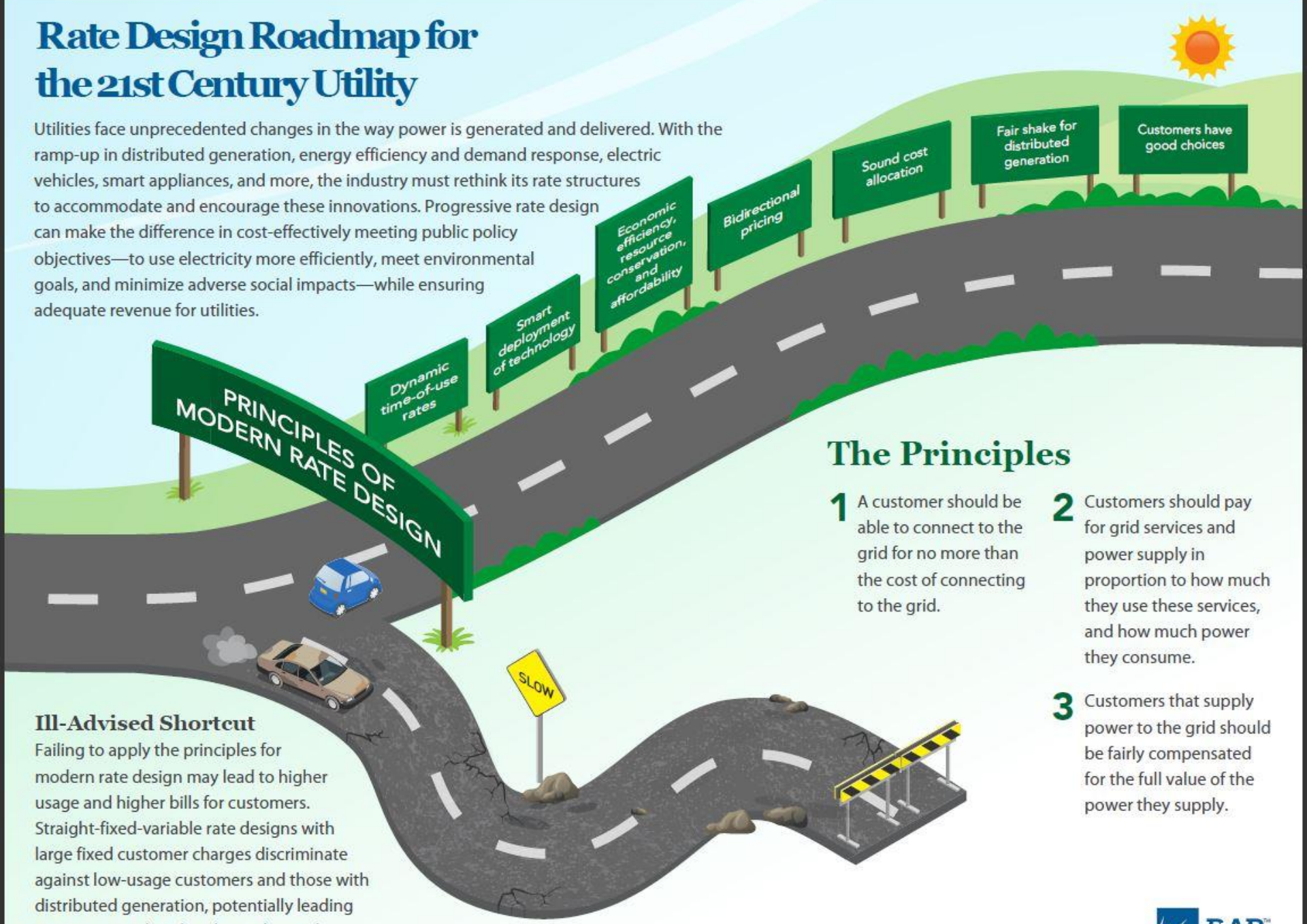
Rate Design Roadmap for the 21st Century Utility

Utilities face unprecedented changes in the way power is generated and delivered. With the ramp-up in distributed generation, energy efficiency and demand response, electric vehicles, smart appliances, and more, the industry must rethink its rate structures to accommodate and encourage these innovations. Progressive rate design can make the difference in cost-effectively meeting public policy objectives—to use electricity more efficiently, meet environmental goals, and minimize adverse social impacts—while ensuring adequate revenue for utilities.



The Principles

1. A customer should be able to connect to the grid for no more than the cost of connecting to the grid.
2. Customers should pay for grid services and power supply in proportion to how much they use these services, and how much power they consume.
3. Customers that supply power to the grid should be fairly compensated for the full value of the power they supply.

Ill-Advised Shortcut

Failing to apply the principles for modern rate design may lead to higher usage and higher bills for customers. Straight-fixed-variable rate designs with large fixed customer charges discriminate against low-usage customers and those with distributed generation, potentially leading customers to abandon the grid entirely.

RAP

RAP Energy solutions for a changing world

Smart Rate Design for a Smart Future

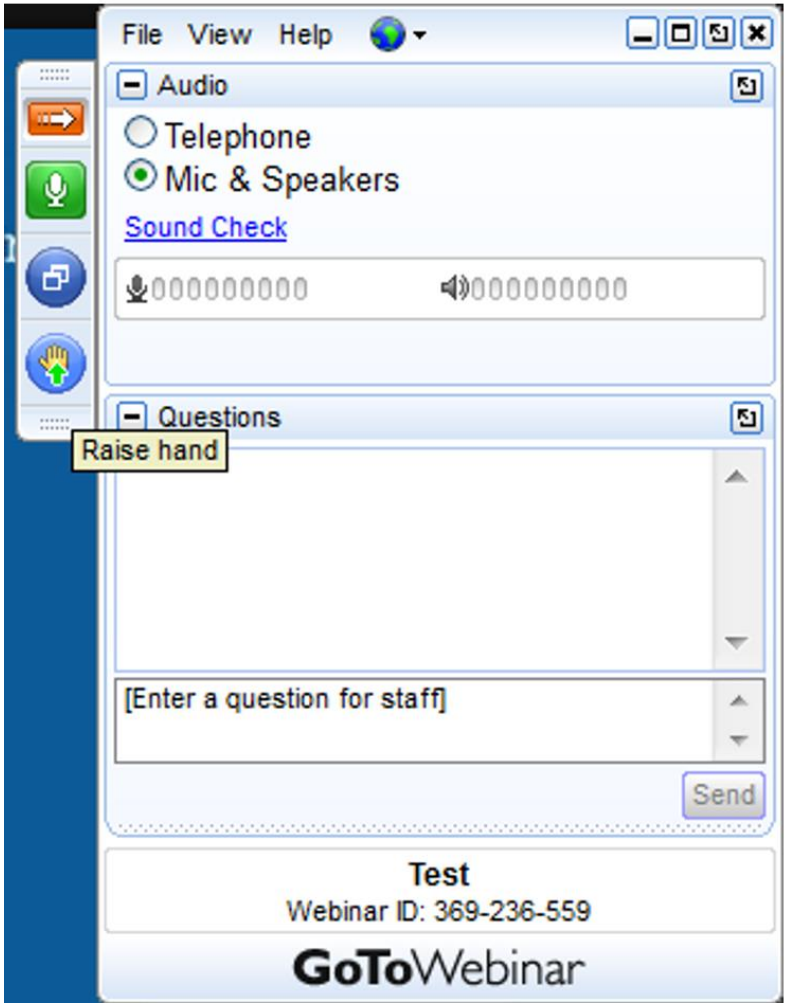
August 4, 2015

Jim Lazar, Senior Advisor, RAP
Wilson Gonzalez, Treehouse Energy and Economic Consulting

The Regulatory Assistance Project
50 State Street, Suite 3
Montpelier, VT 05602
Phone: 802-223-8199
www.raponline.org

Housekeeping

Please submit questions through the Questions pane.



Our Rate Design Experts

Jim Lazar
RAP Senior Advisor

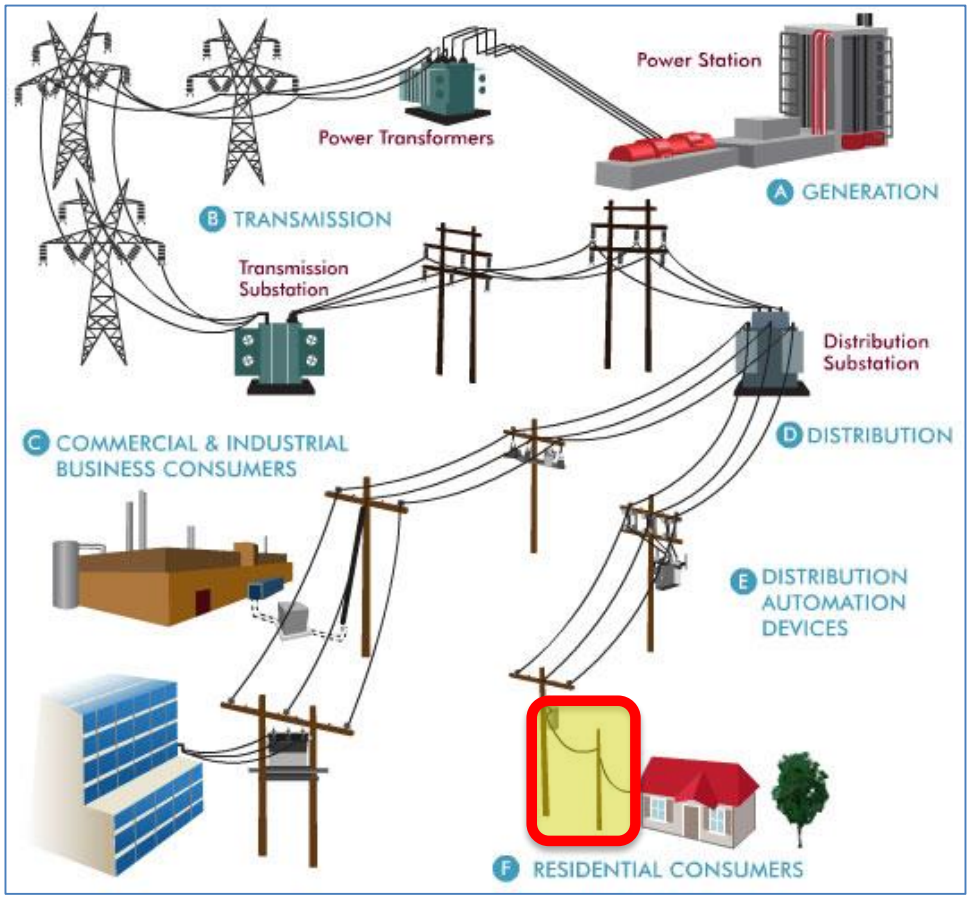
Wilson Gonzalez, Treehouse
Energy and Economic Consulting

Three Guiding Principles

- A customer should be able to connect to the grid for no more than the cost of connecting to the grid.
- Customers should pay for power supply and grid services based on how much they use and when they use it.
- Customers supplying power to the grid should receive full and fair compensation – no more and no less.

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 in proportion to how much they use the grid, and when they use the grid.

Principle #2

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

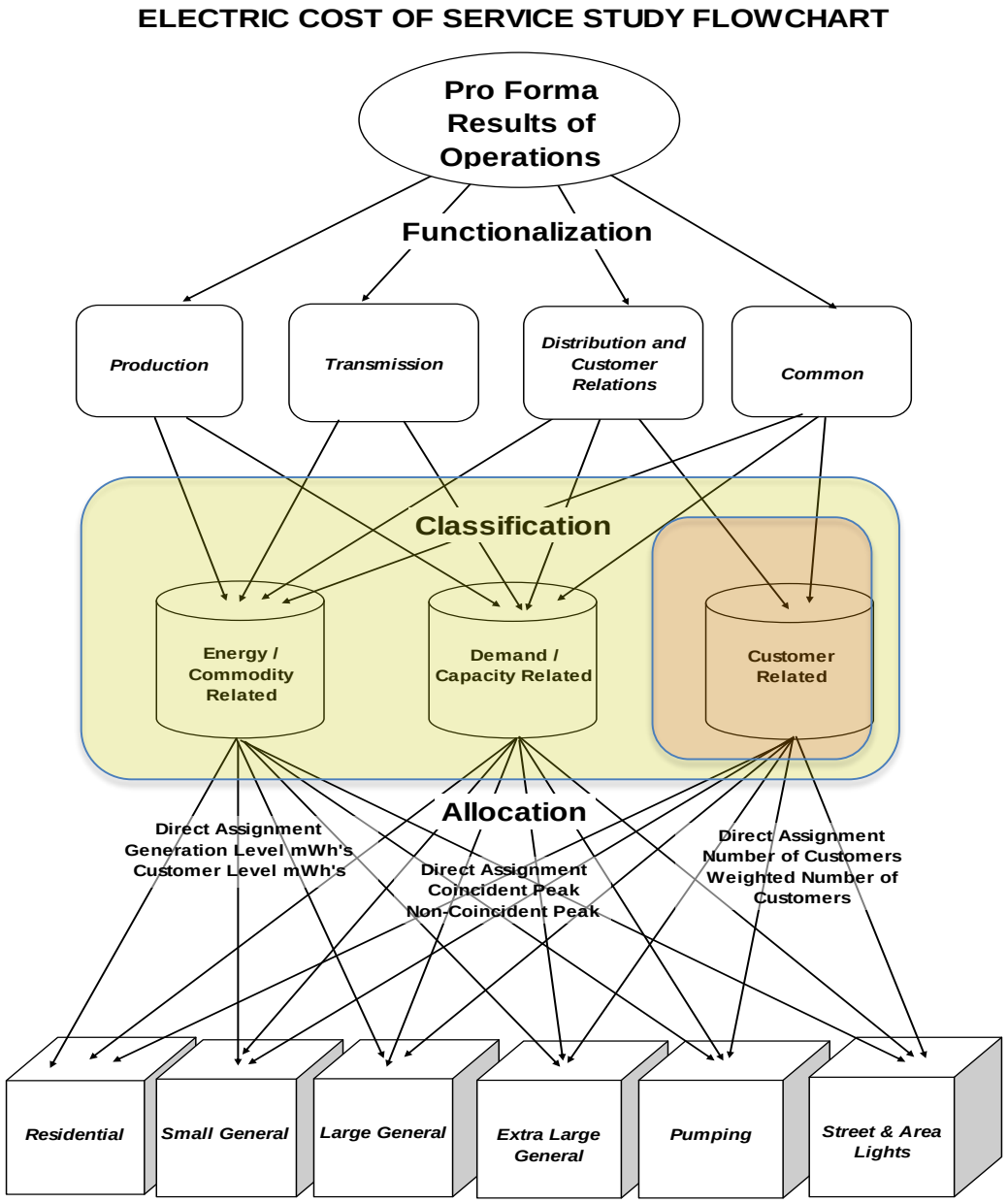
Principle #3

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

Boiling It Down To Rate Design

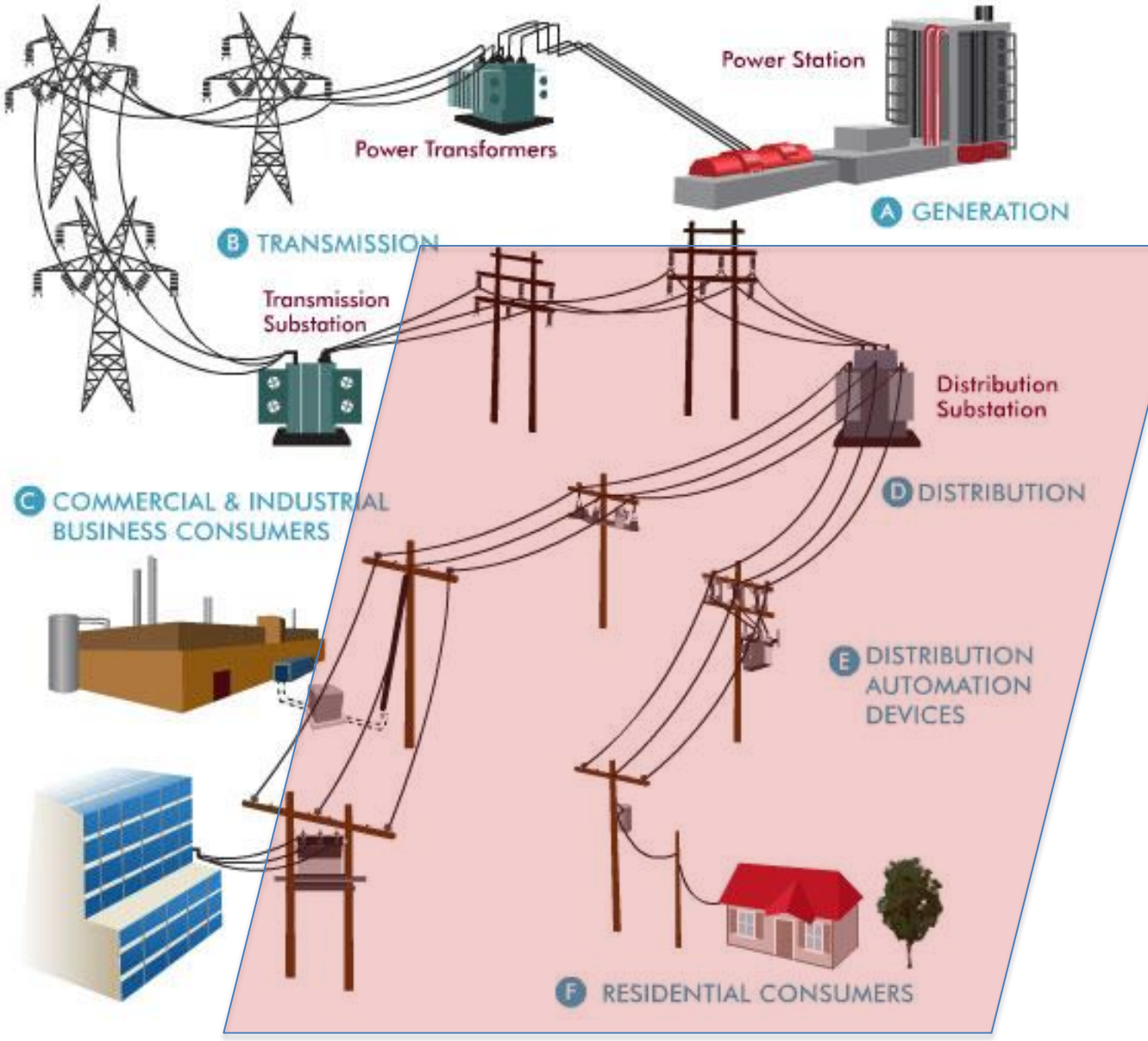
Rate Element	Amount
Costs to Connect to the Grid	
Billing and Collection	$4.00/month
Transformer Demand Charge	$1.00/kVA/month
Power Supply and Distribution (both directions)	
Off-Peak	$.07/kWh
Mid-Peak	$.10/kWh
On-Peak	$.15/kWh
Critical Periods	$.75/kWh

Where Did The Idea that High Fixed Charges are Appropriate Come From?



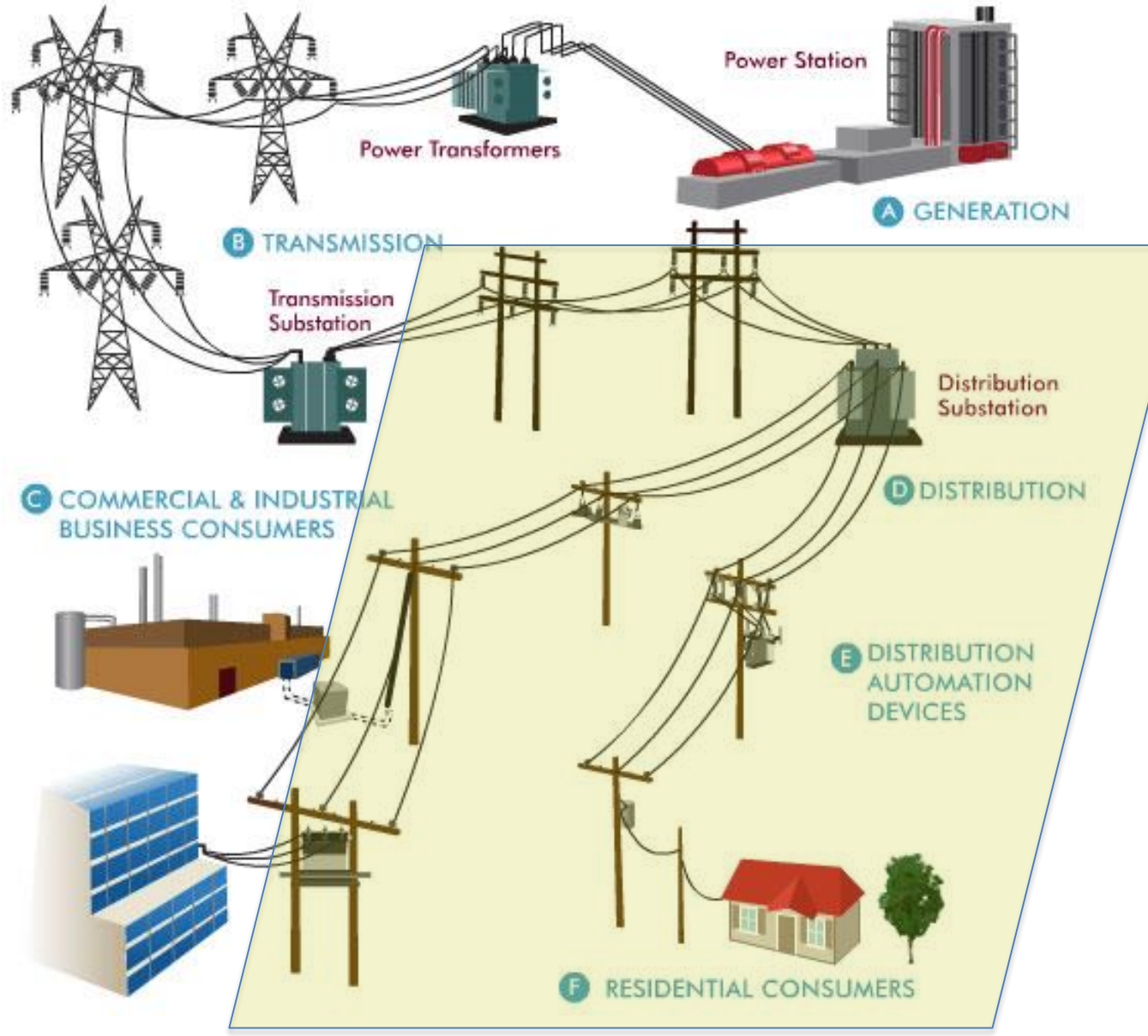
Straight Fixed / Variable:

100% of Distribution System Classified as Customer-related



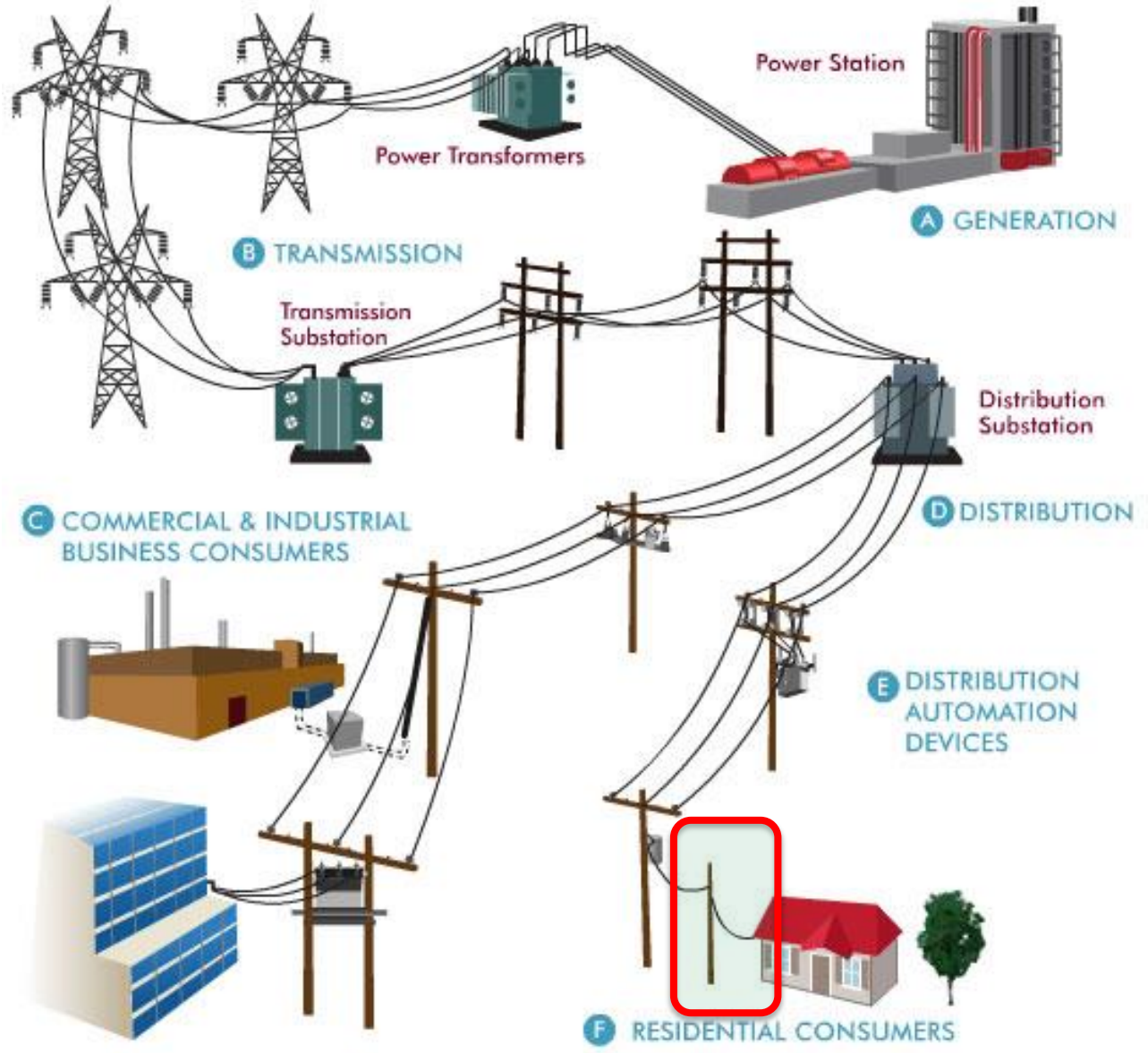
Minimum System Method:

~50% of Distribution System Classified as Customer-related



Basic Customer Method

ONLY customer-specific facilities classified as customer-related



Comparing Methods

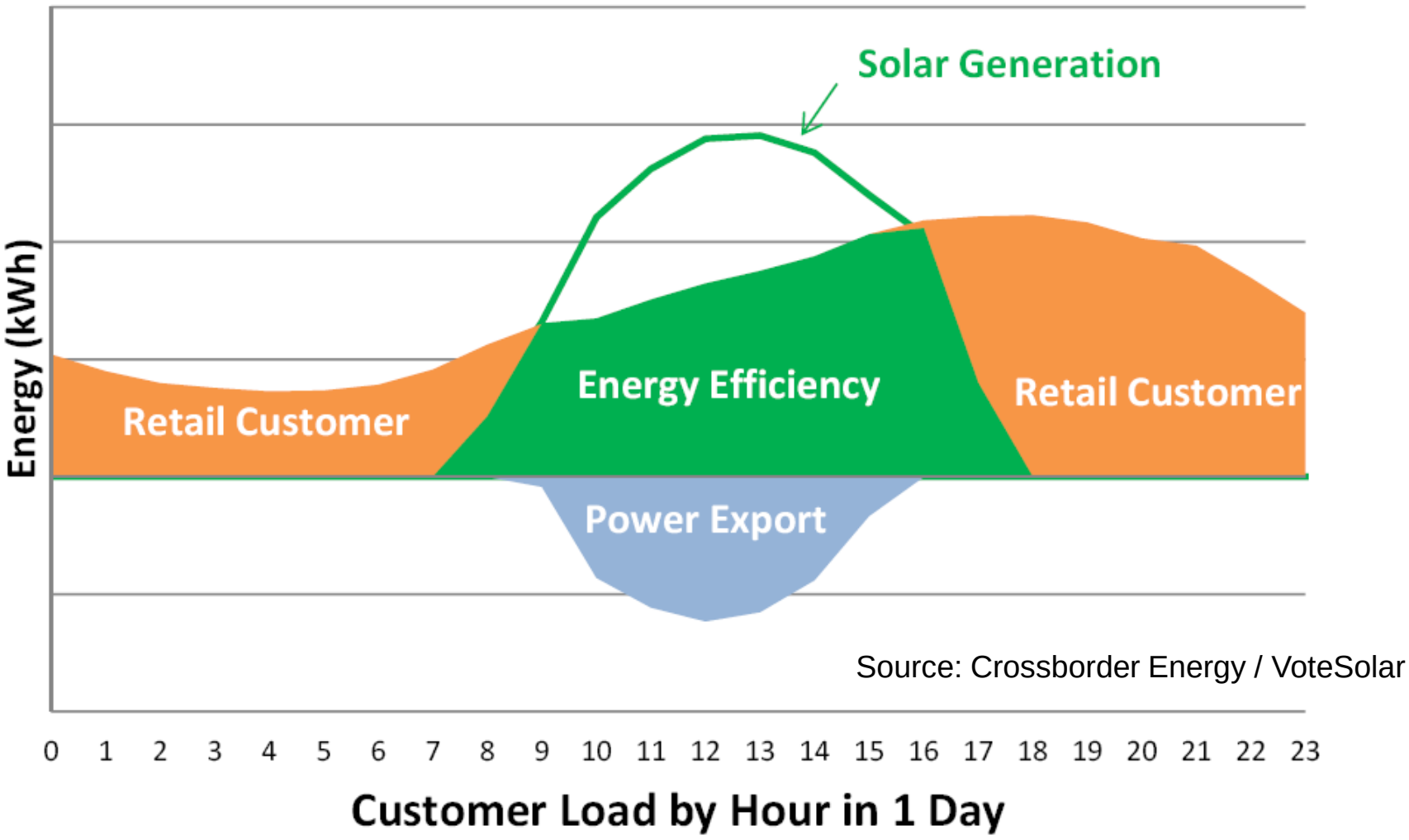
Cost Category	Straight Fixed / Variable	Minimum System Method	Basic Customer Method
	$/month/customer		
Poles	$10	$5	$ -
Wires	$20	$10	$ -
Transformers	$10	$5	$ -
Services	$1	$1	$1
Meters	$1	$1	$1
Billing	$2	$2	$1
Customer Service	$2	$2	$1
Total	**$46**	**$26**	**$4**

What About Other Industries?

Paying On The Basis of Usage

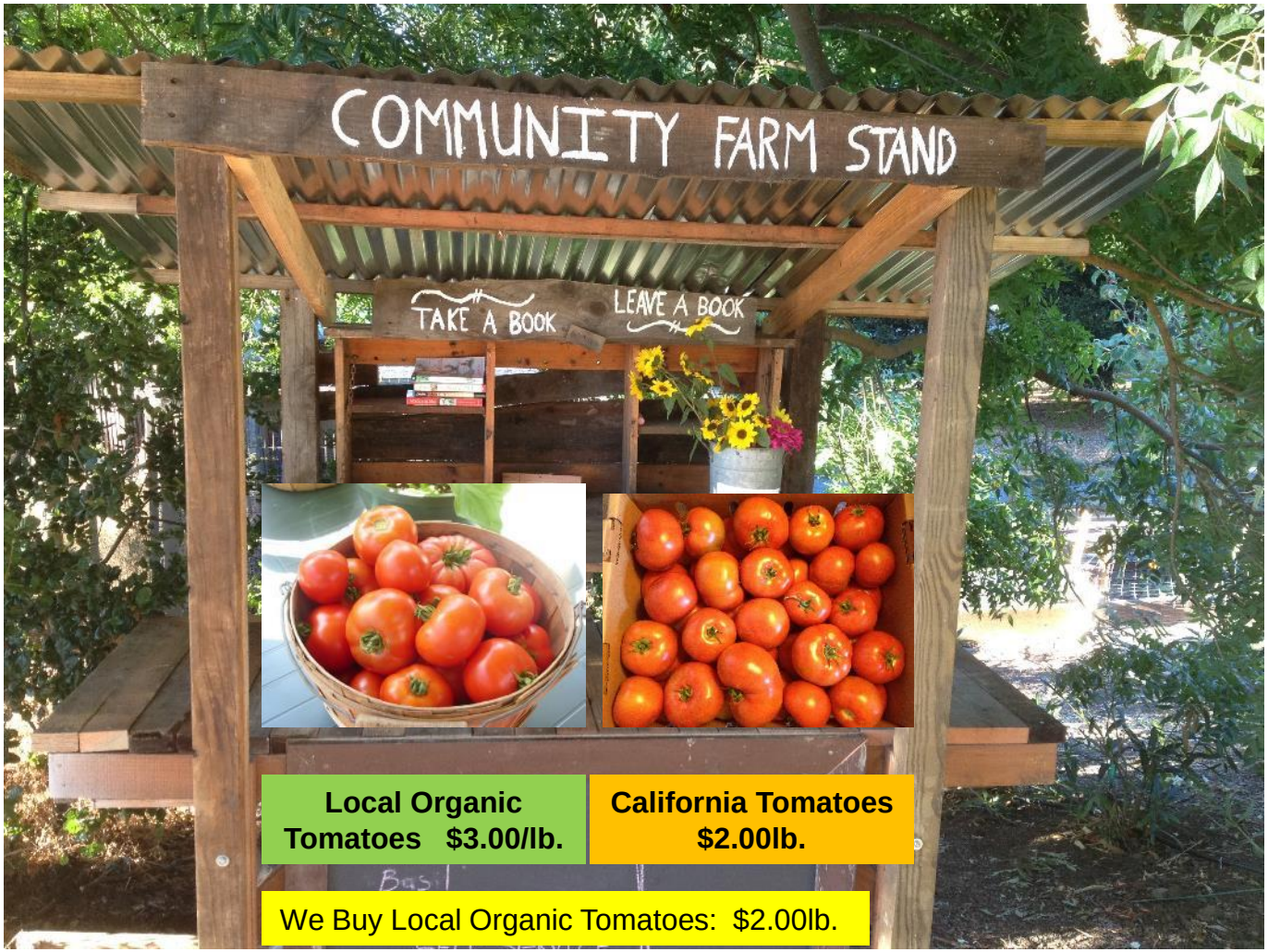
Off-Peak	**Baseload Generation, Transmission, Distribution**
Mid-Peak	**Intermediate Generation, Transmission, Distribution**
On-Peak	**Peaking Generation, Distribution**
Critical Peak	**Demand Response**

Issues With Home-Grown Electricity



Source: Crossborder Energy / VoteSolar

All Kilowatt-Hours Are Not Equal

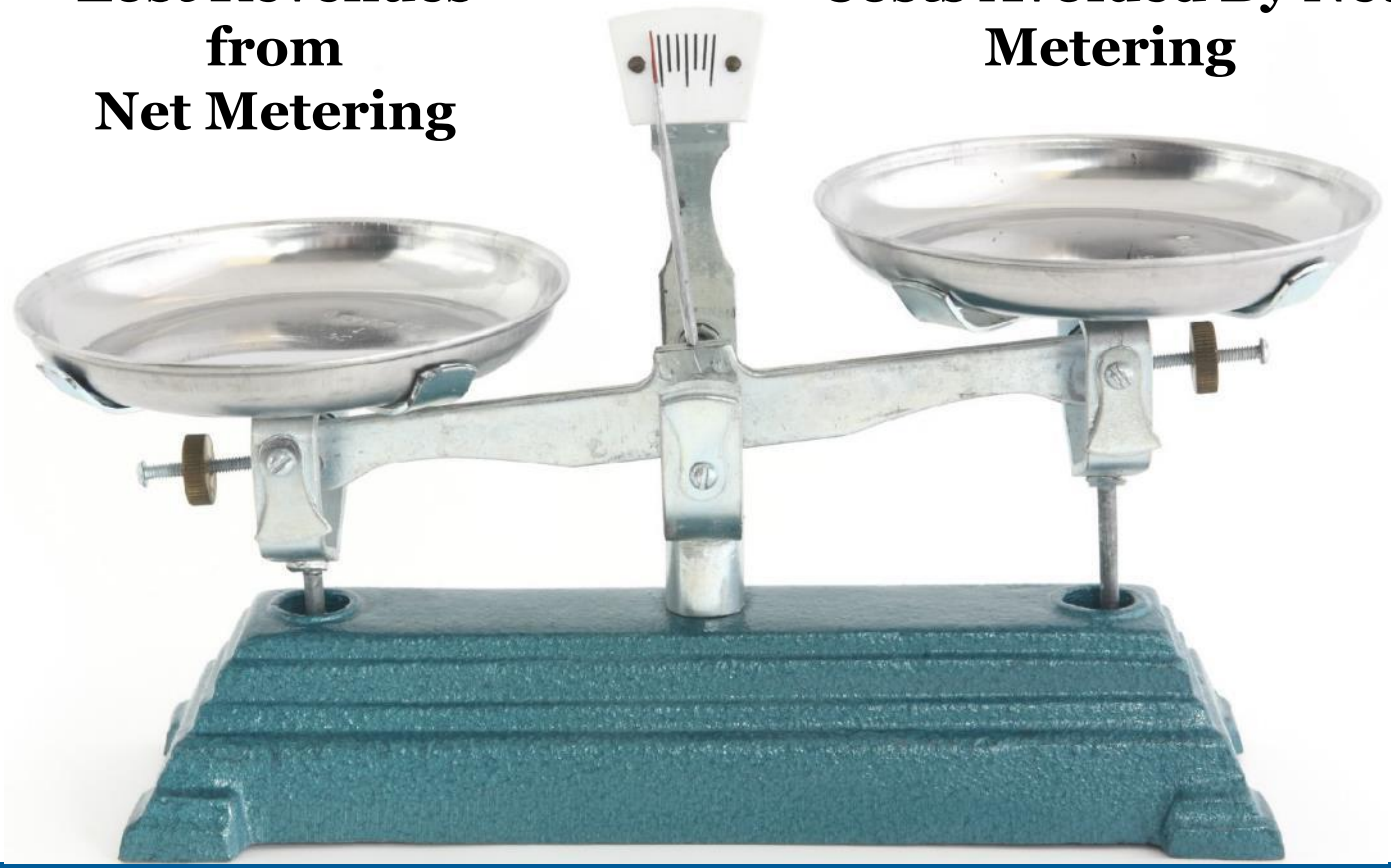


Traditional Ratemaking View

Critical View of Net Metering

Lost Revenues from Net Metering

Short-run Fuel and Purchased Power Costs Avoided By Net Metering



Solar Advocate View of Net Metering

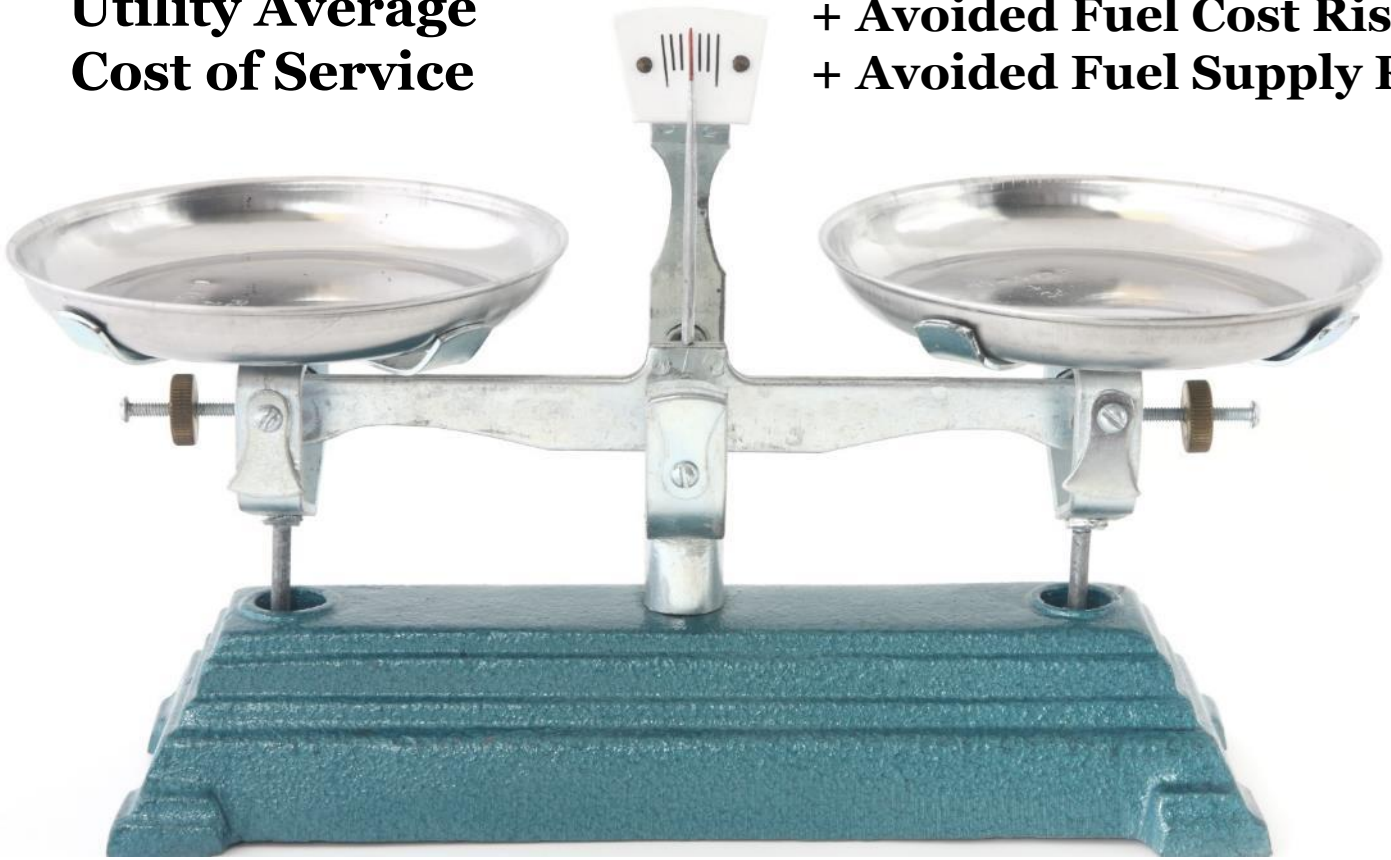
Lost Revenues From Net Metering

Long-Run Avoided Cost for Generation, Trans, Dist
+ Reduced Emissions
+ Avoided Fuel Cost Risk
+ Avoided Fuel Supply Risk
+ Local Economic Development
+ Future Carbon Costs
+ Shading Benefits on AC Load
+ Much, much more

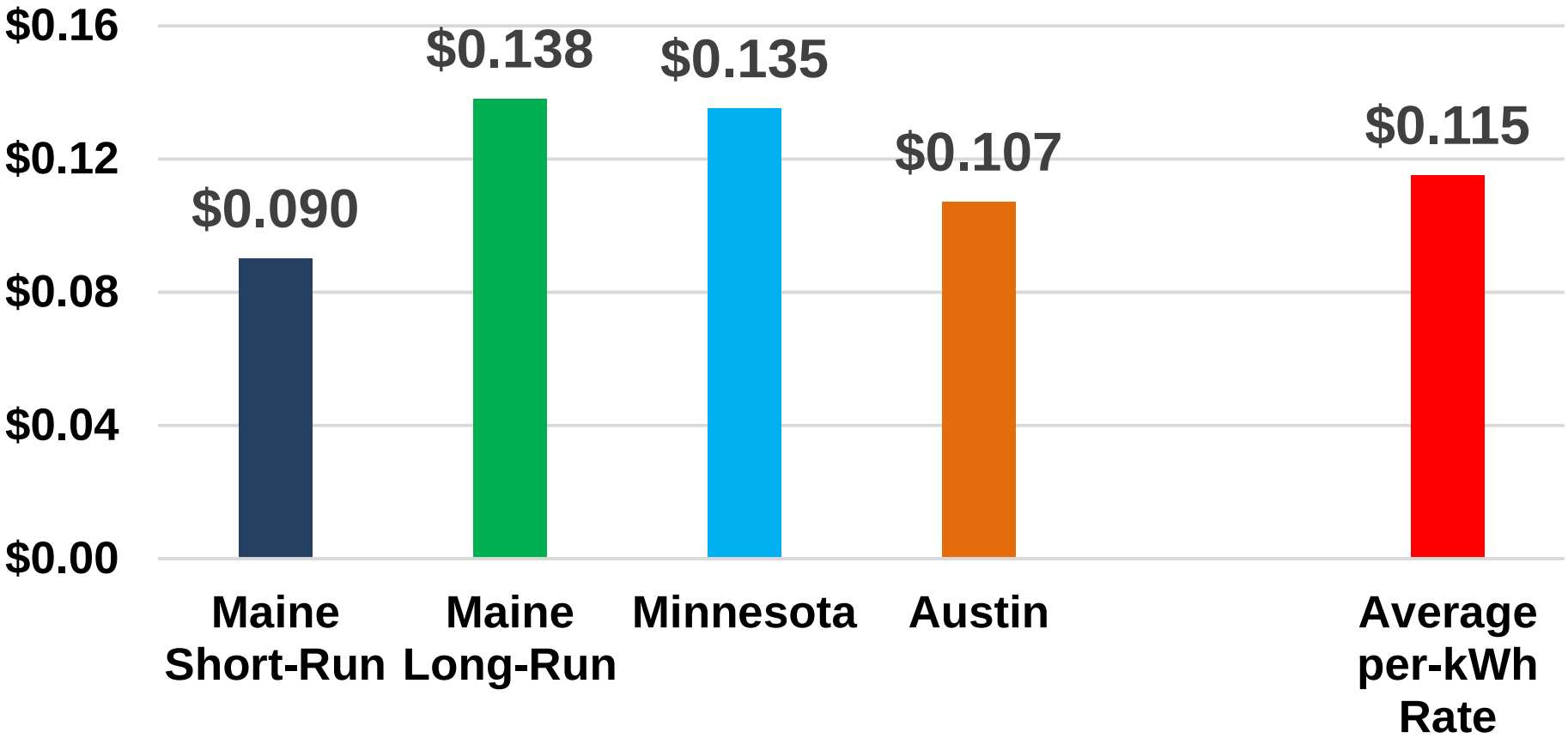
Balanced Net Metering View

Utility Average Cost of Service

Long-Run Avoided Cost for Generation, Trans, Dist
+ Avoided Emission Cost
+ Avoided RPS Obligation
+ Avoided Fuel Cost Risk
+ Avoided Fuel Supply Risk

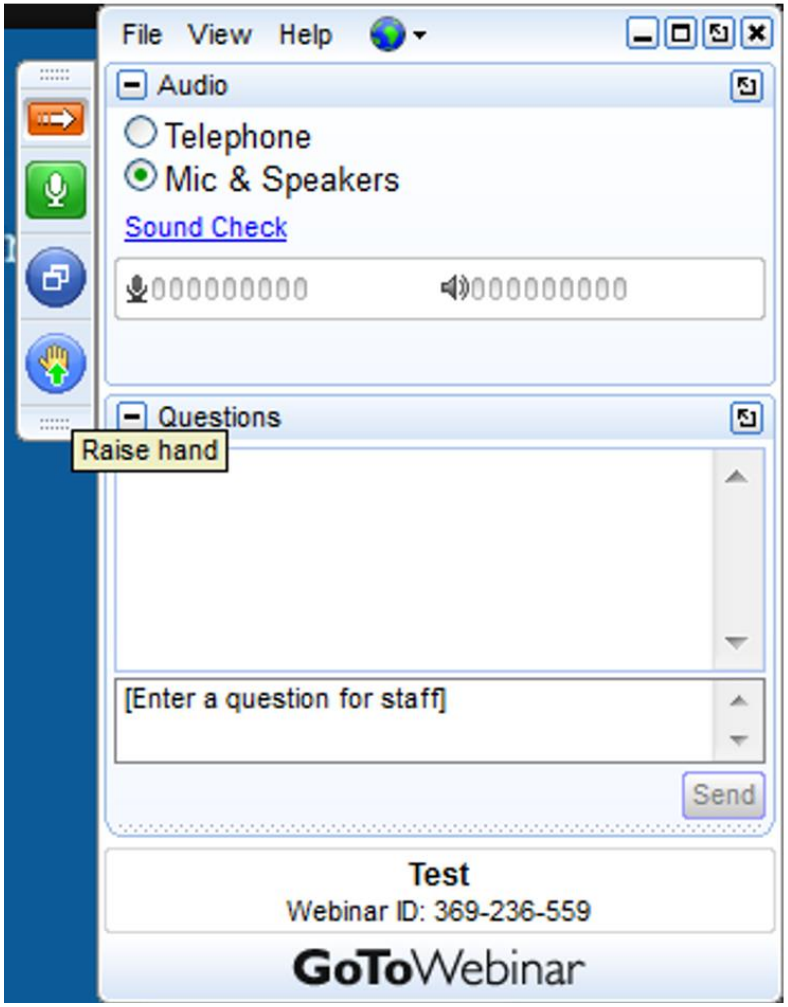


Value of Solar Studies: Utility Economic Values Only



Clarifying Questions?

Please submit questions through the Questions pane.



Empowering Smart Technology

New technologies can minimize total system costs and increase system reliability

Electric Vehicles

- Source of on-peak power (V2G)
- Market for off-peak power
- Provide multiple ancillary services

Path to Smart Electric Future

1. Need Cost-Effective Deployment of Smart Meters/Smart Grid
2. Need development of smart rate designs
3. Need adoption of enabling technology to facilitate transition

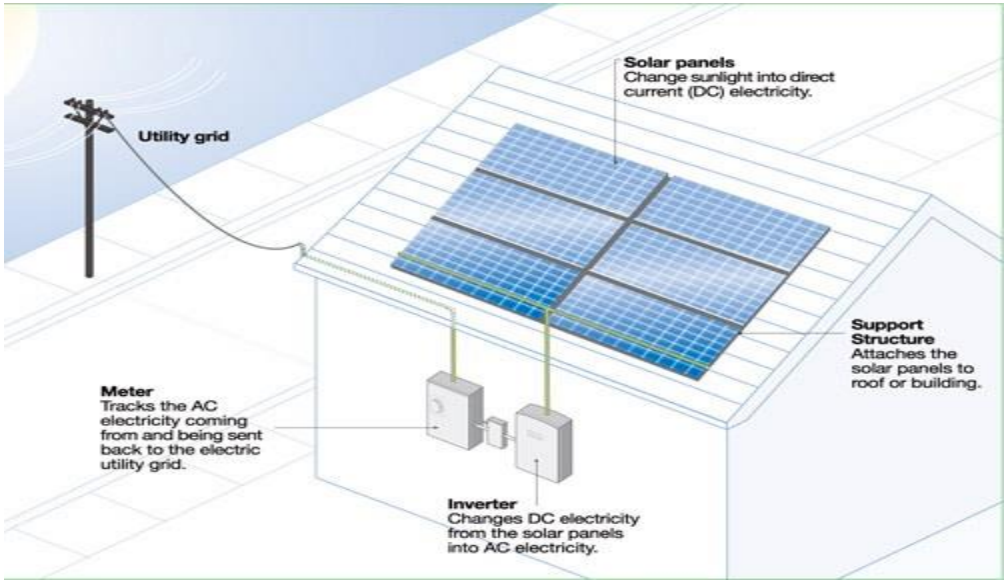
Warner Brothers, 1939

1. Smart Meters/Smart Grid

Enable granular data acquisition, equipment control and communications between the customer and the grid

Smart Meters/Distributed Generation

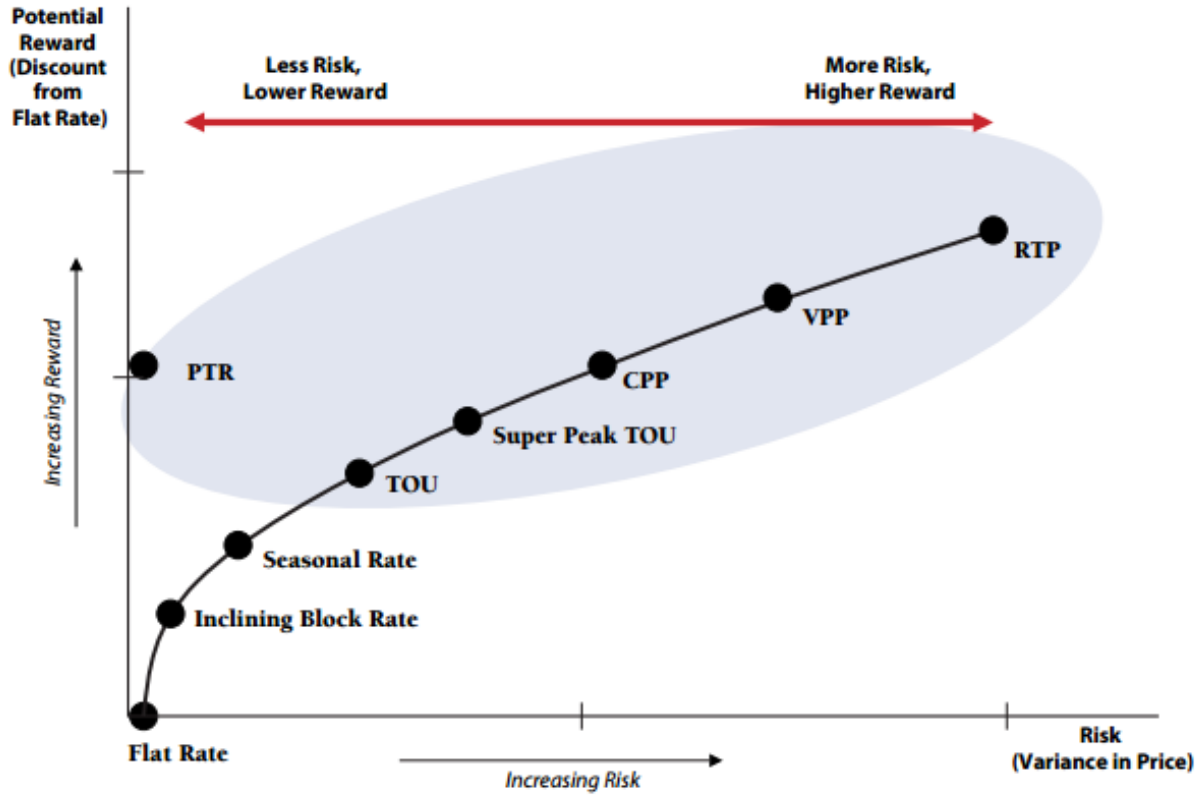
Track power flows of DG (PV's) in both directions on interval basis to determine accurate billing (and value transactions)



2. Implementing Smart Rates

Need smart rates to unleash this technology

Conceptual Representation of the Risk-Reward Tradeoff in Time-Varying Rates[80]

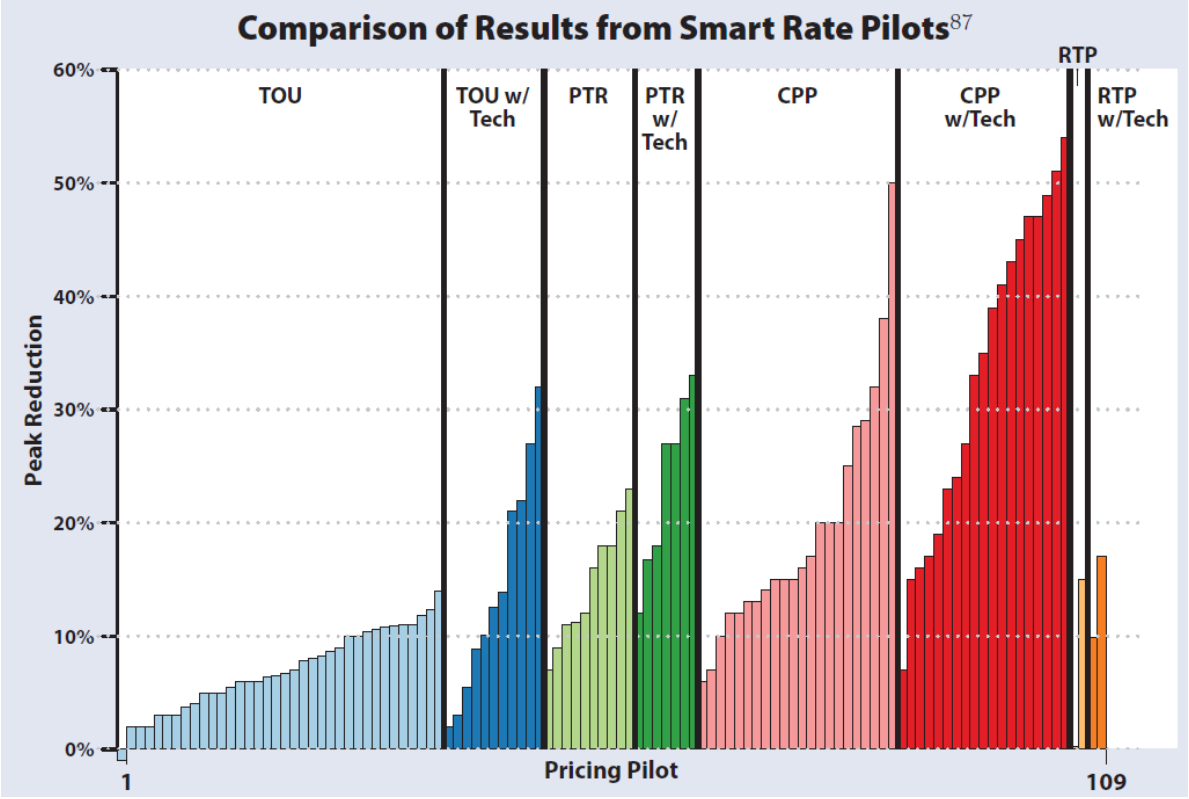


Types of Rates

Rate Type	Description	Customer Risk/Reward	Smart Meter
Single Average	Traditional rate where all hours consumed are charged the same rate.	None	Not needed
Seasonal	Traditional rate that varies depending on the season, usually summer rates are higher for a summer peaking utility.	Low	Not needed
Inverted	Rates vary depending on the level of consumption blocks. Usually the first 500 kWh are cheaper with additional consumption leading to higher rates.	Low to medium depending on consumption level	Not needed
Peak Time Rebate (PTR)	Traditional rate with the customer option of curtailing use when utility signals a "peak event day."	No Risk, opportunity for reward	Yes
Time of Use (TOU)	Rates vary by the time of day, with the lowest rate being off-peak, and shoulder and peak blocks being charged higher.	Medium risk and reward	Yes
Critical Peak Pricing (CPP)	Rates are significantly higher during the period when a utility calls a "peak event."	Higher risks and reward	Yes
Variable Peak Pricing (VPP)	Hybrid of time-of-use and real-time pricing where different periods for pricing are defined in advance, but peak pricing based on utility and market conditions.	Very High	Yes
Real Time Pricing (RTP)	Rate can vary on an hourly basis.	Highest	Yes

Smart Rates Can Reduce Total System Costs & Customer Bills

Smart rates can produce significant peak load reductions and shift energy consumption



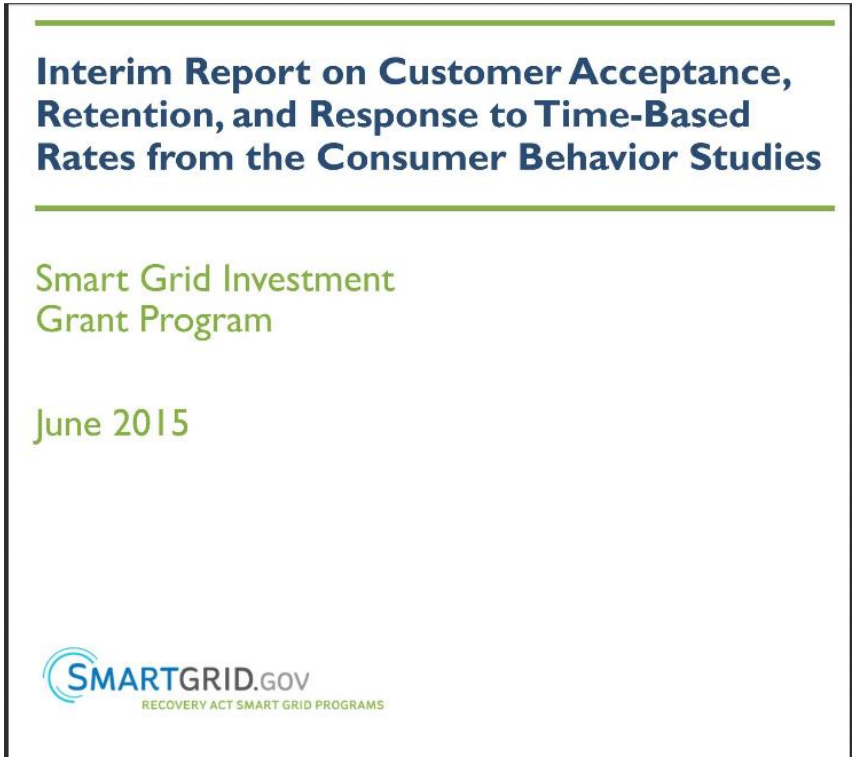
3. Enabling Technology

Rates work best with enabling technology

– "Set and Forget"

Enabling Technology

A recent US DOE study reports that "average peak demand reductions for customers taking service on critical peak pricing (CPP) rates were almost twice the size (21 percent) than they were for customers participating in critical peak rebate (CPR) programs (11 percent)."



Enabling Technology

"However, when automated controls were provided, peak demand reductions were about the same (30 percent for CPP and 29 percent for CPR)."

- See: US DOE. (2015). *Interim **Report** on Customer Acceptance Retention, and Response to Time-Based Rates from the Consumer Behavior Studies.*

Smart Rates and Consumer Protections

- Incorporating Consumer Protections important during roll-out of smart rates
  - Customer education
  - Shadow billing

Smart Rate & Consumer Protections

- "Hold harmless"& bill forgiveness provisions (1 yr.)
- Customers placed on tariffs that usage history determine will lead to lowest bills
- Continue low income programs (Rate discounts, PIPP, usage based discounts, etc.) for "at risk" populations

Integrated Distribution Grid Planning

Identify least-cost solutions to system upgrades

Grid Value from DG – Differentiate by

- **Time**
  - Peaks and managing predictable solar, CHP patterns
- **Location**
  - High marginal cost places
- **Attribute**

-Ancillary

Maturing Solar: Changes Ahead for Net Metering?

Compensation method suited for infant industry

- Emphasis of Simple compensation and interconnection
- Rough compensation "close enough" at smaller numbers
- When higher numbers create a financial effect on the utility, a more rigorous compensation method can be considered

Rate Design Recommendations: DG

State Average Residential Retail Electricity Rate	Conventional Compensation Method	Level of Compensation Based on Range of Value of Solar Studies (VOSS)	Recommended Rate Design	Should Externalities Be Added to VOSS for PV Compensation?
Low Cost Utilities (<10 cents/kWh)	Net-Metering (power supply plus distribution)	Under Compensation	Zero Customer Charge and Inclining Rate Design (or time varying rate) to Conventional net-metering	State by State Determination
Average Cost State (10-20 cents/kWh)	Net-Metering (power supply plus distribution)	Fair Compensation	Low Customer Charge and Conventional net-metering	State by State Determination
High Cost State (>20 cents/kWh)	Net-Metering (power supply only)	Over Compensation	Time varying prices for power supply & distribution services. Pays full retail rate when taking power from the grid. Receives just power supply cost (no distribution) when supplying power to grid. Bi-directional Meter needed.	State by State Determination

Perspective on DG Cross-subsidy Issue

- PV cost recovery responsibility to other customers unfairly characterized as a cross-subsidy
  - Cost-allocations among customers and customer classes dynamic and reflect changing circumstances

Utility Revenue Deficiency Options

- Revenue Decoupling Mechanisms
- Performance Based Ratemaking
- Rate of Return adjustment for increased risk

Policies to Complement Smart Future

- Adopt time-varying and dynamic rate designs
- Revenue regulation to ensure that utilities have a reasonable opportunity to earn a fair return

Policies to Complement Smart Future

- State building codes upgraded to require residential EMS
- DG to install smart inverters
- Federal Appliance Standards to require control technologies to adjust for changing prices

“Not So Smart” Future

- Flat Rate
- SFV
- Discriminatory charges to PV customers

Q & A

Summary

- Three guiding principles
- High fixed charges are improper
- Time-varying pricing is desirable
- Technology enhancement is important
- Value of Solar may exceed retail rates
- DG customers can provide grid services
- Customer protections are important

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

Jim Lazar jlazar@raponline.org
Wilson Gonzalez treehouseenergyecon@gmail.com

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
www.raponline.org