Electricity Costs and Ratemaking

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Agenda

Introduction: Electricity Cost Basics and Concepts

Electricity Costs and Ratemaking

Steps in Electricity Cost of Service Studies and Allocating Costs to Customer Classes

Determining the Per-Unit Costs and Rates for Customer Classes

Importance of Electricity Costs in Ratemaking and Policy

Achieving a good understanding of rate design principles and best practices requires a basic knowledge of electricity costs and how they result in rates that consumers pay.

- Rate design should be "cost reflective"
- Rate design should allocate electricity costs "fairly" among the different customer classes
- Utilities and policymakers develop electricity cost of service studies ("COSS") to guide rate design

An electricity COSS helps answer the following types of questions:

- How are the costs of electricity assets that all customer classes utilize (*e.g.* generation, transmission) allocated?
- Are the different customer classes paying their "fair share" of the electricity network costs?
- What are the cost differences between current and newer generation technologies (fossil fuel *vs.* renewables)?
- What happens to the utility's costs when customers deploy solar photovoltaics, storage, other technologies?

Two Basic Electricity Concepts

The Major Parts of the Electricity System

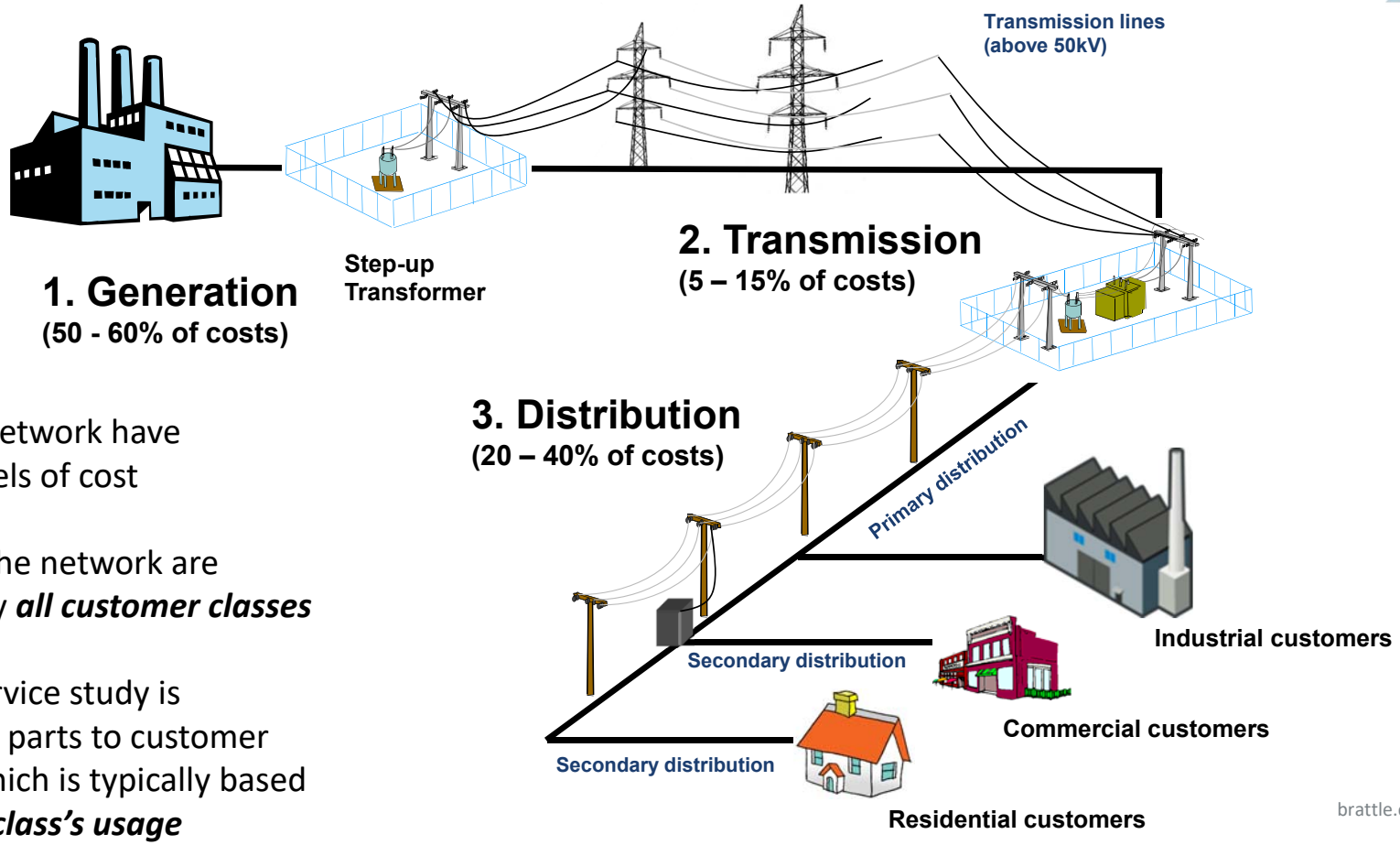
- The different electricity network components (generation, transmission, distribution)

Electricity Measure Concepts

- kilowatts (kW) and kilowatt-hours (kWh)

Key to understanding electricity costs. We'll cover these in the next two slides

The Major Parts of Electricity Systems that Give Rise to Costs



Different parts of the network have different types and levels of cost

The different parts of the network are common and shared by ***all customer classes***

Key task in a cost of service study is allocating the common parts to customer classes in a fair way, which is typically based upon ***amount of each class's usage***

Measures of Electricity are Key to Understanding Electricity Costs

Energy: **Quantity** of power over time, work performed (**kWh**)

- 1 kilowatt-hour = 1 kWh = 1000 watt-hours
- 1 megawatt-hour = 1 MWh = 1,000,000 watt-hours = 1,000 kWh

Capacity/Demand: ***Instantaneous*** measure of power (**kW**)

- 1 kilowatt = 1 kW = 1000 watts
- 1 megawatt = 1 MW = 1,000,000 watts = 1,000 kW

In the electricity industry

- Work is termed energy (*e.g.*, ten 100 Watt fans operating for 1 hour needs 1 kWh of energy/"work")
- Power is termed capacity in discussions of generating plants and demand in discussions of customer usage

Energy and Demand (Capacity) plus Customers are the Main Electricity Cost Drivers

Energy-Related

- Vary with kWh of energy generated
- What are the costs to provide an additional kWh of energy?
- Fuel, lubricants, wholesale purchase power

Demand-Related

- Vary with the kW of instantaneous demand, peak capacity
- What are the costs to add capacity?
- Generation, transmission and distribution capacity

Customer-Related

- Vary with the number of customers
- What are the costs to add an additional customer?
- Meters, service drops, poles, billing and customer care

Variable Costs

Fixed Costs

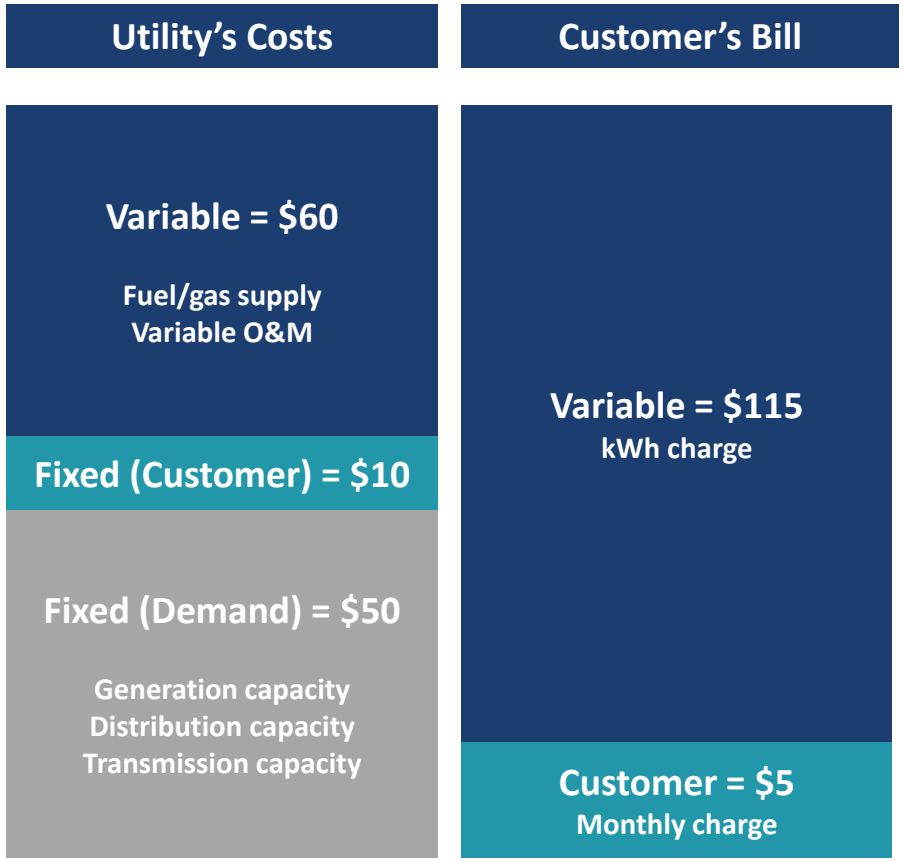
Importance of Fixed vs. Variable Cost Distinction

The typical residential customer's bill does not match the utility's underlying costs

In the example, the variable kWh charge recovers not only the $60 of variable costs, but also $55 of the fixed costs…

…but a utility's fixed costs does not increase when a customer consumes an additional kWh nor does the utility avoid fixed costs when a consumer reduces its usage

This is problematic and is at the heart of many discussions in rate design and electricity policy



Questions and Discussion

Electricity Ratemaking: Three main steps (1)

1. Determine the "**revenue requirement**" for the services offered by a utility

    - How much revenue should the utility be permitted to earn?
    - How much is too much? How much is too little?

A utility company is provided a *reasonable opportunity* to recover its *prudently-incurred* costs. For a company like CPS Energy, revenue requirement includes:

- Capital Expenditures (generation, transmission, distribution, meters, *etc.*)
- Operation and Maintenance Expenses (generation, transmission, distribution, meters, billing)
- Fuel Expenses and Purchased Power
- Administrative and General Expenses (Office buildings, Legal, HR, Executive)
- Taxes
- Payment to City

Electricity Ratemaking: Three main steps (2)

2. Develop **cost of service model** to identify, summarize, and allocate costs to the different classes of customers

   How much of the revenue requirement should residential, commercial and industrial customers be responsible for?

   What is fair among the different customer classes?

   Cost of service model uses an approach and methodology and answers these questions

Electricity Ratemaking: Three main steps (3)

3. Determine the **rate design**, how costs will be recovered from customers within each customer class

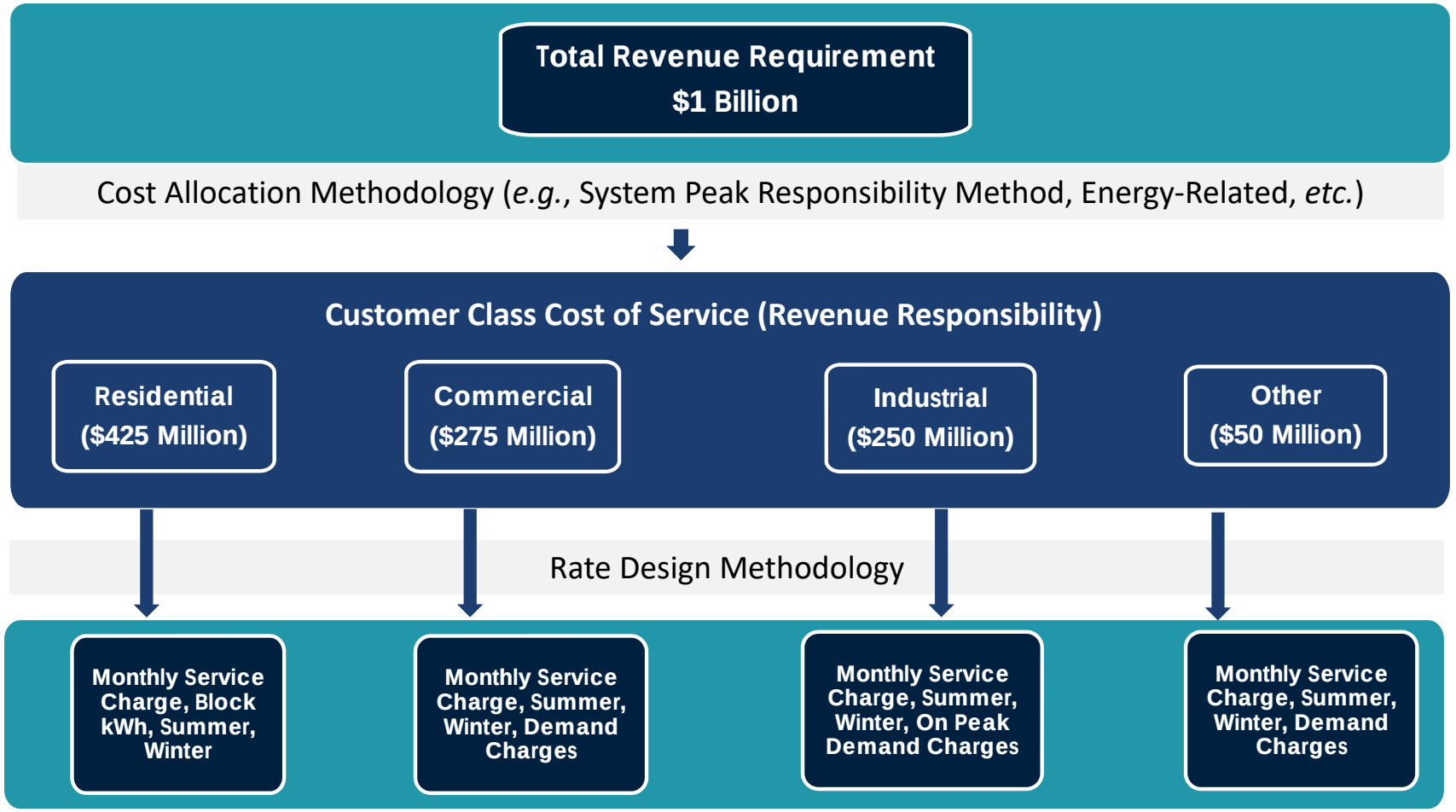
   Should customer pay primarily flat-charges? Charges that vary with usage (blocks)?

   Charges that vary by time of use and season?

   Demand charge during peak usage? What hour(s) of the day?

   The cost of service model provides the cost information and rates to apply in the rate design phase

Electricity ratemaking (hypothetical example)



Questions and Discussion

Three main steps of a cost of service study

1. **Functionalize** the revenue requirement

   Process of dividing the revenue requirement into components, main components are: ***generation, transmission, distribution, and customer***.

2. **Classification** of the revenue requirement

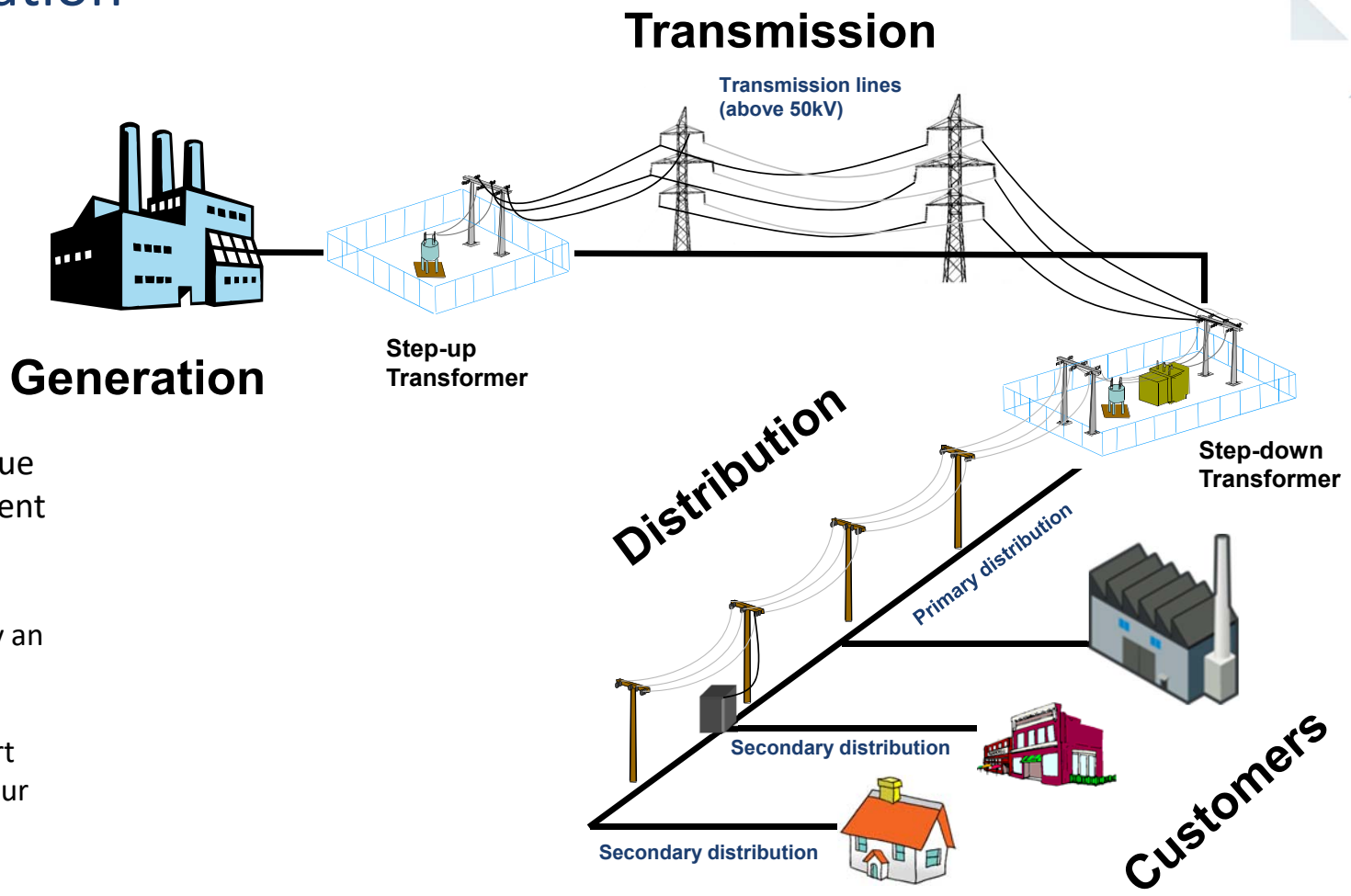
   Process of dividing the functionalized costs by the primary driver for that cost, main cost drivers being: ***energy, demand and customer***.

3. **Allocation** of the revenue requirement

   Process of assigning the functionalized and classified revenue requirement to the different customer rate classes: ***residential, commercial and industrial***.

We'll cover these over the next slides

Functionalization



Step 1: Place the revenue requirement into different network "buckets"

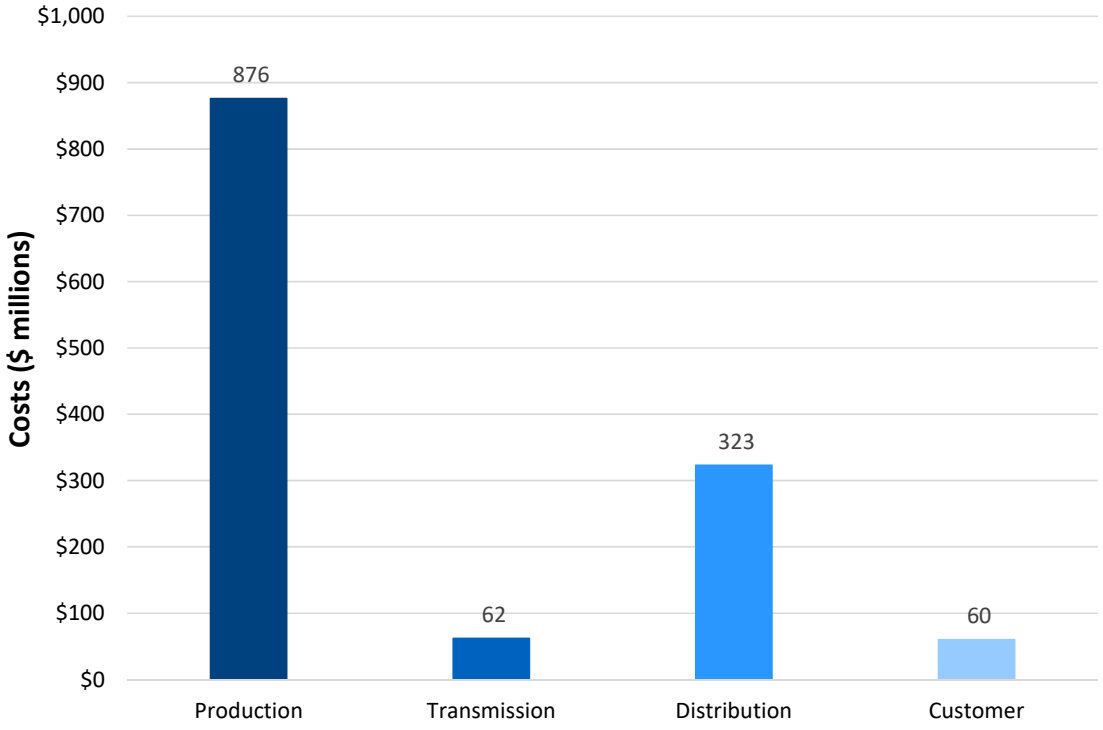
Functionalization is mainly an accounting exercise

Administrative and support costs are rolled into the four functions

Functionalization of the revenue requirement (hypothetical example)

Production (generation) is usually the largest component for a utility, consisting of a utility's own generation plants plus energy and power purchased from the wholesale market.

Distribution (sometimes combined with customer) is next in size, followed by transmission.



Questions and Discussion

Classification

Process of dividing the functionalized costs by the primary driver for that cost, main cost drivers being: ***energy, demand and customer***.

Energy (Fuel, Purchase Power, Variable O&M)

Demand (Generation, Transmission Distribution Capacity)

Customer (Meter, Meter Reading, Billing, Collection and possibly some amount of the distribution capacity)

Classification of the revenue requirement (hypothetical example)

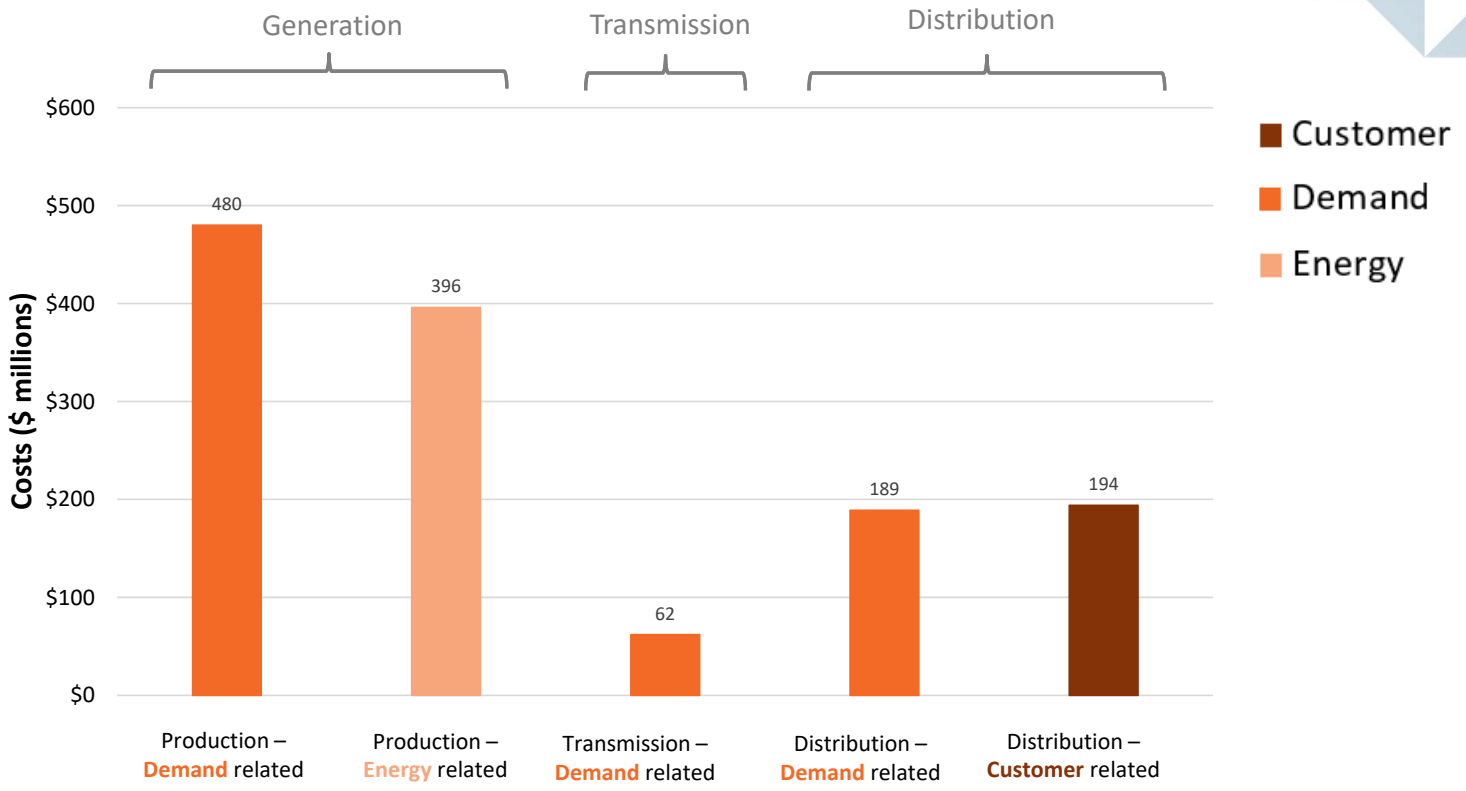
Step 2: Place the functionalized costs into energy, demand and customer "buckets"

The Energy related costs are used to establish the kWh charge

The Demand related costs used to establish a demand charge (if applicable)

The Customer related costs used to establish the monthly customer charge

Last step is to allocate these costs to the different customer classes



Questions and Discussion

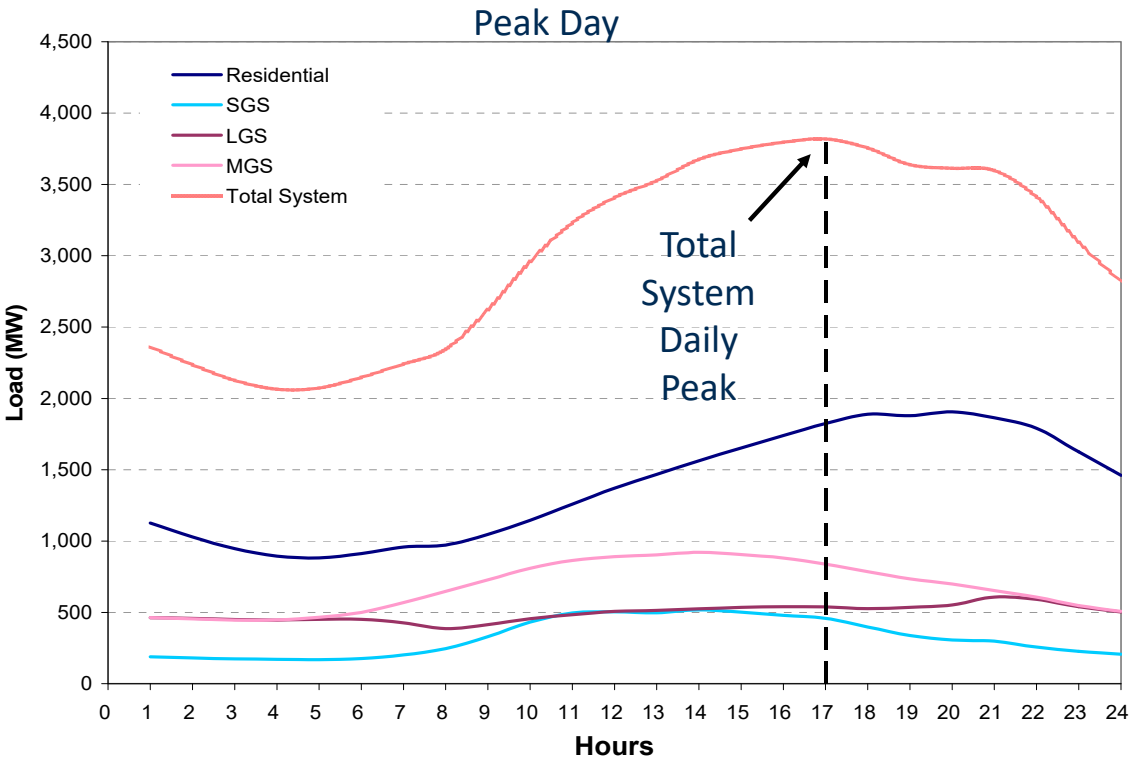
Cost Allocation

The goal of cost allocation is to allocate the functionalized and classified revenue requirements (costs) to the different rate classes based upon **cost causation**

- If customer class A causes more of the revenue requirement to be incurred than customer class B, then customer class A should be responsible for more of the revenue requirement than customer class B
- Most of the facilities in electricity systems—such as generation plant, transmission lines or distribution substations—are used by all the customer classes, they are common facilities. So how do we allocate the costs of these common facilities to each customer class?
- We look at each customer's class usage of the electricity facilities throughout the year and during peak periods of demand in order to allocate costs.
- We develop allocation factors based upon the demand characteristics of the total system as well as individual rate classes. Such analysis is referred to as load research.

Allocation: Load research and allocation factors

Customer classes use the grid differently, use load research information to develop allocation factors



Class Allocation Factor based upon hypothetical system coincident peak (CP)

	Peak Demand (MW)	Allocation Factor (%)
Total System	3550	
Residential	1800	51
Small GS*	550	16
Medium GS	900	25
Large GS	450	13

*GS: General Service

Allocation factors vary by type of costs (1)

Energy-Related Costs (hypothetical example)

- **Allocator based upon the kWh of energy consumed by each customer class (at customer meter or at generation)**

	(kWh sold 000 000)	Allocation Factor (%)
Total System	18,062	
Residential	7,137	39.5%
Small GS	4,118	22.8%
Medium GS	2,855	15.8%
Large GS	3,953	21.9%

Allocation factors vary by type of costs (2)

Customer-Related Costs (hypothetical example)

- **Allocator based upon the number of customers by customer class**
- **Usually weighted number of customers, weighted by meter costs**

	Number of Customers	Allocation based on number of customers (%)	Meter costs ($)	Allocation based on meter costs (%)
Total System	735,500		194,372,558	
Residential	650,000	88.4%	153,336,901	78.9%
Small GS	75,000	10.2%	31,252,172	16.1%
Medium GS	10,000	1.4%	5,884,334	3.0%
Large GS	500	0.1%	3,899,150	2.0%

Allocation factors vary by type of costs (3)

Demand-Related Costs (hypothetical example)

- **Based entirely upon a measure of peak responsibility (1 CP, 4CP, 12 CP) or**
- **Based upon other methodologies such as a mix of peak responsibility and some measure of energy usage (*e.g.*, Average & Excess)**

	Peak Demand (KW)	Allocation Factor (%)
Total System	6,125,000	
Residential	3,250,000	53.1%
Small GS	1,875,000	30.6%
Medium GS	500,000	8.2%
Large GS	500,000	8.2%

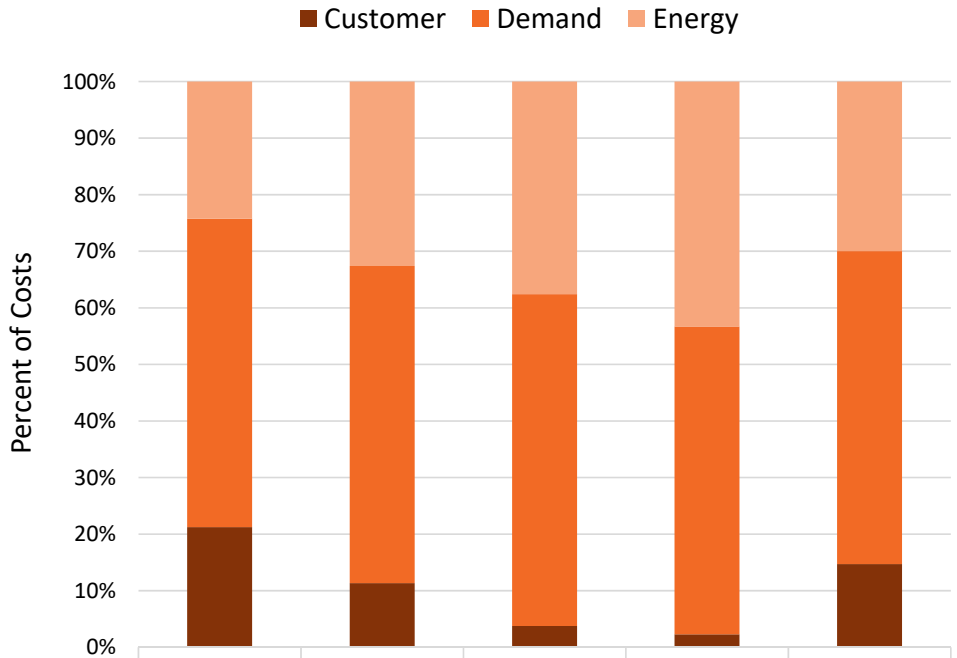
Cost allocation by customer class (hypothetical example)

Step 3: Use the cost allocation factors to allocate the costs to the different classes

We now have the energy, demand and customer related costs allocated to each customer class

We use this information to determine the per-unit energy cost, the per-unit demand cost and the per-unit customer cost for the different customer classes

This is then used in the rate design phase



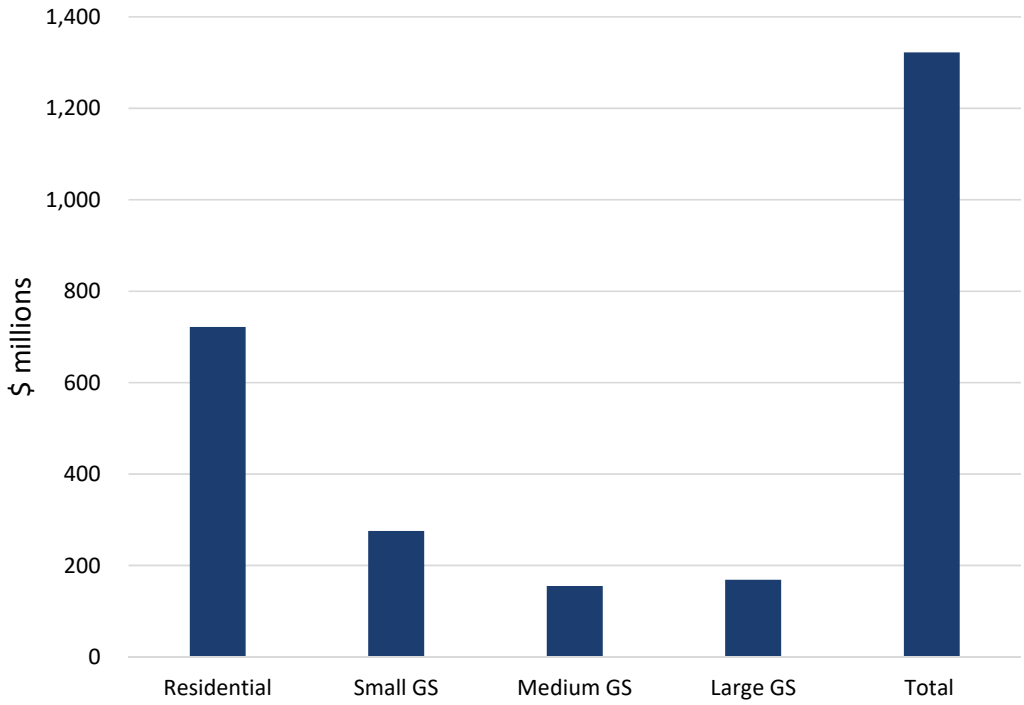
Costs in dollars

	Residential	Small GS	Medium GS	Large GS	Total
Energy	174,778,368	89,877,452	58,353,613	73,179,196	396,188,629
Demand	393,773,762	154,595,239	91,065,546	92,004,413	731,438,960
Customer	153,336,901	31,252,172	5,884,334	3,899,150	194,372,558

Revenue requirement allocation by customer class (hypothetical example)

In the hypothetical example, the cost of service study and methodology resulted in the residential class being responsible for about 55% of the revenue requirement, small GS (20%), Medium GS (10%) and Large GS (15%)

No single reason why that is the case. There are many steps in a cost of service study, and different approaches and methodologies that drive the final results.



Questions and Discussion

Energy cost by customer class (hypothetical example)

Customer Class	Energy (kWh 000 000)	Allocated Energy Costs	Energy Rate ($ per kWh)	Monthly Energy (kWh) per customer	Amount on Bill for Typical Customer
	A	B	C = B/A	D	E = C x D
Total	18,062	$396,188,629	$0.022		
Residential	7,137	$174,778,368	$0.024	915	$22.41
Small GS	4,118	$89,877,452	$0.022	4,575	$99.86
Medium GS	2,855	$58,353,613	$0.020	23,790	$486.28
Large GS	3,953	$73,179,196	$0.019	658,800	$12,196.53

The energy rate is arrived by dividing each customer classes' allocated energy costs by that classes' energy consumption. In this hypothetical example, the kWh costs are very close by customer class

Monthly customer cost by customer class (hypothetical example)

Customer Class	Customers	Allocated Customer Costs	Monthly Customer Charge ($ per customer per month)
	A	B	C = (B/A)/12
Total	735,500	$194,372,558	$22.02
Residential	650,000	$153,336,901	$19.66
Small GS	75,000	$31,252,172	$34.73
Medium GS	10,000	$5,884,334	$49.04
Large GS	500	$3,899,150	$649.86

The monthly customer charge is arrived by dividing each classes' allocated customer costs by the number of customers in the class. In this hypothetical example, the monthly customer charges are significantly different by customer class

Demand cost by customer class (hypothetical example)

Customer Class	Demand (KW)	Allocated Demand Costs	Demand Rate ($ per KW per month)	Monthly Demand (KW) per customer	Amount on Bill for Typical Customer
	A	B	C = (B/A)/12	D	E = C x D
Total	6,125,000	$731,438,960	$9.95		
Residential	3,250,000	$393,773,762	$10.10	5	$50.48
Small GS	1,875,000	$154,595,239	$6.87	25	$171.77
Medium GS	500,000	$91,065,546	$15.18	50	$758.88
Large GS	500,000	$92,004,413	$15.33	1,000	$15,334.07

The demand rate is arrived by dividing each customer classes' allocated demand costs by that classes' demand consumption. In this hypothetical example, the demand rates vary somewhat by customer class

Typical rate design and rates by customer class (hypothetical example)

Customer Class	Demand Rate ($ per KW per month)	Monthly Customer Charge ($ per customer per month)	Energy Rate ($ per kWh)	Monthly Bill ($ per month per customer)
	A	B	C	D = (A x monthly demand in kW) + B + (C x monthly energy use in kWh)
Residential	**NA**	$19.66	$0.080	$92.55
Small GS	**NA**	$34.72	$0.059	$306.36
Medium GS	$15.18	$49.04	$0.020	$1,294.20
Large GS	$15.33	$649.86	$0.019	$28,180.46

Because the typical rate design does not have a demand charge for residential and small commercial, the energy rate for those classes are significantly higher than for the large classes. The energy rate for the residential and small commercial recovers both the energy cost and the demand costs resulting in much higher per-unit rate than larger customers

Questions and Discussion