RAP Energy solutions for a changing world

Demand Charges: Pathway or Detour?

RAP Webinar

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Jim Lazar, RAP

Sean Swe, Burbank Water and Power

The Regulatory Assistance Project

50 State Street, Suite 3
Montpelier, VT 05602

Phone: 802-223-8199
www.raponline.org

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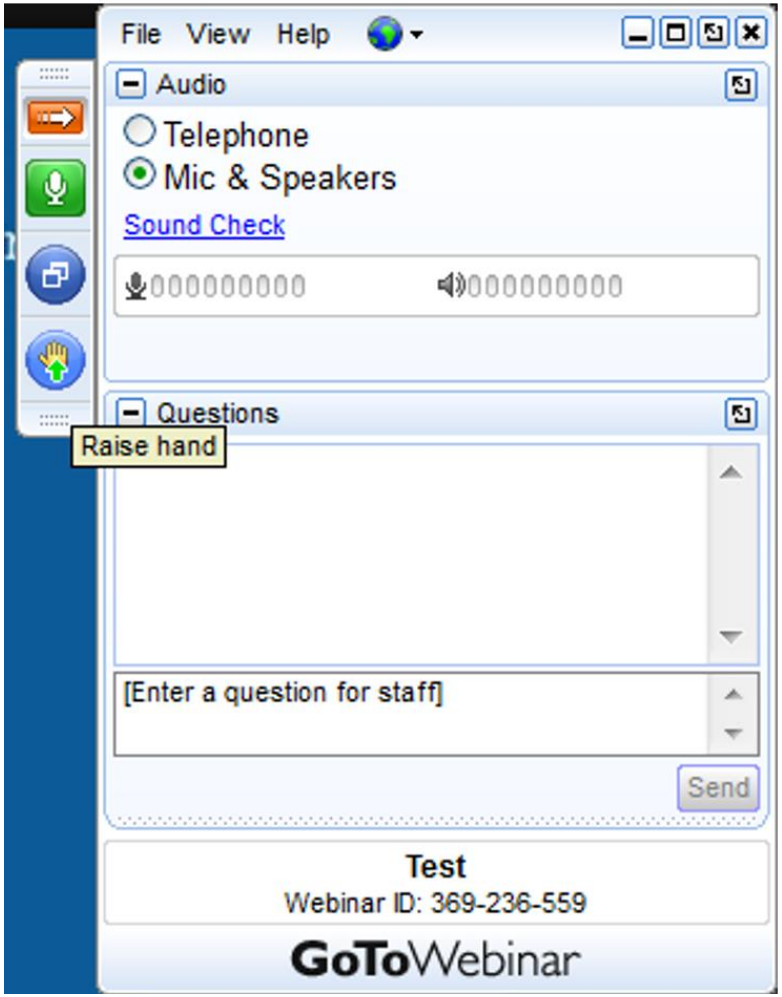
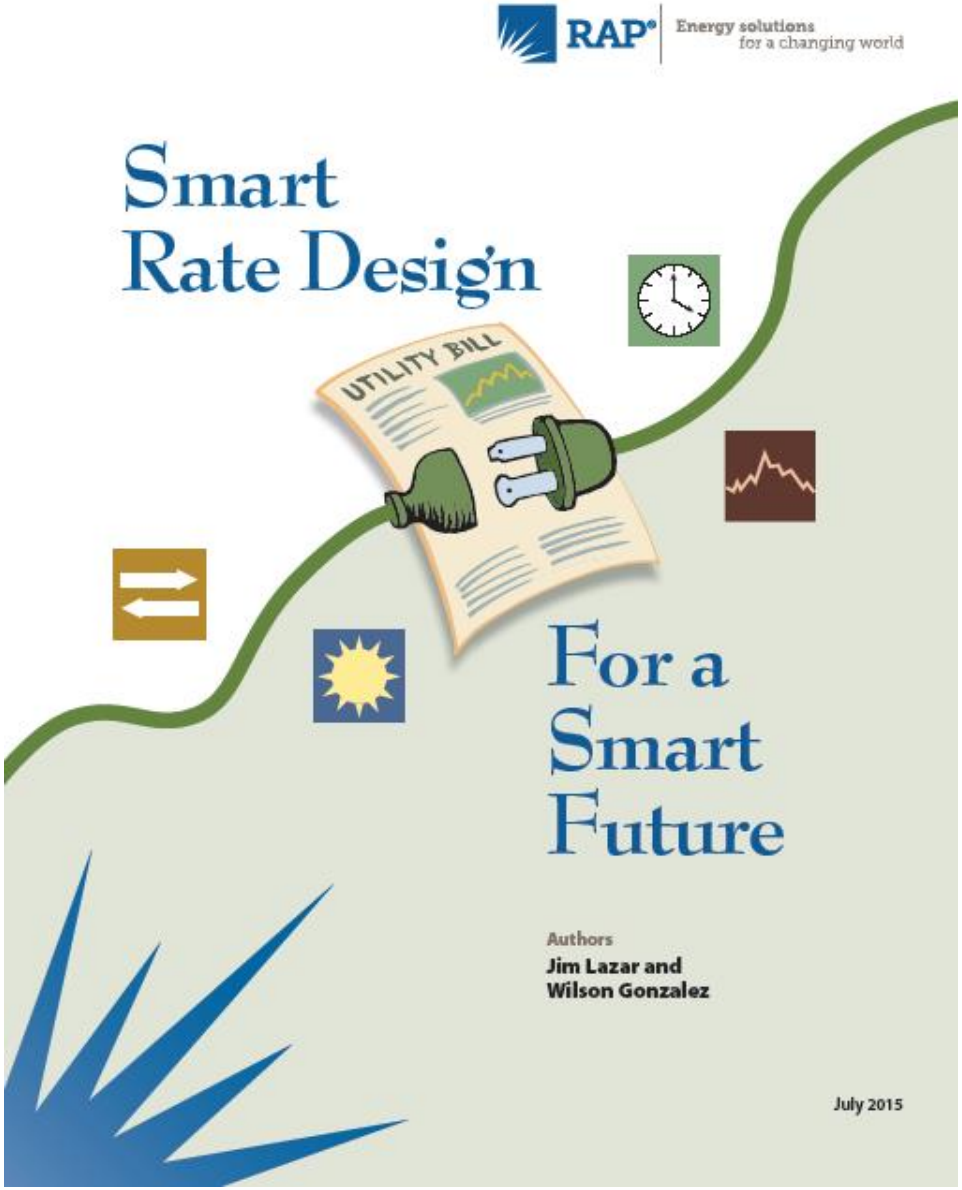


Topics

- What is a Demand Charge?
- Coincident and Non-Coincident Peak Demand
- Diversity
- Special Issues With Residential Demand Charges
- Burbank Experience: Service Size Charge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Authors
Jim Lazar and
Wilson Gonzalez
July 2015

What is a Demand Charge?

A monthly charge imposed based on the customer's highest usage during the month or portion of the month.

- Applied to kW (or kVA)
- Typically based on the highest 1-hour usage or the highest 15 minutes of usage during the month.

Terminology

kW: Kilowatt - Usage at the rate of 1,000 watts of electricity

CP: Coincident Peak - Usage at the time of the system peak demand

NCP: Non-Coincident Peak - Highest usage by the customer at any time during the month

Terminology

Load Factor: The ratio of average usage over a period to peak period usage during that same period.

Ratchet: Year-round demand charge based on highest usage during the year (or the peak season).

Typical Large Commercial Rate **Non-Coincident Peak** Demand Charge

Basic Tariff For Large Commercial Customer	
Rate Element	**Price**
Customer Charge $/month	$20.00
Demand Charge $/kW/month	$10.00
Energy Charge $/kWh	$0.08

Illustrative **Coincident Peak** Demand Charge Rate

			Summer	Winter
Customer Charge			$ 10.00	$10.00
Demand: 4 PM - 8 PM				
$/kW			$ 10.00	$ -
Energy Charge:			$ 0.08	$ 0.08

Calculation of a Demand Charge

		All Distribution Capacity		Transformers, Services Only
Capital Costs		$ 100,000		$ 10,000
O&M Expense		$ 35,000		$ 5,000
Total		$ 135,000		$ 15,000
Sum of Annual Customer Billing Demands		15,000		15,000
Demand Charge	$/kW	$ 9.00		$ 1.00

Demand Charges: History

Commercial demand charges were devised when we could not do interval metering.

Customer maximum demand was a proxy for contribution to peak.

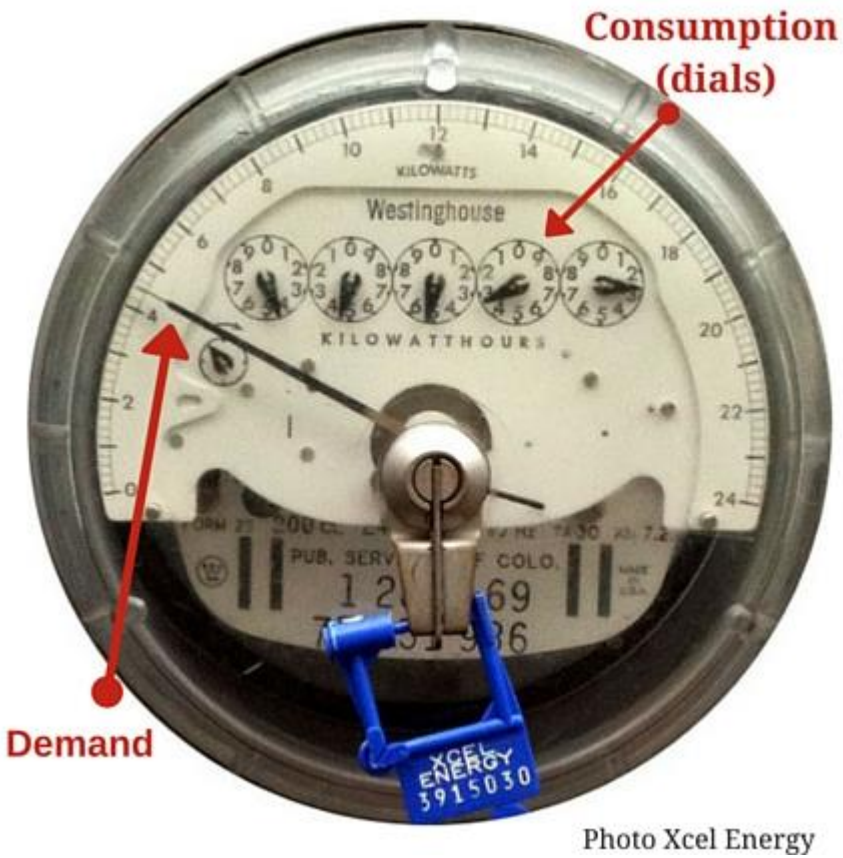


Photo Xcel Energy

Demand Charges: History

The idea was to recover "capacity" costs through a "capacity" charge.

When all power sources had about the same cost, this was a reasonable way to assign capacity-related costs.

We Do Things Differently Now

Baseload Thermal

Baseload Renewable

Intermediate Thermal

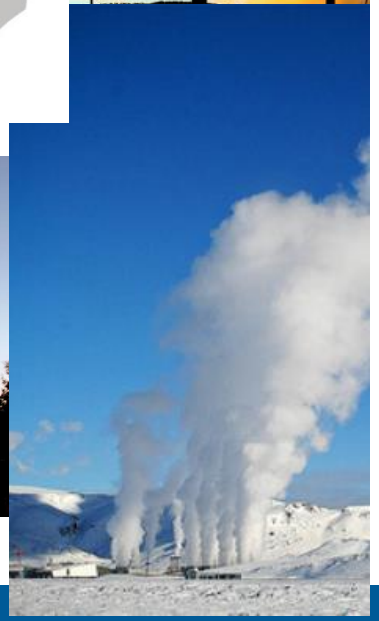
Peaking Thermal

Variable Renewable

Demand Response

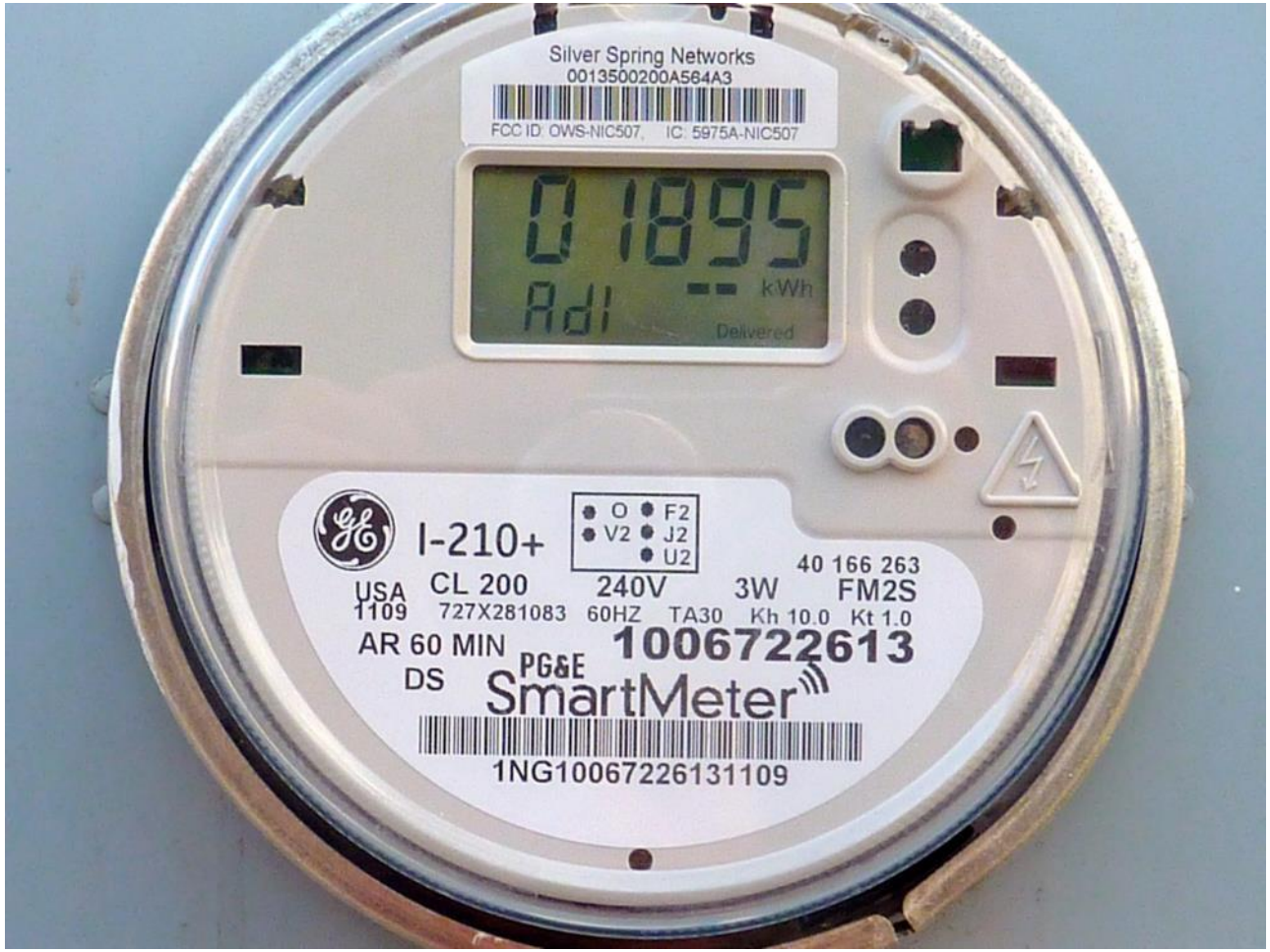
Central Batteries

Distributed Batteries



ENERNOC

We Can Do Better Now



Clarifying Questions?

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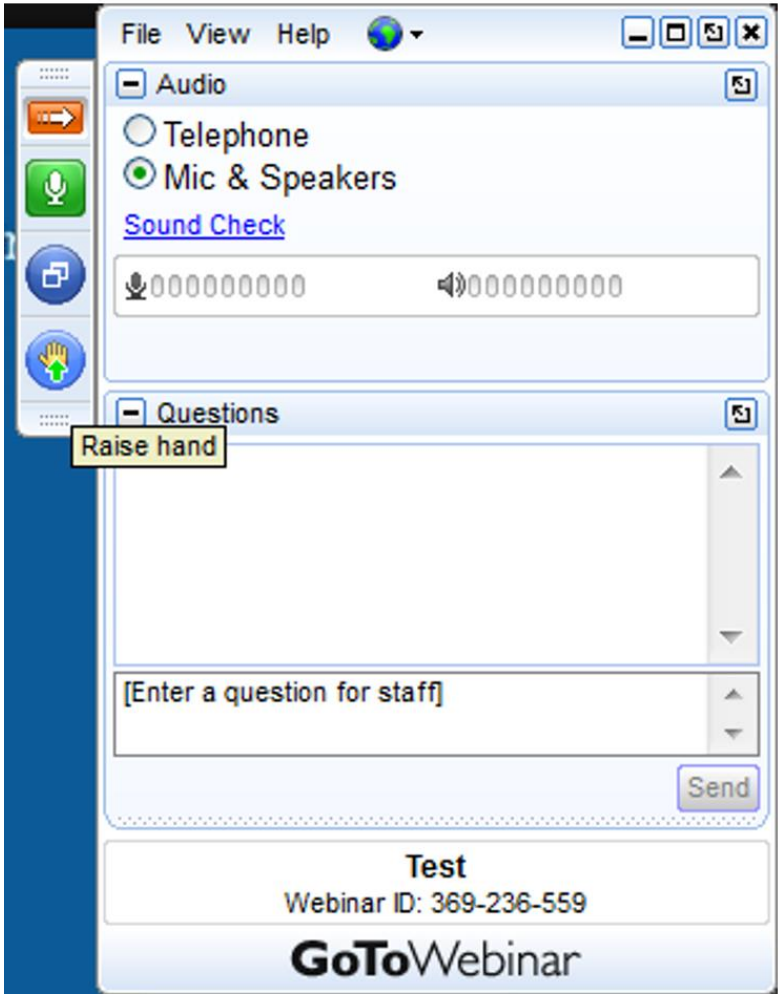


Black Hills Power and Light
NCP Residential Demand Charge Rate

Customer Charge	**$/month**	**$ 13.00**
Demand Charge	**$/kW NCP**	**$ 8.10**
Energy Charge	**$/kWh**	**$ 0.0591**

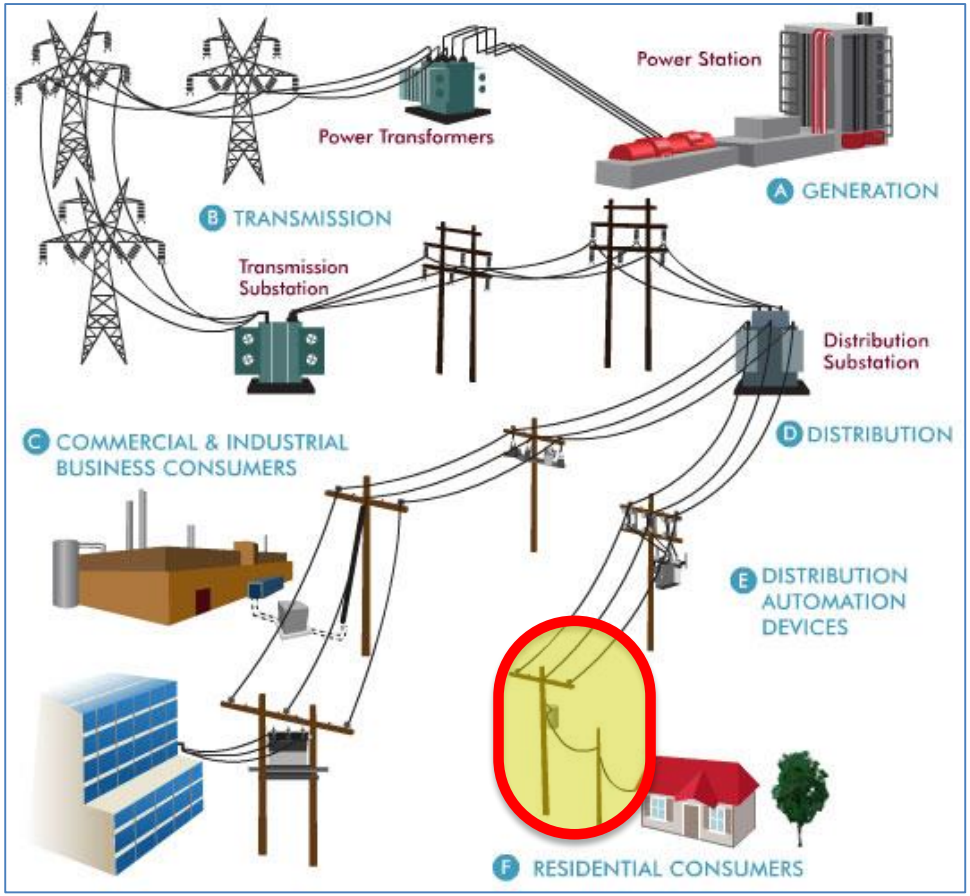
Example Residential NCP Demand Charge Rate: Georgia Power

			Summer	Winter
Customer Charge			$ 10.00	$ 10.00
Demand Charge:			$ 6.53	$ 6.53
Energy Charge:				
	On-Peak:		$ 0.135	$ 0.129
	Off-Peak		$ 0.049	$ 0.042

The Basic Issue: Very Few Costs Are Related To Customer-Specific Demand

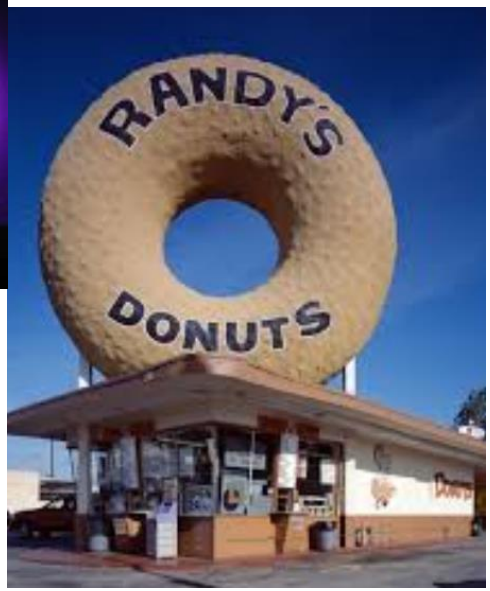
Most of the distribution system is shared, and sized to the group **coincident** demand.

Only the connection to the system is sized based on customer **non-coincident** demand.



Lower Load-Factor Customers Can Share Capacity

- Morning loads
- Evening loads
- 24/7 loads
- Both CP and NCP rates unfair to shared demand customers.



High School Stadium Lighting: The Caricature of the Problem

CP: None

NCP: 1% Load Factor

Demand Charges Shift Costs to Occasional Users

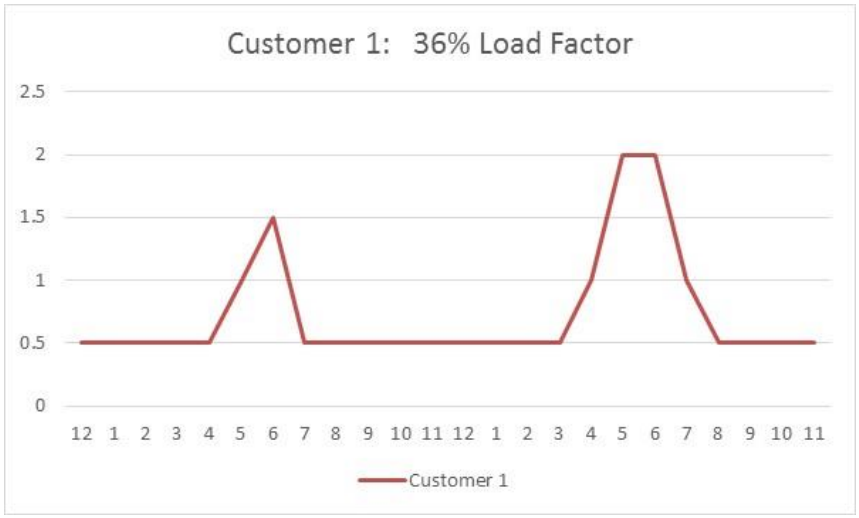
With $10/kW Demand Charge:

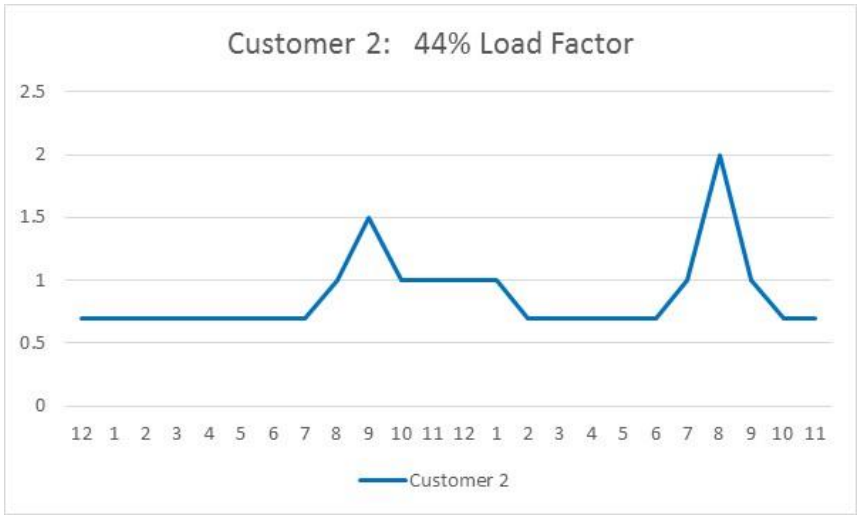
Use 5 kW for **1 hour** in month:	$50
Use 5 kW for **720 hours** in month:	$50

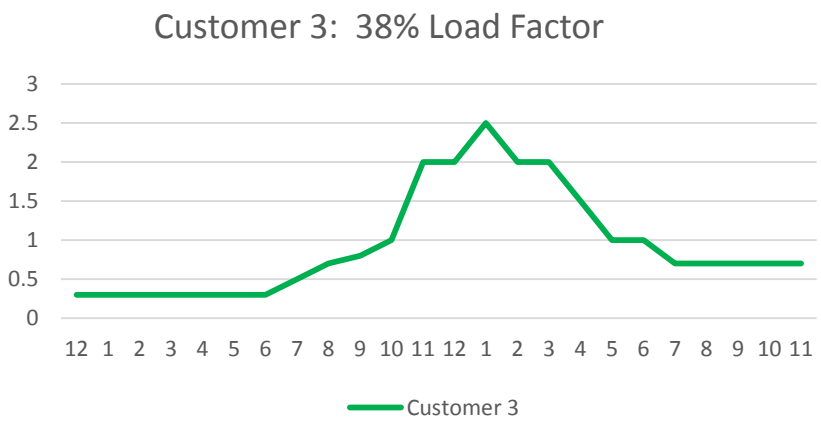
Residential Diversity Issues

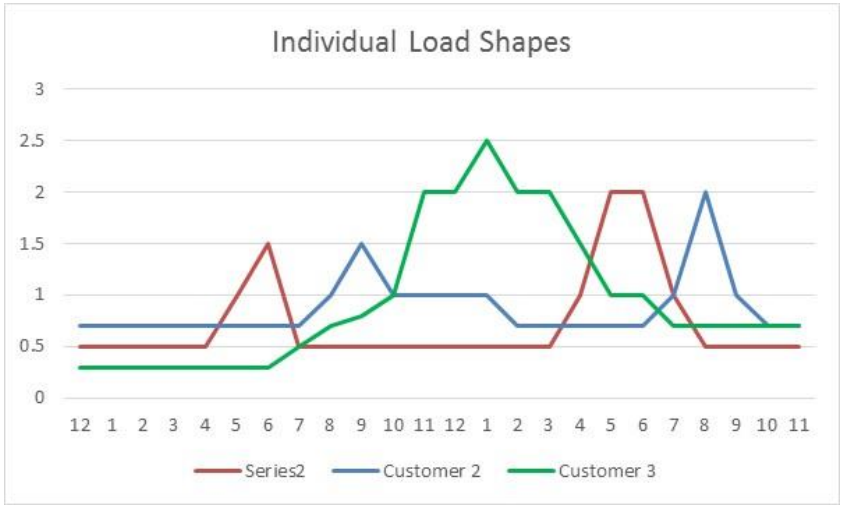
- Early and late risers
- Early and late returners
- Customer peaks ≠ system peaks
- Apartments
  - Few people / meter
  - Many customers / transformer
  - Electric water heaters common
  - Utility sees only the combined load

Individual Load Shapes Vary

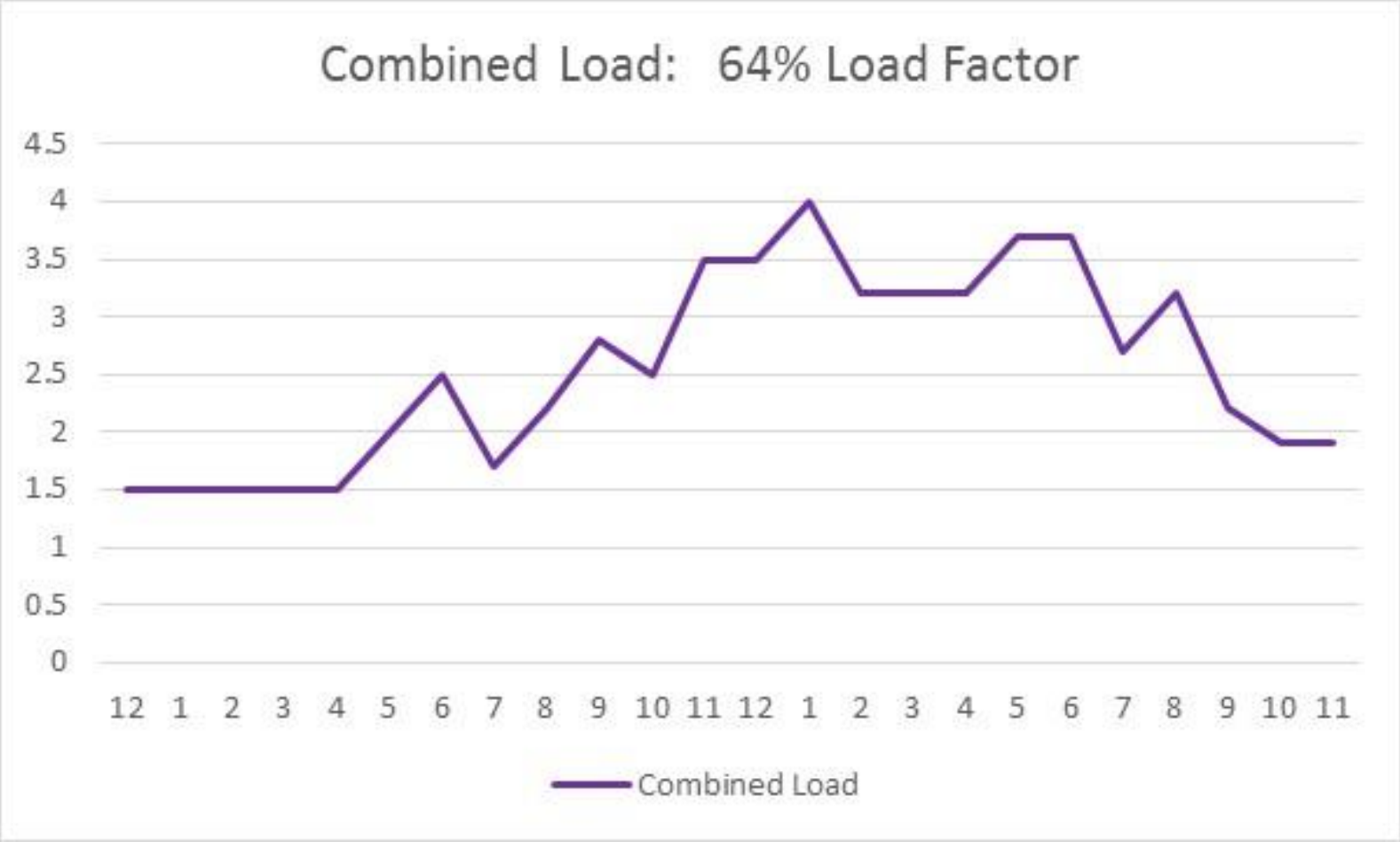




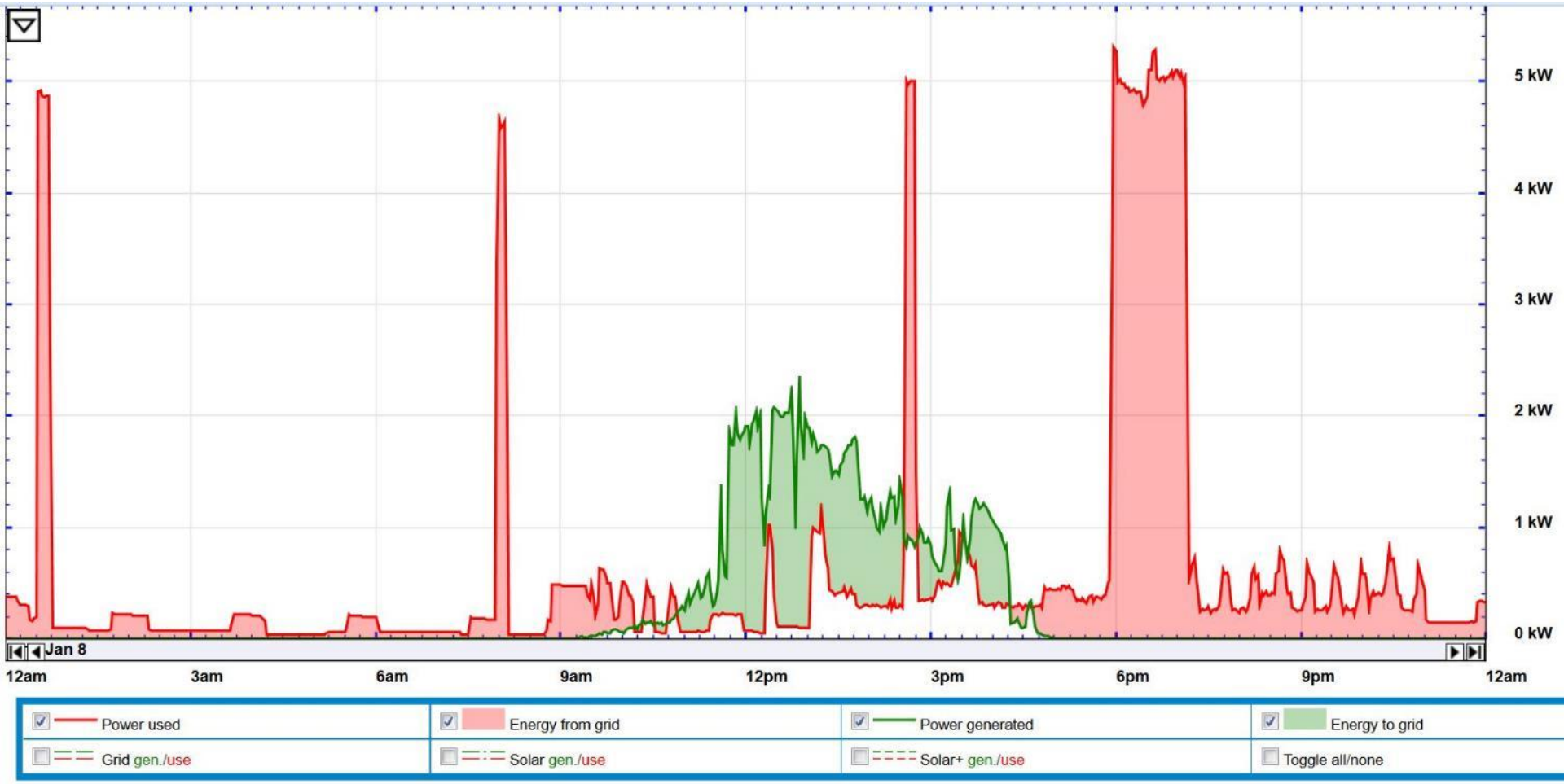




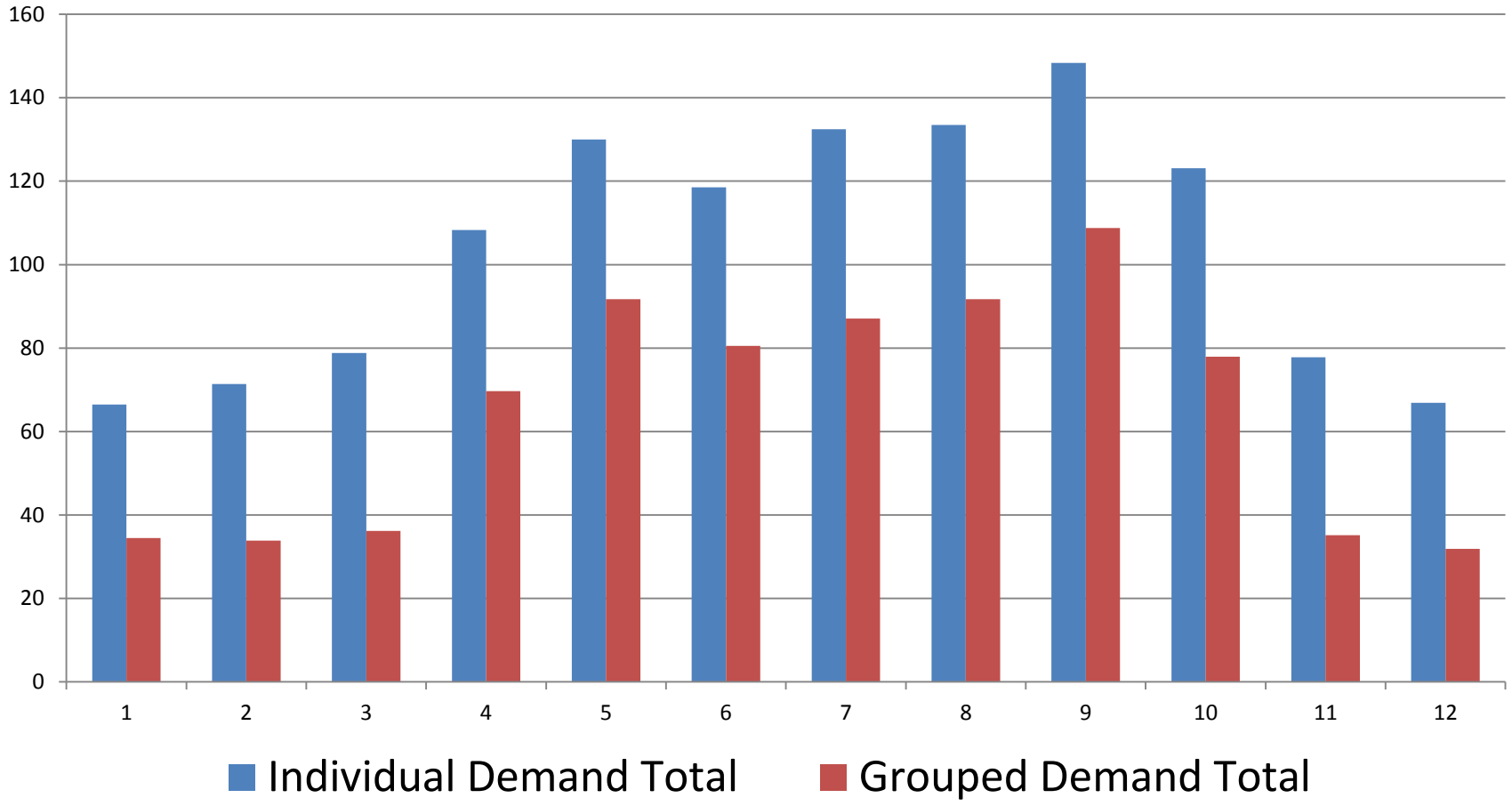
The Utility Sees the **Combined** Load of Multiple Customers With Different Shapes



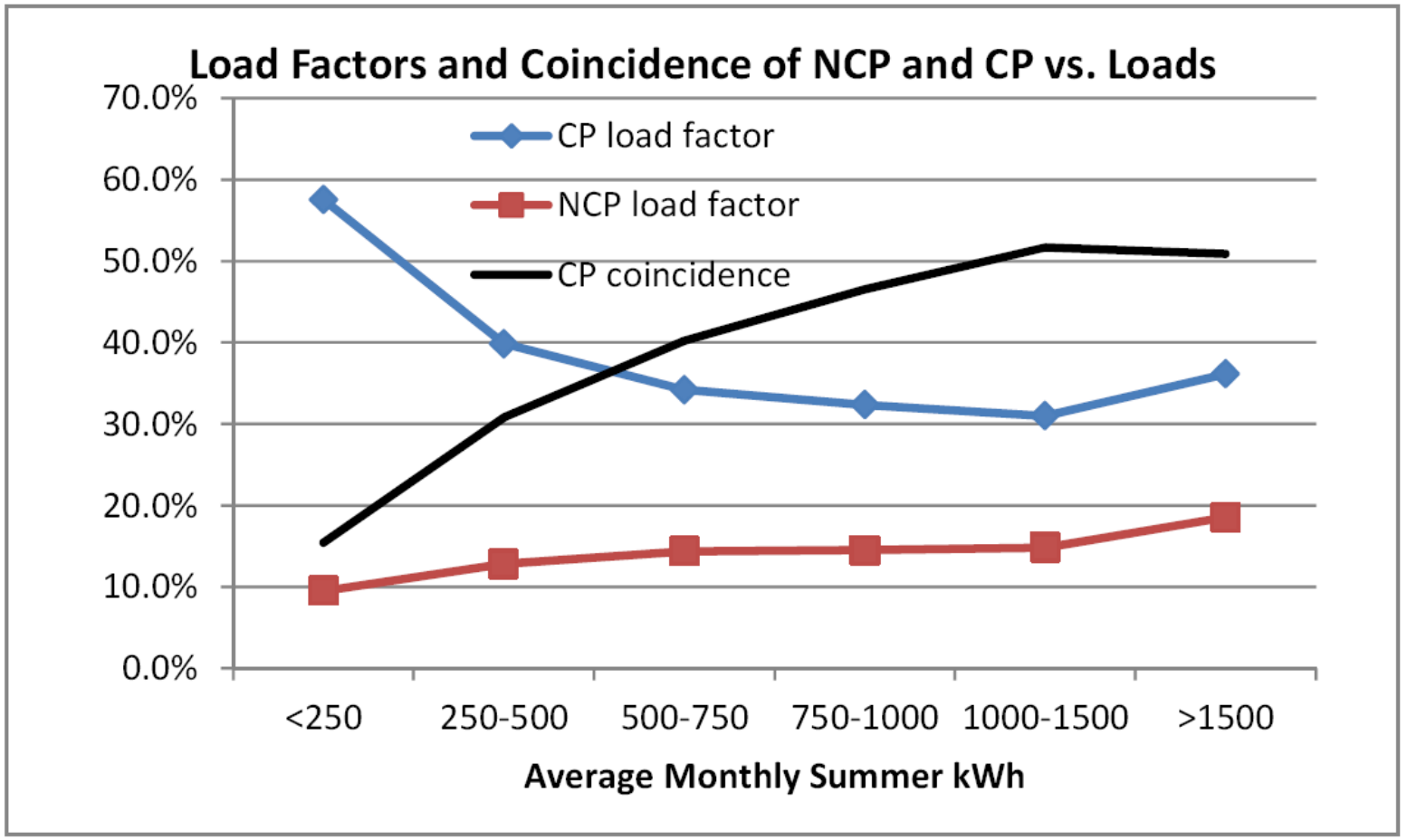
Electric Water Heat: A Thorny Issue



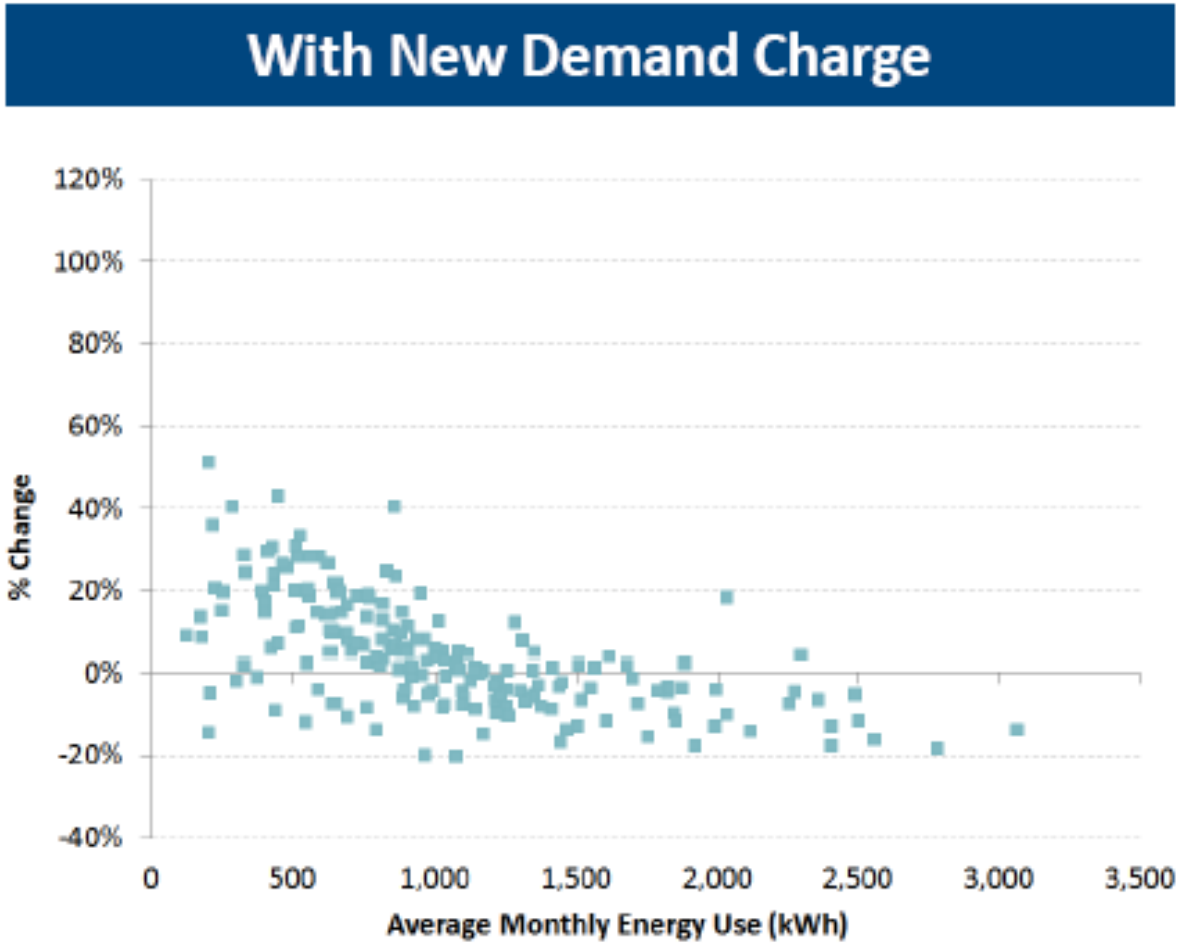
Lots of Diversity at the Transformer
26-Unit Apartment Complex, L.A. Area



Small Users Are Losers
Southern California Edison



Small Users are Losers (Ryan Hledik, Brattle)



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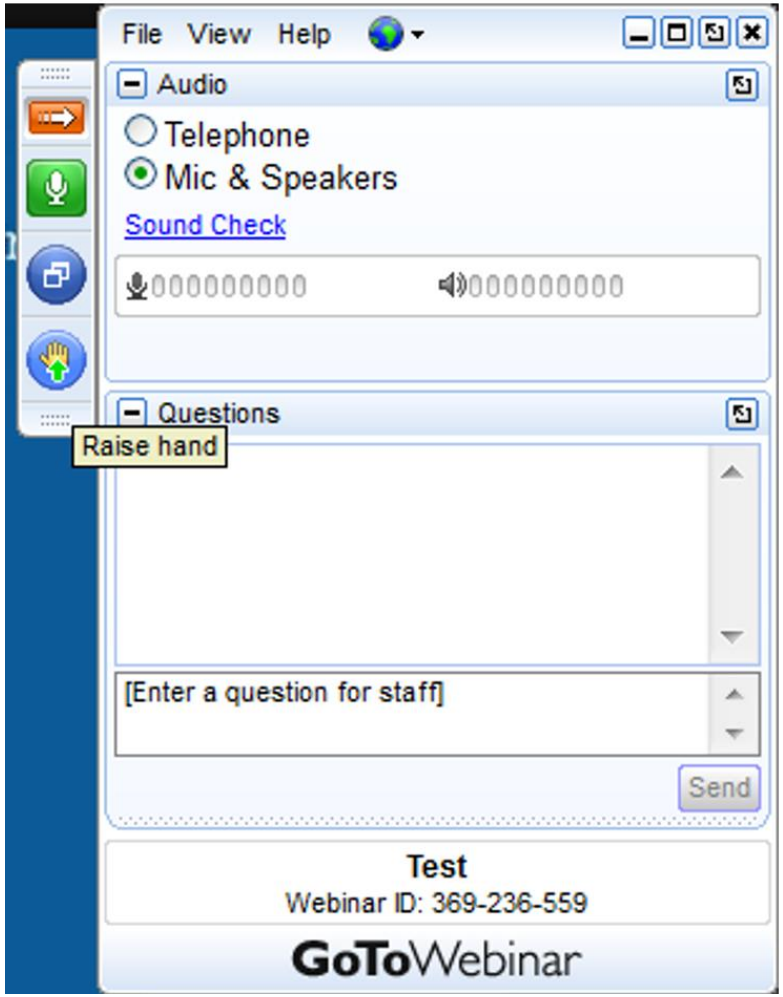
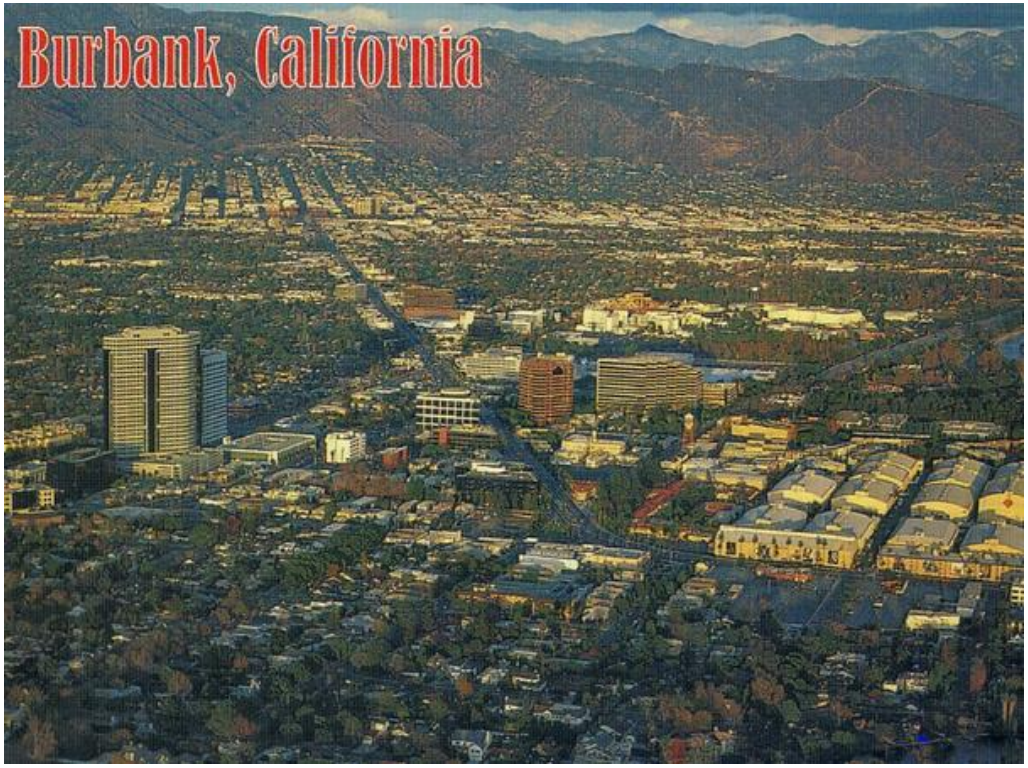


Burbank Water and Power Residential Rate Design

- 45,000 customers
- 300 MW peak
- Employment Center
- Residential is 25% of load
- Smart meters city-wide
- Most Commercial have TOU rates
- Residential TOU planned by 2018/19



Evaluating Residential Demand Charge

- Completed cost of service study in 2013;
- Demand charges for commercial above 20kW
- Evaluated recovering customer-specific distribution costs with
  - Measured demand charge
  - Fixed monthly charge
  - Service size charge
- Service size charge prevailed
  - Easier to explain
  - Easier to administer
  - More equitable than one-size-fits-all

Burbank: Service Size Definitions

Small: Service location with two (2) or more meters per service drop; typically multi-family residential

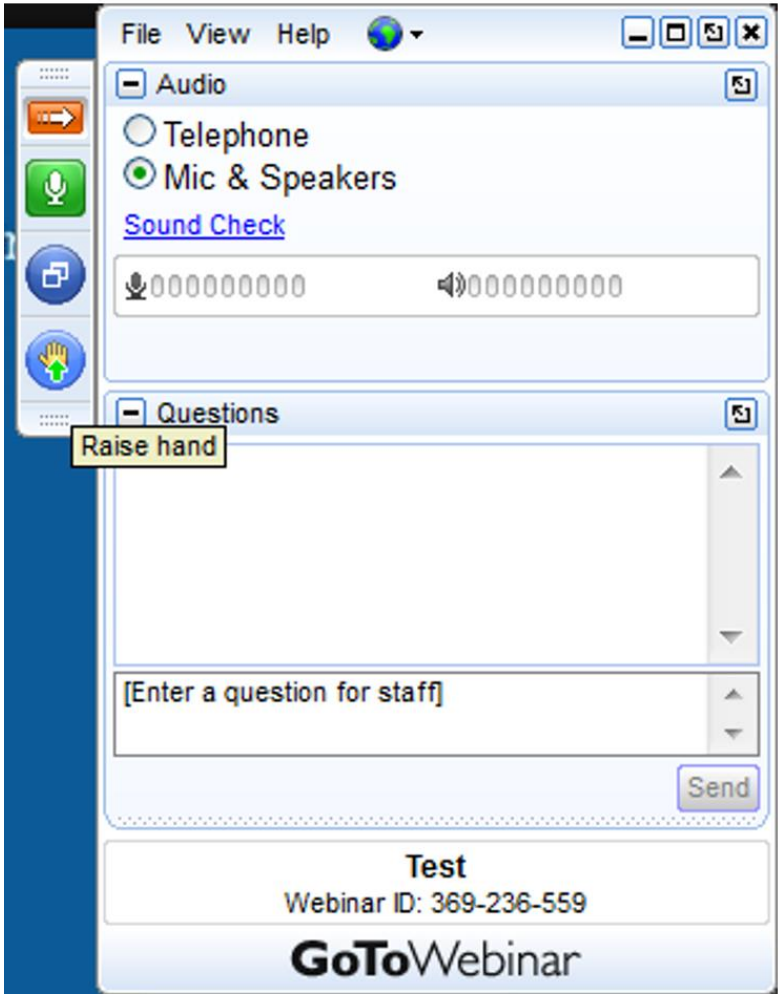
Medium: Service location with one (1) meter per service drop; typically single family residential

Large: Service with panel size greater than 200A; typically large single-family with central AC and swimming pool

Burbank Residential Rate

Rate Element		Amount
Customer Charge	$/month	$7.11
Service Size Charge	$/month	
Small	Most multifamily	$1.40
Medium	Most single family	$2.80
Large	Over 400 Amp Panel	$8.40
First 300 kWh	$/kWh	$.1153
Over 300 kWh	$/kWh	$.1672

Clarifying Questions?



Garfield and Lovejoy Principles

Public Utility Economics: 1964

- All customers should contribute to capacity costs;
- On-Peak customers should pay the most;
- Customers using capacity more hours should pay more than those using it fewer hours.

Garfield and Lovejoy Criteria		CP Demand Charge		NCP Demand Charge		TOU Energy Charge
All customers should contribute to the recovery of capacity costs		N		Y		Y
The longer the period of time that customers pre-empt the use of capacity, the more they should pay for the use of that capacity		N		N		Y
Any service making exclusive use of capacity should be assigned 100% of the relevant cost;		Y		N		Y
The allocation of capacity costs should change gradually with changes in the pattern of usage;		N		N		Y
Allocation of costs to one class should not be affected by how remaining costs are allocated to other classes;		N		N		Y
More demand costs should be allocated to usage on-peak than off-peak;		Y		N		Y
Interruptible service should be allocated less capacity costs, but still contribute something;		Y		N		Y

Principles for Modern Rate Design

Universal Service: A customer should be able to connect to the grid for no more than the cost of connecting to the grid.

Time-Varying: Customers should pay for grid services and power supply in proportion to how much they use and when they use it.

Fair Compensation: Customers supplying power to the grid should be compensated fairly for the value of the power they supply.

A Simple Cost-Based 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

A Cost-Based Residential Demand Charge Rate
EdF (France) Base Rate

Typical Dwelling Units	Contract power-rating (kVA)	Subscription Including Tax $/month	Price per kWh incl. tax $/kWh	Incre-mental $/kW / Month
Apartments	**3**	$ 4.76	$ 0.154	
	6	$ 7.73	$ 0.154	$ 0.99
Small SF Home	**9**	$ 10.24	$ 0.154	$ 0.84
	12	$ 15.75	$ 0.154	$ 1.84
	15	$ 18.07	$ 0.154	$ 0.77
Large SF Home	**18**	$ 20.78	$ 0.154	$ 0.90
	24	$ 44.24	$ 0.154	$ 3.91
	30	$ 54.67	$ 0.154	$ 1.74
	36	$ 63.32	$ 0.154	$ 1.44

Summary: Issues with Residential Demand Charges

- Very high diversity, especially among small users
- Very poor customer understanding
- Shifts costs from larger users with higher coincident peaks to smaller users with lower coincident peaks
- Reduces per-kWh cost, so makes EE and RE options comparison more difficult

Essential Elements for Residential Demand Charges

- **Small**: Cover only customer-specific distribution capacity – Services and Transformers
- **Multi-Hour:** Based on *average* of several hours of demand
- **BUT:** Recovering *system* capacity costs through a TOU rate is more equitable and MUCH easier to explain.

Questions?

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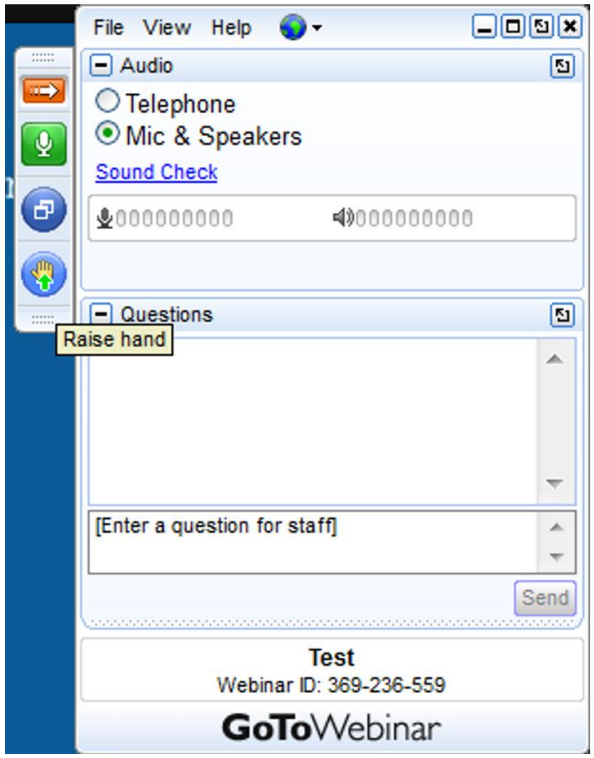

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The Regulatory Assistance Project (RAP) is a global, non-profit team of experts that focuses on the long-term economic and environmental sustainability of the power and natural gas sectors. RAP has deep expertise in regulatory and market policies that:

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

Learn more about RAP at www.raponline.org

jlazar@raponline.org

The Regulatory Assistance Project
Beijing, China • Berlin, Germany • Brussels, Belgium • **Montpelier, Vermont USA** • New Delhi, India
50 State Street, Suite 3 • Montpelier, VT 05602 • *phone:* +1 802-223-8199 • *fax:* +1 802-223-8172
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