RAP® Energy solutions for a changing world

# Rate Design Fundamentals and Seattle City Light

Seattle City Council
Energy and Environment Committee
July 25, 2017

Presented by Jim Lazar
RAP Senior Advisor

# Regulatory Assistance Project (RAP)

RAP is a global, non-profit team of experts focused on the long-term economic and environmental sustainability of the power sector.

We provide assistance to government officials on a broad range of energy and environmental issues.

Mostly assist state utility regulators, but Burbank and Austin are cities that have asked for our help.

# Jim Lazar

**Jim Lazar, Senior Advisor**

- Economist
  - Consulting practice in rate design and resource planning beginning 1979.
  - Based in Olympia, Washington
  - RAP since 1998

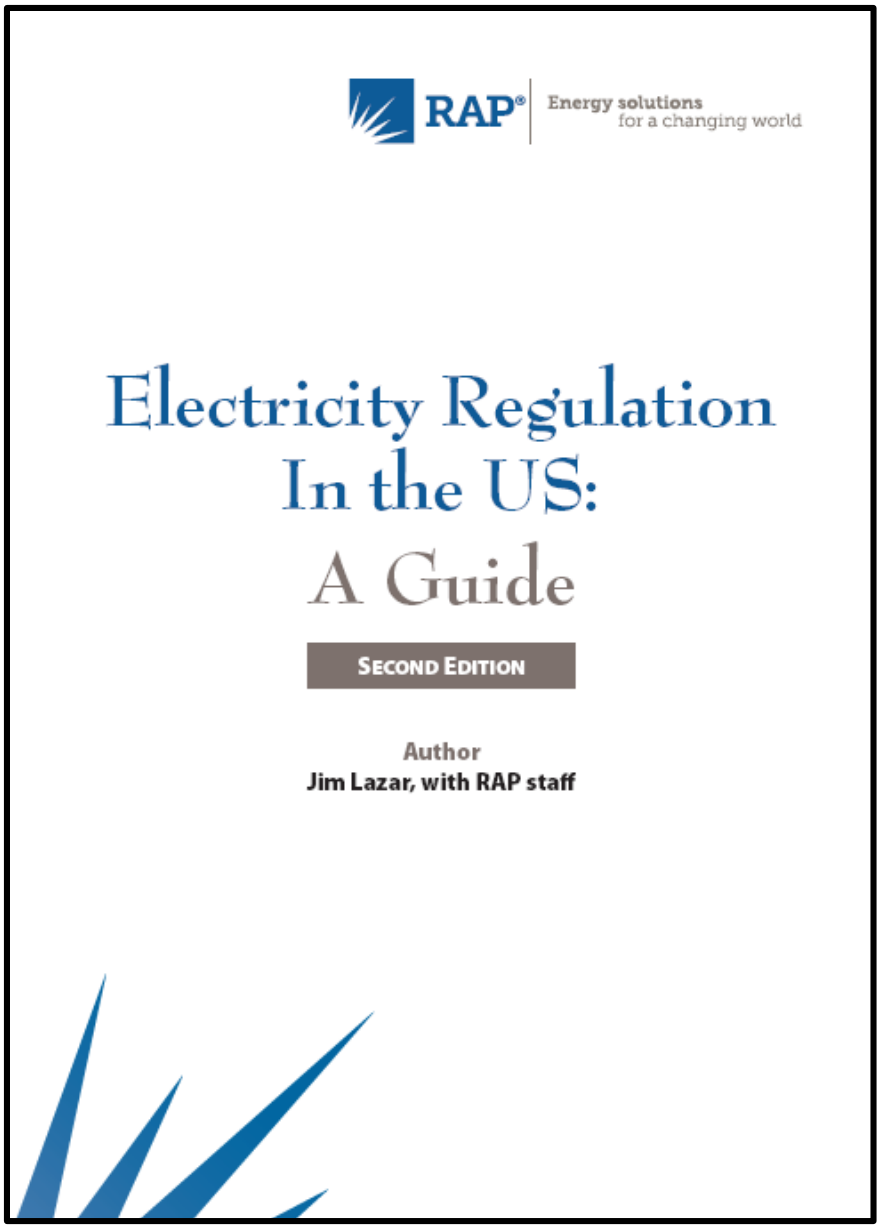
# Overview

- The Steps in Rate Design
  - Revenue Requirement
  - Cost Allocation Between Classes
  - Rate Design Within Classes
- Cost Allocation:  Dividing the Pie
  - Embedded Costs
  - Marginal Costs
  - "The Public Power Dividend"
- Residential Rates

# A Few Highlights From the RAP Publication Collection

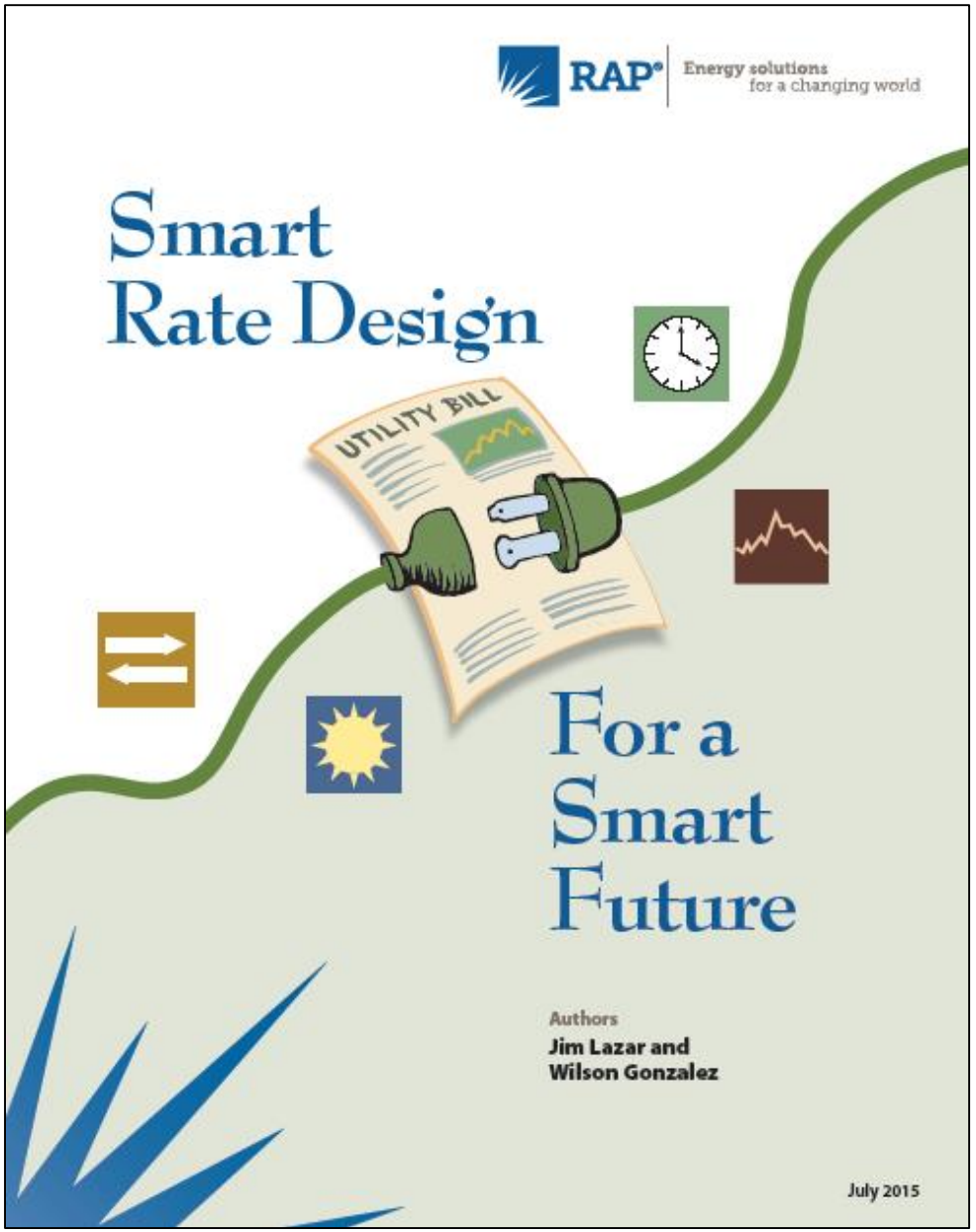
Available for Free Download
www.raponline.org

# The basics of regulation.



# Smart Rate Design:

# Rate design as though the future is important.

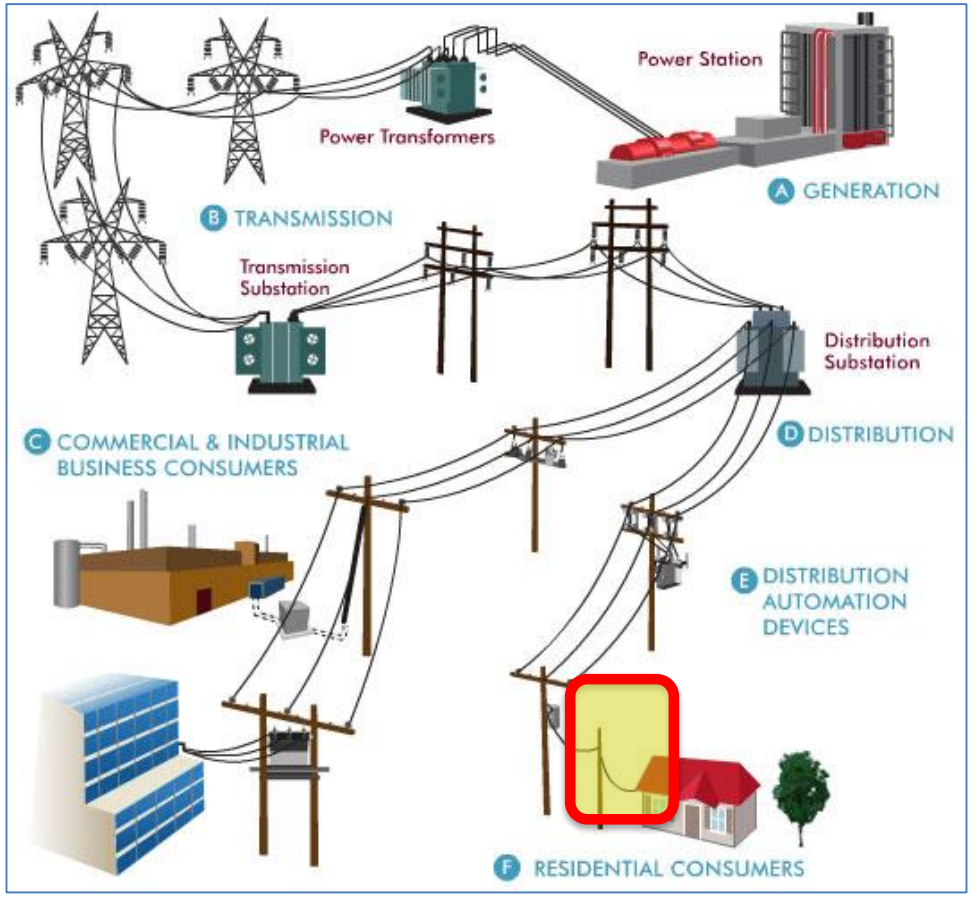


# People DO Understand Rate Design

# Three Guiding Principles for Rate Design

## Principle #1:

A customer should be allowed to connect to the grid for no more than the cost of connecting to the grid.



# Principle #2

Customers should pay for the grid and power supply in proportion to **how much they use,** and when they use it.

# Principle #2

Customers should pay for the grid and power supply in proportion to how much they use, and **when they use it.**

# Principle #3

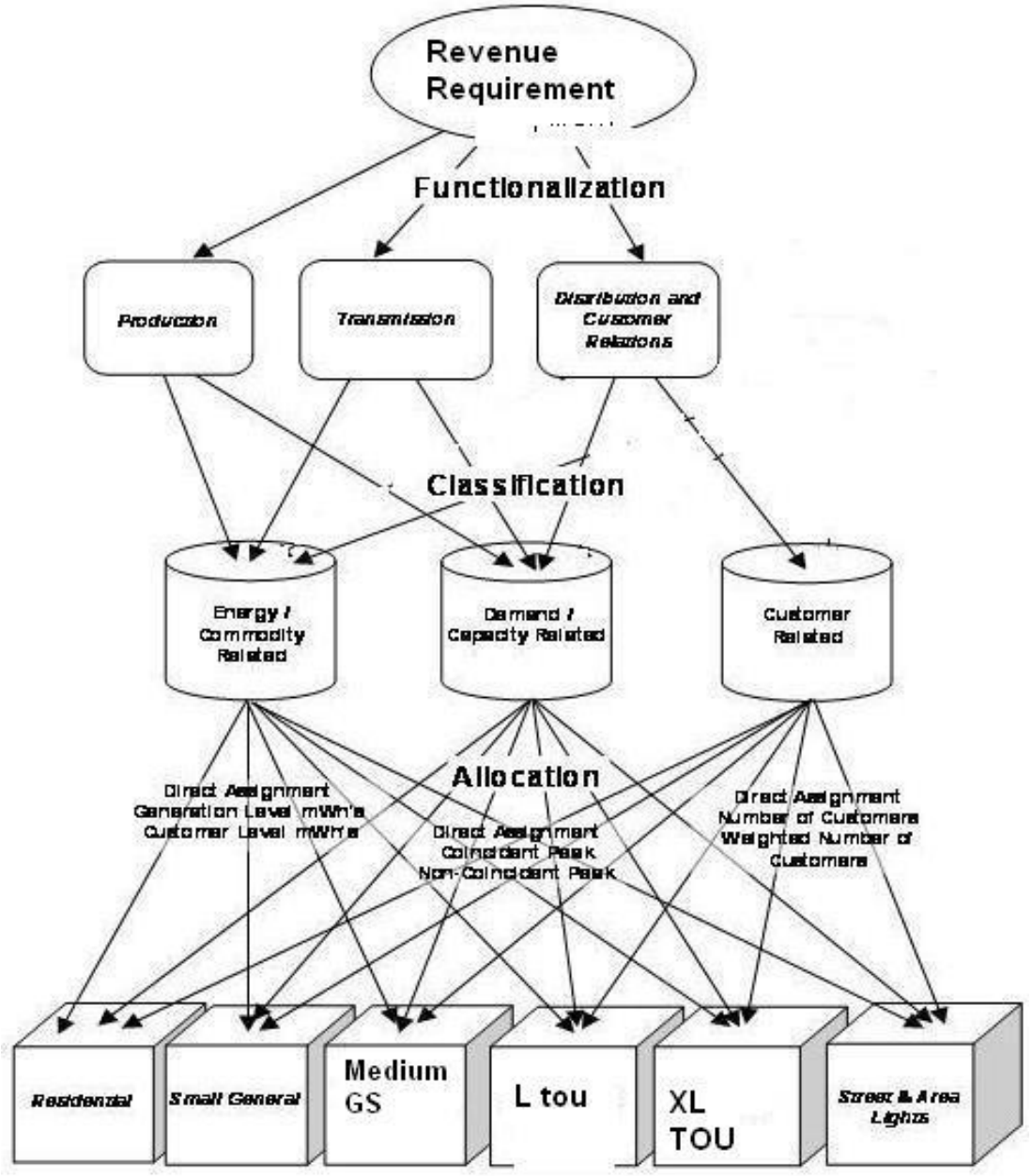
Customers delivering services to the grid should receive full and fair value –- no more and no less.

# Smart Rate Design

| Customer-Specific Charges | | |
|---|---|---|
| Customer Charge | $/Month | $ 3.00 |
| Transformer: | $/kVA/Mo | $ 1.00 |

| Bi-Directional Energy Charges | | |
|---|---|---|
| Off-Peak | $/kWh | $ 0.08 |
| Mid-Peak | $/kWh | $ 0.12 |
| On-Peak | $/kWh | $ 0.18 |
| Critical Peak | $/kWh | $ 0.75 |

# Cost Allocation



***"Allocation of costs is not a matter for the slide rule. It involves judgment of a myriad of facts. It has no claim to an exact science."***

Justice William O. Douglas
U.S. Supreme Court
Colorado Interstate Gas Co. v.
Federal Power Commission,
324 US 581, 589 (1945)

# Cost Allocation Framework

- Cost of Service Methods
  - Embedded Cost
  - Incremental Cost
  - Long-Run Marginal Cost
- Value of Service Methods
  - Compare to other utilities

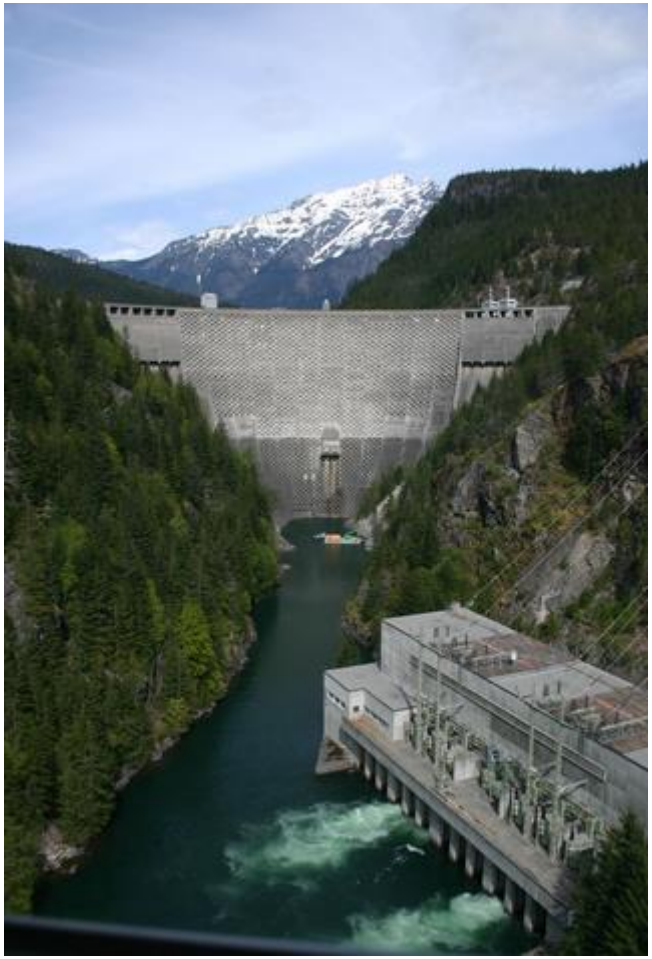
- There are as many methods as there are analysts preparing studies.

# Embedded Cost Methods Generation

- Peak Responsibility
  - Fixed Costs Classified as Demand or Customer
  - Variation:  Average and Excess Demand
    - Takes account of seasonal variations
- Peak and Average Demand
  - Classifies some costs to energy
- Base-Intermediate-Peak
  - Assigns “baseload” system costs to all hours
- Energy-Weighted
  - Classifies most costs to energy

# Generation

- Historical cost relatively cheap.
- Replacement cost much higher.
- ~40% of residential bill
- ~60% of industrial bill



# Transmission

- Connects remote generating facilities to system.
- Is purpose “peak” related or “energy” related?

# Distribution

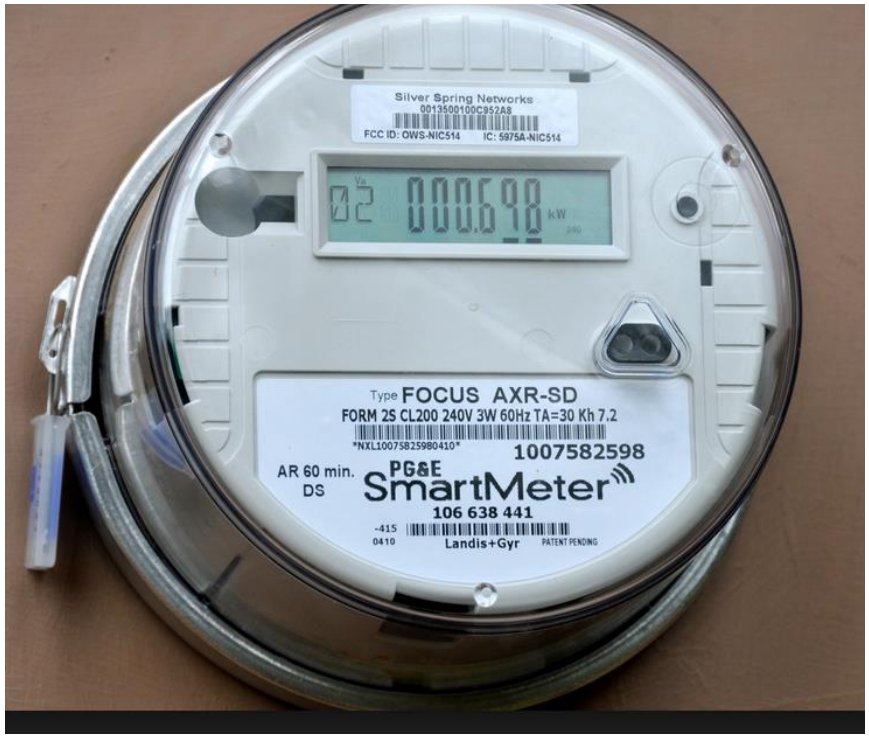
- Built to deliver **energy**.
- Designed to carry peak **demand**.
- Connects to every **customer**.

- **WHY** was the system built in the first place?

# Meters

**Historical:** used only for billing

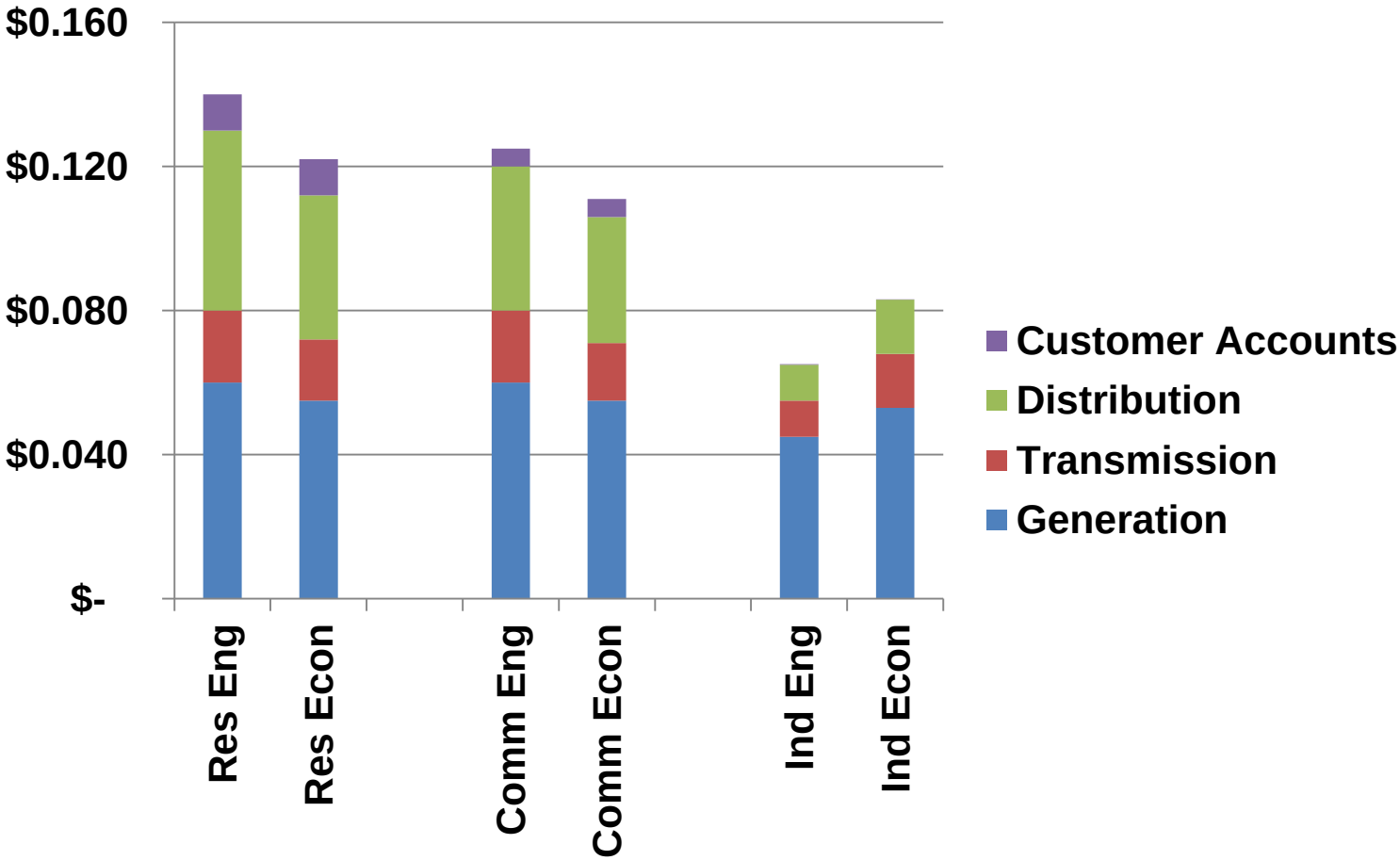
**Smart Meters:** Used for conservation program design, peak load management, reliability services, and billing



# Engineering vs. Economic Approaches

| Cost Category | Engineering Approach | Economic Approach |
|---|---|---|
| | | |
| Baseload Power Plants | Demand | ~75% Energy |
| Other Power Plants | Demand | ~50% Energy |
| Demand Response | Demand | Demand |
| Fuel / Purch. Power | Energy | Energy |
| Transmission | Demand | Mostly Energy |
| Substations | Demand | Demand |
| Poles, Wires, Xfmrs | Demand/Customer | Demand/Energy |
| Meters | Customer | Demand / Energy / Customer |
| Billing and Collection | Customer | Customer |

# Comparison of Results of Two Studies: Engineering vs. Economic



# Marginal Cost Approaches

- **Long-Run** Marginal Costs: ~$.15/kWh
  - All costs are variable
  - Full cost of system reproduction
- **Short-Run** Marginal Costs ~$.04/kWh
  - Existing Capital Facilities
  - Fuel and variable labor costs only
- **Intermediate** Time Frames
- **Mixed** Time Frames

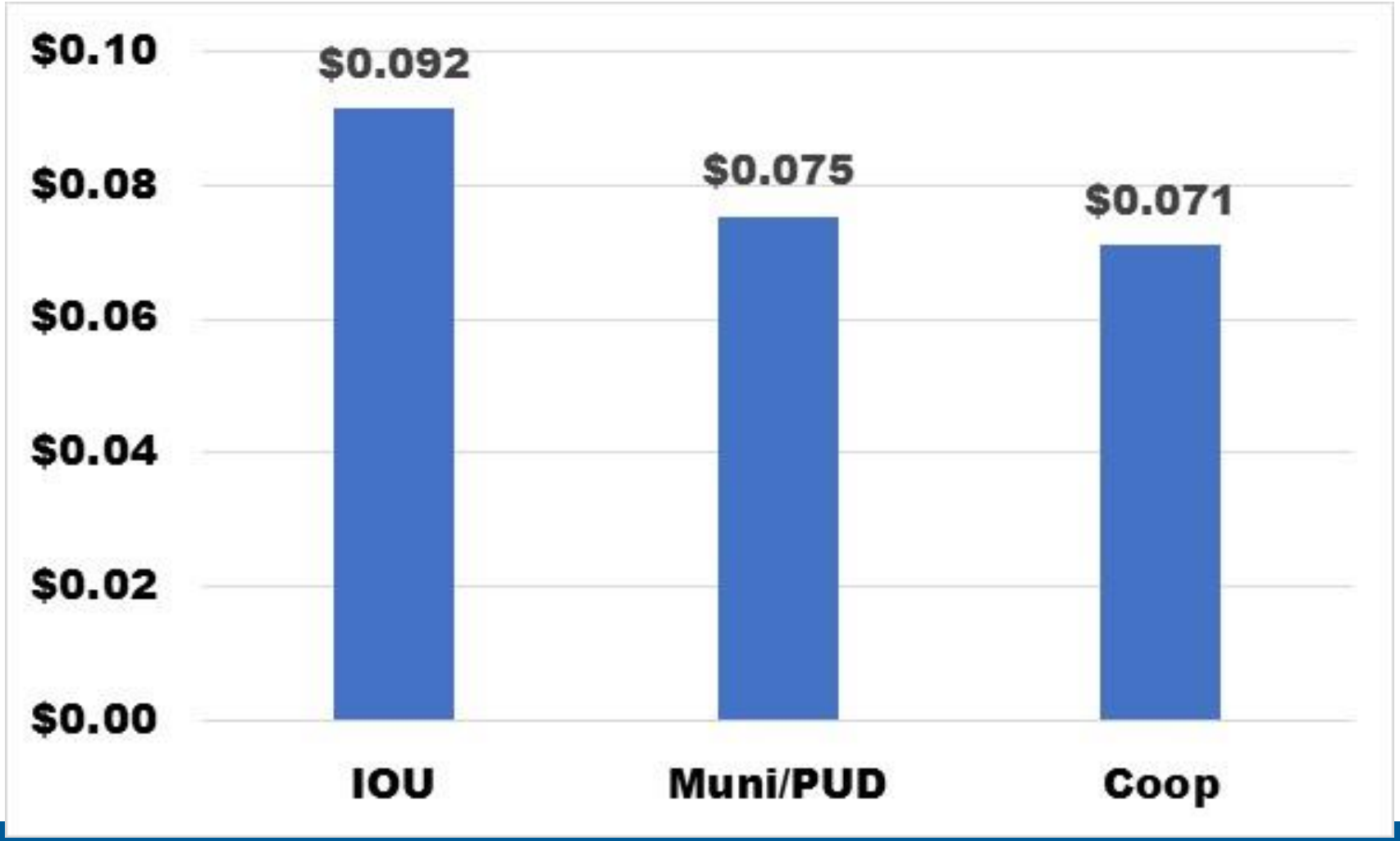
# Controversy in Marginal Cost Analysis

- Mixed time horizons
  - Short-run cost for energy (dispatch)
  - Long-run cost for peaking capacity and distribution investments
- Reconciliation to Revenue Requirement

# Value of Service Methods
# The "Public Power Dividend"

- Public power utilities are usually lower cost.
  - No shareholder profit
  - Lower cost of borrowing
  - Access to BPA preference power

# Relative Rates: 2014 USEIA Data
# State of Washington



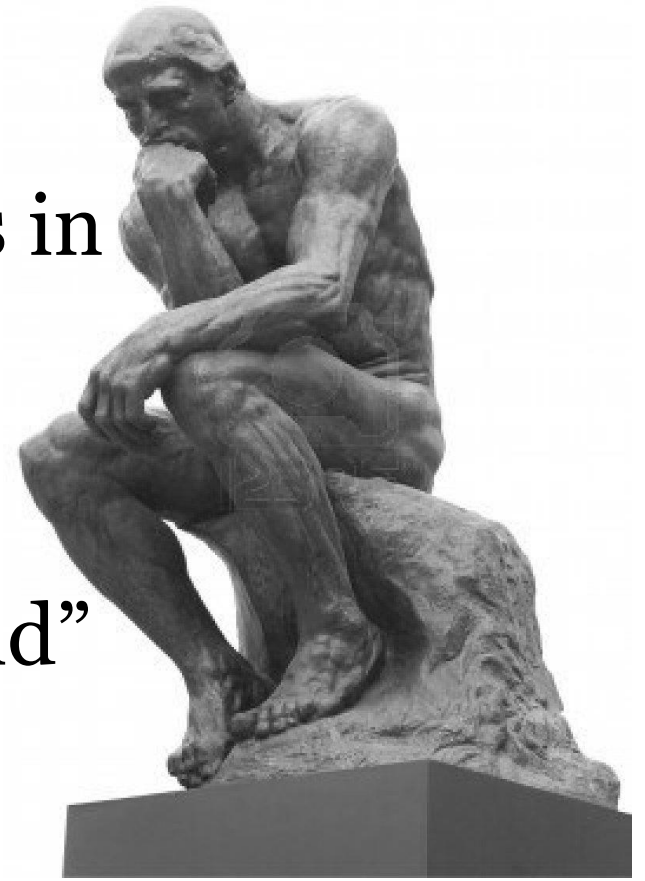
# Seattle vs. PSE 2014 USEIA Data

| | Seattle | Puget Sound Energy | Seattle % Lower than PSE |
|---|---|---|---|
| Residential | $ 0.087 | $ 0.097 | 9.7% |
| Commercial | $ 0.075 | $ 0.094 | 20.2% |
| Industrial | $ 0.064 | $ 0.088 | 27.7% |
| All Customers | $ 0.078 | $ 0.095 | 18.4% |

**Average Public Power Dividend: 18.4%**

# Bottom Line on Cost Allocation

- Many methods;
- "How" system is built vs. "Why" system is built results in very different conclusions.
- Multiple studies often considered.
- Is the "Public Power Dividend" being allocated equitably?
- There is no "right" way to compute this.



# Rate Design

# Rate Design is Full Of Inequities

- Single-Family vs. Multi-Family
- Urban vs. Suburban vs. Rural
- In-City vs. Outside City Limits
- Overhead vs. Underground
- New loads vs. existing loads
- Customer generation

# How Has Seattle Addressed These?

| Residential | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Rate Class** | **City** | **Shoreline** | **SeaTac** | **Tukwila** | **Burien** | **Lake Forest Park** | **Suburban*** |
| **Rate Code** | **RSC** | **RSH** | **RSE** | **RST** | **RSB** | **RSL** | **RSS** |
| First Block ($ | $0.0701 | $0.0722 | $0.0722 | $0.0719 | $0.0708 | $0.0708 | $0.0701 |
| End-Block ($ | $0.1288 | $0.1376 | $0.1376 | $0.1370 | $0.1351 | $0.1351 | $0.1288 |
| Base Service | $0.1621 | $0.1751 | $0.1751 | $0.1743 | $0.1718 | $0.1718 | $0.1621 |
| Undergrounding ($/kWh) | | $0.0007 | | | $0.0037 | | |
| | | $0.0017 | | | $0.0013 | | |
| | | $0.0018 | | | | | |
| | | $0.0005 | | | | | |
| | | $0.0022 | | | | | |

# Most Important Inequity To Study

- Single-Family vs. Multi-Family
- Urban vs. Suburban vs. Rural
- In-City vs. Outside City Limits
- Overhead vs. Underground
- New loads vs. existing loads
- Customer generation

# Basic Residential Rate Forms

**Three Basic Rate Designs**

| Rate Designs | Flat Rate | Inclining Block Rate | Straight Fixed/ Variable Rate |
|---|---|---|---|
| Customer Charge $/month | $5.00 | $5.00 | $30.00 |
| First 500 kWh/month | $0.085 | $0.070 | $0.060 |
| Next 500 kWh/month | $0.085 | $0.100 | $0.060 |
| Over 1000 kWh/month | $0.085 | $0.140 | $0.060 |

# Fixed or "Customer" Charges

- Customer-specific costs
  - Billing
  - Collection
  - Customer Service
- Typically $5 - $10/month
- California:  Zero or very low
- Seattle:  PURPA decision: Zero;
  Now $5/month

# What Costs **Change** With Number of Customers?

- Poles?
- Underground Conduit?
- Conductors?
- Transformers?
- Meters?
- Billing and Collection?
- Customer Service?

# The Controversy

- Inclusion of distribution costs in fixed charges.

*"Costs such as meter reading, billing, the cost of meters and service drops, are properly attributable to the marginal cost of serving a single customer. The cost of a minimum sized system is not."*

*WUTC Docket U-89-2688*

# Illustrative Customer Charges (2016)

| Customer Charges: Largest U.S. Utilities | | |
|---|---|---|
| Pacific Gas & Electric Co. | CA | None |
| So Cal Edison | CA | $0.87 |
| Public Service E&G | NJ | $2.43 |
| Detroit Edison Co | MI | $6.00 |
| Virginia Electric Power | VA | $7.00 |
| Florida Power & Light Co | FL | $7.24 |
| Georgia Power Co | GA | $9.00 |
| Commonwealth Edison Co | IL | $15.06 |
| Consolidated Edison | NY | $15.76 |

These utilities serve one in six Americans.

# The Most Common Residential Rate Design: Inclining Block

- About 60% of World Population
  - All of China
  - Nearly all of India
  - All of Indonesia, Mexico, Brazil
  - Most of Central/Eastern Europe
  - Most of Western US

# The Most Common Residential Rate Design: Inclining Block

- Goals include:
  - Allocation of low-cost resources (hydro)
  - Large use customers are “peak” oriented
  - Encouragement of conservation
  - Essential needs at affordable cost
  - Low-income benefits

# Pacific Gas and Electric Company

| | |
|---|---|
| Total Energy Rates ($ per kWh) | |
| Baseline Usage | $0.19979 (I) |
| 101% - 400% of Baseline | $0.27612 (I) |
| High Usage Over 400% of Baseline | $0.40139 |
| Delivery Minimum Bill Amount ($ per meter per day) | $0.32854 |

**"Baseline" quantity determined by housing type and climate zone**

**No Fixed Customer Charge; $10/month minimum bill**

# Issues With Inclining Block Rates

- Single-Family vs. Multi-Family
  - Different Baseline Allowances
- Imperfect metric of peak orientation
  - TOU rates more accurate

# Impact of Different Rate Forms on Customer Usage

- Inclining Block:

  ~ 60% of customers representing ~80% of usage see the tail block as their marginal cost.

  ~80% of usage has an incentive to constrain usage.

  ~Typical savings are ~10% of consumption.

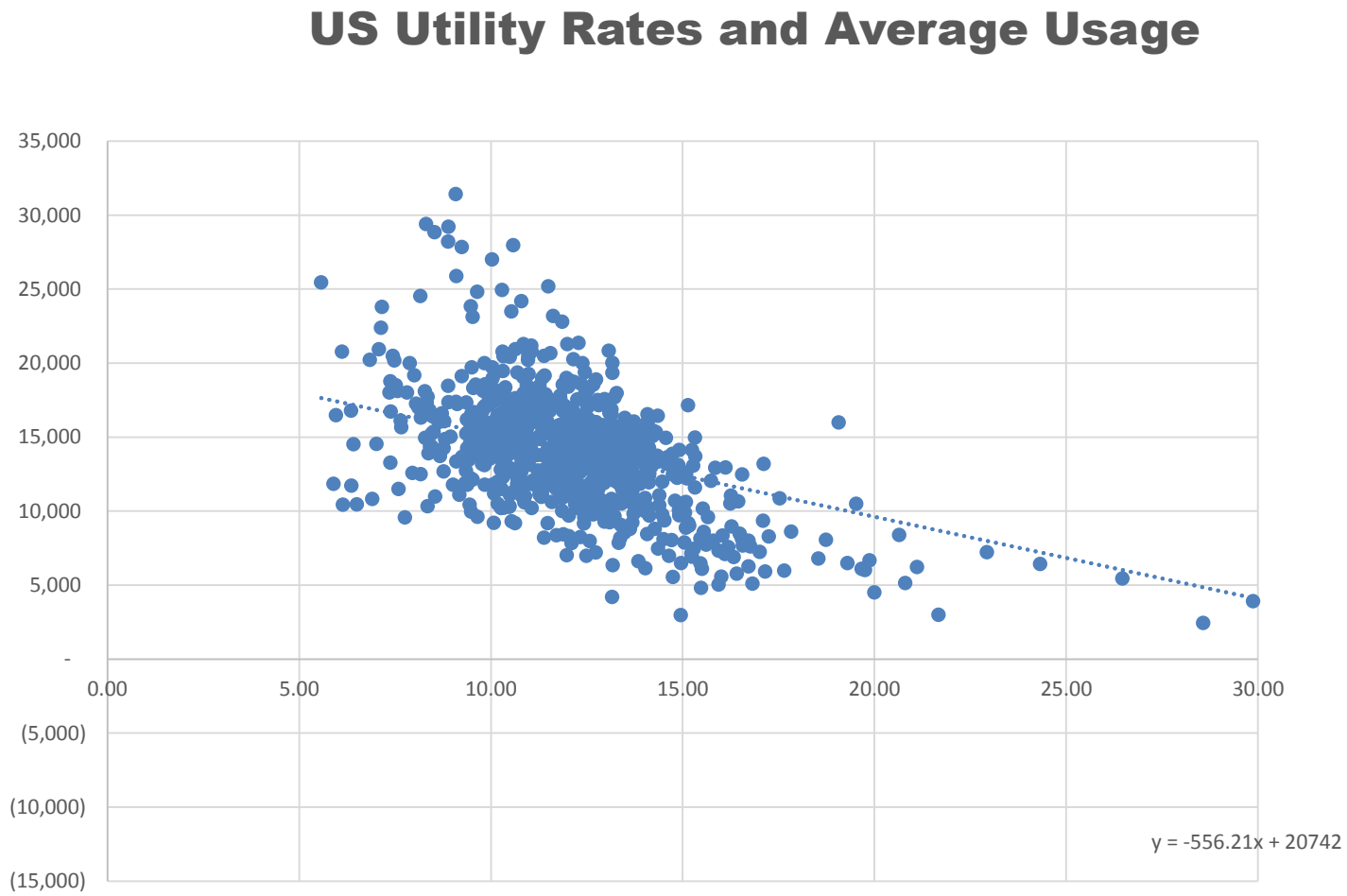
# Impact of Different Rate Forms on Customer Usage

- High Fixed Charge

  A $10/month increase means a $.015/kWh decrease = about 15%

  A 15% decrease in the per-kWh charge yields a 3% to 10% increase in usage.

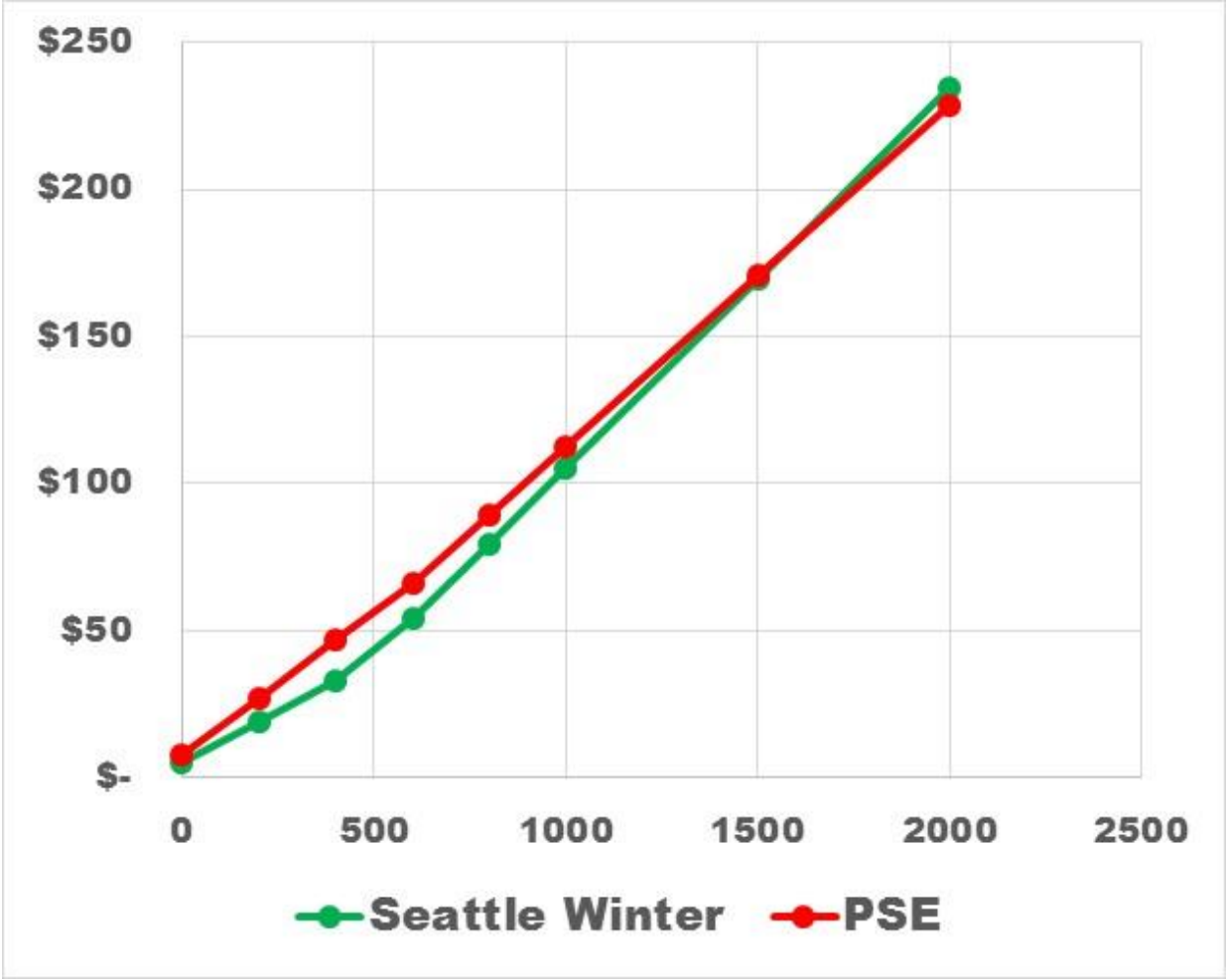
# Relationship Between Average Rate and Average Usage



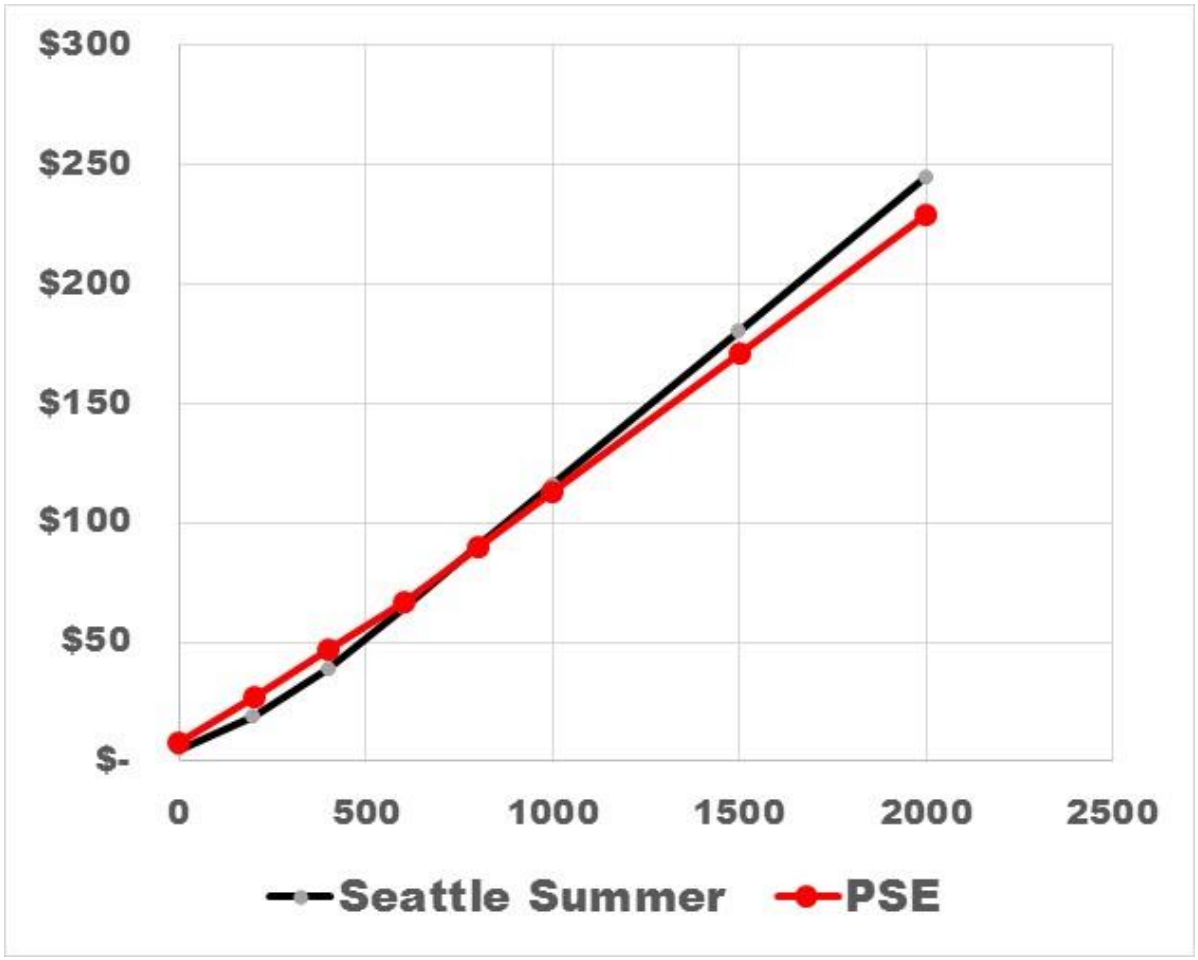
# SCL vs. PSE Residential Rates

| | Seattle Winter | Seattle Summer | PSE |
|---|---|---|---|
| Customer Charge | $ 4.86 | $ 4.86 | $ 7.87 |
| First 300 kWh | $ 0.070 | $ 0.070 | $ 0.098 |
| Next 180 kWh | $ 0.070 | $ 0.129 | $ 0.098 |
| Next 120 kwh | $ 0.129 | $ 0.129 | $ 0.098 |
| Over 600 kWh | $ 0.129 | $ 0.129 | $ 0.116 |

# The "Public Power Dividend" within the Residential Class



# The "Public Power Dividend" within the Residential Class



# Summary on Rate Design

- Low customer charge encourages low usage
- High fixed charge particularly unfair to apartment dwellers
- Inclining block rate reflects per-customer allocation of SCL hydro benefits and policy goal for essential service at an affordable cost.
- **Rates Matter**

# People DO Understand Rate Design

# About RAP

that power

The Regulatory Assistance Project (RAP) is a global, non-profit team of experts focuses on the long-term economic and environmental sustainability of the sector. RAP has deep expertise in regulatory and market policies that:

- Promote economic efficiency
- Protect the environment
- Ensure system reliability
- Allocate system benefits fairly among all consumers

Learn more about RAP at www.raponline.org

**Jim Lazar: jlazar@raponline.org**
**360-786-1822**