RAP Energy solutions for a changing world

Sustainable Rate Design for a Modern Grid

New Hampshire PUC Energy Efficiency Workshop

Presented by Richard Sedano

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Introducing RAP and Rich

- RAP is a non-profit organization providing technical and educational assistance to government officials on energy and environmental issues. RAP staff have extensive utility regulatory experience. RAP technical assistance to states is supported by US DOE, US EPA and foundations.
  - Richard Sedano directs RAP's US Program. He was commissioner of the Vermont Department of Public Service from 1991-2001 and is an engineer.

Agenda Discussion Points

- Encourage **wise use** of energy and **reduce the use of energy at peak times**
- Avoid creation of **cross subsidies** that would **encourage inefficient use or production** of energy
- Consider adoption of **optional rate designs** for each customer class that encourage efficiency
- Encourage the **addition of distributed generation** with the right **size**, **location** and operating **times** to have positive impact on the **grid** and the **cost** to serve customers
- **Revenue adequacy** via Implementing decoupling or lost revenue recovery mechanisms
- Promote use of smart meter/smart grid **technology**/consider time of use, real time **pricing**

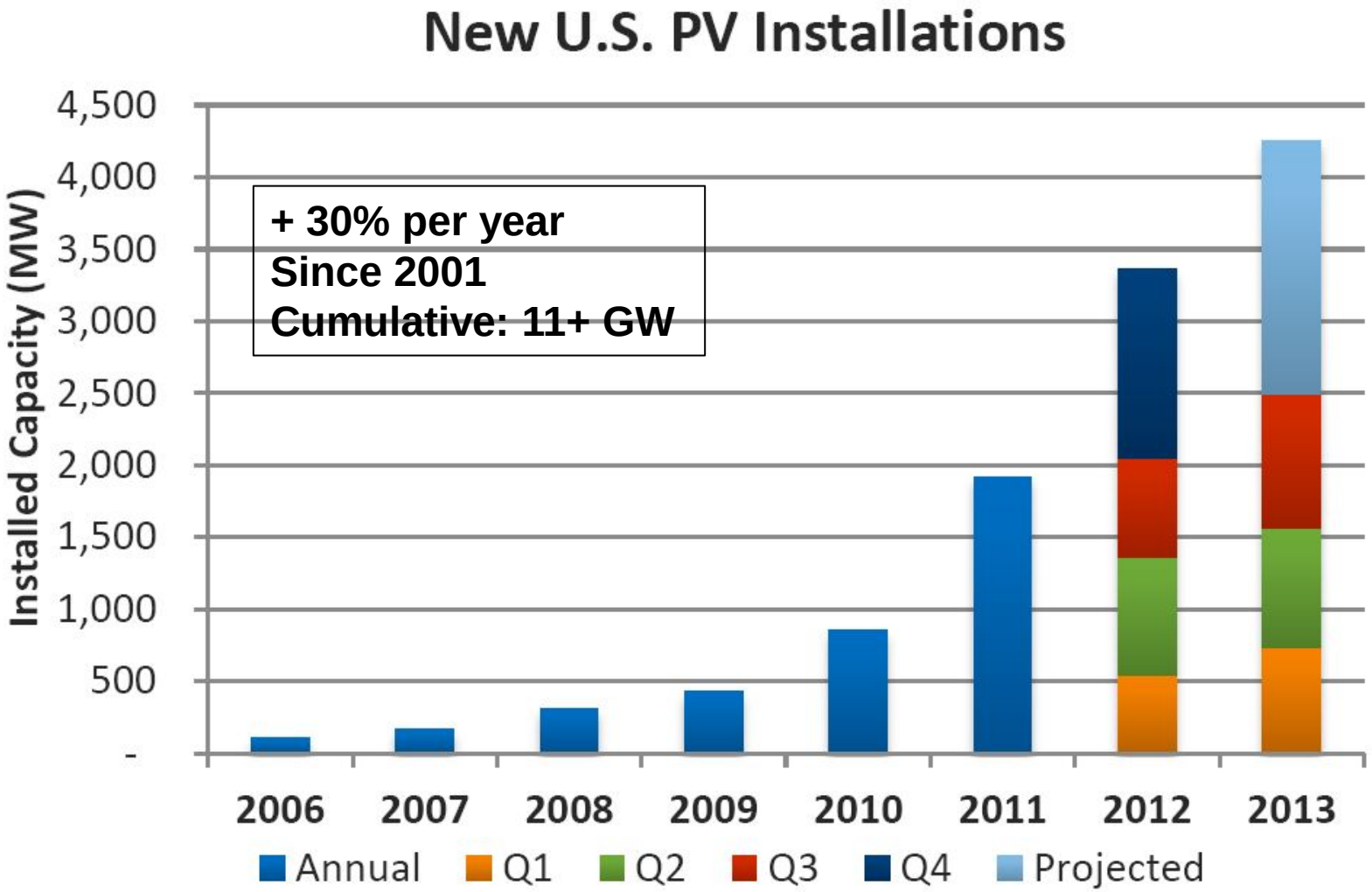
Principles for Modern Rate Design

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

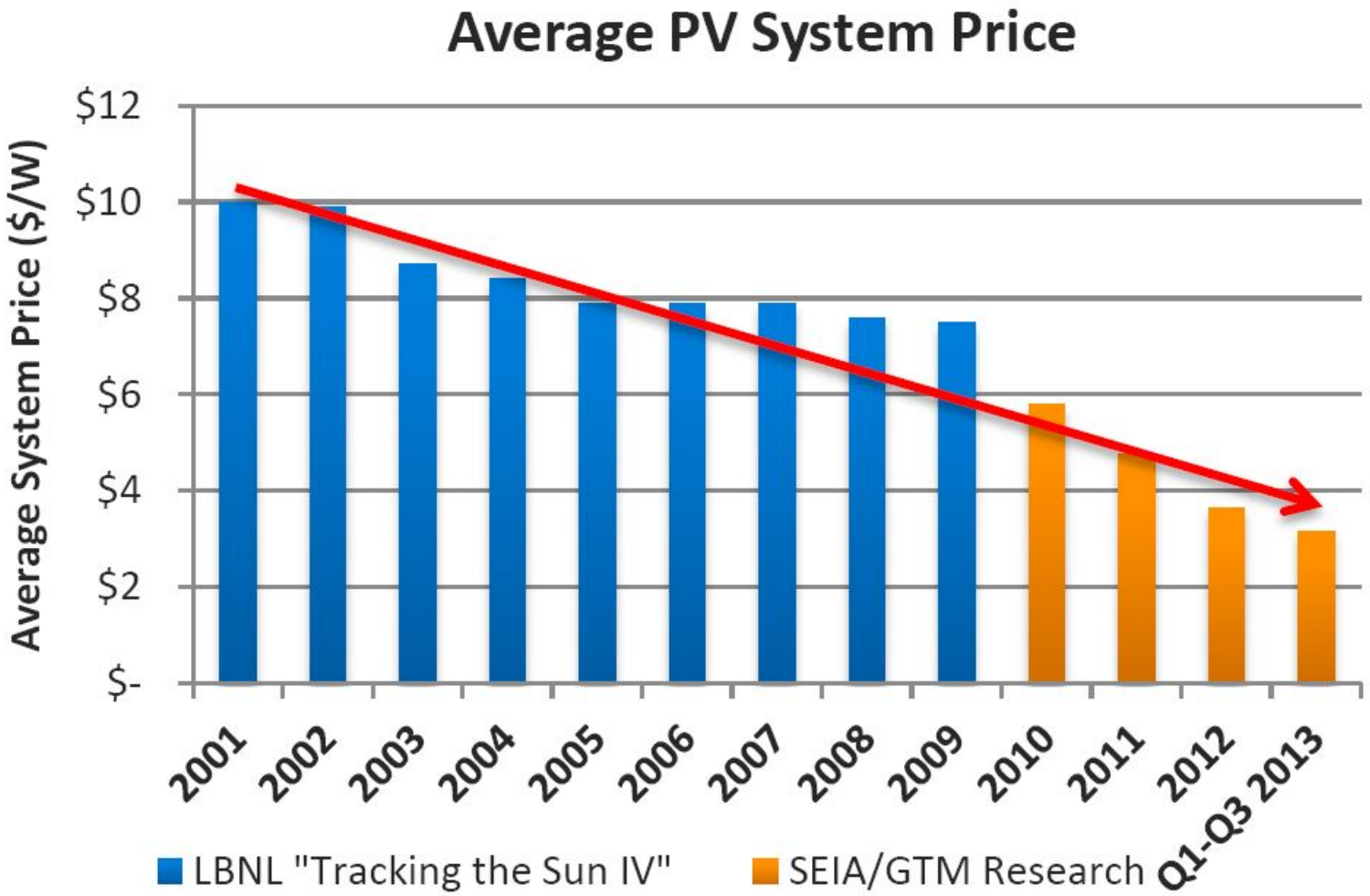
Time-Varying: Customers should pay for grid services and power supply in proportion to how much they use and when they use it.

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

Distributed Generation is Growing



Costs Continue to Decline



Why Reassess? Why Change? Why Now? A Decentralized Grid Rising

- On site generation
  - Prices to deploy are trending down
  - Electricity users value choice
    - To secure prices
    - To assure zero emissions, to do their part
    - To be cool
    - To cooperate with neighbors
- Automation (comms, smart systems, stds) keeps it simple while chasing value

Consumer Perspective

- Rates are **Prices**
- Prices represent a **message to consumers**
- Utility Prices **signal system value**

- Consumers have **new choices**
  - Respond to value
  - Exit is … (your vision here)

Grid **Value** from DG – Differentiate by

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

Cross-Subsidies

- Subsidies are endemic in utility rates
- Averages smooth out distinctions among customers
  - They don't all just average out
- Rough justice coupled with some intentional bias is the norm
- Explicit, appropriate subsidies are fine
  - No more

Rate Design Options for a Modern Grid

from RAP paper: Smart Rate Design for a Smart Future

- **Time of Use (with critical peak)**
- Demand charge
- Net metering
- Minimum bills
- High Customer Charges
- Cost driven Customer Charge, DG & large houses
- Subscription demand charges
- Bidirectional rates
- Value of solar
- Fees imposed on DG users
- Feed-in-tariffs

A Fixed TOU Rate in Use

- **On-Peak**
  Summer: weekdays 10 a.m. - 8 p.m.

  Winter: weekdays 7 a.m. - 11 a.m. and 5 p.m. - 9 p.m.
- **Intermediate-Peak**
  Summer: weekdays 7 a.m. - 10 a.m. and 8 p.m. - 11 p.m.
  Winter: weekdays 11 a.m. - 5 p.m.
- **Off-Peak**
  Summer: weekdays 11 p.m. - 7 a.m.
  Winter: weekdays 9 p.m. - 7 a.m., Saturday, Sunday, holidays

Sample Time of Use with Critical Peak:

Rate Element	Based On the Cost Of	Illustrative Amount
Customer Charge	Customer-Specific Costs Only	$7.00/month
Off-Peak Energy	Baseload Resources + transmission and distribution	$.08/kWh
Mid-Peak Energy	Baseload + Intermediate Resources + T&D	$.11/kWh
On-Peak Energy	Baseload, Intermediate, and Peaking Resources + T&D	$.15/kWh
Critical Peak Energy (or PTR)	Demand Response Resources	$.75/kWh

A Peak Time Rebate in Use

- Delaware Delmarva Power and Light (DPL) has a critical peak rebate program for residential customers.
- Customers receive a $1.25 credit for every kWh they reduce their usage below a baseline during an event.
- Customers get this credit automatically; they do not have to enroll in the program.
- DP&L: http://www.delmarva.com/Peak-Energy-Savings-Credit.aspx

Opt In

- Why would a customer choose an unfamiliar rate design?
  - Demonstrated savings
    - Shadow bill
    - Opportunity/Control “Smart Home Rate” (NY)
    - “stick it to the man, beat the system”
  - Low/no risk (PTR in MD)
  - Validators (CNT real time rate in IL)
- Opt in rates have a weak track record

Is “Opt in” a stop on the way to mandatory/”opt out?”

- Findings from ARRA Smart Grid Projects
  - Many interesting ones
  - Customers are “sticky”

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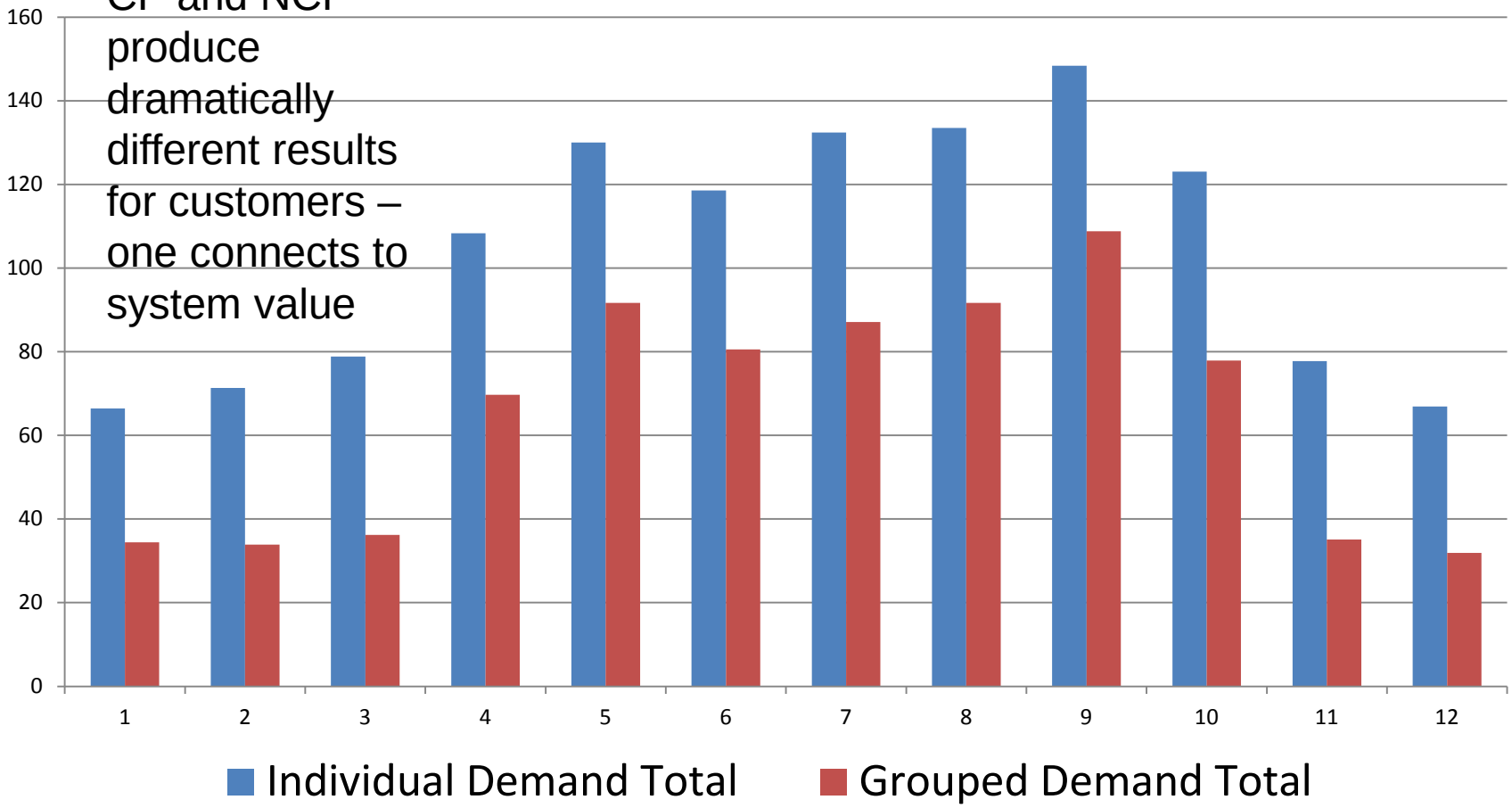
Demand Charge

- Addresses system peak costs if it is a **coincident** peak charge
- To motivate consumer response, use a **short ratchet period** (daily is best, monthly is better than annual)
- A daily demand charge and a well designed **TOU rate with a critical peak** converges in effect, latter seems easier to understand, manage

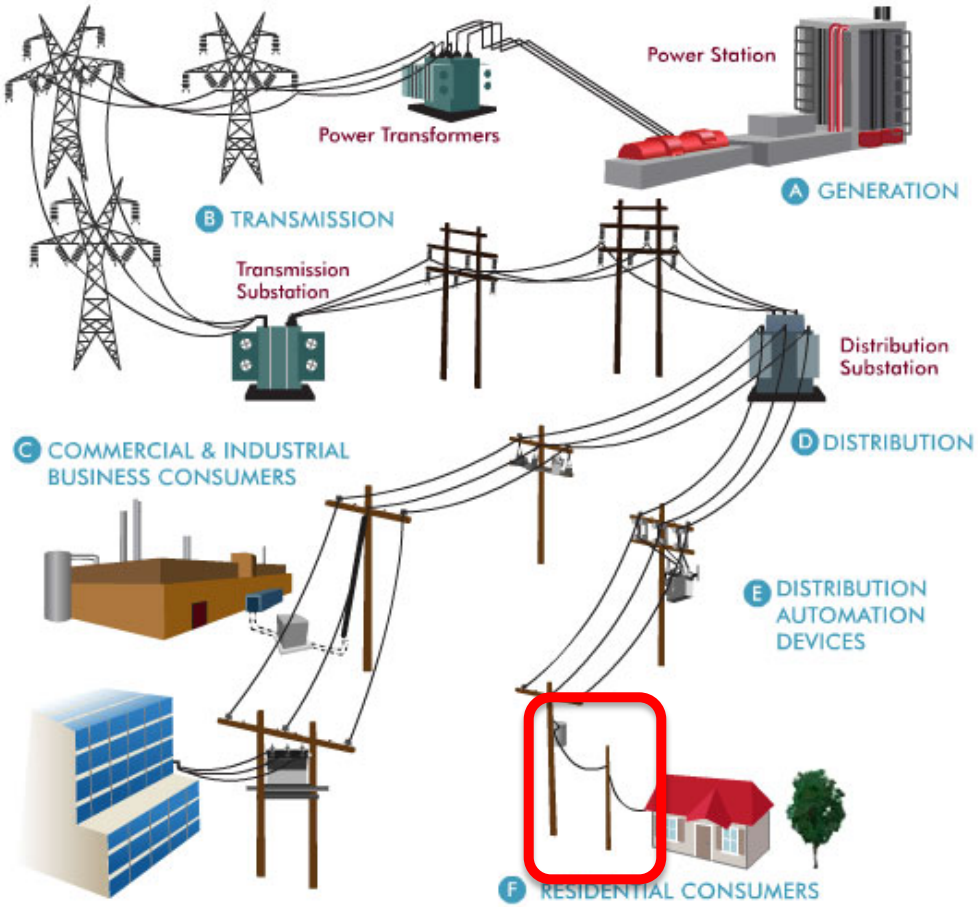
Lots of Diversity at the Transformer
26-Unit Apartment Complex, L.A. Area

CP and NCP produce dramatically different results for customers – one connects to system value



Which Parts of the System Are Designed Based on NCP Demand?

Only the line transformer and service drop must handle the customer Non Coincident Peak



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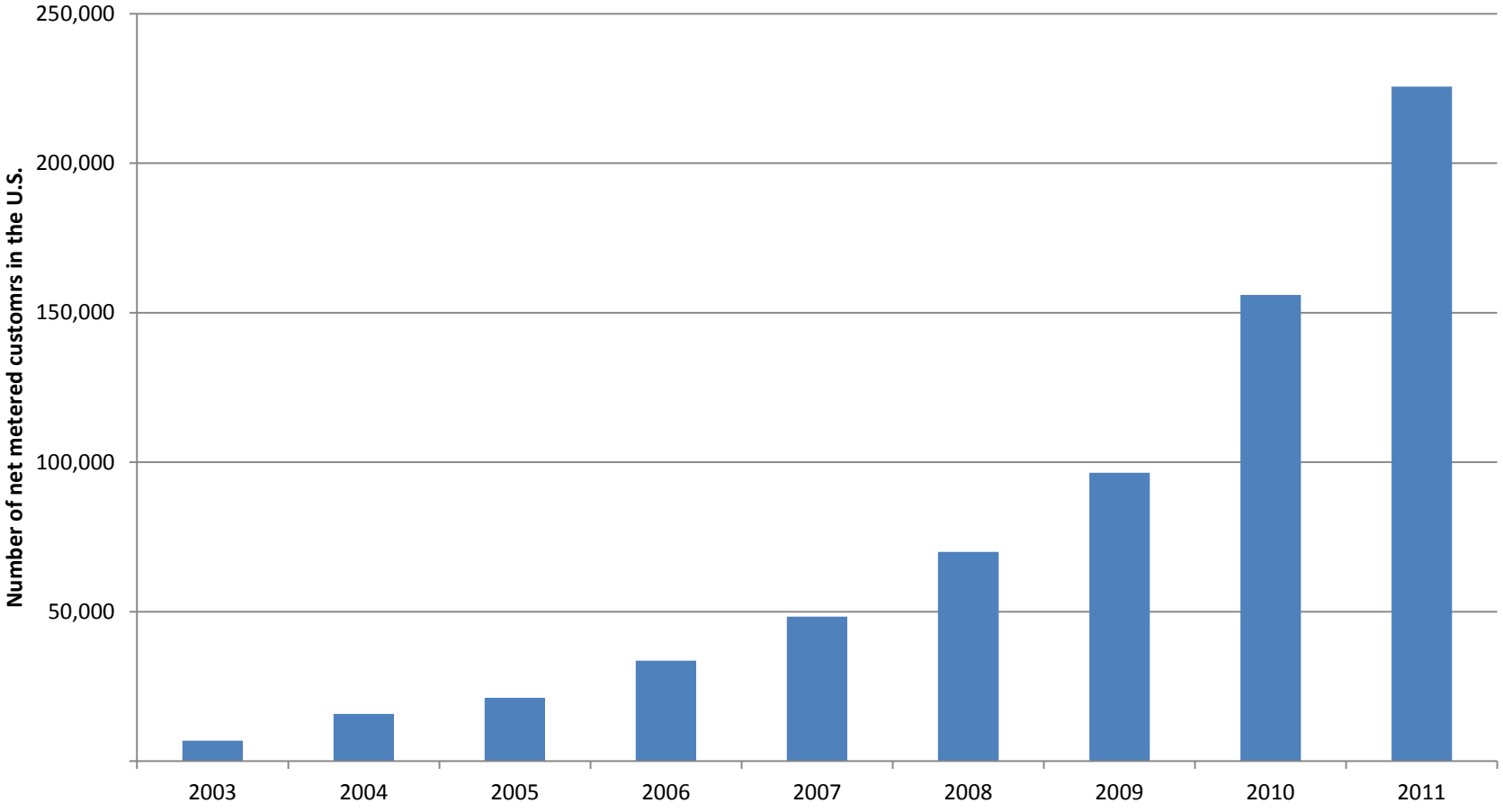
Nearly Every State Authorizing Net Metering

- Solar service industry growing
  - Making use of declining material cost
  - Making use of favorable federal fiscal policy
    - Some states supplement the deal
  - "Soft costs" declining
  - Lease business model removes first cost barrier

Net metering growth



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

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Revenue Assurance: Monthly charge increase or Minimum Bill

- Raising assured monthly collection from members in order to reduce risk of revenue erosion from customer resources
- Monthly charge increase - risks:
  - Lower usage rate below long run marginal cost adds demand, raises overall costs
  - Motivating consumers to bypass, or
  - Only partially solving revenue adequacy leaves problem in place

Price Elasticity at Work

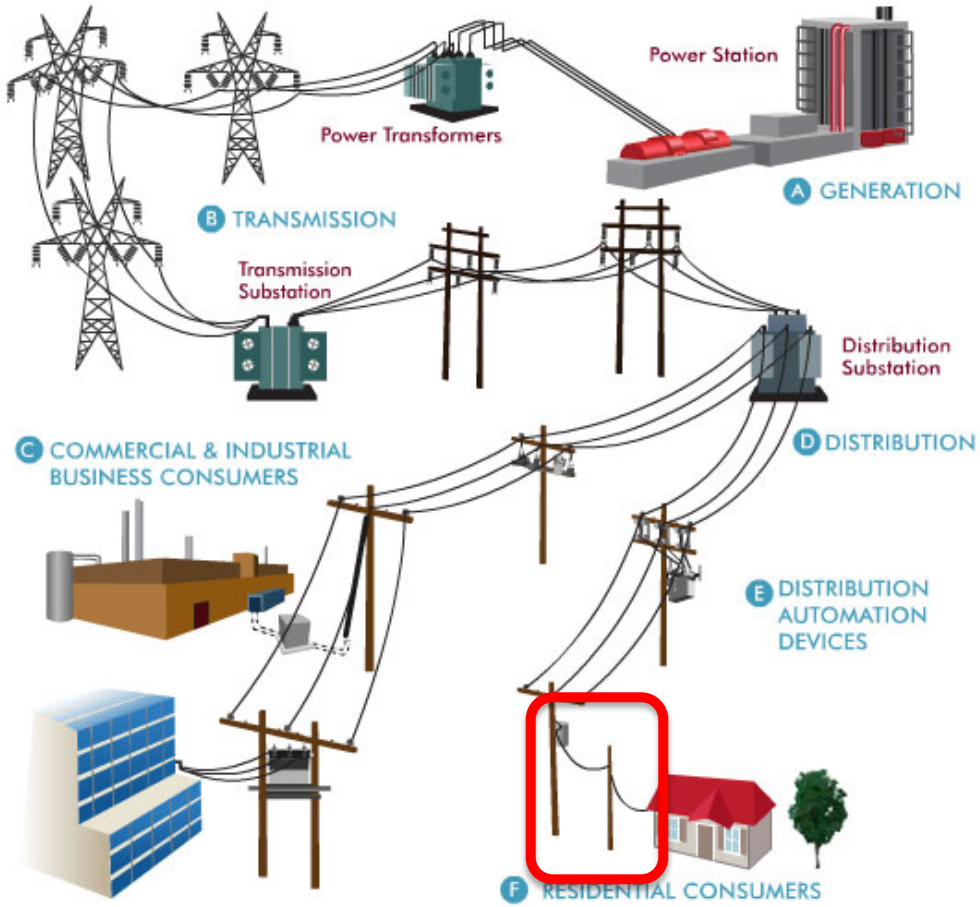
Customer Charge	$5.00		$20.00
Energy Charge	$0.12		$0.09
Change in Price/kWh			-25%
Predicted Change in Usage			+5%

	kWh	Low Customer Charge	High Customer Charge
Customer Charge		$5.00	$20.00
Minimum Bill			
Per-kWh Charge		$0.10	$0.085
Customer Bills	10 kWh	$6.00	$20.85
	100 kWh	$15.00	$28.50
	200 kWh	$25.00	$37.00
	500 kWh	$55.00	$62.50
	1,000 kWh	$105.00	$105.00
	1,500 kWh	$155.00	$147.50
	2,000 kWh	$205.00	$190.00

**The minimum bill will only apply when customer's usage is so low that their bill falls below $20.*

Customer Specific Costs Appropriate for the Monthly Customer Charge

- Billing
- Collections
- Share of transformer and service drop



Rate Design Principles for DG Users

- DG users should not experience discrimination
- Time-varying rates are appropriate in both directions
- PV user should be able to connect to the grid for no more than the cost to connect
- PV user should be able to avoid the retail rate for all on-site consumption of on-site power
- PV user should pay for T&D service at non-discriminatory rates for all power received from the grid
- Recognize “value of solar” to the grid when establishing fair rates and compensation for DG users

Complementary Policies

- Distribution Planning
- Revenue Adequacy and throughput incentive solutions
- Outcome-based regulation
- Technology (Advanced meter infrastructure and the smart grid)

Distribution Planning

- Largely done today outside the view of the regulator
- Keep depreciation line steady
  - Fill in urgent projects to fill budget
- In most places, still a one-way system
  - But signs of change are evident
  - Can distribution planning drive distributed resource deployment? And vice versa?

California and New York

- California PUC has directed its utilities to open up the distribution planning process
  - Use DG and DR as primary resources
- NY PSC in its Reforming the Energy Vision process has set its utilities on a similar path
  - Anticipates avoiding significant grid costs from typical solutions
  - Note transfer of cost from utility to customers choosing to deploy DG and DR

Decoupling

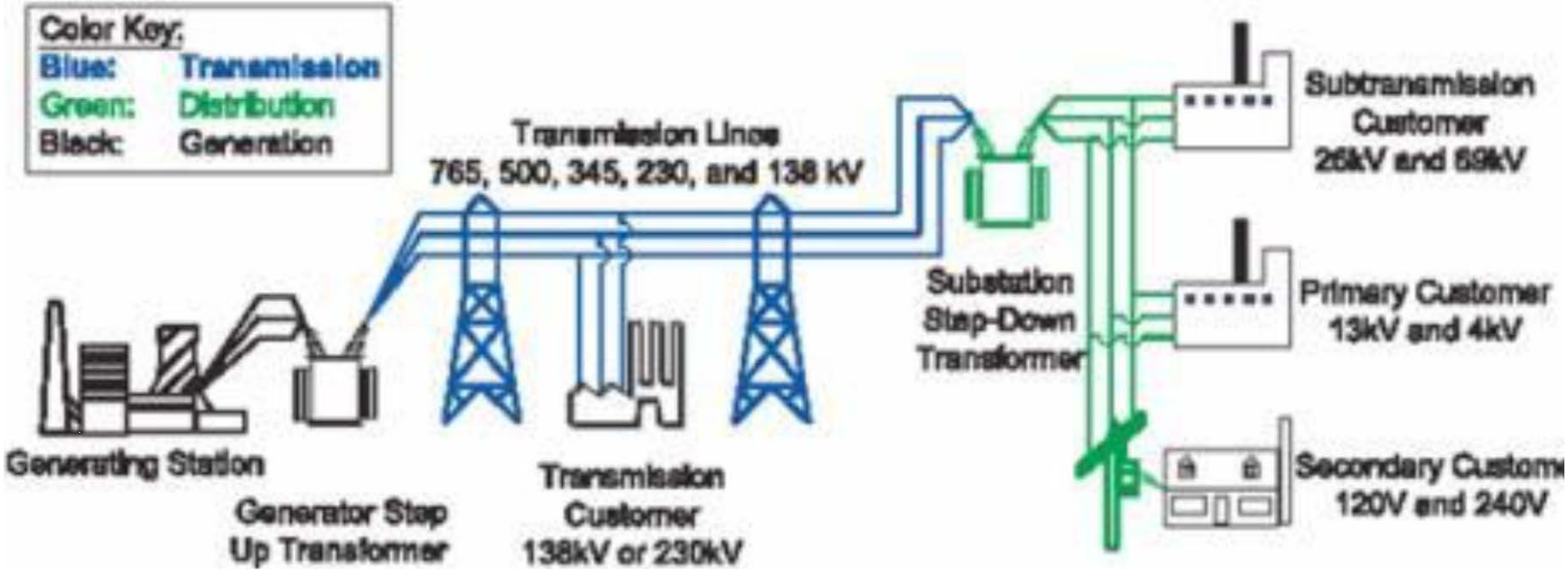
- A way to address revenue assurance without affecting rate design

Periodic Decoupling Calculation	
From the Rate Case	
Target Revenues	$10,000,000
Test Year Unit Sales	100,000,000
Price	$0.10000
Post Rate Case Calculation	
Actual Unit Sales	99,500,000
Required Total Price	$0.1005025
Decoupling Price "Adjustment"	$0.0005025

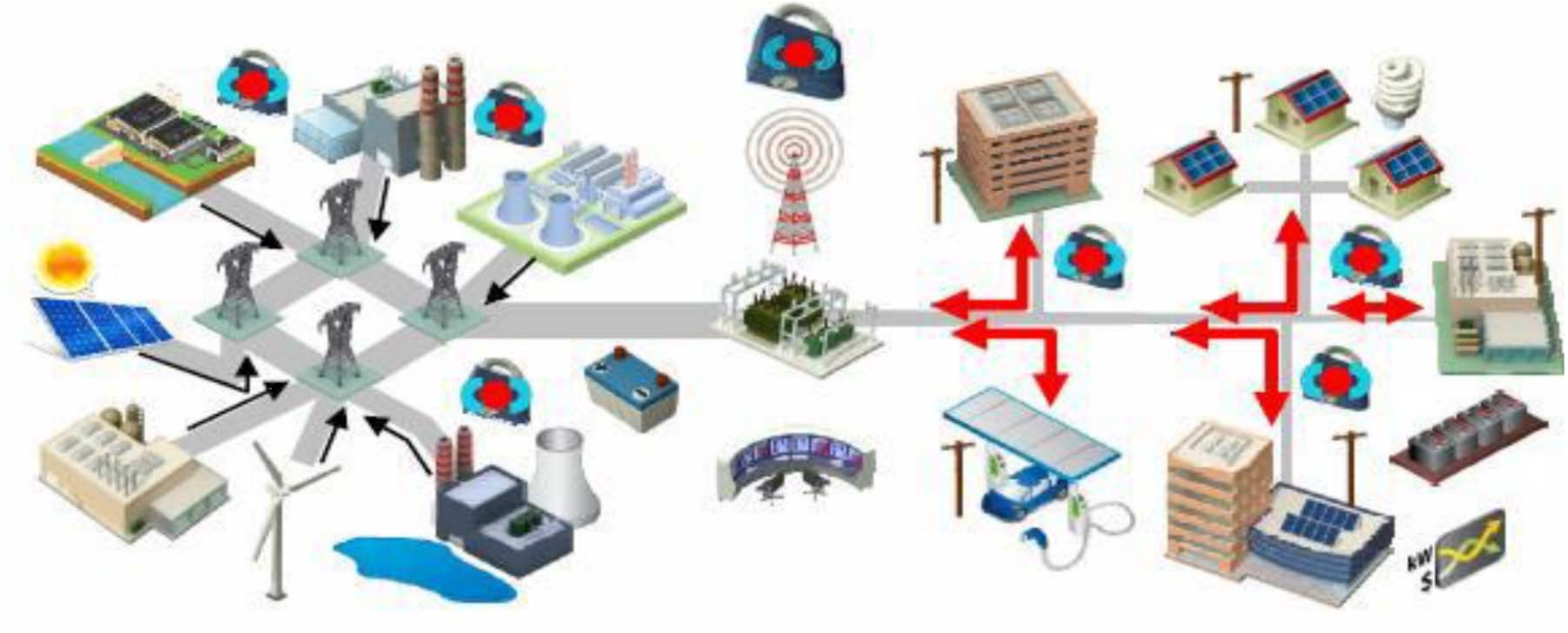
Outcome-Based Regulation

- Used for isolated
  - EE, reliability, customer service
- Could be more significant in driving utility behavior, performance, and earnings

The System We Grew Up With



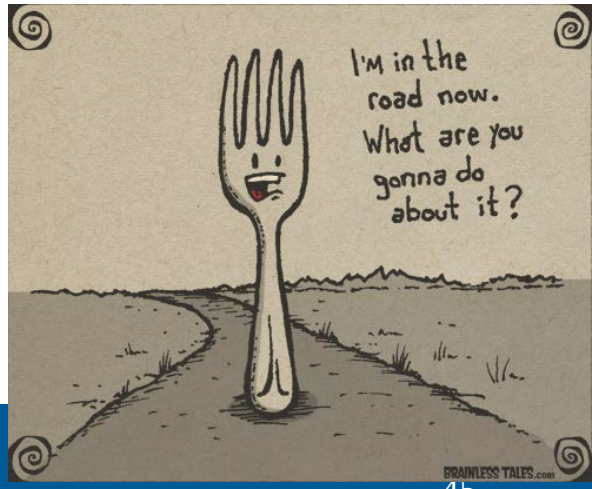
A Vision of A Future System



US DOE

Technology

- What will motivate technology on utility side of the meter?
- What will motivate new meter technology?
- What will motivate efficient, responsive and producing technology on the customer side of the meter?



Investment Incentives for all Emerge from Regulation

- Planning to produce information
- Prices to convey information
- Earnings to drive behavior

- It is not just operating the pieces we have better
  - It is driving efficient investment that manages costs for decades

Trends are Clear

- More automation
- More choices for individuals
  - Potential for more consumer interest for services
  - What happens if storage becomes more accessible to consumers?
- What will utilities and their regulators do?

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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