RAP Energy solutions for a changing world

Rate Design: Part 2

Into the Weeds on Cost Allocation, Dynamic Pricing, Net Metering, and Alternatives

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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.

Our Rate Design Experts

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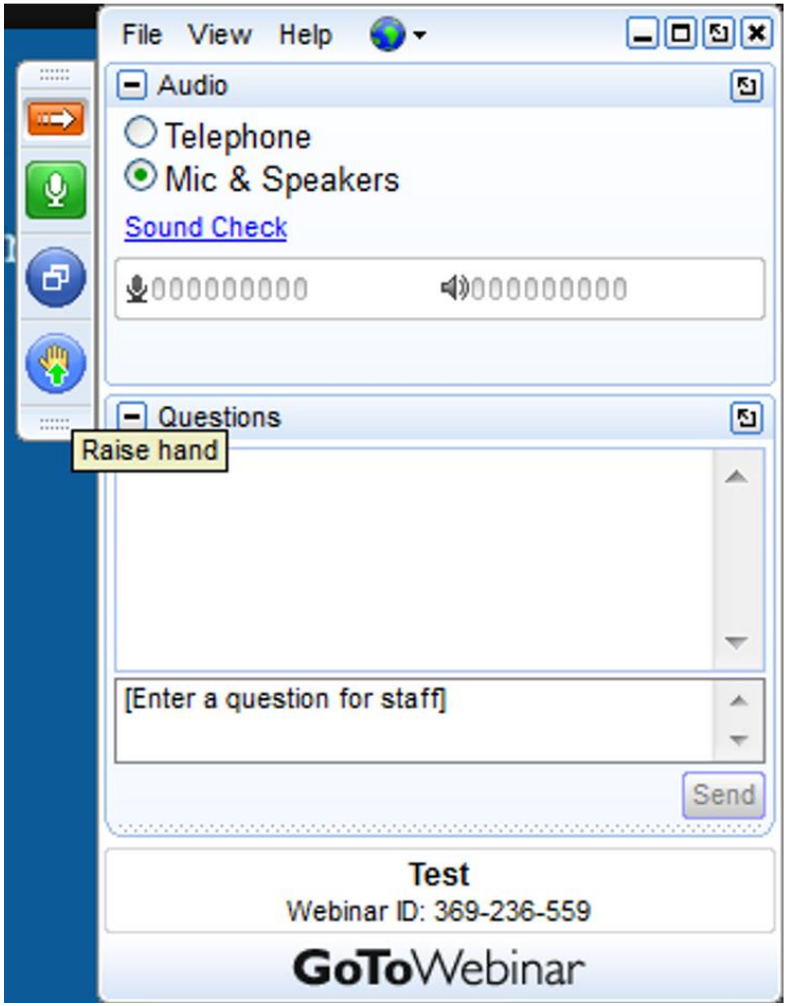
Overview

- Cost Allocation
  - Embedded Cost Approaches
  - Marginal Cost Approaches
- Advanced Residential Pricing Options
  - Demand Charges
  - Critical Peak Pricing
  - Real-Time Pricing
- Net Metering and Alternatives

Housekeeping

Please send questions through the chat box.



Embedded Cost Methods

1. Peak Responsibility
   - Fixed Costs Classified as Demand or Customer
   - Variation: Average and Excess Demand (takes into account seasonal variations)

Embedded Cost Methods

2. Peak and Average Demand

– Classifies some costs to energy (or allocates demand-related costs on a broad measure of "demand.")

Embedded Cost Methods

3. Energy-Weighted

- Classifies most costs to energy
- Generally Time of Use (TOU)

Baseload Generation

- Expensive to build
- Cheap to operate
- Lower fuel costs
- Issue: Classify part of capital cost as though it is avoided fuel cost

Transmission

- Purpose may be to move power, cheaper than moving fuel
- Issue: Classify a portion of the investment as energy (avoided fuel)?

Distribution

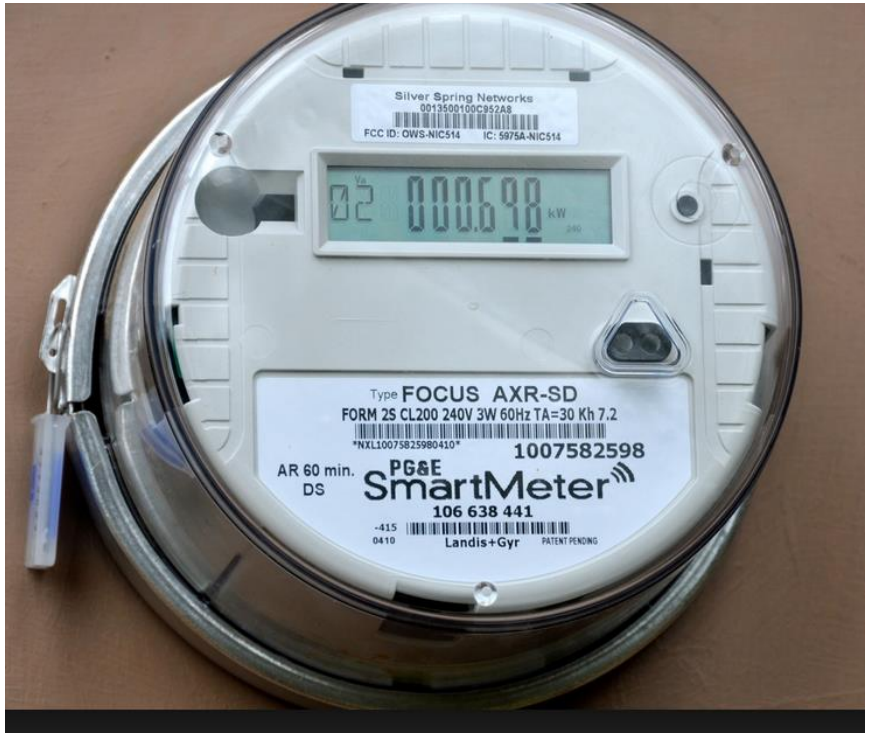
- Built to deliver energy
- Designed to carry peak demand
- Connects to every customer
- WHY was the system built in the first place?

Meters

Historical: Used only for billing

Meters

- Smart Meters Used For:
  - Conservation program design
  - Peak load management
  - Reliability services
  - 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

Embedded Cost Study Results: Engineering vs. Economic

Marginal Cost Approaches

- **Long-Run** Marginal Costs
- **Short-Run** Marginal Costs
- **Intermediate** Time Frames
- **Mixed** Time Frames

Marginal Cost Approaches

- Long-Run Marginal Costs
  - All costs are variable
  - Full cost of system reproduction

Marginal Cost Approaches

- Short-Run Marginal Costs
  - Existing Capital Facilities
  - Fuel and variable labor costs only

Marginal Cost Approaches

- Intermediate Time Frames
  - 2 – 10 Years
  - Avoiding imminent but avoidable capital costs

Results of Marginal Cost Studies

- $/kW for demand for peaking resources
- $/kWh for energy, time-varying
- $/customer for customer-specific facilities

- Typically does not match the utility revenue requirement
- Reconciliation required

Controversy in Marginal Cost Analysis

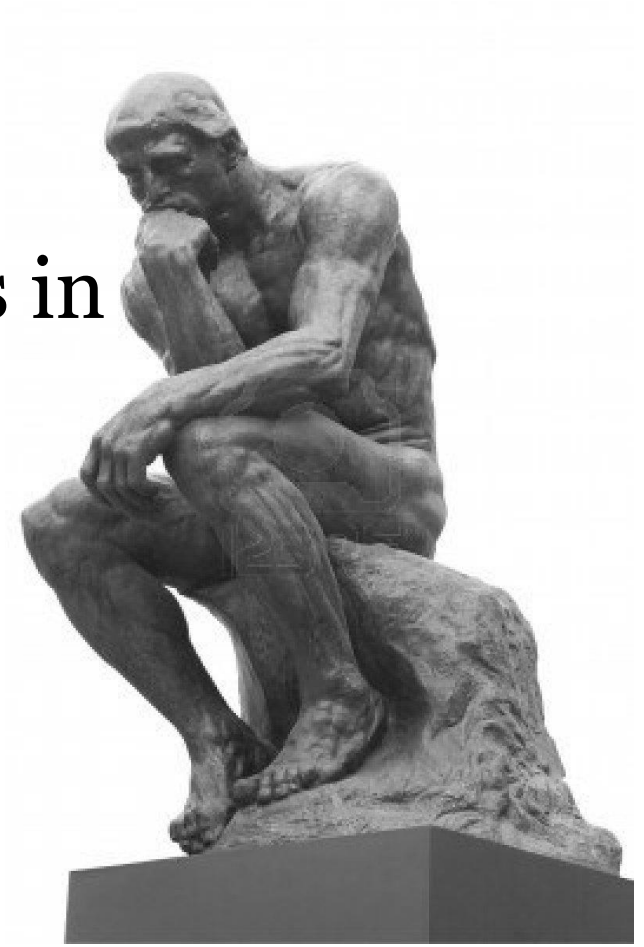
- Mixed time horizons
  - Short-run cost for energy (dispatch)
  - Long-run cost for peaking capacity and distribution investments
- Reconciliation to Revenue Requirement

Comparing Study Results: Revenue to Cost Ratio

	Embedded Study 1	Embedded Study 2	Marginal Study 1	Marginal Study 2
Class Revenue to Cost Ratio				
Residential	80%	110%	85%	115%
Small Commercial	90%	100%	95%	105%
Large Commercial	100%	95%	105%	95%
Industrial	120%	70%	115%	85%

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
- There is no "right" way to compute this



"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)

Questions?

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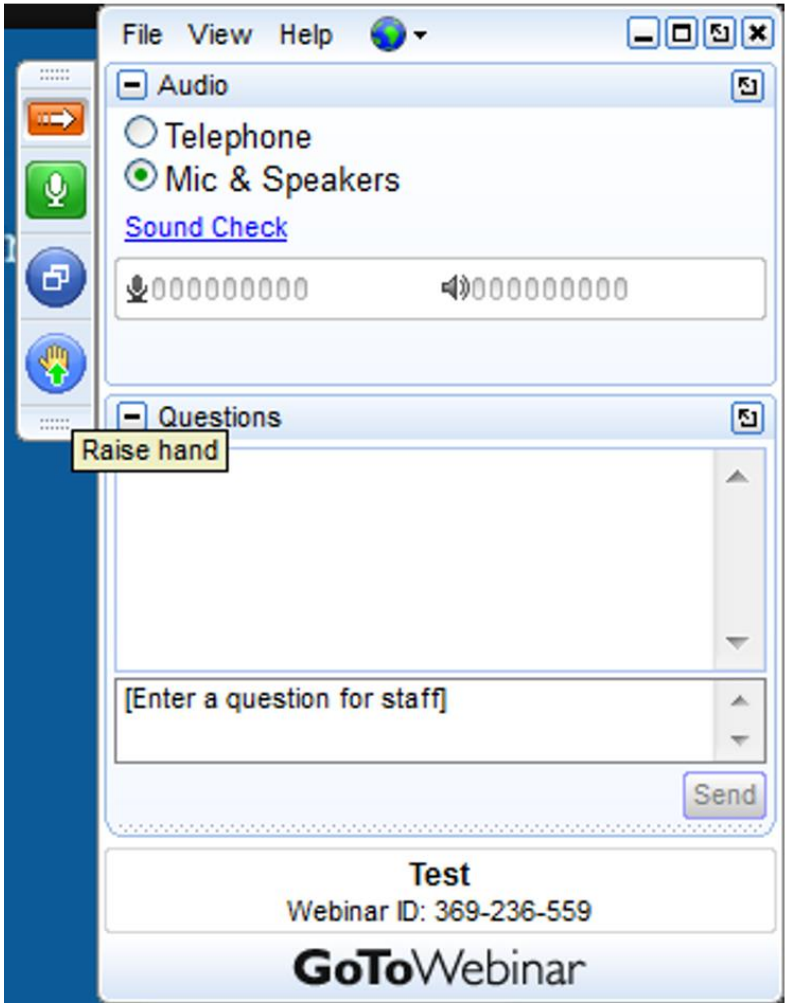


More Complex Residential Rates

- Demand Charges
- Critical Peak Pricing
- Real-Time Pricing

Panel Size "Demand" Charges

Manitoba Hydro	
Customer Charge	
• Below 200 Amps	$7.28
• Over 200 Amps	$14.56
Energy Charge	$0.0738/kWh

Subscription Demand Charges

Power Rating	Monthly Customer Charge	Price per kWh
(kVA)	(Euros)	(Euros)
3	€ 5.43	€ 0.17
6	€ 8.81	€ 0.17
9	€ 11.66	€ 0.17
12	€ 17.98	€ 0.17
15	€ 20.63	€ 0.17
18	€ 23.73	€ 0.17

Metered Demand Charges
Arizona Public Service Company

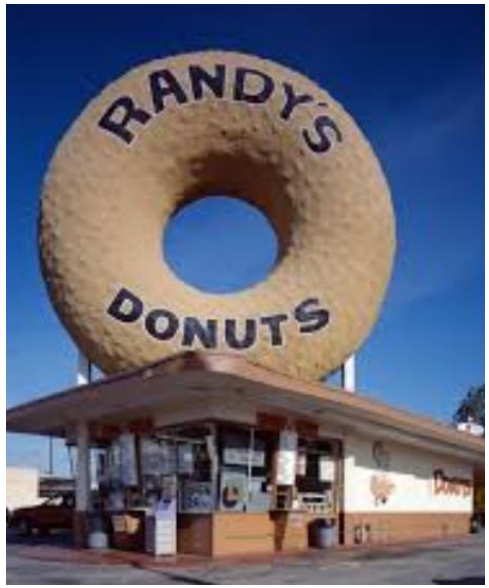
Summer	
Demand Charge $/kW	$13.50
On-Peak $/kWh	$0.08867
Off-Peak $/kWh	$0.04417
Winter	
Demand Charge $/kW	$ 9.30
On-Peak $/kWh	$0.05747
Off-Peak $/kWh	$0.04107

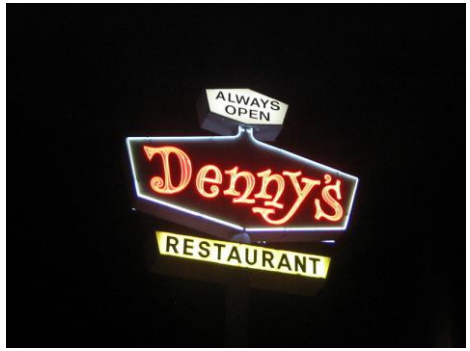
Concerns with Residential Subscription Demand Charges

- Small appliances add up to significant demand;
- Only run a few minutes each;
- Multiple customers per transformer;
- Essential to measure demand on an 1-hour or 2-hour basis.

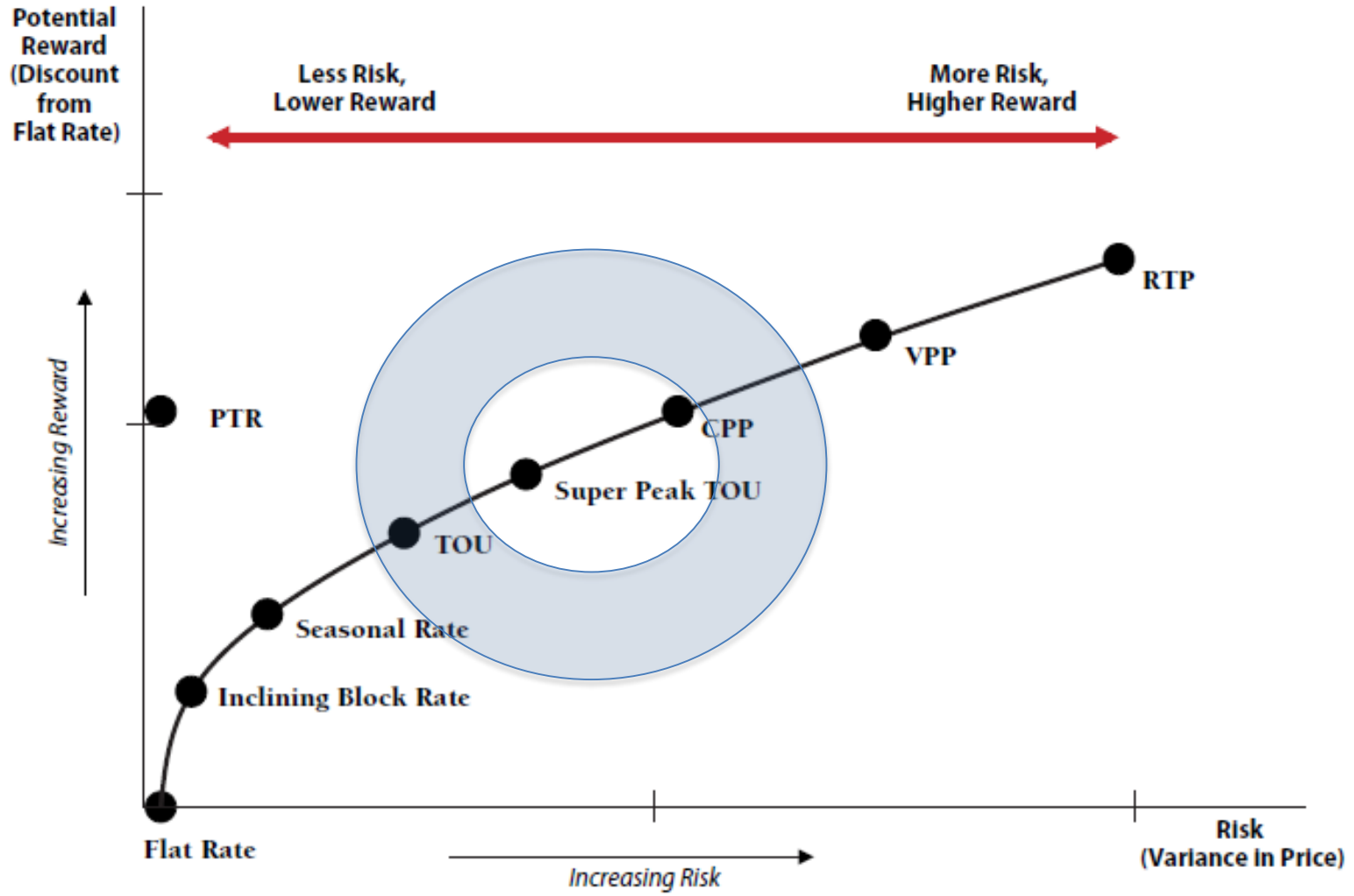
Concerns With Demand Charges

- Demand at different times;
- Shared Capacity;
- Short-duration customers overpay;
- **TOU Rates a Better Choice**





Dynamic Pricing

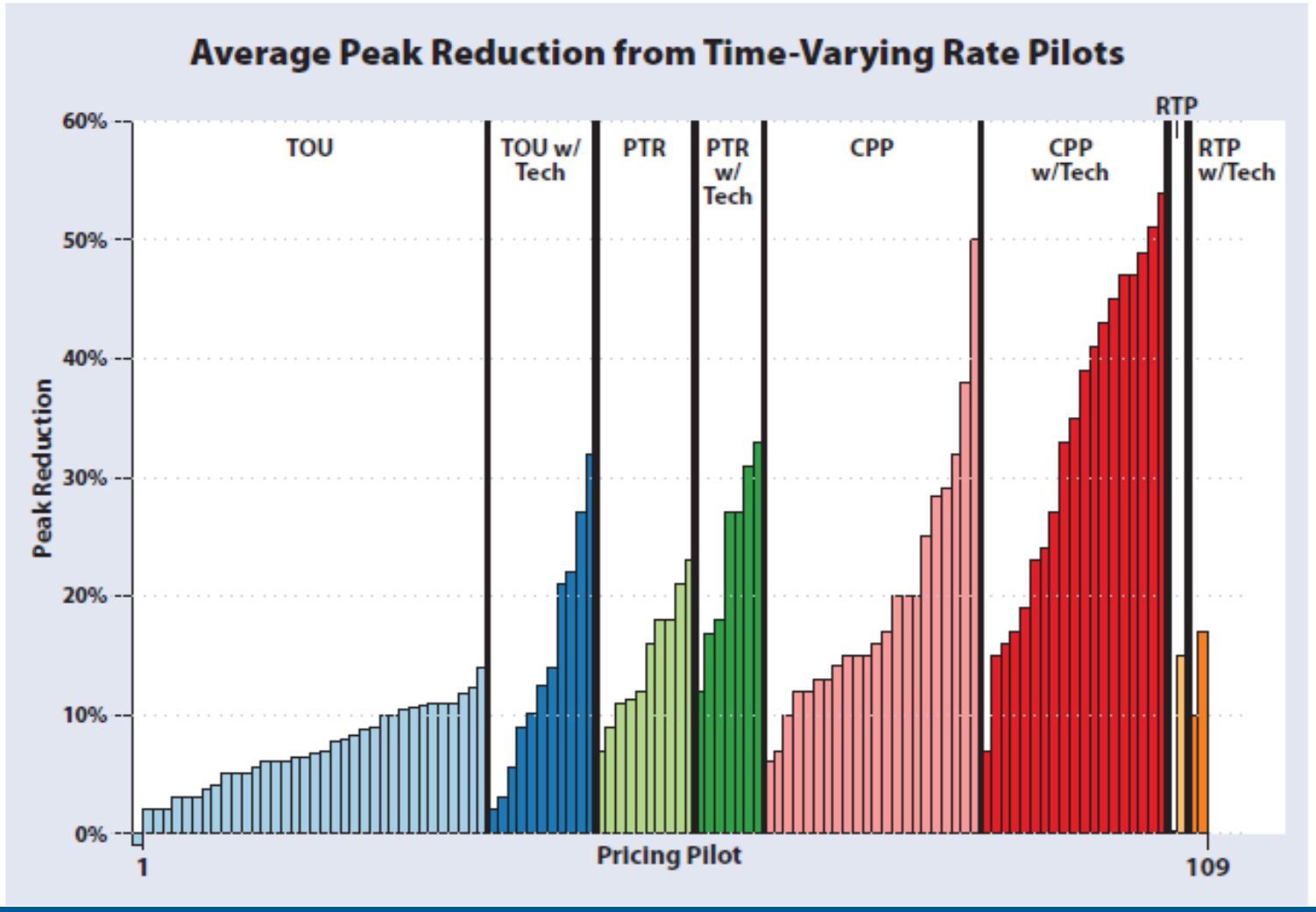


Example Residential Critical Peak Rate

Portland General Electric (Oregon)	
Customer Charge	$9.00
Off-Peak $/kWh	$0.0916
On-Peak $/kWh	$0.1166
Critical Peak $/kWh	$0.4335

Critical Peak Maximum: 4 hours per day; 10 days per year

Results of TOU / CPP Pilot Programs

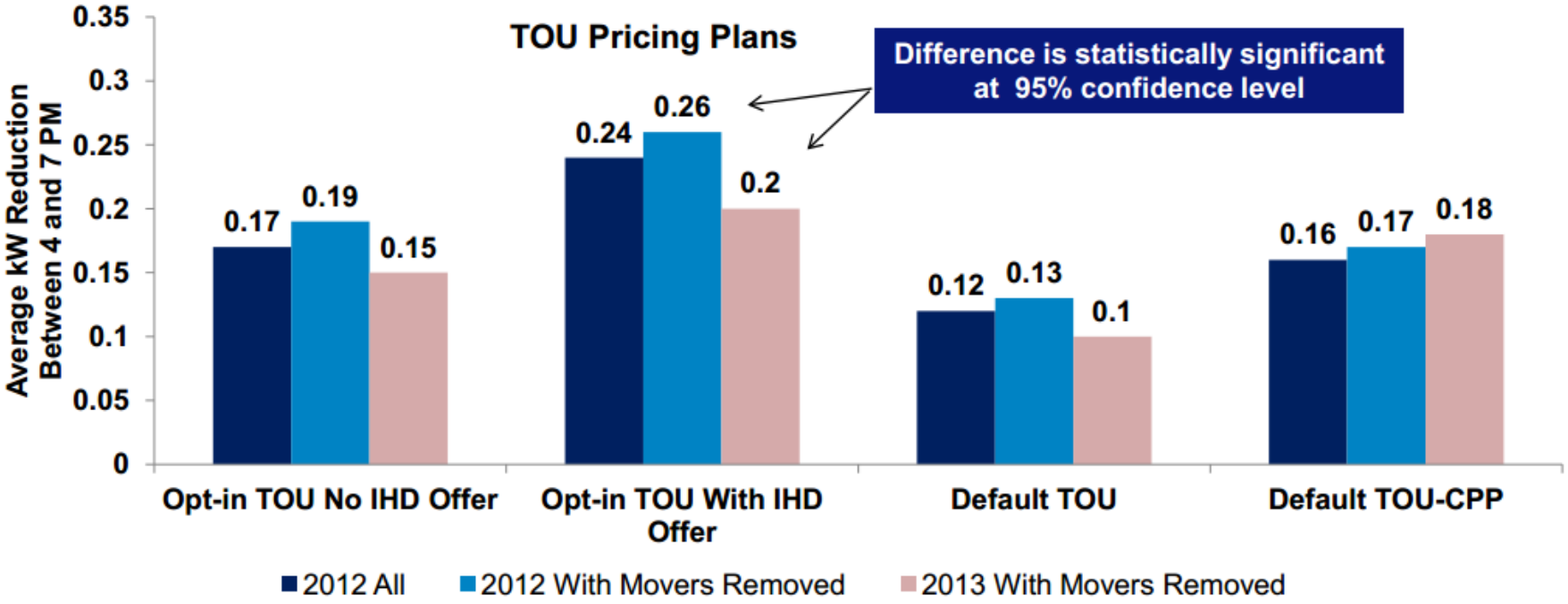


Critical Peak Pricing
France: TEMPO

- Tempo unit shows what price in effect
- Inclining customer charge tied to kVa
- Maximum 22 Red days per year
- All days have off-peak (HC) and on-peak (HP)

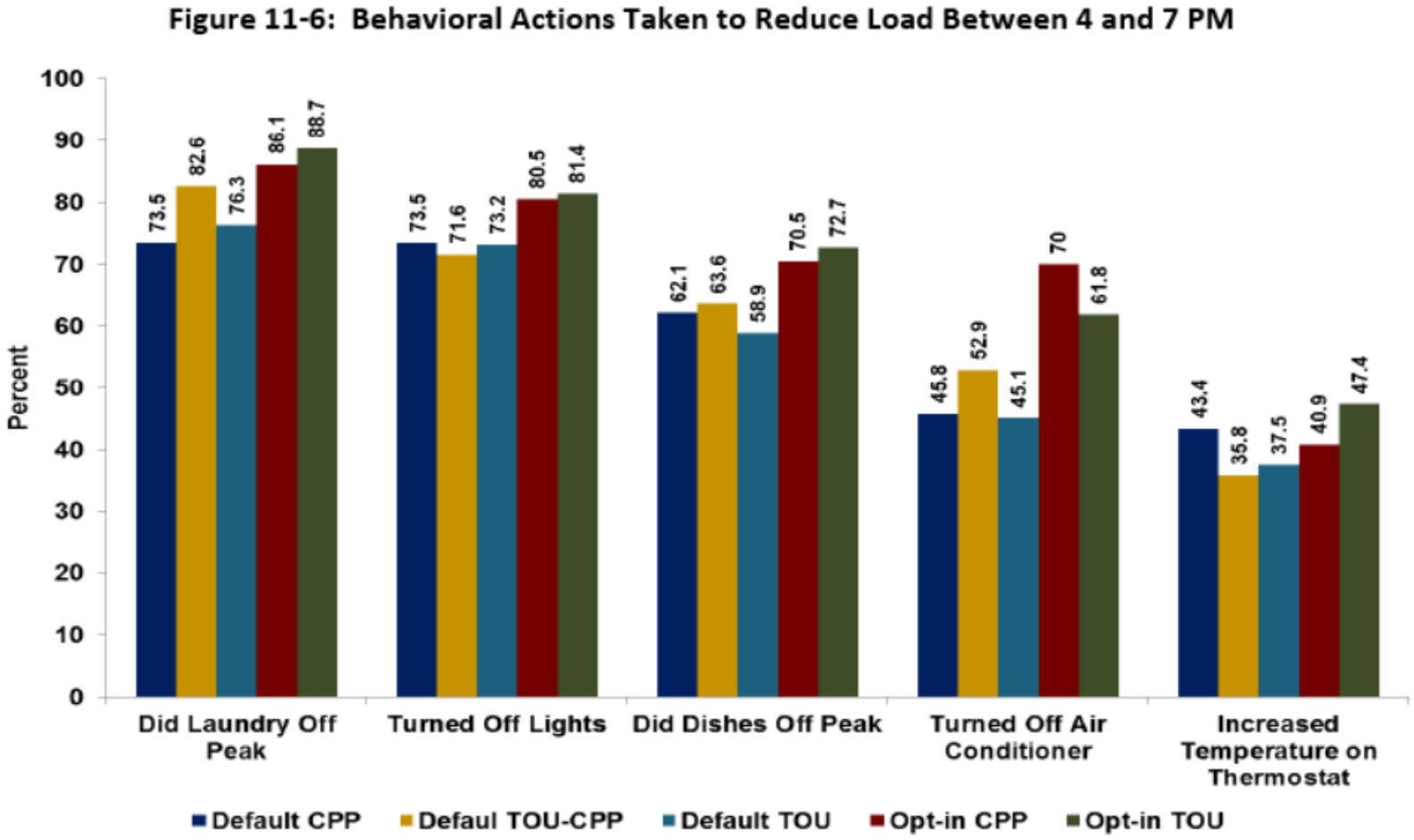
Signed Power (kVa)	Annual subscription TTC (€)	Blue HC	Blue HP	White HC	White HP	Red HC	Red HP
		For 1 kWh (€ TTC)					
9	116.82	0.0763	0.0907	0.1074	0.1272	0.1971	0.5119
12	218.10	0.0763	0.0907	0.1074	0.1272	0.1971	0.5119
15	225.80	0.0763	0.0907	0.1074	0.1272	0.1971	0.5119
18	233.50	0.0763	0.0907	0.1074	0.1272	0.1971	0.5119
30	496.83	0.0763	0.0907	0.1074	0.1272	0.1971	0.5119
36	614.79	0.0763	0.0907	0.1074	0.1272	0.1971	0.5119

Sacramento Critical Peak Pricing



- 3,000 Customers, 1,000 low-income
- Both Opt-in and Default; both CPP and TOU

Sacramento Critical Peak Pricing



Future Real-Time Pricing

Modeled on Georgia Power's Industrial Rate	
Customer Charge	$10.00
Distribution Charge $/kWh	$0.04
Energy $/kWh	$0.05 - $0.50
Average Rate Guarantee* $/kWh	$0.10

* Applies to usage up to historical baseline

Questions?

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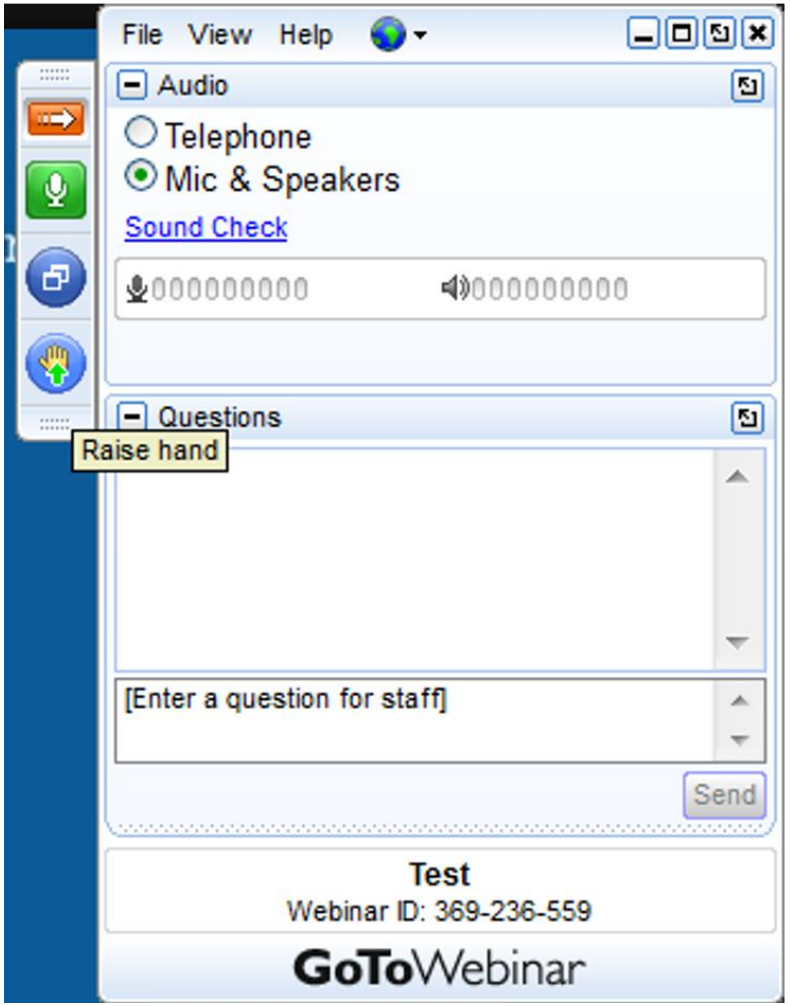


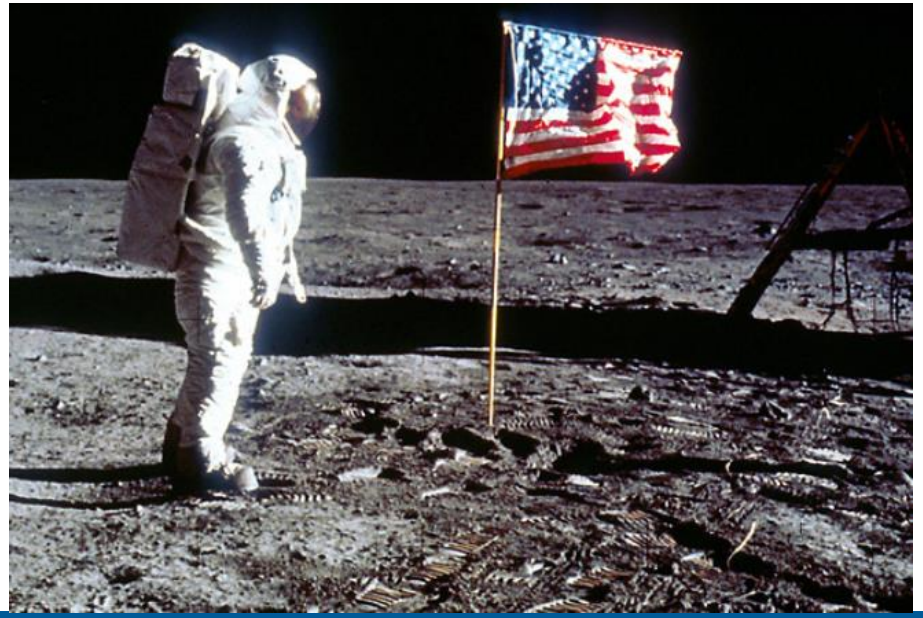
Net Metering and Alternatives

- Net Metering:
  - Customer pays for net kWh consumed at retail rate
  - In effect, a full retail rate credit for all power fed to the grid
  - Can result in a bill for only the customer charge
  - May be fair or unfair

Alternatives to Net Metering

- Infant Industry Subsidy
- Value of Solar Tariff (VOST)
- Higher Customer Charge
- Special Charge for PV Customers
- Demand Charge
- Directional Pricing

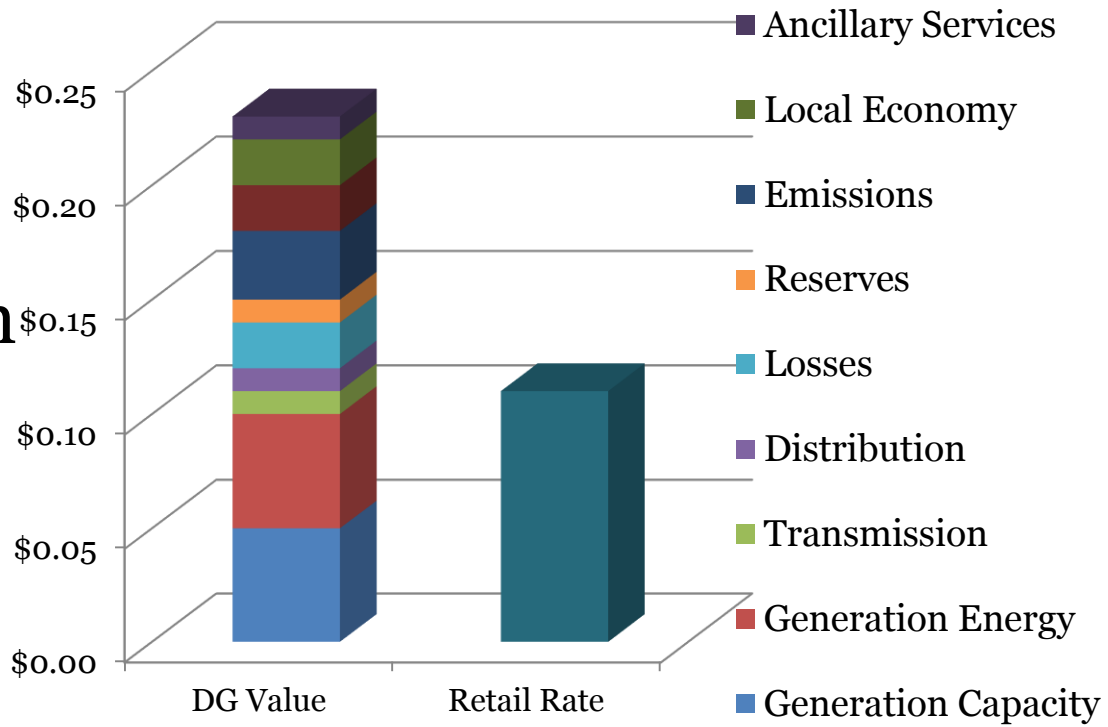
Infant Industry Subsidies



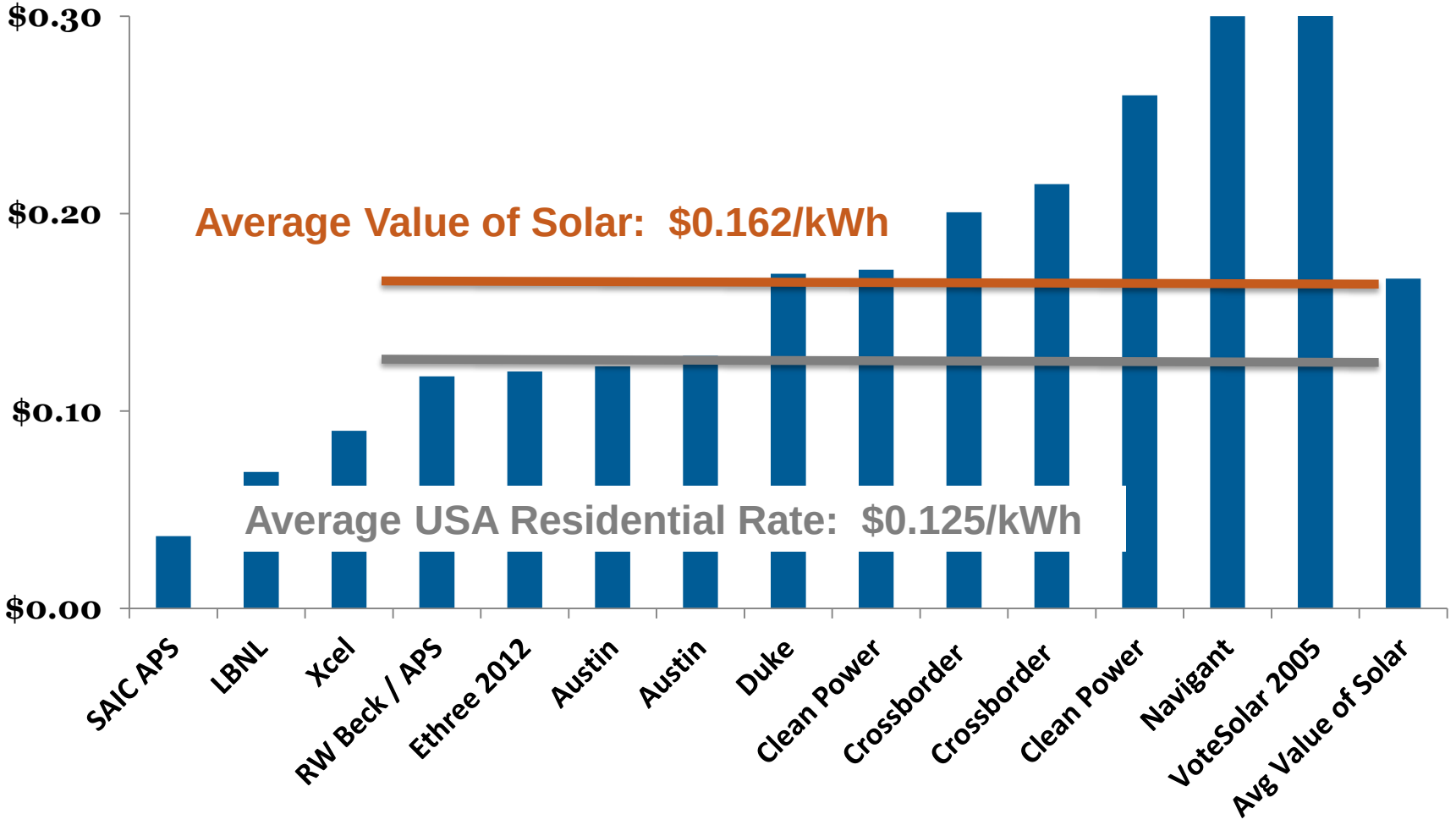
Value of Solar Tariff (VOST)

Recognize all values of solar:

- Renewable
- New Resource
- Delivered to System
- Environmental
- Fuel Cost Risk
- Price Suppression



Value of Solar Tariff



Higher Customer Charge

Customer Charge	$5.00		$20.00

Higher Customer Charge

Customer Charge	$5.00		$20.00
Energy Charge	$0.12		$0.09
Change in Price/kWh			-25%

Higher Customer Charge

Customer Charge	$5.00		$20.00
Energy Charge	$0.12		$0.09
Change in Price/kWh			-25%
Predicted Change in Usage			+5%

Does not recognize value of solar, particularly on lower-cost utilities.

Special Charge for PV Customers

Tied to estimated additional costs for voltage regulators and other grid investments to accommodate PV.

- Arizona: $0.90/kW of panel size (adopted)
- Hawaii: $16/month (proposed)

Residential Demand Charge (or panel size charge)

- Customer pays based on size of connection to grid.
- If recovering ONLY transformer cost and additional costs to accommodate solar, may be cost-based.
- Does not recognize value of solar.

Directional Pricing

Directional Pricing Example		
Customer Charge	Billing and Collection	$5.00/month
Distribution Charge	All Delivery Costs	$0.05/kWh
Power Supply (either direction)		
• On-Peak	Peak and Baseload	$0.15/kWh
• Off-Peak	Baseload Only	$0.08/kWh

May be appropriate for high-cost utilities, where current rate is > value of solar.

Summary on Alternatives to Net-Metering

- Infant-industry subsidy
- Value of Solar Tariff (VOST) > Price for most utility
- Fixed charges increase usage
- Alternatives such as directional pricing may be appropriate for high-cost utilities

Survey: What Are YOU Interested In? Click on All Topics of Interest

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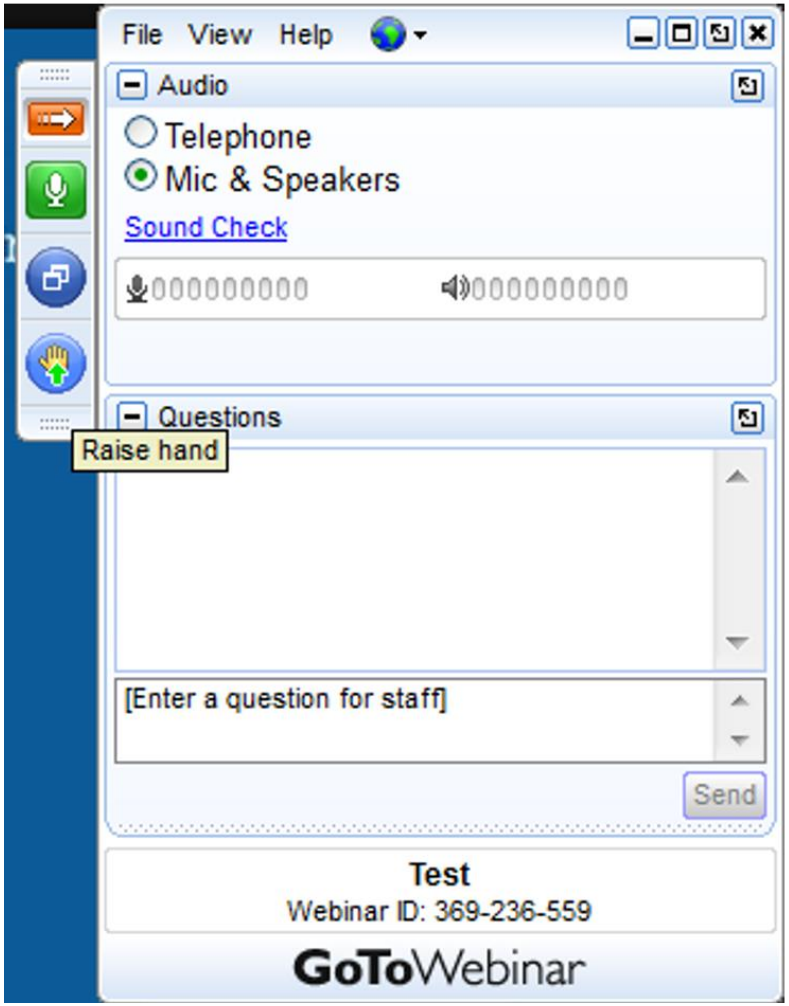

Wrap-Up

- Cost allocation is an inexact science
  - Multiple studies may be appropriate
- Customers DO respond to advanced prices.
  - Costs and benefits
- Alternatives Available to Net Metering
  - Most applicable to high-cost utilities

About RAP

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

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