Utility Ratemaking and Rate Design
Background and Best Practices

Energy Innovation Fellows Seminar

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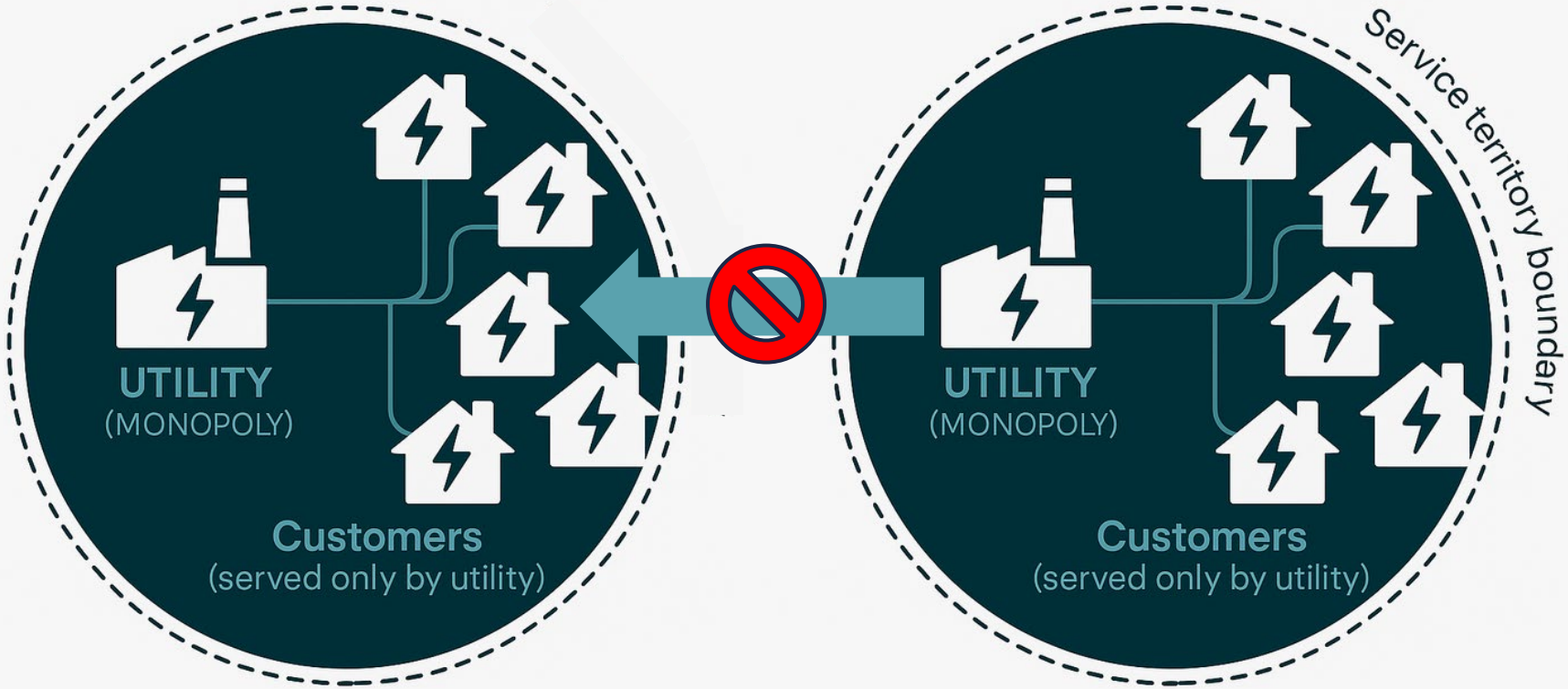
February 24, 2026

Utilities are Monopoly Providers of Electricity with an Obligation to Serve All Customers at Just and Reasonable Rates



Exclusive rights inside service territory

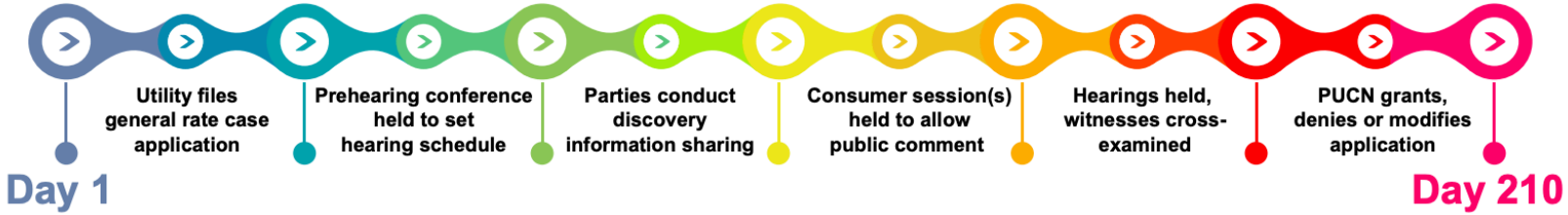
Regulated monopoly— single provider per territory

Graphic Credit: LBL Assistant Image Generator

General Rate Case (GRC)

- GRCs are formal, contested or litigated proceedings that establish the rates utilities can charge customers
- Cost of service ratemaking is the method used by regulatory agencies in a GRC to determine the rates that utilities can charge customers

Nevada PUC's GRC Process



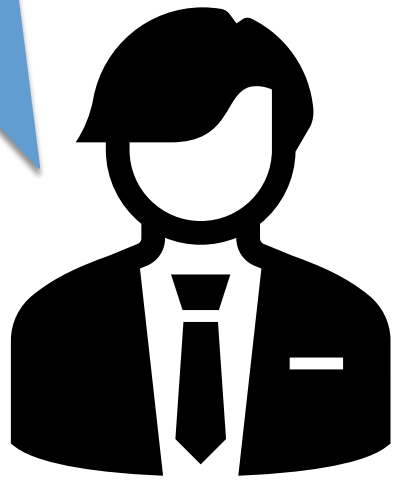
Sources: RAP, NARUC Desk Manual, Nevada PUC

Overview of Cost of Service (COS) Ratemaking

- Regulators strive to approve rates that are reflective of the costs of the services rendered by utilities
  - **Costs** must be deemed to be **prudently incurred** for inclusion in rates
  - **Capital assets** repaid through rates with an **allowed rate of return** must be deemed **used and useful**
  - Rates are determined to be **fair and reasonable**
  - Rates must allow a utility **the opportunity** to both **sufficiently recover its incurred costs** and **to earn allowed returns** comparable to what a similarly situated utility would achieve

Three Key Questions in Ratemaking

How much revenue should the utility be allowed to collect?

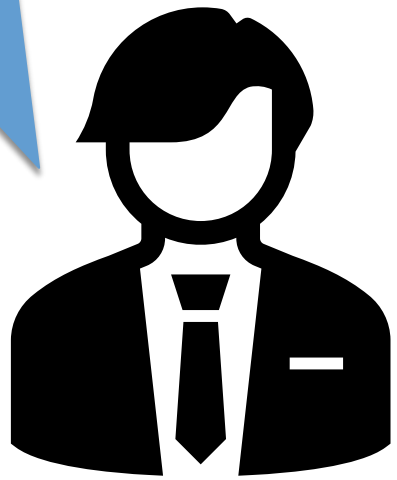


How much of the total revenue should be collected from each class of customers?

How much of the classes' revenue should be collected from each customer?

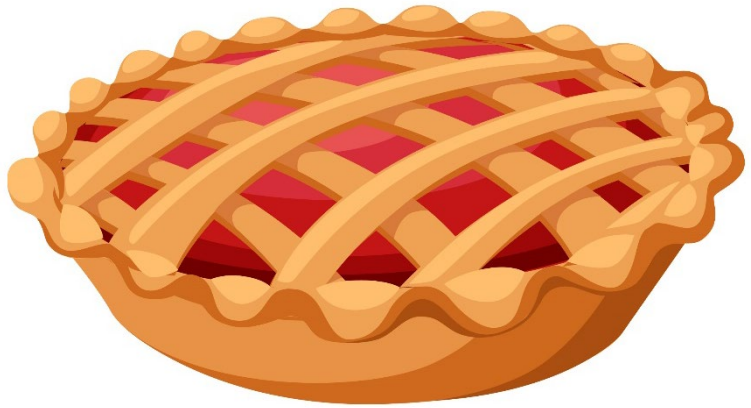
First Key Question in Ratemaking

How much revenue should the utility be allowed to collect?



A Cost of Service study is used to develop a <u>revenue requirement</u>

Test Year Revenue Requirement (RR)



- The annual revenue requirement amount can be compared to the size of a pie that is needed to cover the utility's costs to serve all of its retail customers over a year.
- The "Test Year" RR is the amount used to design rates in a General Rate Case.
  - **Historic Test Year** – A recent 12 month period which reflects the actual results of operations as adjusted for known and measurable changes
  - **Current/Future Test Year** – A future 12 month period which reflect the anticipated results of operations

Components of Revenue Requirement (RR)

Operating & Maintenance Costs +

- Fuel & Purchased Power
- Non-fuel Operations
- Maintenance
- Customer Service and Sales
- Administrative and General

Depreciation +

- Return **of** utility capital invested in the utility's rate base (i.e., assets)
- Depreciation is often defined as the gross asset investment ÷ useful life of rate base assets
- More complex depreciation expense schedules can be applied for a variety of reasons

Return +

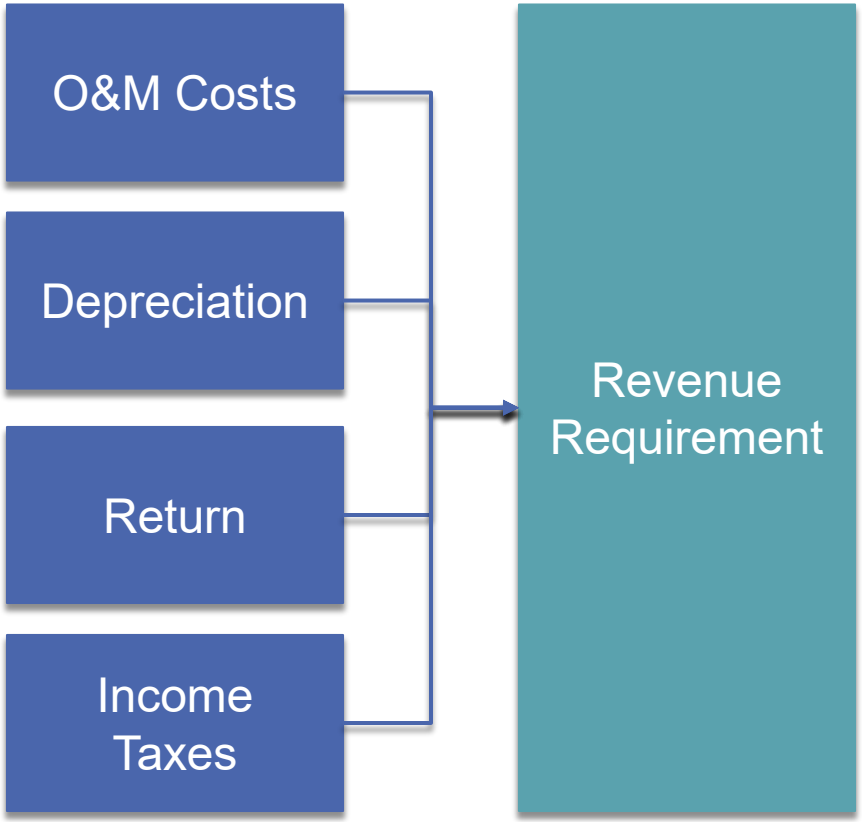
- Return **on** capital invested in rate base
- Debt interest
- Equity return (ROE)

Income Tax

- State income tax
- Federal income tax
- Note income tax is not applicable to all utilities

Elements of a Cost of Service (COS) Study

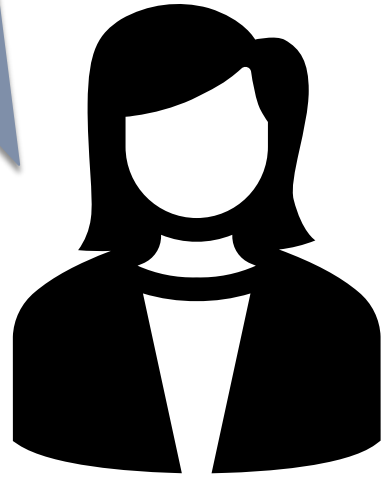
1. Determine the annual cost of serving all of the utility's customers



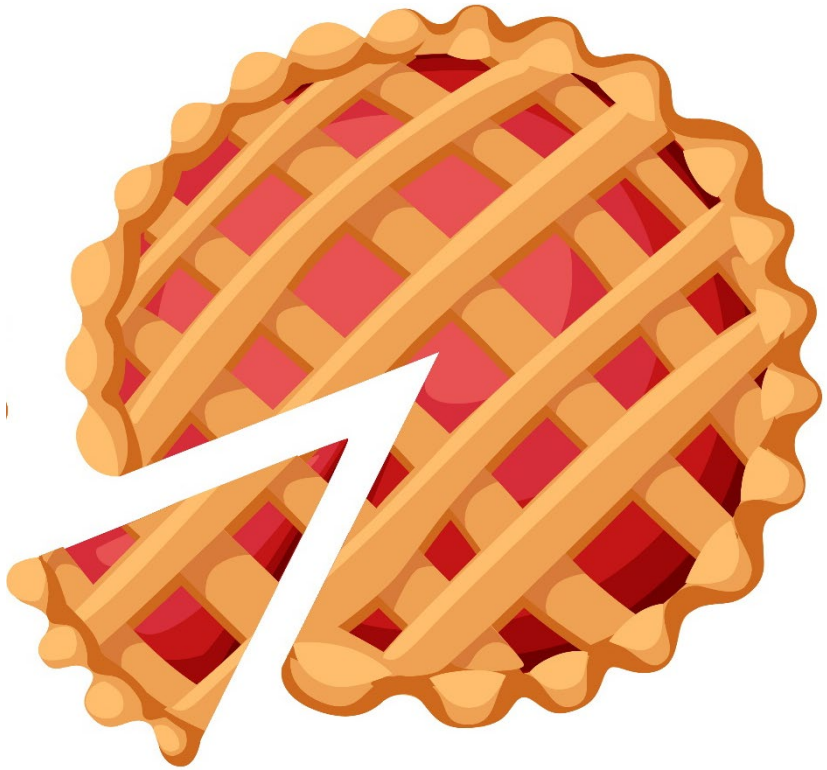
Second Key Question in Ratemaking

COST ALLOCATION IS USED TO DETERMINE HOW MUCH OF THE REVENUE REQUIREMENT TO COLLECT FROM EACH CLASS

How much of the total revenue should be collected from each customer class?



Allocation of Revenue Requirement to Customer Classes

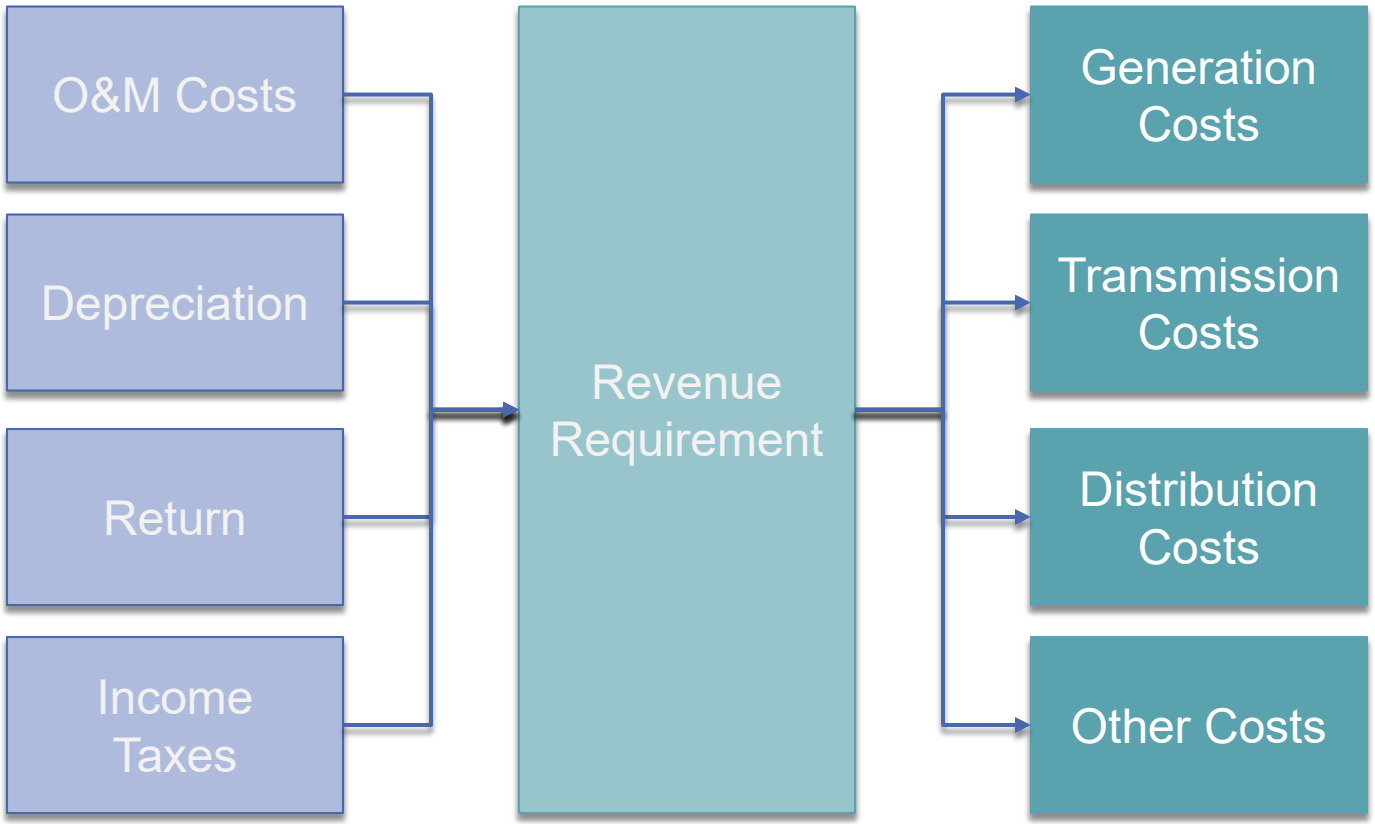


- The revenue requirement allocation determines how much of the utility's costs are caused by each customer class
- This is analogous to dividing the pie into slices that correspond to the revenue responsibility for each customer class

Three Step Process

1. **Functionalization -** Assign all of a utility's costs into major **functional** groups
   - Allows the utility to separate out costs for more granular rate design approaches (i.e., unbundling of transmission, generation, and distribution rate components)

Functionalization of the Revenue Requirement

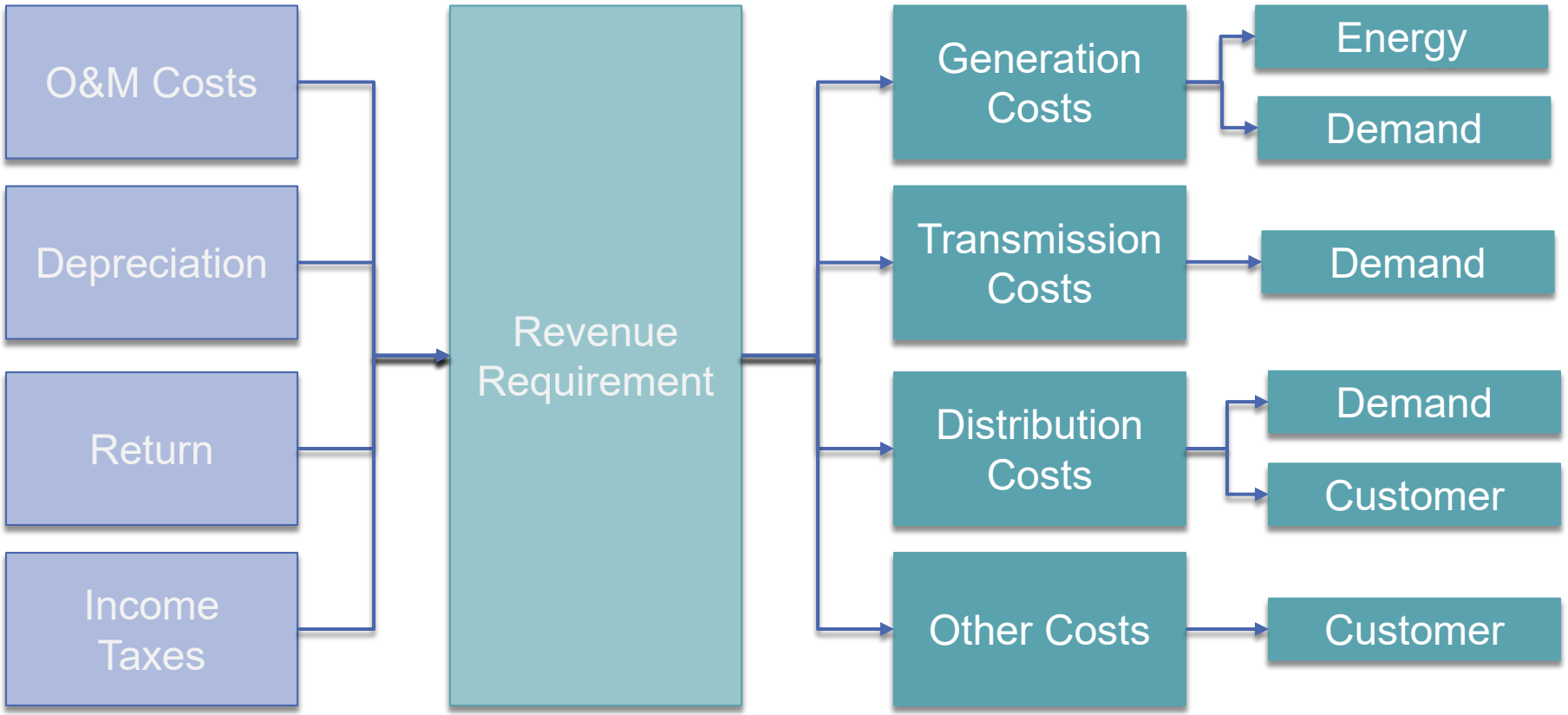


Three Step Process

1. Functionalization - Assign all of a utility's costs into major **functional** groups
   - Allows the utility to separate out costs for more granular rate design approaches (i.e., unbundling)

2. **Classification** - Classifies the functionally assigned costs by the major cost driver
   - Electricity driven costs vary with the volume of electricity (kWh) consumed
   - Demand driven costs vary with the volume of maximum demand (kW) for electricity
   - Customer driven costs vary with the number of customers served

Classification of the Revenue Requirement



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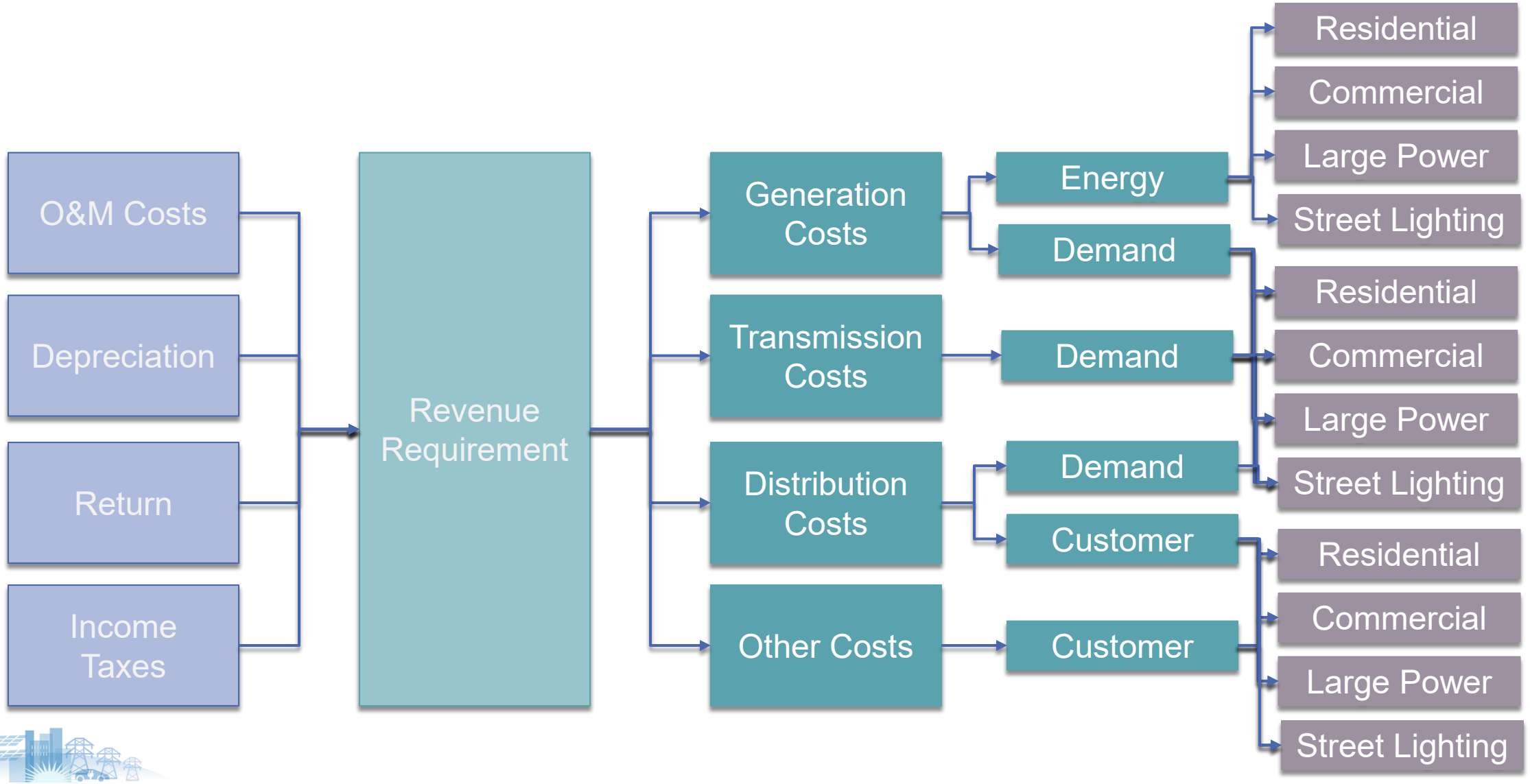
   - Demand driven costs vary with the volume of maximum demand (kW) for electricity
   - Customer driven costs vary with the number of customers served

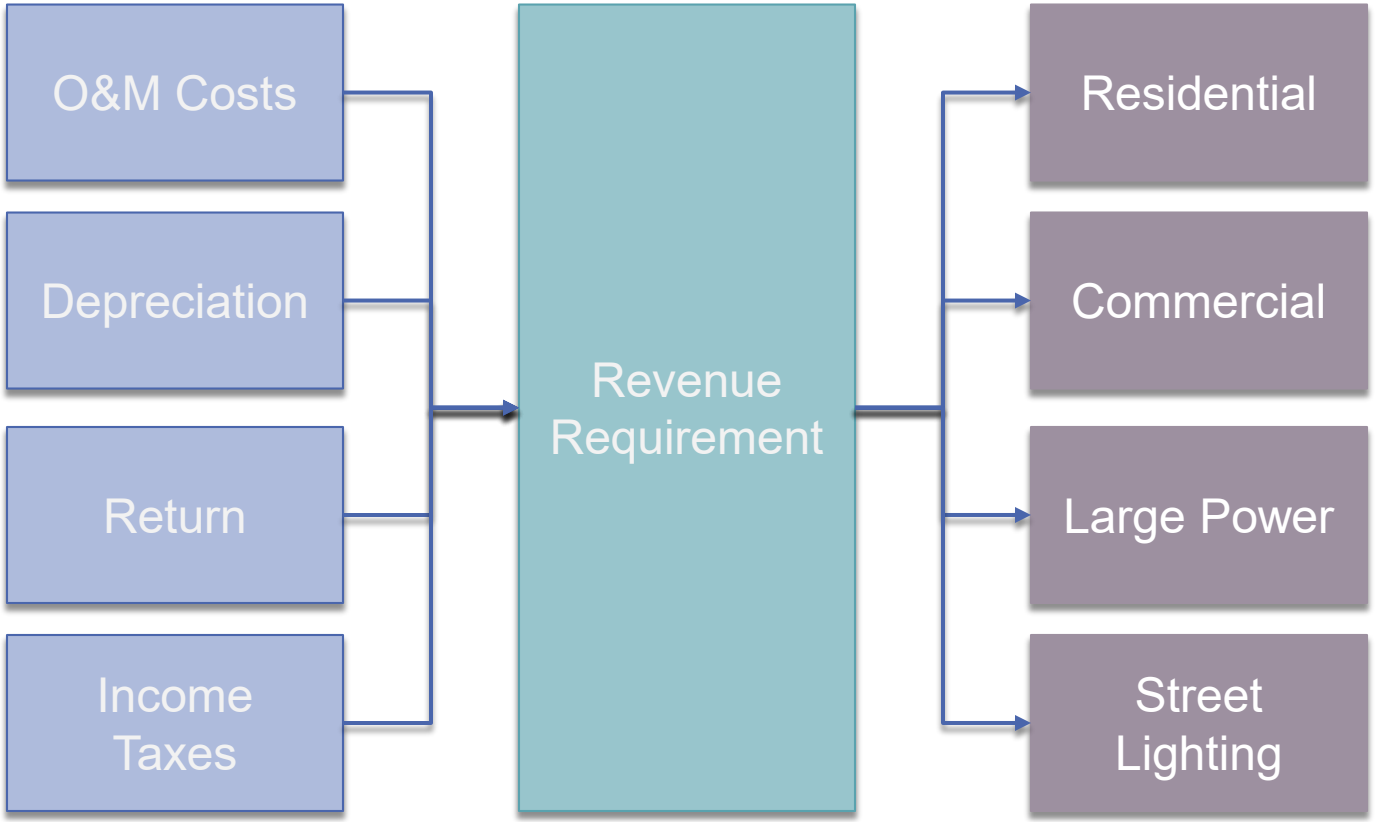
3. **Allocation** – Assigns costs to each customer class by their share of the major cost driver

Allocation of the Revenue Requirement



Elements of a Cost of Service (COS) Study

2. Determine the cost responsibility for each customer class



Third Key Question in Ratemaking

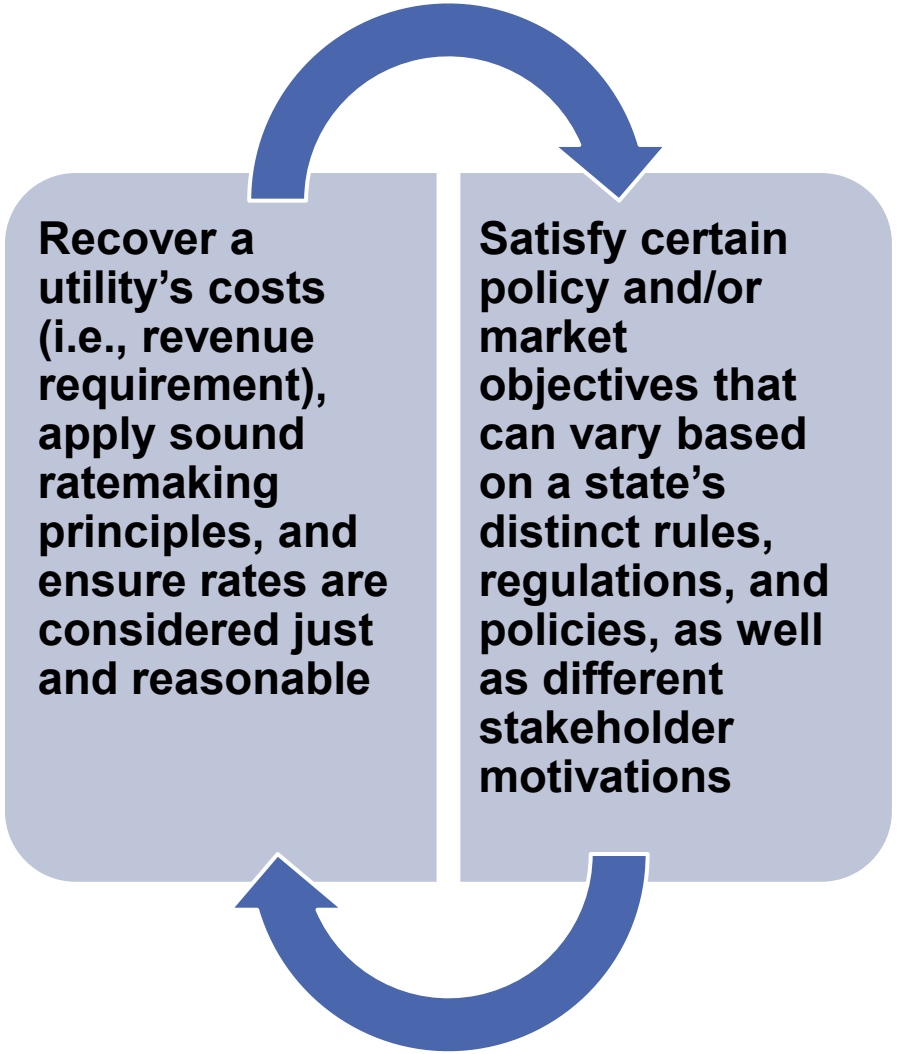
***RATE DESIGN* IS USED TO COLLECT THE CLASSES' REVENUE REQUIREMENT FROM EACH CUSTOMER IN THE CLASS**

How much of the classes' revenue should be collected from each customer?

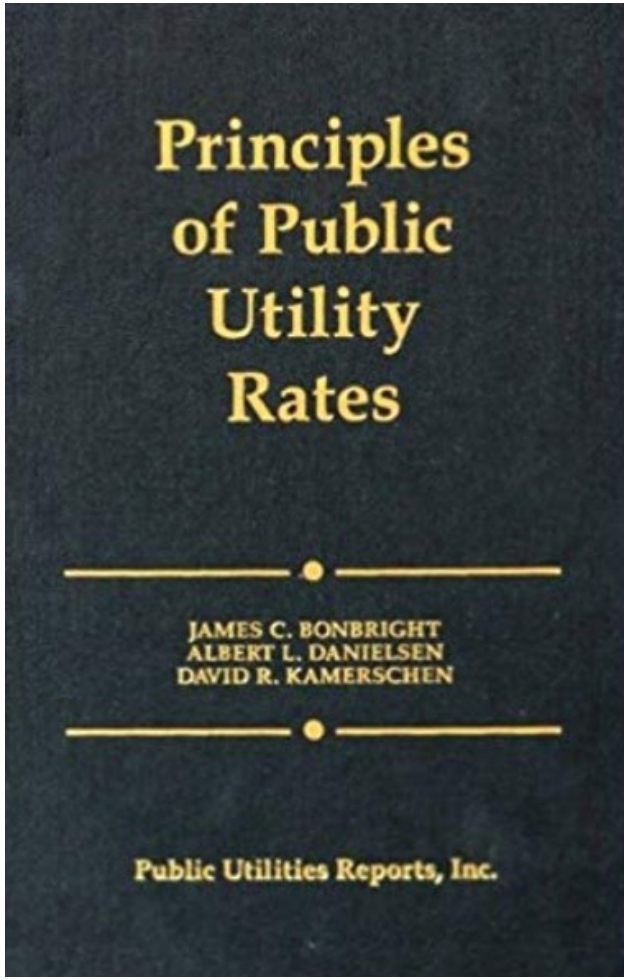
Rate Design

- Rate design determines how each slice of the revenue requirement pie is collected
- The rate design step allocates revenue responsibility to each customer in each class.
- Ideally, the entire slice of pie is collected from customers in each class annually.

Retail rates are designed based on two broad concepts



Rate Design Criteria (Bonbright Principles)



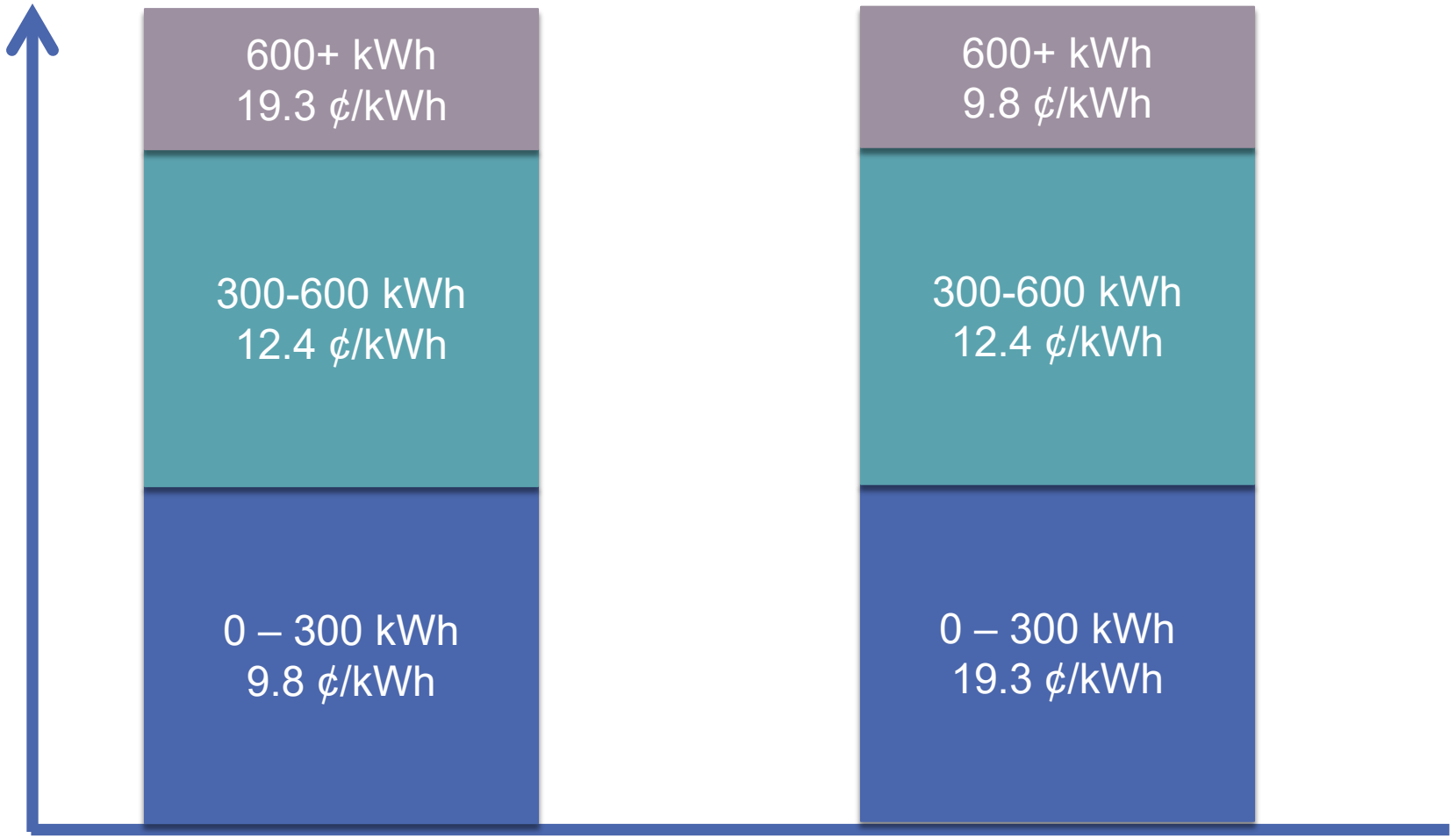
- **Commonly employed rate design principles include the following:**
  - Collect utility's cost of service
  - Fairly apportion costs among customers
  - Avoid undue discrimination
  - Customer understanding
  - Ease of implementation
- **Balancing these principles can be more of an art rather than a science**
  - Typically involves prioritizing policy goals such as sending economically efficient price signals, achieving state policy goals, enabling or promoting adoption of distributed resource technologies

Rate Design: Common Rate Components

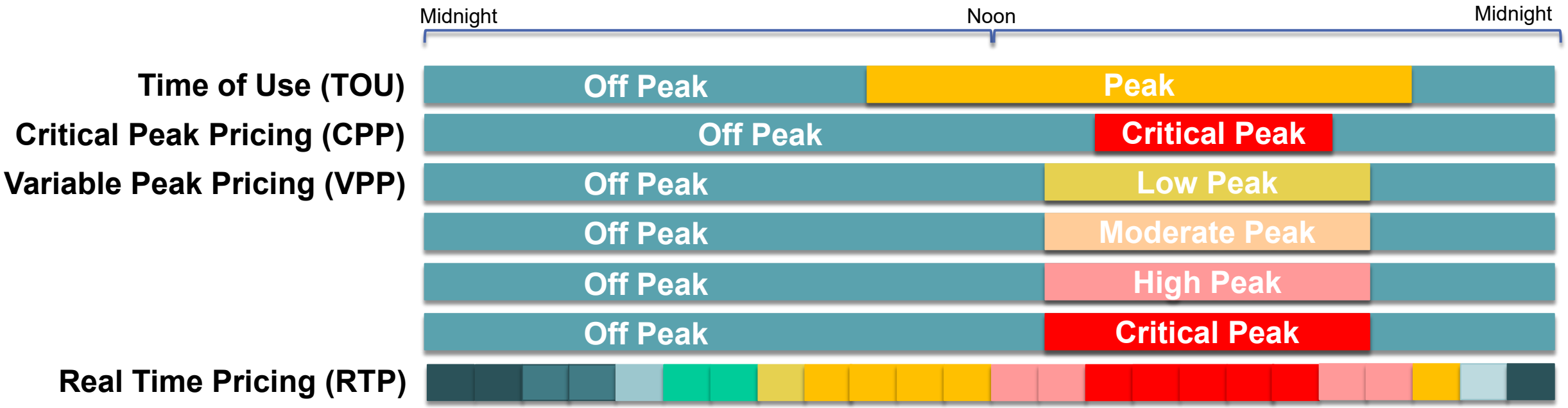
$/kWh Volumetric Energy Charge

- **Science**: Ideally based on energy costs driven by electricity usage. Can include generation production costs.
- **Art**: In actuality, balances policy goals and ability of customers to understand and respond to price signals.

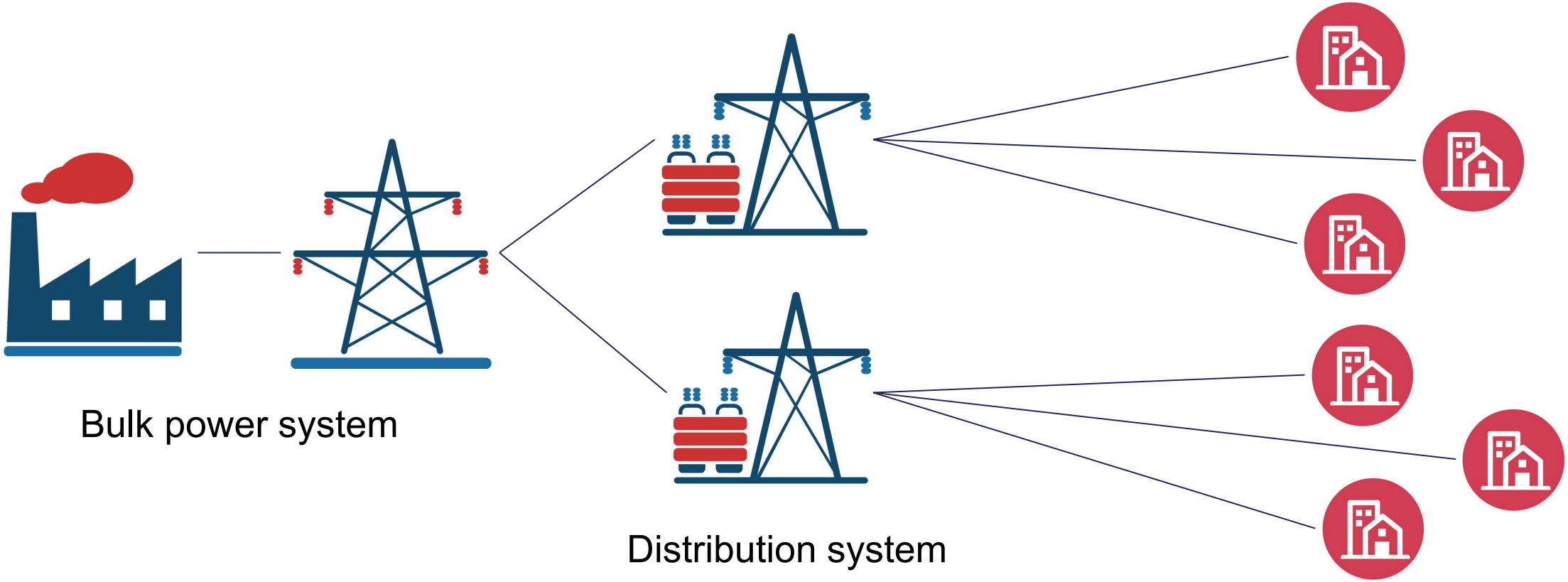
Dimensions of Volumetric Energy Charges:
Quantity Differentiation



Dimensions of Volumetric Energy Charges:
Temporal Differentiation



Dimensions of Volumetric Energy Charges:
Locational Differentiation



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$/kW-mo Volumetric Demand Charge

- **Science**: Ideally based on fixed costs driven by transmission, distribution and/or generation capacity infrastructure.
- **Art**: In actuality, balances metering capability and customer understanding of demand-based price signals.

Dimensions of Volumetric Demand Charges

Max Demand Period	Demand Ratchet	Seasonal	Coincident vs. Non-Coincident
• The period over which maximum demand is measured	• The number of months the maximum demand level is allowed to be reset after	• The period over which the maximum demand level is allowed to be set • The period over which the demand charge may differ	• The timing in which the maximum demand level is set (i.e., at the same time as the grid maximum demand or at the time of the customer's maximum demand)

Rate Design: Common Rate Components

$/kWh Volumetric Energy Charge

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$/kW-mo Volumetric Demand Charge

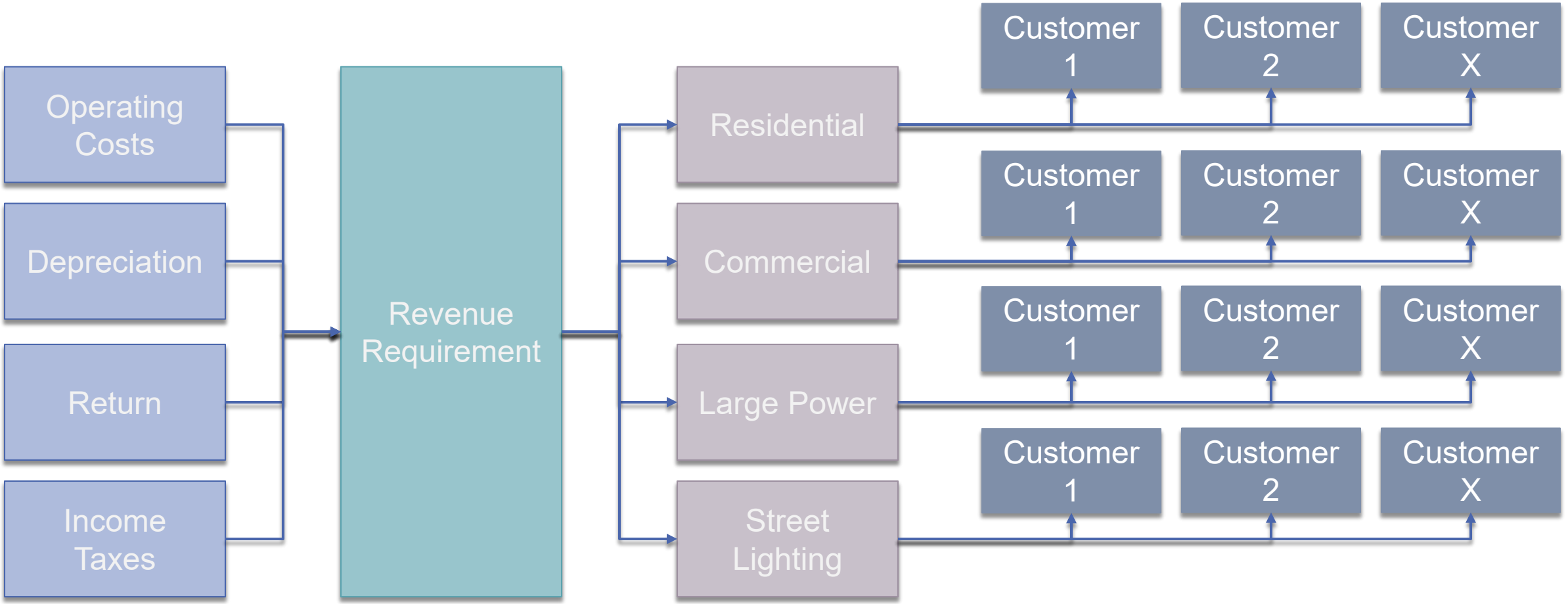
- **Science**: Ideally based on fixed costs driven by transmission, distribution and/or generation capacity infrastructure.
- **Art**: In actuality, balances metering capability and customer understanding of demand-based price signals.

$/Month Customer Charge

- **Science**: Ideally based on customer-related fixed costs (metering, billing, accounts).
- **Art**: In actuality, balances energy price signal and impacts on low-usage customers.

Elements of a Cost of Service (COS) Study

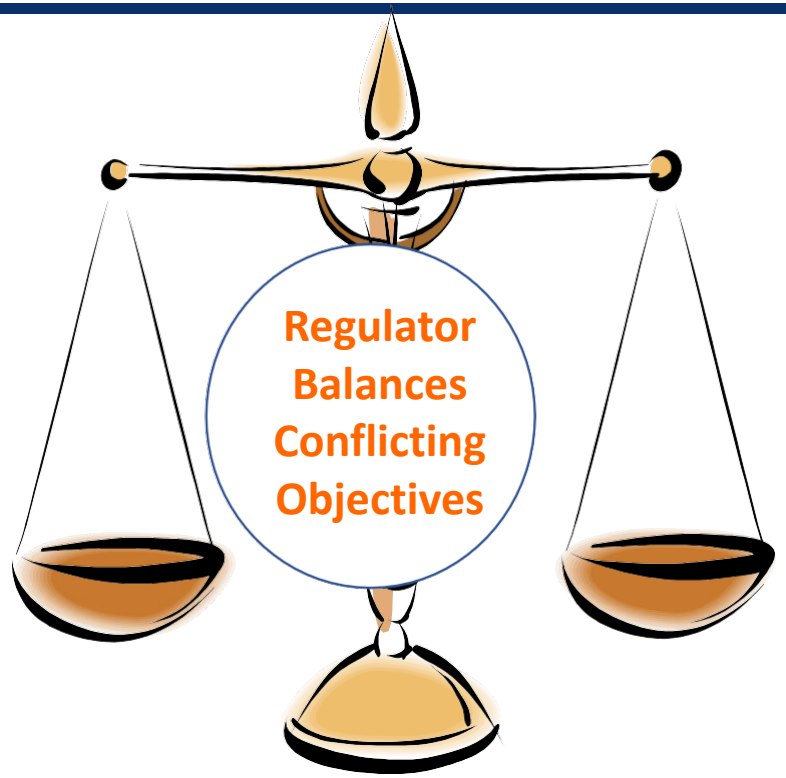
3. Design rates that collect class-level revenue requirement for all customers in the class



The Regulatory Balancing Act: Balancing Utility, Policy and Ratepayer Objectives

Utility Financial Health

- Allowed revenue requirement & allowed rate of return
- Allowed rate levels
- Approval of capital expenditures
- Interval between general rate cases
- Surcharges, decoupling



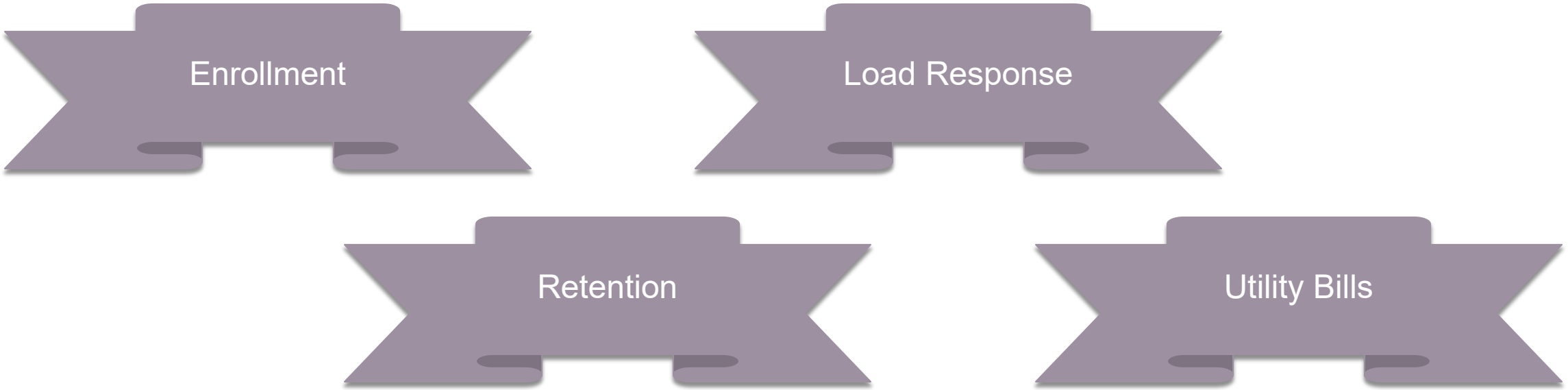
Impacts on Ratepayers

- Retail rate levels
- Bill impacts
- Complexity of rate structures
- Distributed resource programs, including program incentives
- Cost shifts from DER programs

Common Policy Issues:

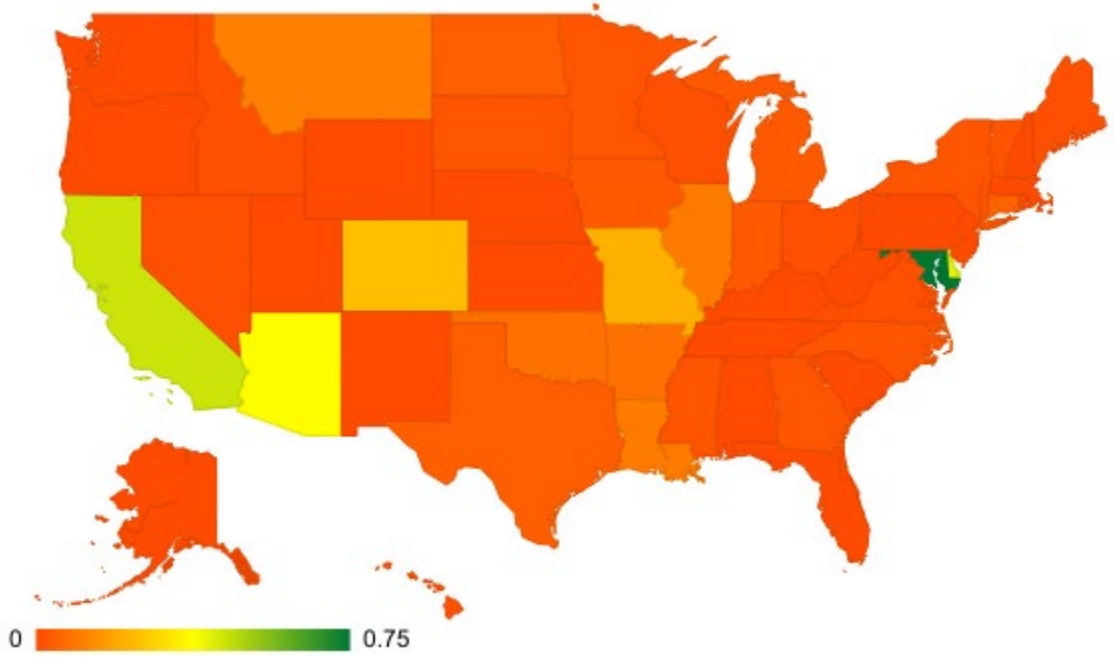
- GRC frequency, rate designs, low-income customer protections
- Distributed energy resource adoption and utilization
- Utility vs third-party ownership of assets
- Utility shareholder incentives
- Predictable regulation to support beneficial outcomes for utility financial health

Metrics of Interest When Reviewing Rate Design Proposals



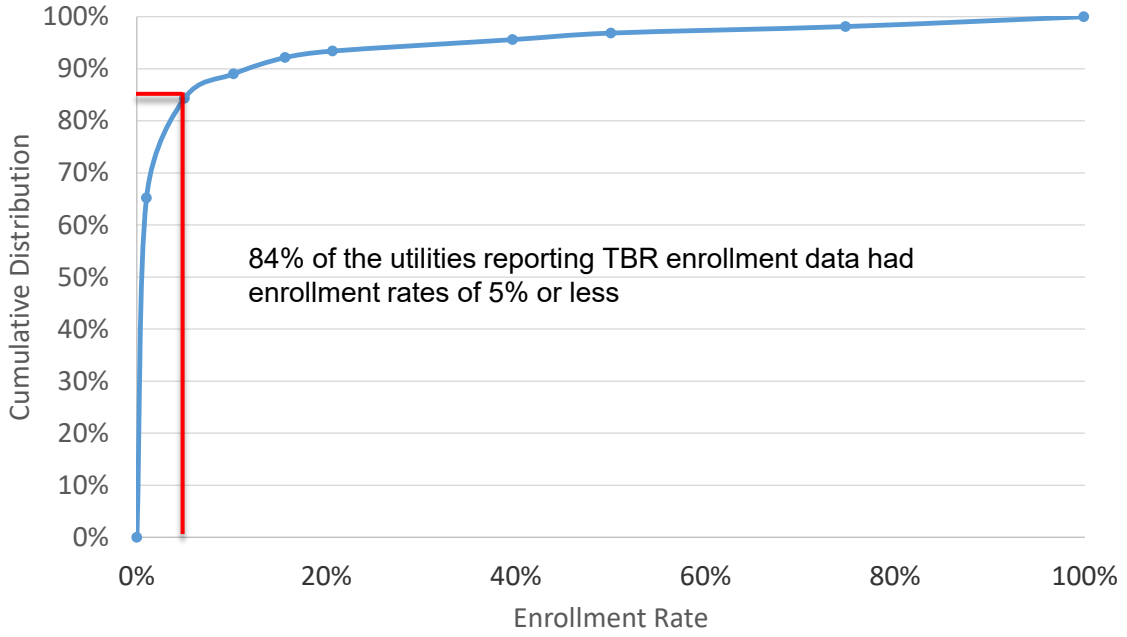
Enrollment in TBR has historically been very low, with a few exception

Share of Residential Customers Enrolled in TBR When Offered(2022)



Source: EIA 861 (2022)

Cumulative Distribution of Share of Residential Customers Enrolled in TOU When Offered (2018)



Source: EIA 861 (2018). TOU='Y'. Res Total Enrolled Customers / Total Res Customers. N=319

Poor Marketing, Education, and Outreach
Utilities Have Limited Experience Engaging Customers

- Many utilities put rather limited resources into promoting their voluntary residential TOU rate offering
- The marketing material they do develop may not make the rate offering very appealing

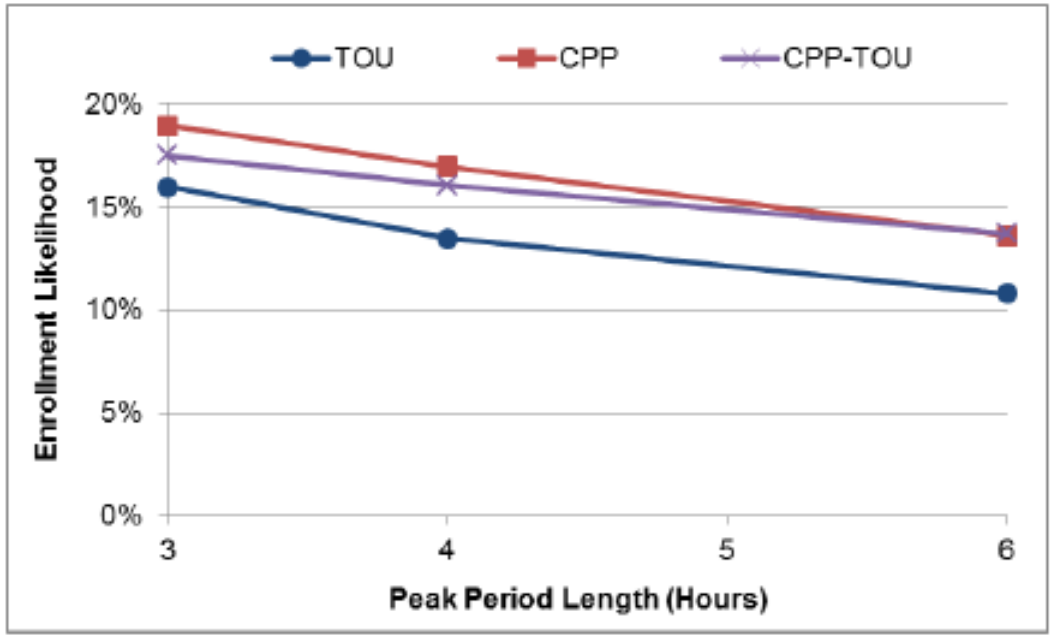
"This program will not be beneficial for all customers contacted."

"If you have children who are home using electronics during peak hours, or if you are making dinner between 2pm-7pm, this rate may not be a good fit for you."

"What's the best way to ensure we'll have an ample supply [of electricity] to take advantage of all the opportunities the future holds?"

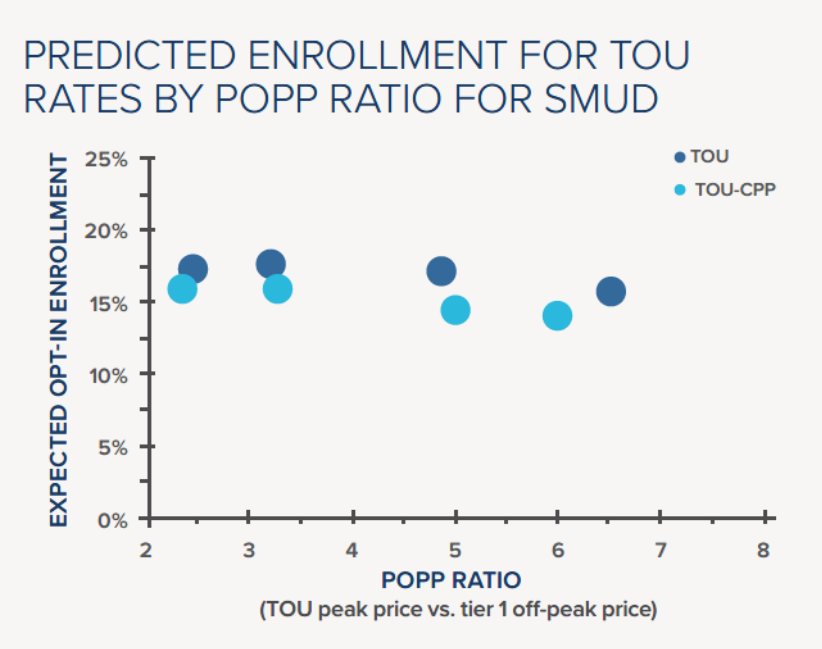
Poor Rate Designs
Utilities May Set TOU Peak Periods To Be Too Long

- Some TOU rates in the U.S. define the peak period to be consistent with wholesale forward-market power contracts (6:00 am – 10:00 pm for a sixteen hour length); others define the peak period much more narrowly (2:00 - 6:00 pm for a four hour length)
- Customers **prefer shorter peak periods** to longer peak periods



Source: Potter et al. (2014)

Some Rate Design Elements Are More Important
TOU Price Ratio Doesn't Seem to Affect Enrollment



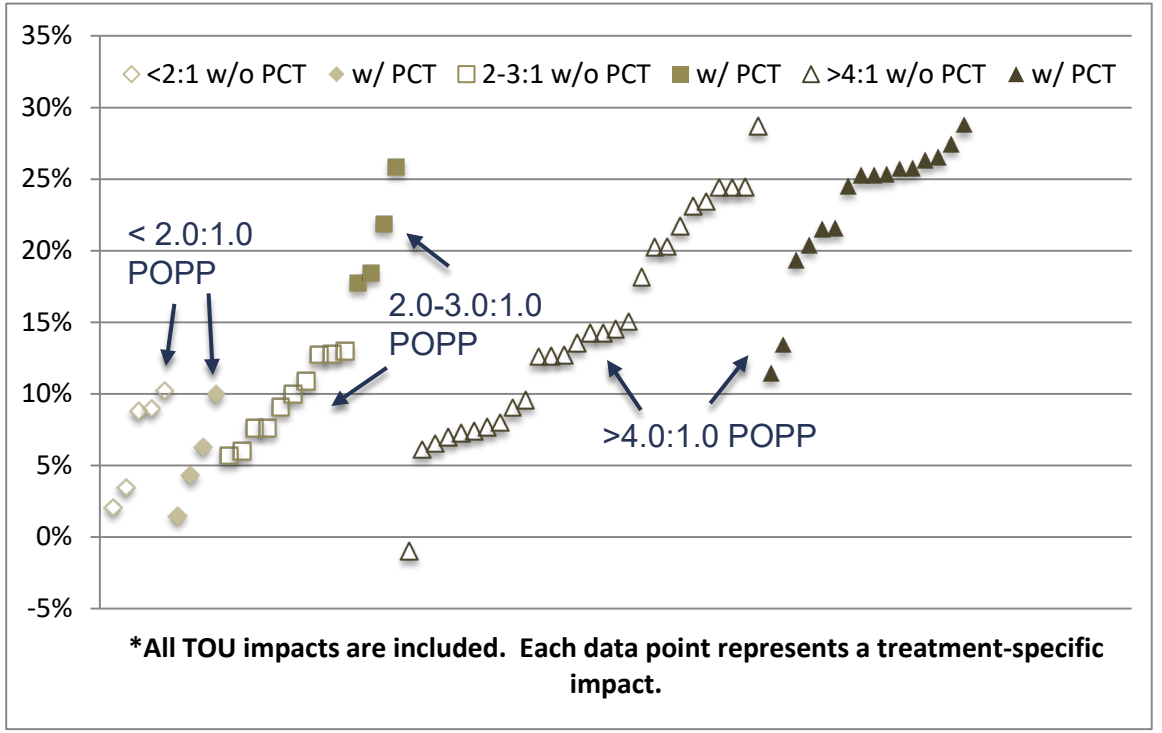
Source: Sherwood et al. (2016)

- Historically, many TOU rates had modest Peak-to-Off-Peak Price (POPP) ratios (less than 2.0:1.0)
- Customers **do not seem to have strong preferences for POPP ratios**
- They only **modestly prefer lower POPP ratios to higher ones**

Some Rate Design Elements Are More Important
TOU Price Ratio Does Seem to Affect Load Response

- Customers do seem to generally provide higher load or peak demand reductions to TOU rates with higher POPP ratios, especially when control technology is in the mix

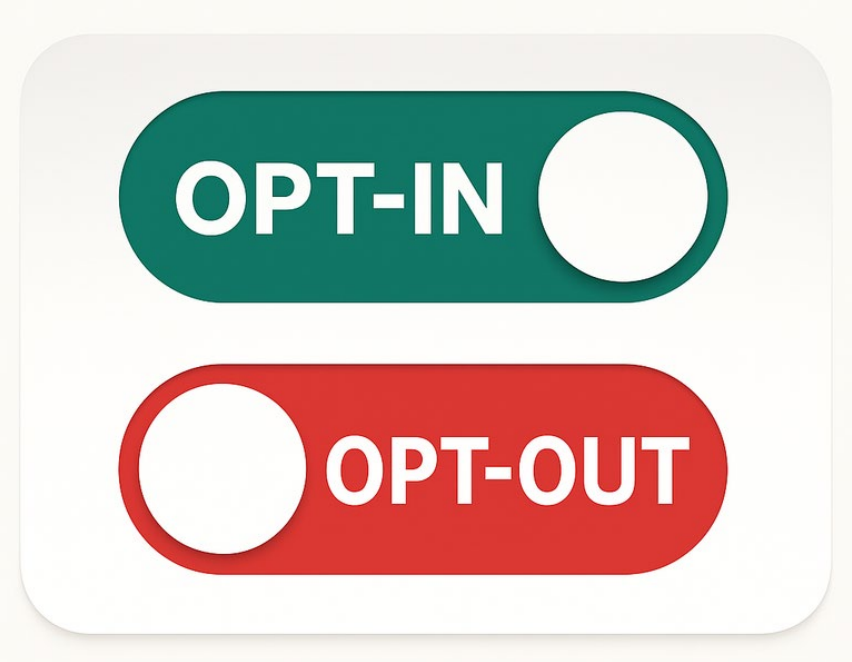
POPP	Range of Peak Load Reduction
<2.0:1.0	1%-10%
2.0-3.0:1.0	6%-26%
>4.0:1.0	-1%-29%



PCT: Programmable Communicating Thermostat

Source: Cappers and Scheer (2016)

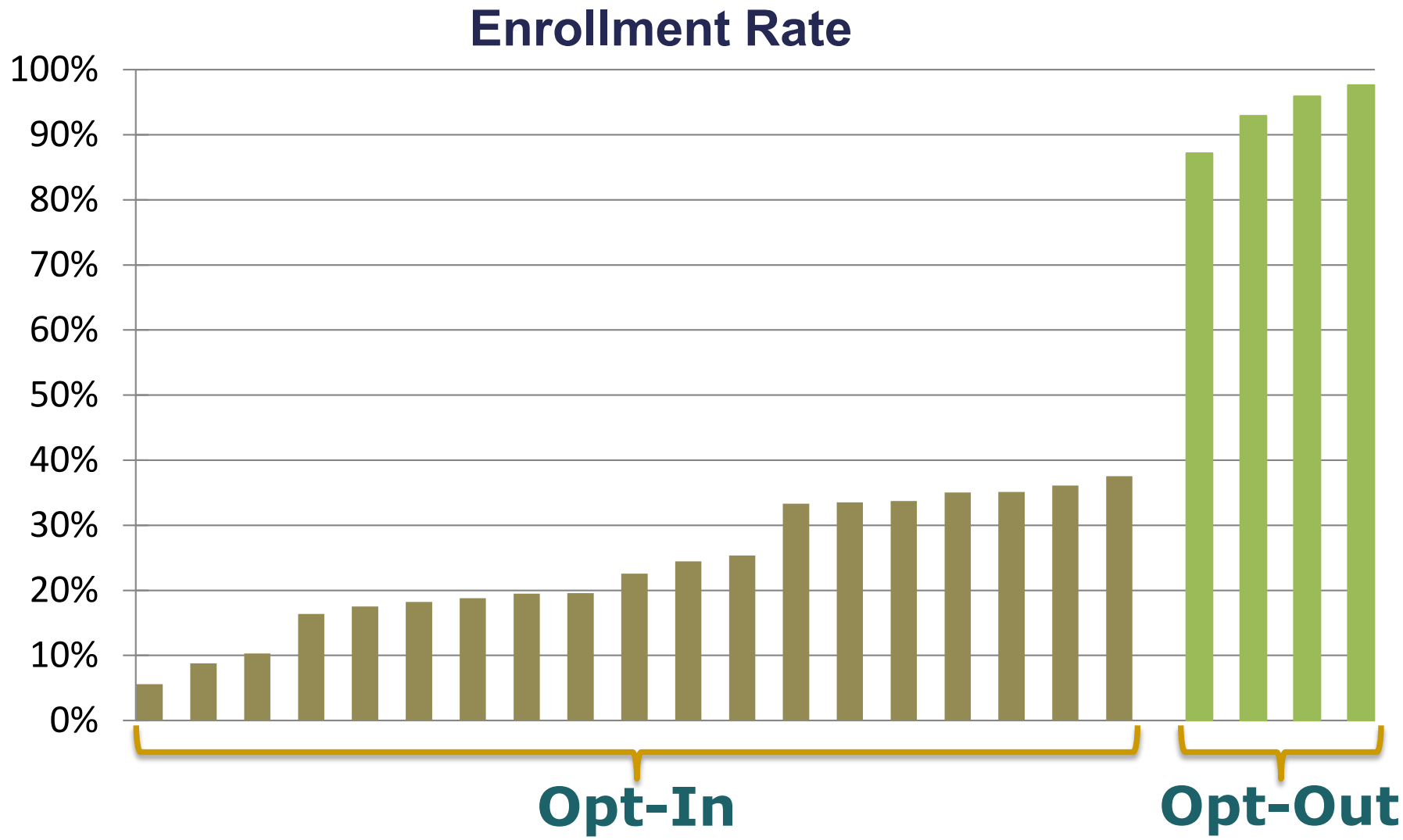
Enrollment Approach Concerns
Opt-In vs. Opt-Out



Source: Berkeley Lab Image Generator (2026)

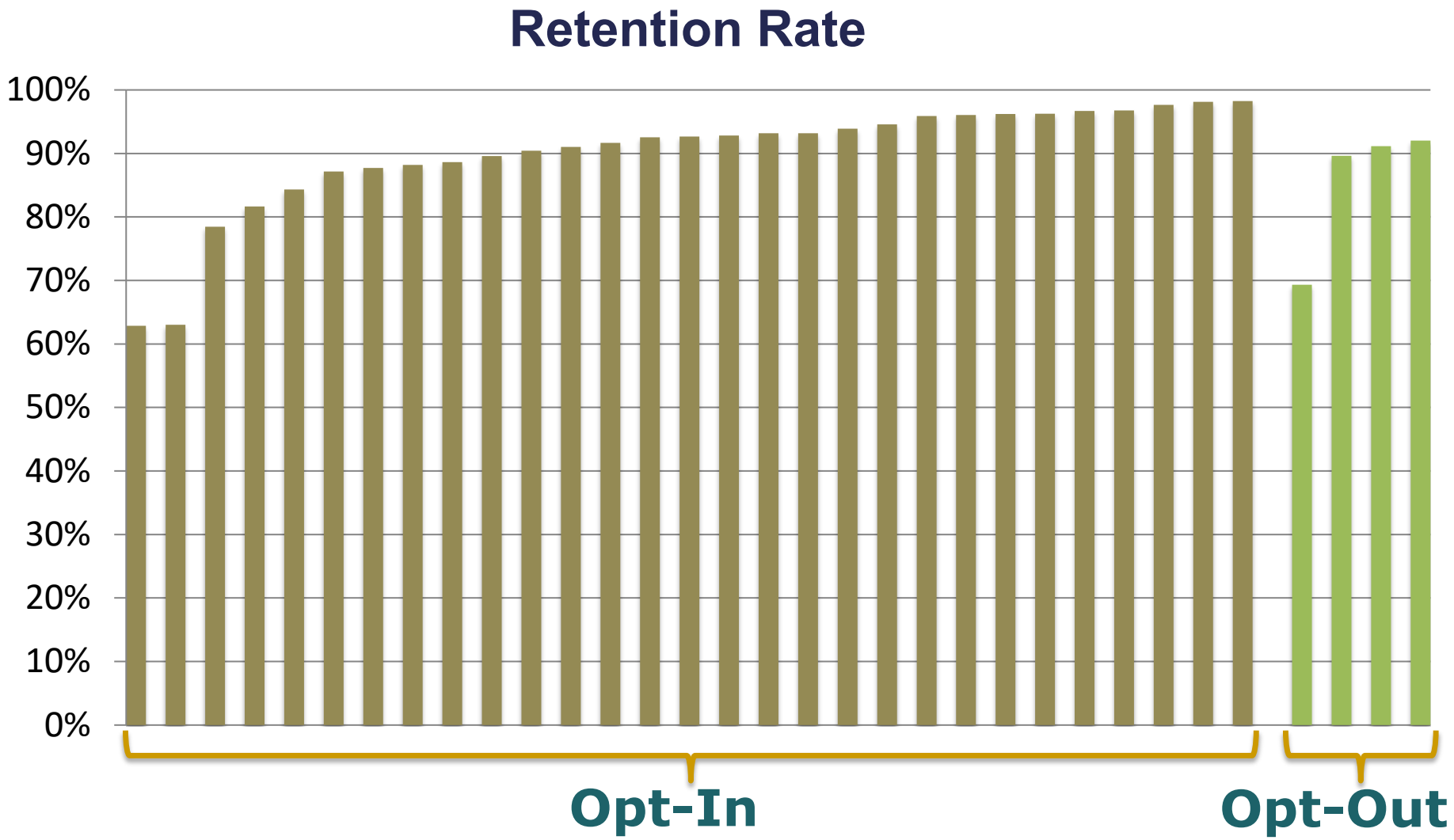
- Residential customers have been historically asked to volunteer (i.e., opt-in) to take service under TBR; but with the introduction of smart meters, a handful of states have made TBR the default (i.e., opt-out)
- Some consumer advocates and others have expressed concerns about using an opt-out method for exposing customers to TBR

Enrollment rates are orders of magnitude higher under opt-out vs. opt-in recruitment approaches



Source: Cappers (2016)

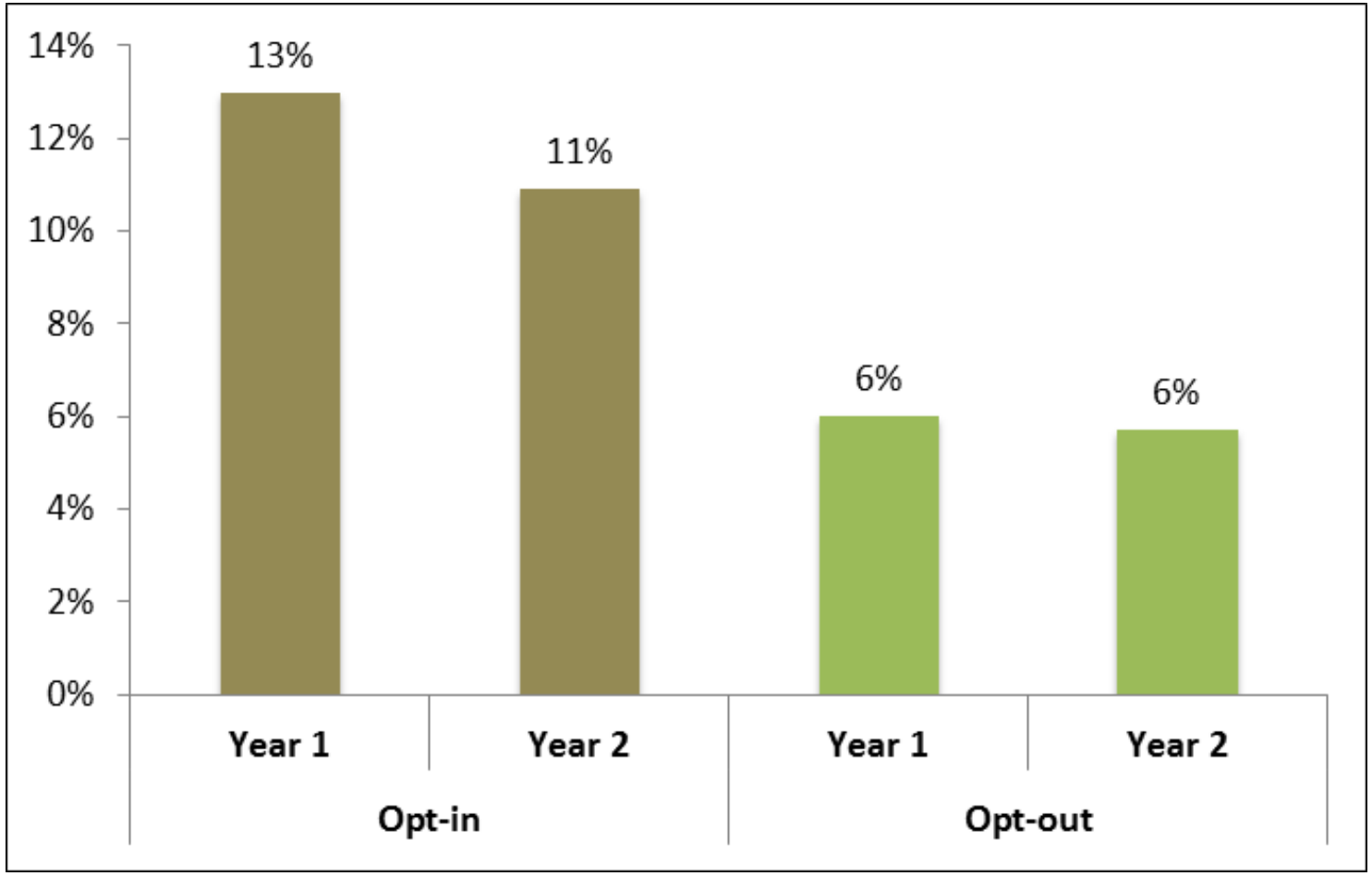
Recruitment approach has little to no impact on retention rates



Source: Cappers (2016)

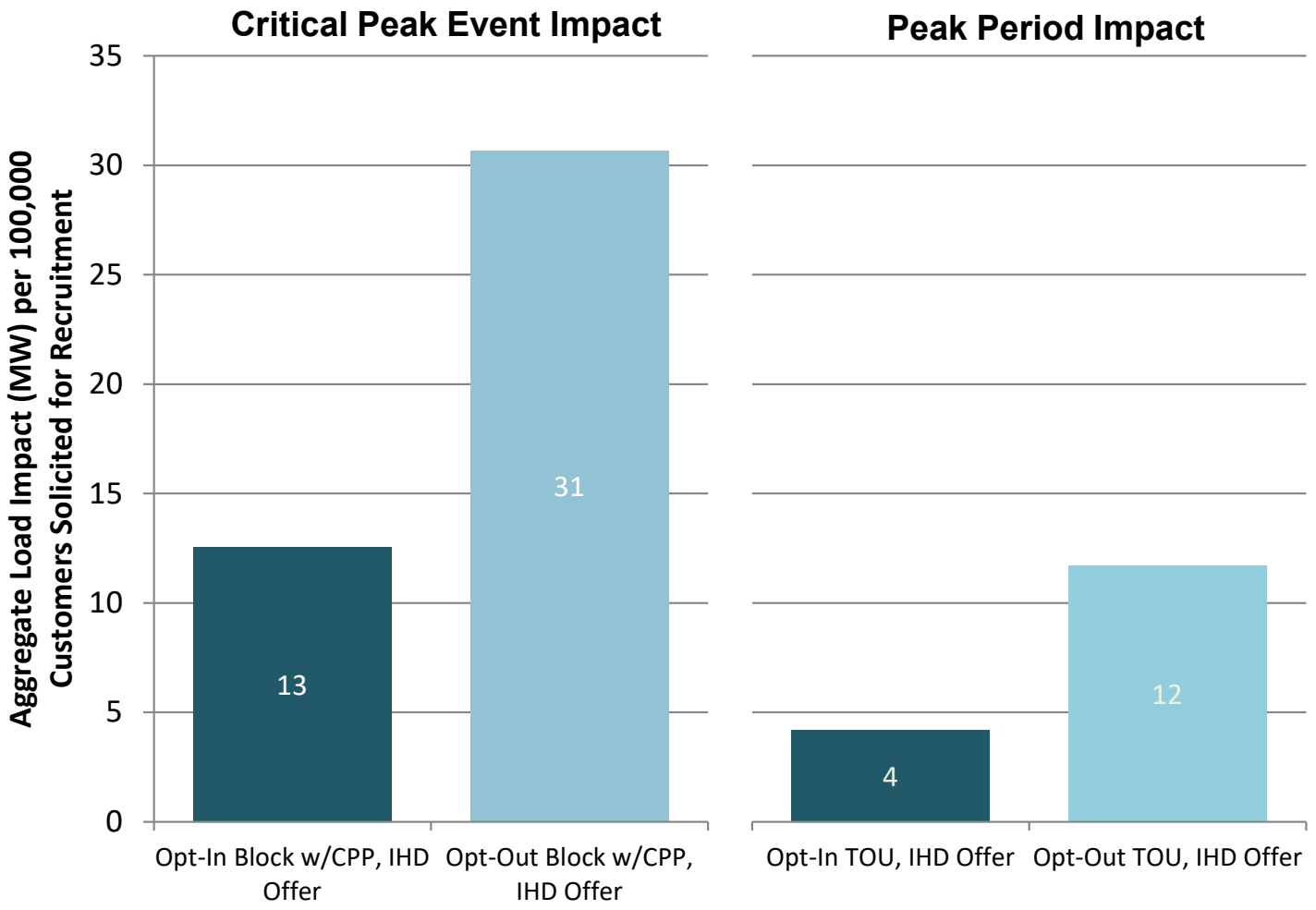
Opt-out customers produced lower per customer load impacts than opt-in

Peak Demand Reductions



Source: Cappers (2016)

Opt-out customers produced higher aggregate load impacts than opt-in

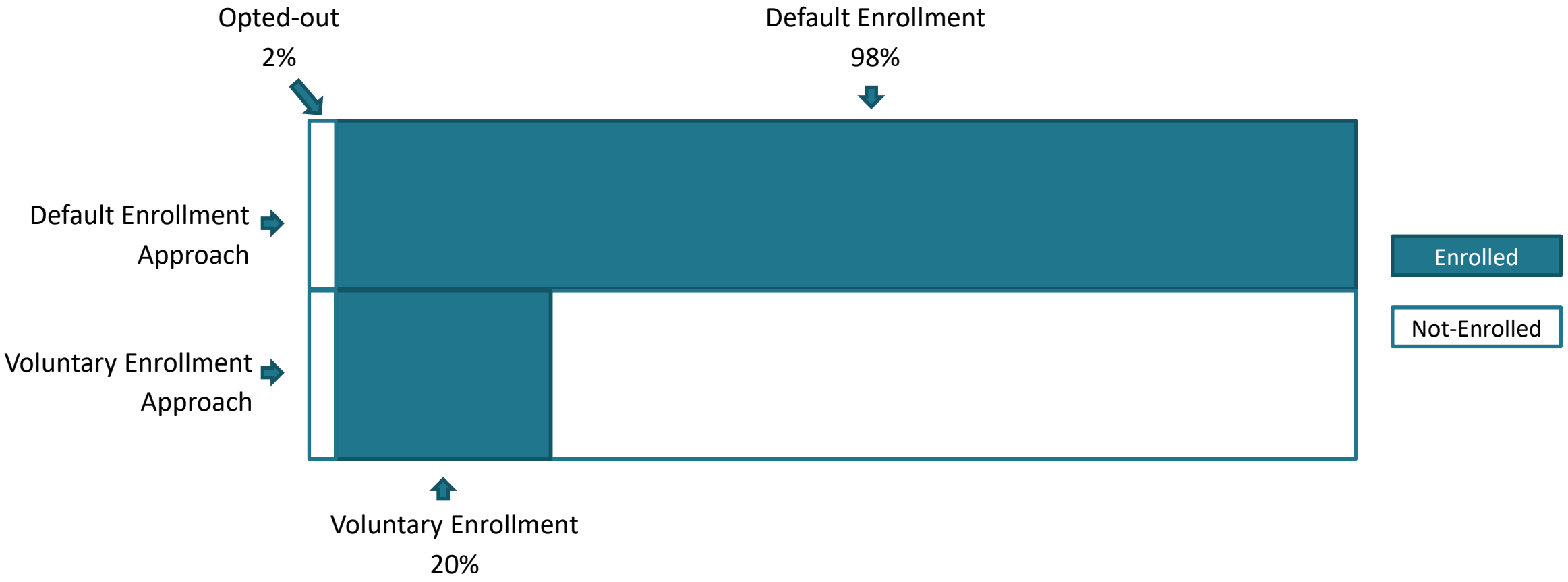


- SMUD simulated giving 100K customers same offer under opt-in and opt-out
- Opt-out aggregate impacts 2-3 times as large

*Source SMUD Interim Evaluation Report, 2013

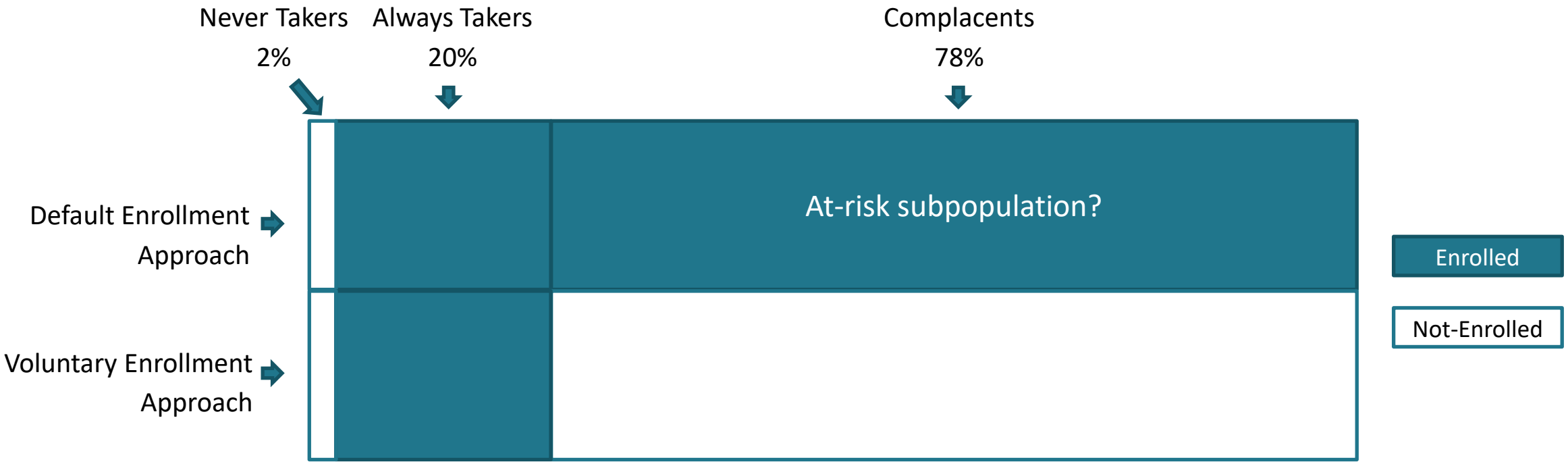
Source: Cappers (2016)

Representation of Customers under Voluntary vs. Default Enrollment



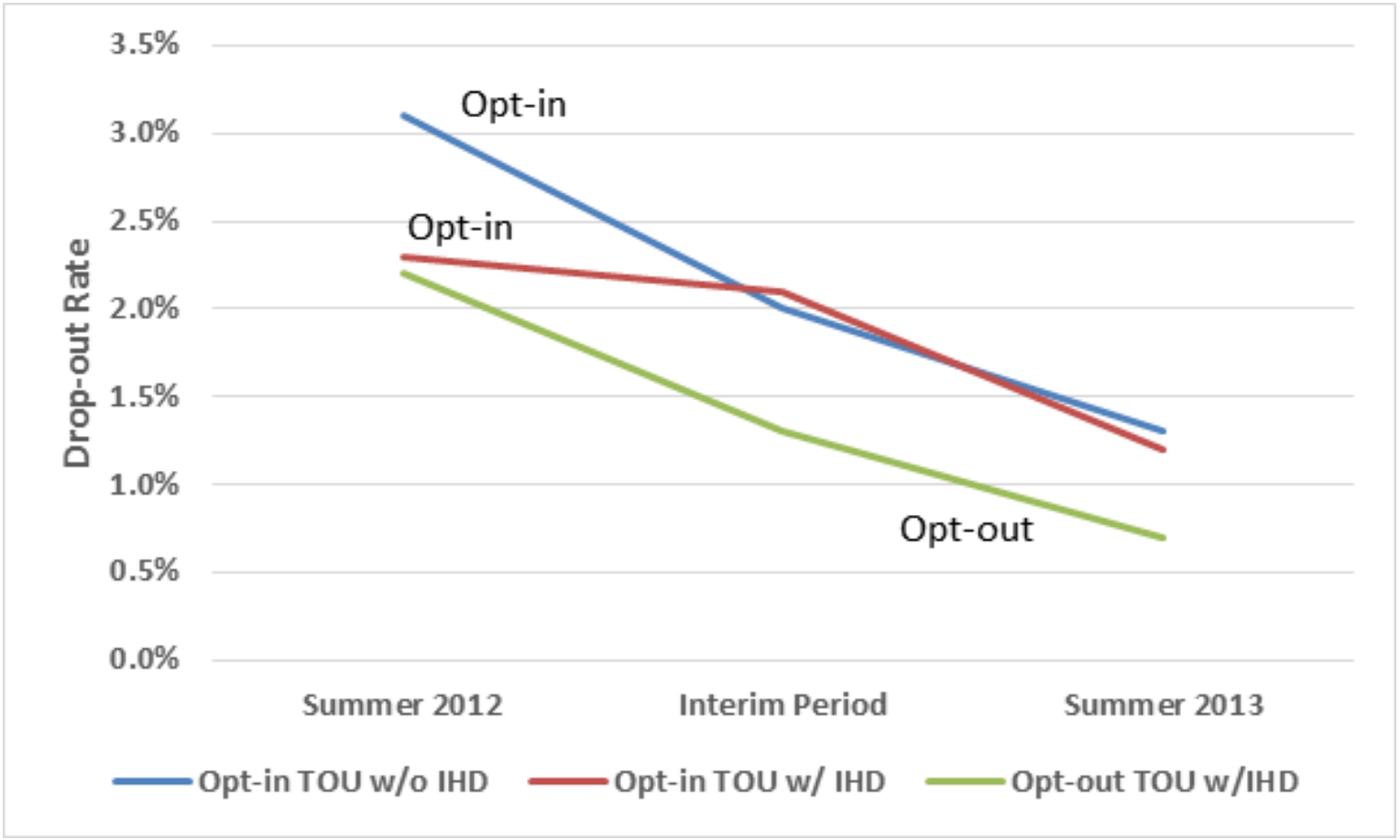
Source: Cappers (2016)

Representation of Customers under Voluntary vs. Default Enrollment



Source: Cappers (2016)

Similar Retention Rates Suggests *Complacents* Remained at a Higher Rate than *Always Takers*



Source: Cappers (2016)

Big Positive or Negative Bill Impacts Induce Customer Response – More so for *Always Takers* than *Complacents*

Source: Cappers (2016)

Questions?

This is Wallie ☺