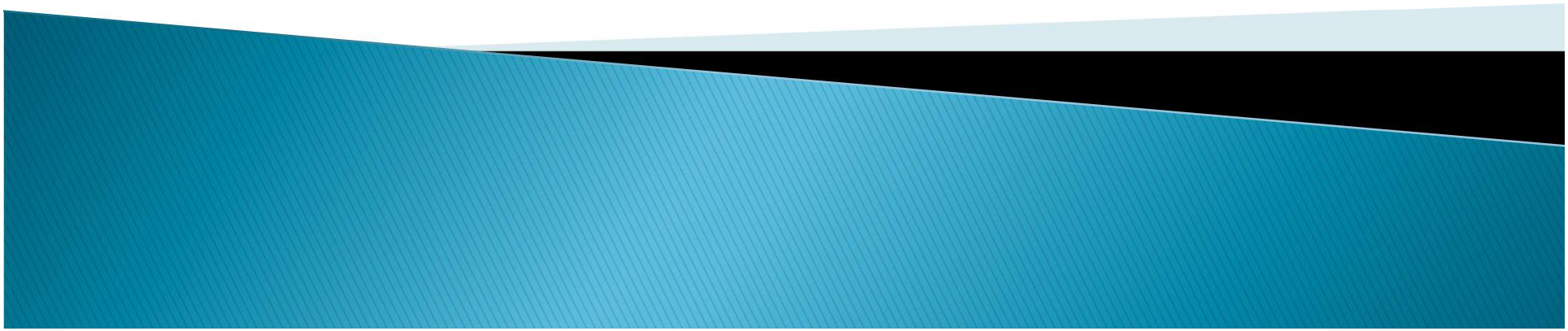
- Marginal cost principles – difficulties of calculating long run marginal costs
- Embedded costs – normally used
- Cost to serve
  - Identification of costs
  - Allocation of costs
- Differential prices
  - Costs
  - Equity principles
  - Historical rates that are often skewed
- Challenge of looking at historical costs to predict the future



Issues to be addressed in design of tariff principles

- Establishing the financial viability of the utilities
  - Necessary to attract investments (both private & public)
  - To protect long term interest of the consumers
- Inducing efficiency in the sector
- Conforming with legislation
- Acceptance by stakeholders
  - Need to incorporate regulatory commitment, e.g. tariff philosophy,
- Recognising Government's need to pursue social objectives through subsidy
- Balancing between
  - The need to increase prices to cost reflective levels
  - Efficiency improvements that a regulatory regime may bring about to reduce the prices
  - Risk perception of the prospective investors

Approach to Tariff Setting



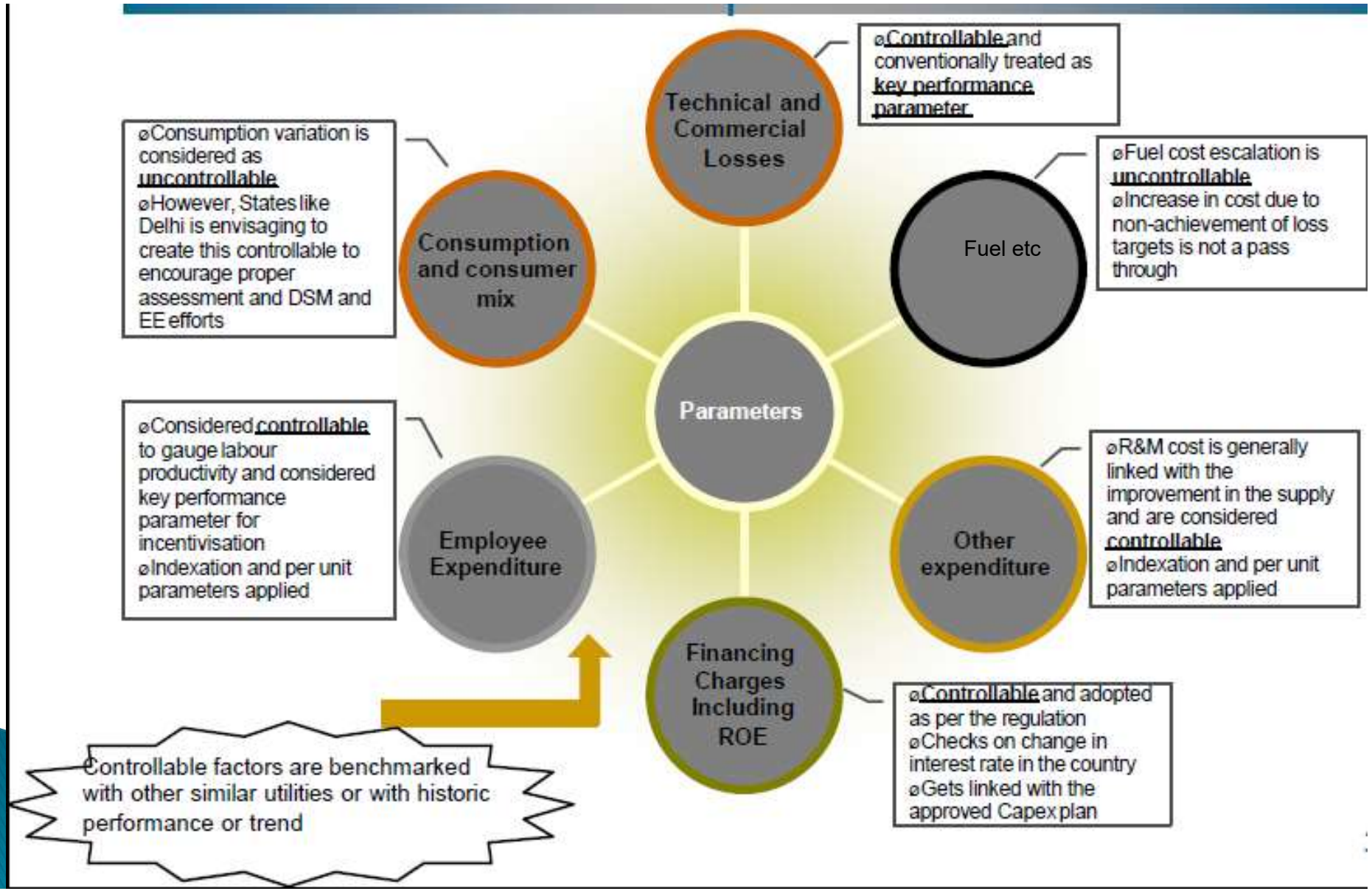
Approach to Tariff Setting

- Rate of Return or Cost Based Regulation
- Performance Based Regulation
- Hybrid Approaches
- Observations:
  - RoR – Resource intensive, information intensive, intrusive, expensive, time consuming, tends towards micro management
  - PBR – Need to "get it right" – opportunity for mid way correction is limited
  - Hybrid approaches need to be designed
  - Studies to indicate that RoR and PBR may converge in many circumstances

MYT – Hybrid Approach

- Incentivise utilities to become more efficient in operations.
- Obviate regulatory uncertainty – reduce regulatory risk
- Less intrusive and avoids tendency to micro manage
- Assists the utility to plan its business
- Helps ERCs in the *suo moto* determination of tariffs (APTEL Directive)

MYT Framework



Controllable & Uncontrollable Factors

- Costs are categorised as controllable & uncontrollable
- Uncontrollable factors include:
  - Force Majeure events
  - Change in law/ judicial pronouncements by govts or commission
  - Fuel price variation
  - Power purchase in accordance with FPPPA formula
  - Variation in consumer number or mix or quantities of electricity supplied to consumers/ under open access
  - Transmission loss
  - Variation in market interest rate
  - Taxes & statutory levies
  - Taxes on income

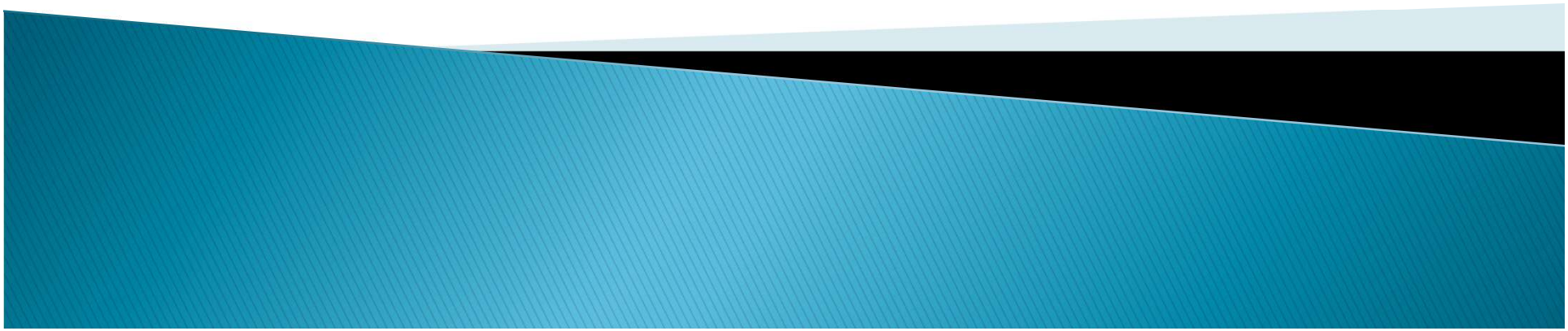
Controllable Factors

- Variation in capitalization on account of time or cost overruns or inefficiencies in implementation
- Variation in interest & financial charges on account of the above
- Variation in technical an commercial losses of discoms
- Variations in performance parameters
- Variations in working capital requirements
- Failure to meet performance standards
- Variation in labour productivity
- Variation in O&M expenses
- Variation in wires availability

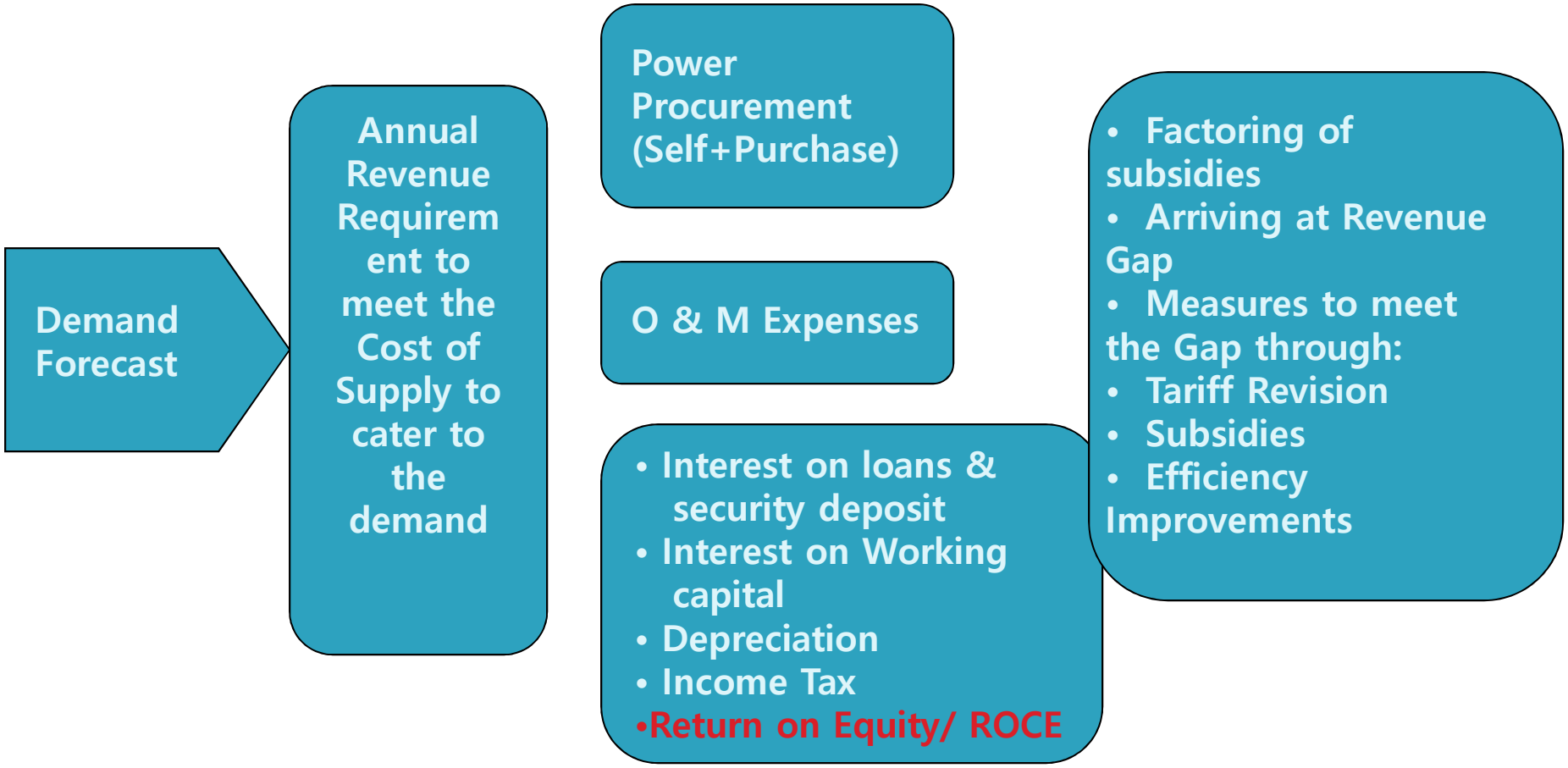
Mechanisms to deal with gains/ losses on Truing up

- Uncontrollable factors
  - Aggregate gain or loss on account of uncontrollable factors is a pass through in the next year's ARR
- Controllable factors
  - In case of gain, one third is passed onto consumers, one third shall be retained in a speial reserve and the remaining to be utilised at the discretion of the utility
  - In case of loss, one third of the loss may be passed on as additional charge over tariffs and balance absorbed by the utility

Overview of Tariff Setting



A Typical Tariff Application of Discom has to include

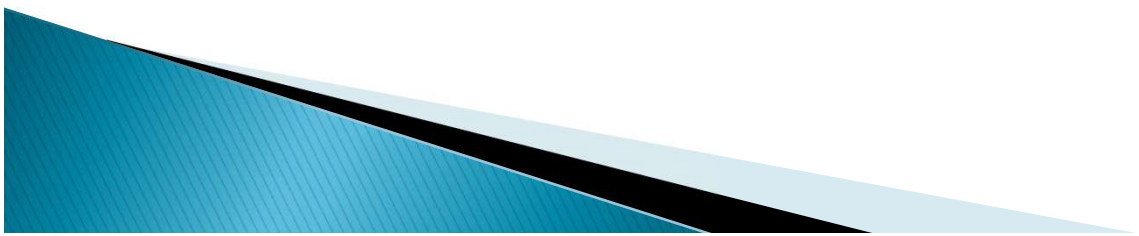


The petition would also include performance review of the previous year and truing up of the prior year for which audited results are available

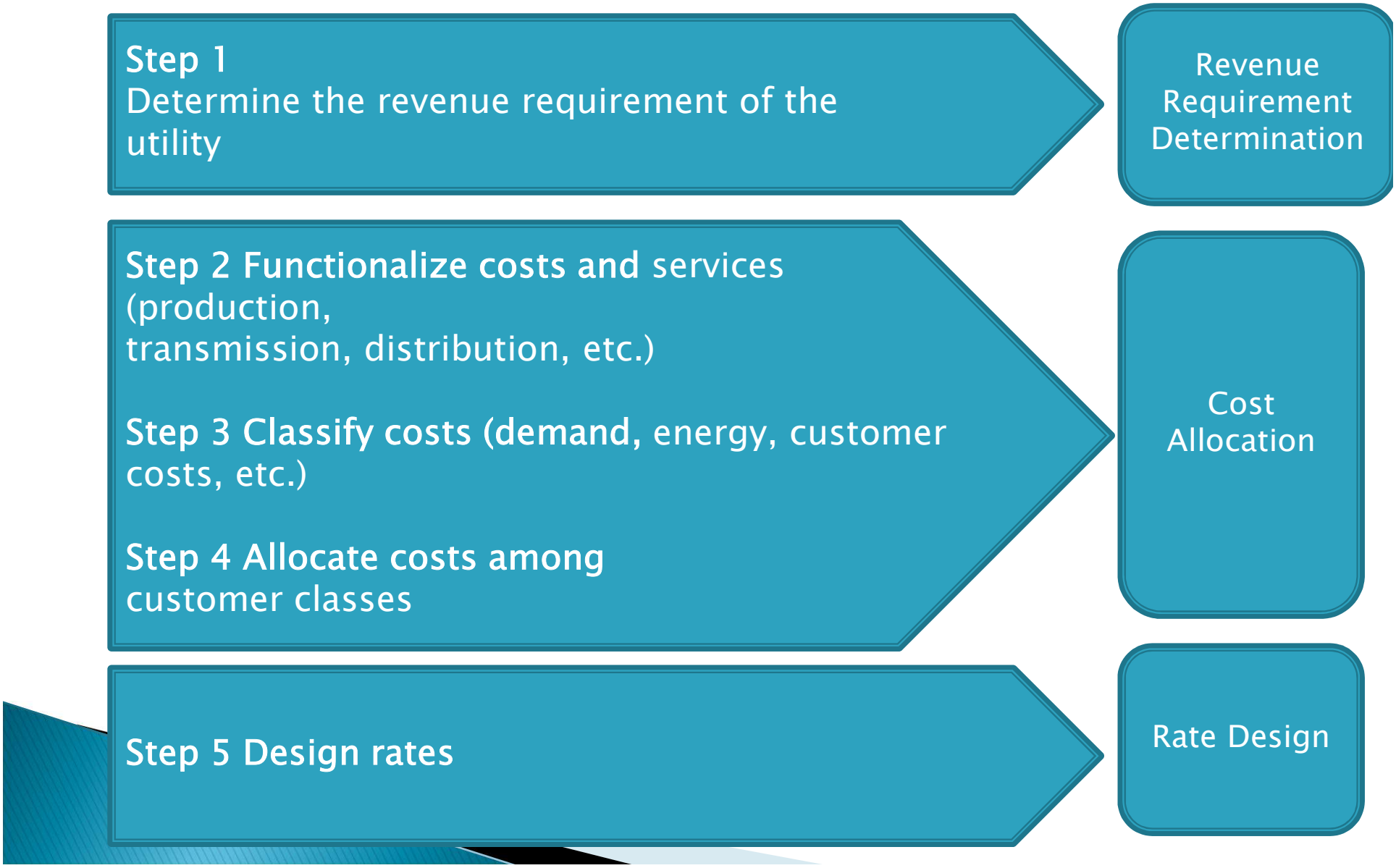
Components of ARR

Observation

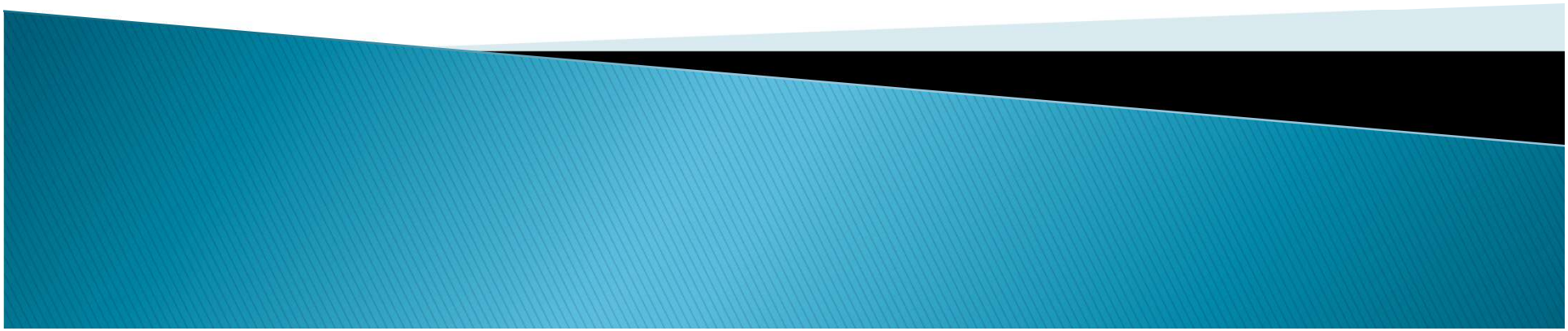
- Much attention is paid to scrutiny and approval of ARR which is the first stage of Tariff Setting
- The second stage is to allocate the costs to consumer categories
- Costs have to be aligned to prices
- In case of non-alignment e.g. BPL households, Agriculture etc., clear indication of the difference between cost and rate so that the gap can be bridged through subsidies (cross subsidies from other consumers and subsidies from the government)



Ratemaking process overview

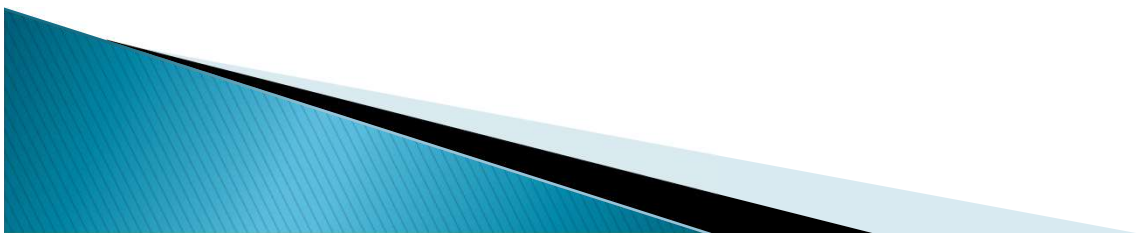


Rate Design



Retail Tariff Structure & Design

- Design of Tariffs at the retails level must satisfy the objectives of efficiency, equity and sustainability
- Compulsions of meeting universal obligation as also meeting the social objectives of providing electricity to all requires working out tariff designs for categories based on considerations of 'capacity to pay'
- Rate Base tariff design enable meeting the objectives of sustainability and efficiency; Equity dimension however require redesign often based largely on considered judgment
- Retail tariffs require building in cross-subsidies between those who can pay and those who cannot - What should be the level of cross subsidy

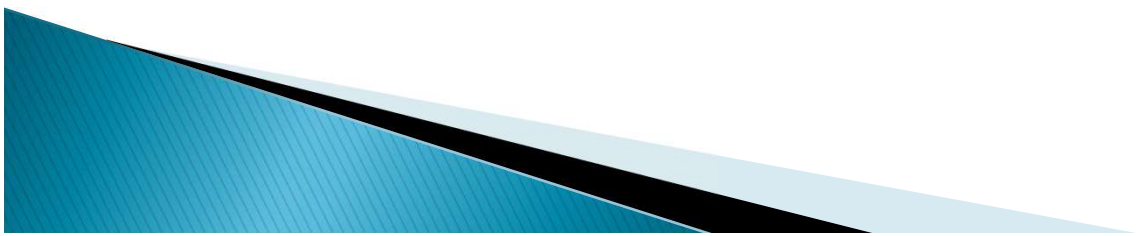


Objectives of Tariff Design

- Revenue-Related Objectives:
  - Rates should yield the total revenue requirement;
  - Rates should provide predictable and stable revenues; and,
  - Rates themselves should be stable and predictable.
- Cost-Related Objectives:
  - Rates should be set so as to promote economically-efficient consumption (static efficiency);
  - Rates should reflect the present and future private and social costs and benefits of providing service (i.e., all internalities and externalities);
  - Rates should be apportioned fairly among customers and customer classes;
  - Undue discrimination should be avoided; and,
  - Rates should promote innovation in supply and demand (dynamic efficiency).
- Practical Considerations:
  - Rates should be simple, certain, payable conveniently, understandable, acceptable to the public, and easily administered.
  - Rates should be, to the extent possible, free from controversies as to proper interpretation.

Cost of Supply vs Cost to Serve

- Cost of Supply: ARR/ No of Units is the average cost of supply
- Cost to Serve: Costs (both fixed and variable) relating to ARR has to be allocated to different consumer categories depending in the cost drivers
- Cost to serve is related to:
  - Demand factors such as peak & off-peak demand (by the day, season etc.)
  - Demand at different voltages
  - Merit order of supply



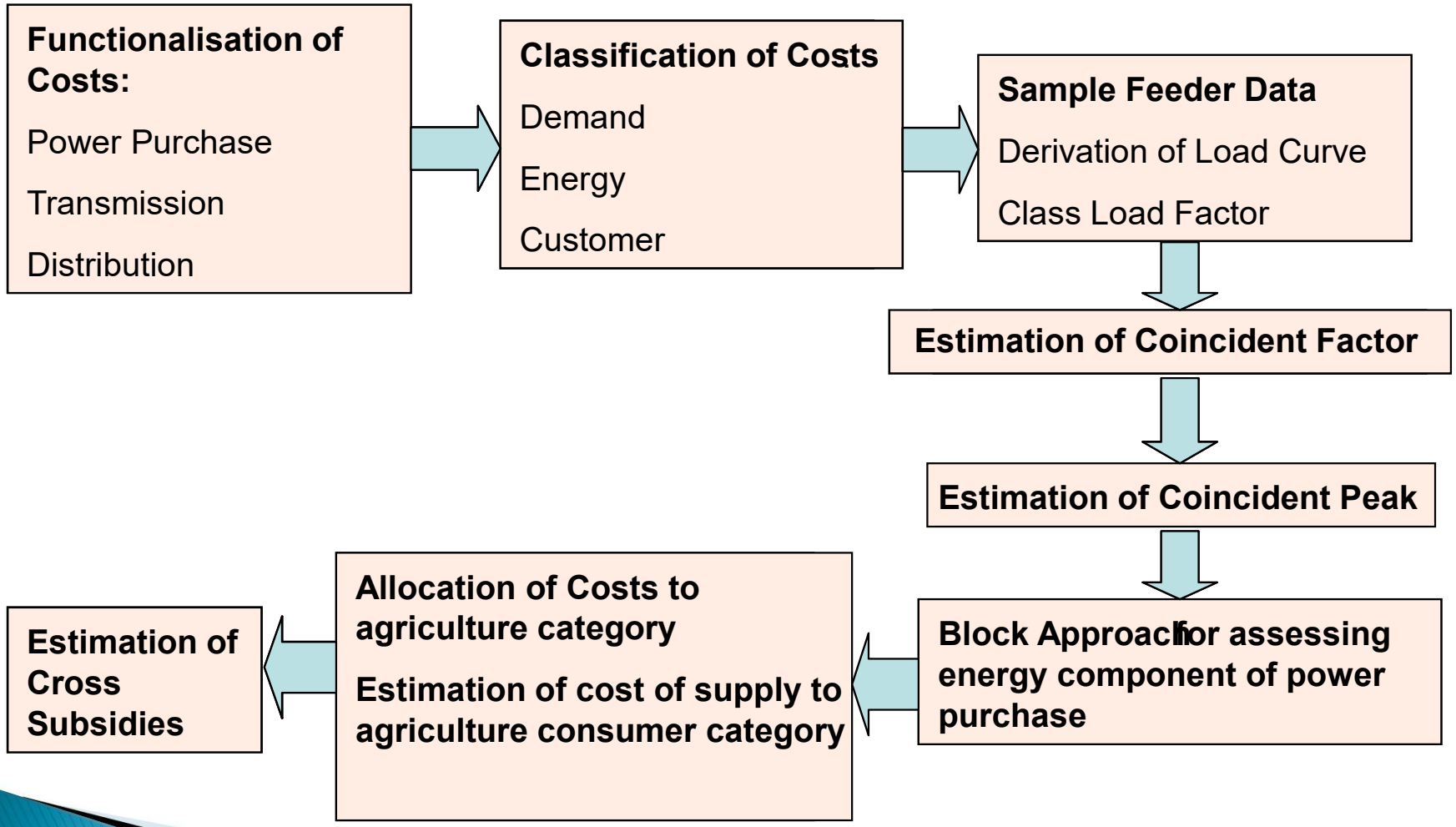
Cost Allocation

- The objective of cost allocation is to attribute the revenue requirement to the various classes of customers in a fashion that reflects the cost of providing utility service to each class
- The cost allocation process consists of three major parts:
  - Functionalization of costs
  - Classification of costs and
  - Allocation of costs among customer classes

Cost of Service : Objectives

- Identify the cost drivers and proportionately allot the responsibility of costs based broadly on the principle of causation;
- Provide the framework for policy decisions on future tariff directions;
- Provide the basis for comparative revenue and cost analysis;
- Highlight the distortions in the existing pricing structure and the consequences of such distortions;
- Indicate the importance and urgent need to conduct an extensive load research study to accurately determine the incidence of costs; and
- Identification of cross-subsides

Model for Determination of CoS



Information Requirement

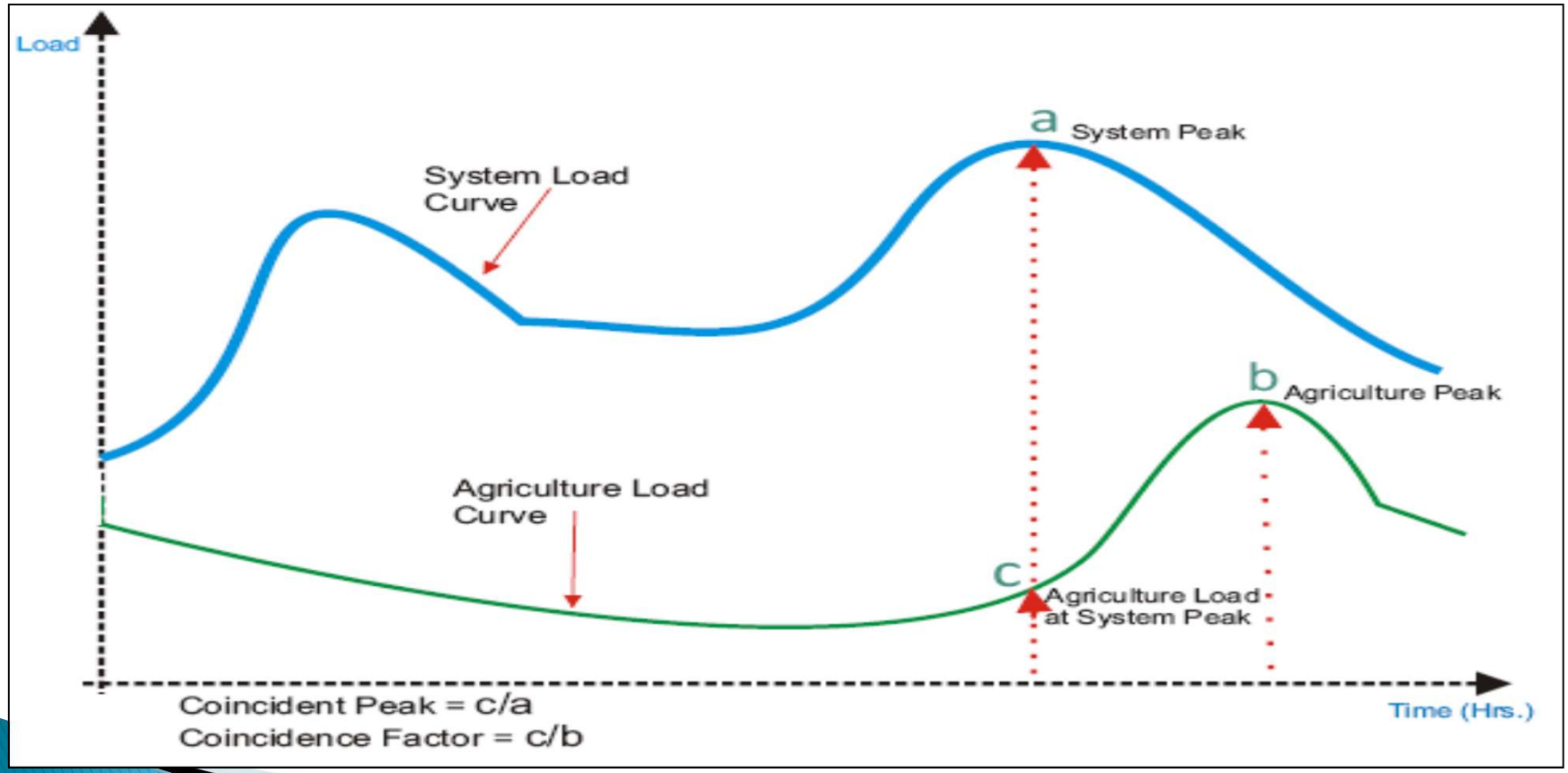
- Utility system load details
- Power purchase details (base year and relevant year)
- Energy details of the utility
- Profit & loss accounts of the utility
- Balance sheet and its respective schedules of the utility
- Revenue details of the utility
- Detailed composition of all costs incurred by the utility
- Details of technical and commercial losses in agricultural category
- Voltage level wise classification of cost
- Load data of the sample feeders

Sources for Data Collection

- Secondary sources such as Tariff orders, Profit & Los Accounts, Trial balance, Balance sheet etc.
- Discussions with the concerned utilities and State Electricity Regulatory Commission.
- Load studies are based on sample survey in consultation with the concerned utilities.

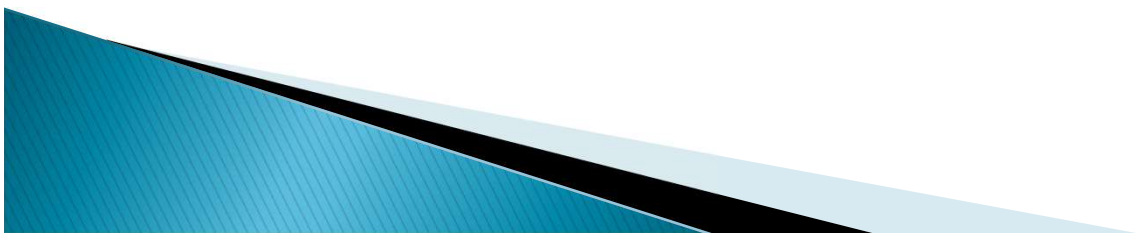
Estimation of Coincident Factor: e.g. agriculture

Coincident factor is the ratio of agricultural demand at the time of the system peak to the agricultural peak demand



Calculating Cost of service : Three Steps

- Functionalization of costs through assigning revenue requirement of the company to specified utility functions such as the power purchase, transmission and distribution.
- Classification of costs into demand related and energy related components, and
- Fair allocation of functionalized and classified costs among customer classes based on principles of cost causation



Functionalization of Costs

- The utility costs are separated according to function. The typical functions used in an electric utility "cost allocation" study are:
  - Generation or purchased power: costs associated with power generation and wholesale power purchases
  - Transmission: costs associated with the high voltage system utilized for the bulk transmission of power to and from interconnected utilities and the various regions or load centers of the utility's system
  - Distribution: costs associated with the distribution system that connects the customer to the transmission system
  - Customer Service and Facilities: costs associated with providing the service drop and meter, meter reading, billing and collection, and customer information and services
  - Administrative and General: the costs of management, administrative buildings etc., that cannot be assigned to the other major cost functions

Classification of Costs

- The next step is to separate the functionalized costs into classifications based on the components of utility service being provided.
- The three principal cost classifications for an electric utility are:
  - Demand costs: costs that vary with the KW demands imposed by the customer
  - Energy costs: costs that vary with the energy or KWH that the utility provides
  - Customer costs: costs that are directly related to the number of customers served

Cost causation

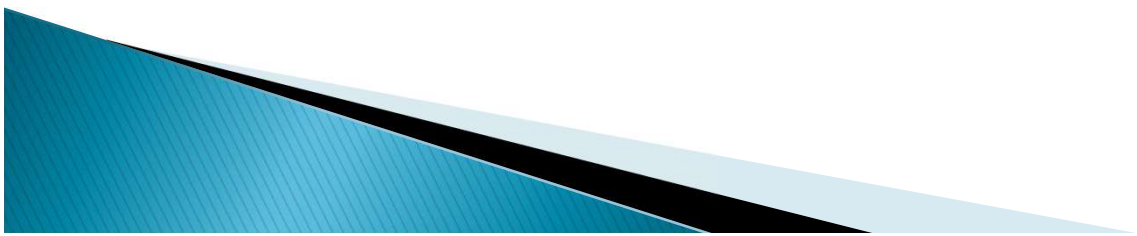
- Production: Demand related costs are associated with generation capacity, such as depreciation and capital costs on investment. Energy related costs are directly related to the quantity of energy produced, such as cost of fuel and certain O&M expenses. Fuel inventory costs may be either demand or energy related
- Transmission: Costs of transmission are typically considered fixed and associated with demand, and do not vary with the quantity of energy transmitted. Some portion of the transmission may be classified as energy related to the extent that transmission investment enables a utility to avoid line losses.
- Distribution: demand and the number of customers primarily affect Costs of distribution system. As in transmission, it may be possible to identify some energy component of the cost.
- Customer Service: costs are related to the number of customers.

Cost recovery in rate design

- Customer charges: are those utility costs that vary with the number of customers on the system. For example, typically the capital cost associated with metering, service connection and some distribution facilities, and operating expenses associated with meter reading, billing and accounting are included in the customer charge. Whether a customer uses any electricity or not the utility needs to cover the costs of meter and service drop on the customer premise, and read the meter and send a bill.
- Demand or Capacity costs: those costs that are generally fixed in the short run, whether customers are using more or less electricity. The costs generally included in this category are cost of capital and depreciation for utility's fixed costs. Although customers may not be always be using the utility plant, they want the plant to be available to serve them any time and, therefore should pay for that availability.
- Energy Costs: those costs that vary with the usage levels of customers. The costs generally included in this category are fuel costs to produce power, variable operating and maintenance costs.

Allocation of Costs among Customer Classes

- After the costs have been functionalized and classified, the next step is to allocate them among the customer classes.
- Customer classes must have an economic or technical rationale
- The principal customer classes are
  - domestic,
  - commercial,
  - industrial and
  - agricultural.
- Some of the classes are typically subdivided based on characteristics such as size of load and voltage level at which the customer is served.
- Nature and purpose of use has been a basis for dividing and sub-dividing customers. For example, there can be classification such as Export Oriented Unit, Small Scale Industries and Marginal Farmers



Rate Structures

- Level of Use: Flat, Inclining, and Declining block rates
- Time of Use: Time of Day, Seasonal, Hourly
- End User Base: Lifeline Rates
- Competitive Rates: Negotiated Rates, Economic Development Rates
- Type of Use: Interruptible Rates and Standby Rates
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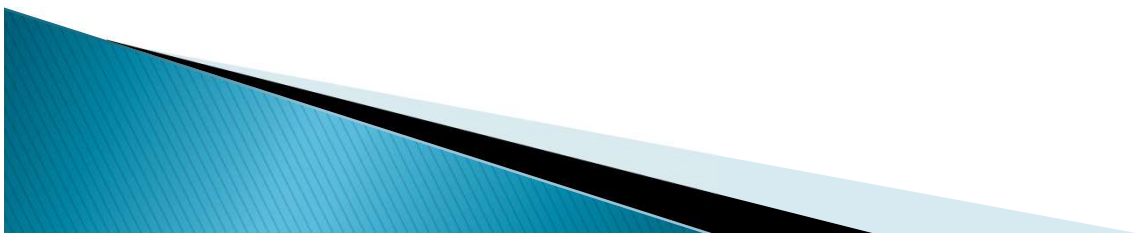


Time of Use: seasonal rates

- Seasonal rates:
  - currently used for seasonal industries: ice factories, sugar factories
  - Can also be used for air conditioning loads in summer and space heating loads in winter
  - Seasonal rates are not that difficult for consumers to understand or difficult for the utility to administer.
  - The rate structure is probably fairer as it reflects cost of service perspective better.
  - Customers who use more during peak season, thus causing more costs on the utility system, will pay more correspondingly.
  - Revenue stability would be a concern if there is high price elasticity or some other reason for consumers not to consume as much as predicted in determining rates, as more of the revenues are collected during peak season.

Time of Use: Time of Day

- The prices in this approach vary depending on when electricity is consumed in a given day.
- Typically, there will be two periods in a day (peak and off-peak) or three periods (peak, shoulder, and off-peak).
- While TOD prices are not difficult to understand, more sophisticated TOD metering is needed to store information by time of use, so that the utility can bill accordingly.
- For most domestic and small commercial customers, however, the incremental cost of metering may outweigh the benefits of fairer pricing and more economic price signals.
- Some environmental advocates prefer this approach because the pricing could send high price signals to customers during peak hours and thus influence them to conserve (reduce or shift load to off peak periods) electricity consumption.

Time of Use: Hourly Pricing

- It is a more sophisticated version of the above rate structure and is applied primarily for very large industrial customers in the western part of the world.
- Customers receive hourly prices for each of the 24 hours in a day, a day ahead of consumption.
- Customers can then decide, based on the prices for each of the hours, how much they want to consume in any given hour.
- Before a scheme like this can be implemented, there is a need to measure customer's load on an hourly basis.
- While metering technology is available to do so, it is somewhat expensive.
- In addition, of course the utility should be able to provide price signals that are delineated by the hour.
- As the revenue requirement is not guaranteed with uncertain sales amount in such an arrangement, other mechanisms need to be put in place to make sure fixed costs are covered. Obviously, this is a fairly complex scheme, only meant for very large customers.

End Use Based Rates

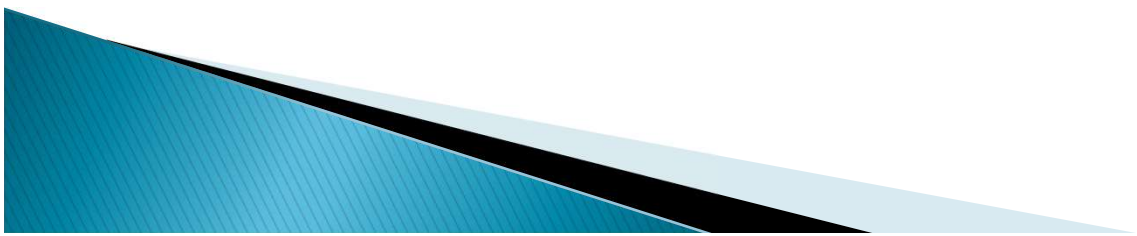
- Low-income customer rates: BPL Households, Lifelines rates, Agricultural rates
  - Rates are designed to make them affordable
  - These rates are typically funded through cross subsidies and subsidies – implications for tariff distortions
- Economic Development Rates
  - Negotiated rates are offered to promote economic development activities in a given region.
  - A special rate is negotiated between a customer and utility. The purpose of such a rate is to attract new businesses, retain a business that might leave the utility system or allow for an expansion of an existing business.
  - The economic development rate would be lower than tariff rate and is offered to targeted qualifying customers who provide overall economic benefit to the community in terms of jobs, local tax revenues etc.
  - In offering these rates, utilities should ensure that they cover at least the energy costs and contribute some to utility's fixed costs.

Type of Use Rates: Interruptible rates

- This is a rate provided to a customer who is willing to have his service interrupted by the utility at the utility's discretion, under certain terms and conditions.
- This is an attractive option to the utility when its maximum day or maximum hour load consistently approaches the physical limitations of its capacity.
- The interruptible service arrangement allows the utility to avoid the need to install additional capacity to serve that portion of its load.
- Power is made available to the interruptible customer when the utility has the ability to service its firm load, plus additional capacity to serve interruptible load.
- The rate is somewhat complex to design.
  - The utility needs to know how much load relief is needed.
  - The customer needs to determine how much he can afford to be interrupted without making it an uneconomic proposition.
  - Utility needs to decide the level of cost savings it would achieve as a result of offering this service and how much of it can be passed on to the customers subscribing to the service.
  - The rates are considered fair because the customers are only getting a lower service quality and hence are entitled to a lower price. One implementation feature is to install devices and monitoring mechanisms to ensure that the customer is actually interrupting the load when he is called upon by the utility.

Type of Use Rates: Standby Rates

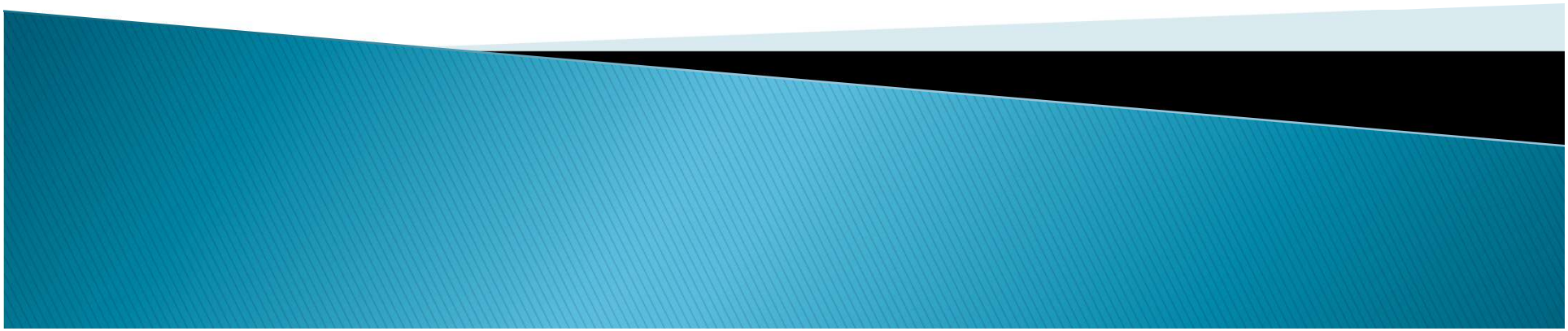
- This is a rate offering to customers who have captive generation on site and rely on the utility for service when their own generation is unavailable due to planned or forced outage. These rates are somewhat complex to design. The utility needs to determine the cost causation of such customers and design a rate to cover those costs. To the extent the rates are cost based, then they are fair.



Typical Tariff Design: Summary

- Telescopic Rates
  - Increasing block
  - Decreasing block (public policy to shift to another fuel)
- Flat Rates
  - Issues of conservation
- Time of Day
  - Peak
  - Off-Peak
  - shoulder
  - Whether to penalise peak or incentivise off-peak
- Time of Year
  - Seasonal
- Geographical variation
  - Rural / urban tariff

Regulatory Processes



Regulatory Process – e.g Tariff setting

Filing of Proposals for Tariff revision

Notification in the News Papers

Receipt of objections

Public hearings by the Commission

Commission Decision

Notification of Tariffs

Petition for review

Petition for Judicial review

Stakeholder Participation

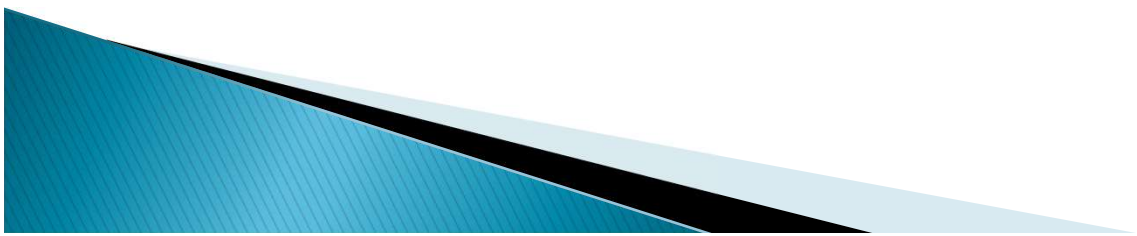
- Crucial to regulatory reform
- Regulatory design mandates stakeholder participation
- Procedure laid down in Act and Commission regulations

Engaging the Public

- Consultation
  - Soliciting inputs
    - Public Hearings
    - Consultation papers
    - Stakeholder meetings
- Consumer Education
  - Media
  - NGOs
  - Local Governments

To Conclude

- Consumer categories must be rationalized and kept simple
- Not to lose sight of the basic goals of cost recovery, efficiency of use and equity



Thank you