THE INTERPLAY OF DISTRIBUTED ENERGY RESOURCES AND PRICING FOR UTILITY SERVICES

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Presented by

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The Regulatory Assistance Project (RAP)

We are a global, non-profit team of experts focused on the long-term economic and environmental sustainability of the power and natural gas sectors, providing assistance to government officials on a broad range of energy and environmental issues.

About RAP – US

RAP provides technical and policy support at the federal, state and regional levels, advising utility and air regulators and their staffs, legislators, governors, other officials and national organizations.

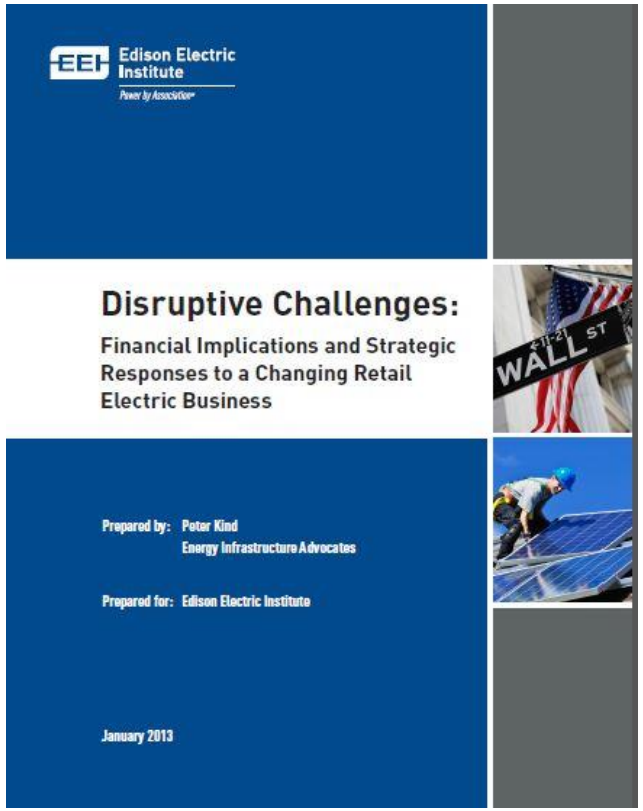
We help states achieve ambitious energy efficiency and renewable energy targets and we provide tailored analysis and recommendations on topics such as ratemaking, smart grid, decoupling and clean energy resources. RAP publishes papers on emerging regulatory issues and we conduct state-by-state research that tracks policy implementation.

Background on the Debate

Rapid growth in distributed solar has led to increased attention

- Utilities concerned that:
  - DG reduces utility revenues and undermines traditional utility business models
  - the fixed cost of maintaining the grid is spread across fewer customers and fewer kWh sales
  - cost shifts are occurring between solar and non-solar customers

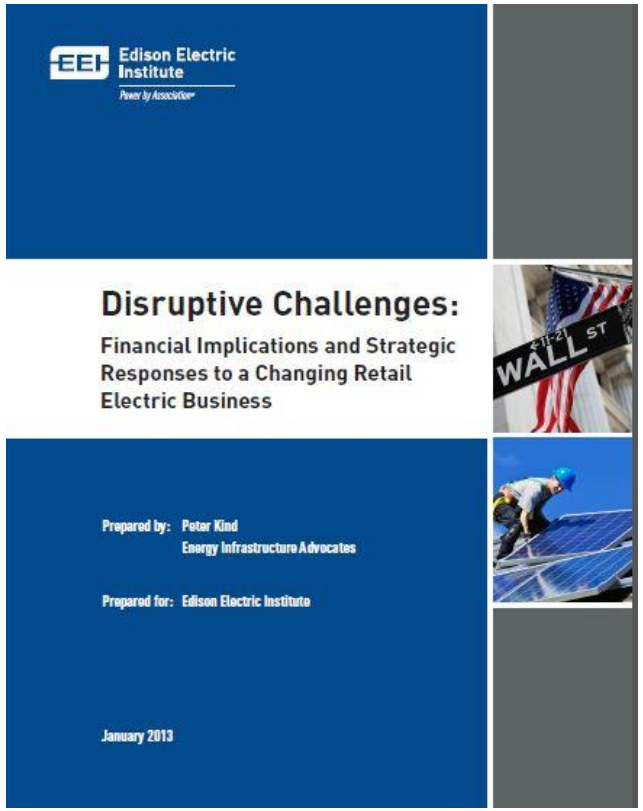
- Solar industry concerned that:
  - Policy and rate changes will under-value solar generation and hinder the solar market



Background on the Debate

Rapid growth in distributed solar has led to increased attention

- Consumers Concerned that:
  - DG reduces utility revenues and the lost revenue shortfall will be borne by non-DG customers
  - cost shifts are occurring between solar and non-solar customers
  - Impact on low income/fixed income customers.



Utility of the Future

Some states have begun to re-examine their traditional utility models and to consider regulatory changes that address the intersection of customer options and new the emergence of new technologies and choices.

- New York – Reforming the Energy Vision (REV)
- California – New Docket

NY PSC Staff Report: Questions

- Indicate that nearly everything is up for grabs
  - Role of the utility and their incentives
  - Role of the regulator
  - Role of markets and innovators, including wholesale
  - The customer experience
  - Activities in planning, investment, valuation, information, rate setting, coordination
  - The transition process

NY Insights

- Customer is key ("**partner**")
- Driving innovation is where the value is
  - While protecting consumers remains a key purpose for regulation, perhaps executed differently
- Strong preference for significant role for utility (knowledge, planning, scope)
  - With reliance on output based regulation and need to set outputs and levels well
  - And strong attention to needs of innovators -- tension

NY Insights

- Strong preference for distributed energy resources as priority resources
- Elevation of resilience in status, with cost, reliability, along with maximum use of markets to engage customers
  - Recognition that public interest requires special attention from regulators in markets
- Business as Usual is not an option

Outcome Based Regulation: What is it?

- Enterprise wide
- Output Metrics affecting everything utility does
  - In terms of value to customers, public interest outcomes
  - All employees can contribute to at least one metric (merit pay)
  - Most powerful if levels are aggressive
    - Potential substitute for policy mandates
- A “meaningful” portion of utility net income from performance compensation
  - Not just the icing on the cake – performance is the cake

Outcome Based Regulation: What is it?

- Determine public interest outcomes from utility service
  - A public exercise, change over time
  - “protect” and “progress”
  - Identify priorities
- Identify utility outputs that support these
  - Select a diverse set for use in financial formula
    - Substitute in subsequent rounds

Outcome Based Regulation: What Is it?

- Levels drive innovation, efficiency
  - Benchmarking challenge
  - Allowance for recalibrating (fail forward)
  - “protect” metric levels will tend to be steady
  - “progress” metric levels will tend to move

What's On the Horizon?

Convergence of multiple events:

- Customer empowerment
- New Technologies and Competitive Service Offerings

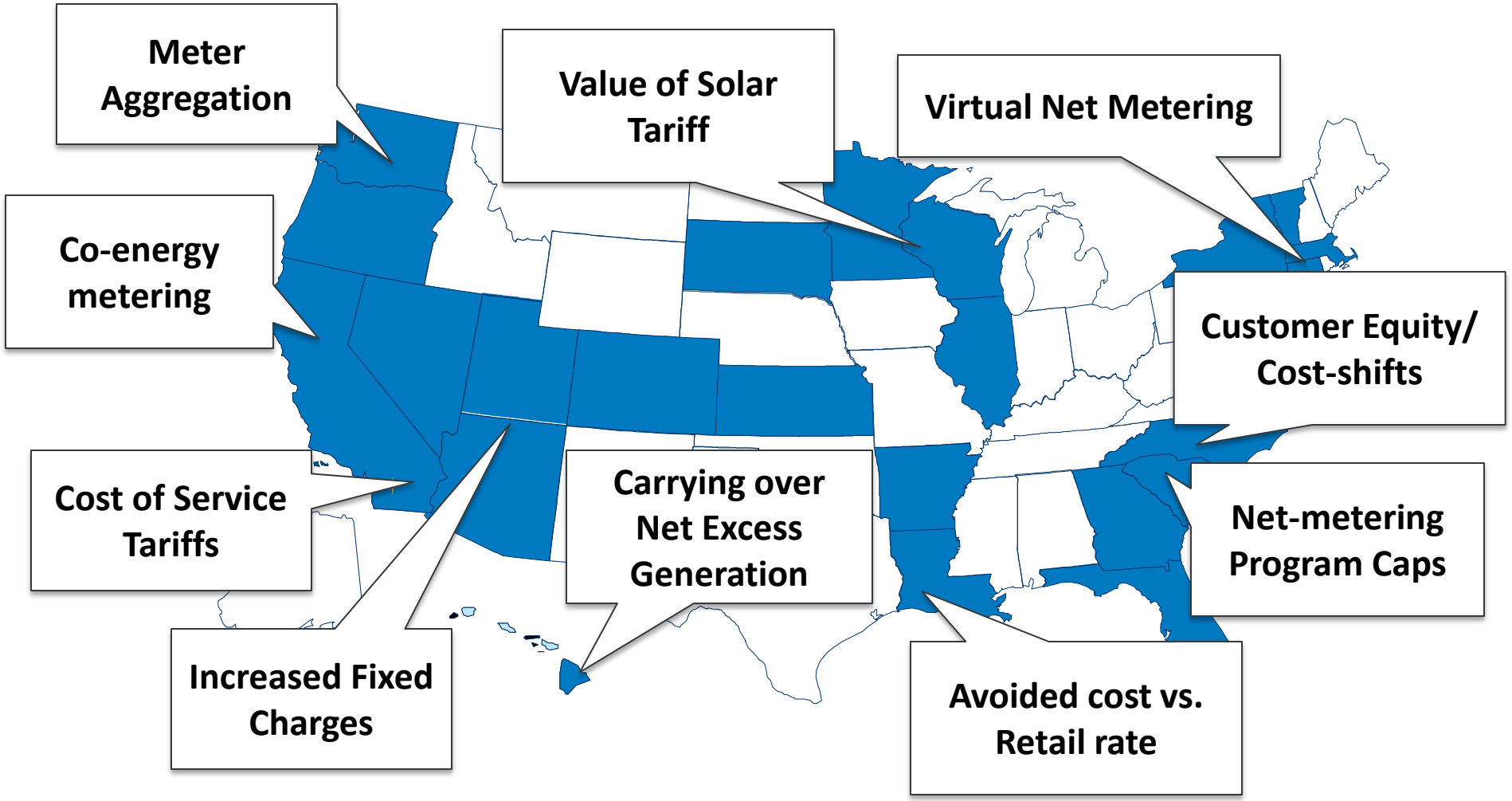
This Leads to:

- Reduction in utility sales and hence revenues
- Potential rate responsibility shifts and equity questions

This is pitted against:

- Public interest in low carbon energy solutions
- While grid resilience becomes increasingly important in the wake of severe climate

A Variety of Discussion Topics



A Variety of Discussion Topics

- **Net-metering**
  - What should the cap be?
  - What method should be used to calculate the installed capacity and the cap?
  - At what rate should net excess generation be credited?
  - Should excess generation carry over year-to-year or expire at the end of the year?
  - How can Time-of-Use rates be combined with net metering?
  - Is meter aggregation allowed/required?
  - Is Virtual Net Metering allowed/required?
  - Or should there be bi-directional charge for what is purchase from the grid and delivered to the grid

A Variety of Discussion Topics

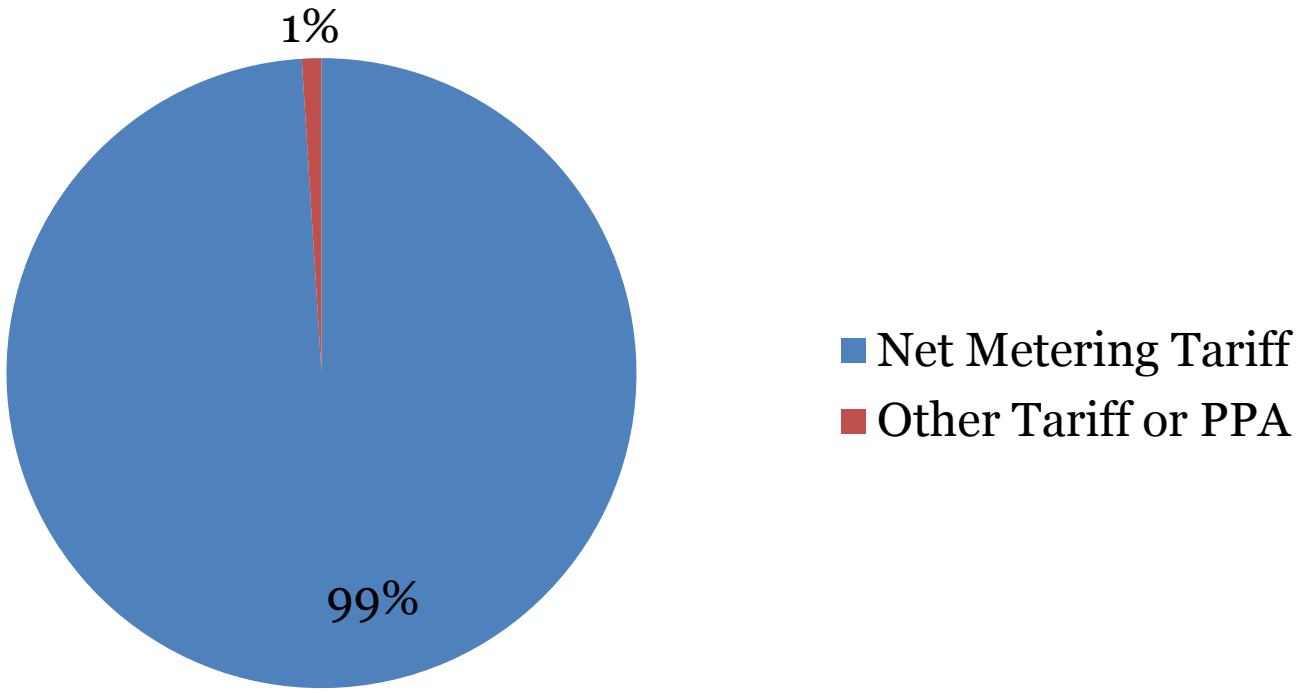
- **Cost-shifts / Lost Revenue**
  - Is there a cost-shift from solar to non-solar customers? How large? How to address?
  - What is the impact of distributed PV on utility revenues?
  - Should fixed charges be increased to cover infrastructure costs? Should they apply to only self-generators or to all customers, with corresponding reduction in volumetric rates?
  - What other rate structures can address the cost-shift and lost revenue issue?

- **Value of Solar Tariff**
  - What variables should be included in a value of solar tariff?
  - What value should each cost and benefit be assigned?
  - How should a value of solar program be designed?

Net-Metering

Net-metering is a mechanism under which a customer owning distributed generation nets the electricity produced from its system with the electricity it purchases from the utility and is compensated at the full retail rate.

Almost All PV Systems are Net Metered

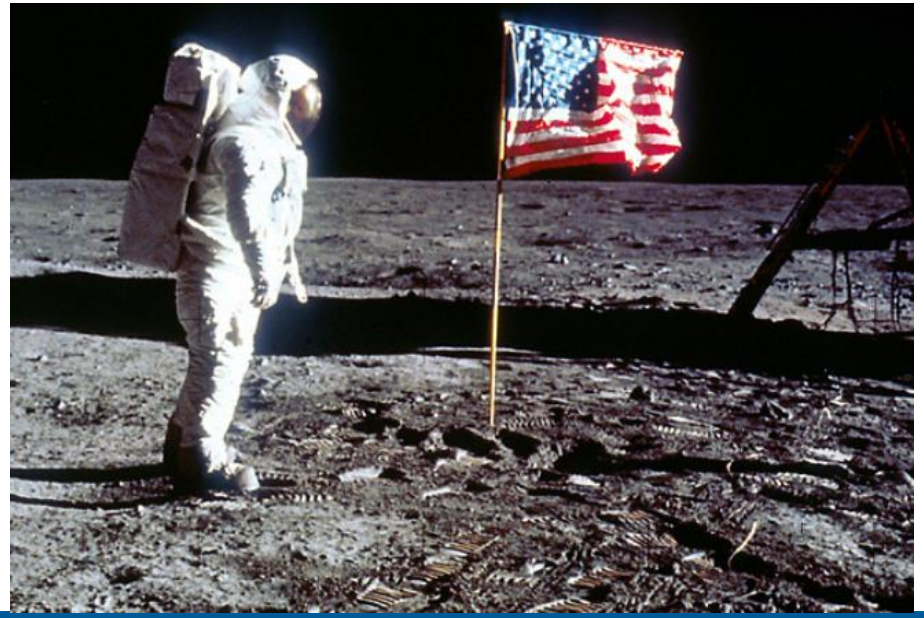


Source: Solar Electric Power Association (2012)

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



Are potential cross-subsidies a significant problem?

- Some level of cross-subsidy is normal
    - Customer classes, not individual rates
    - *Undue* discrimination is bad
- At low penetration levels, these lost revenues are extremely small compared to the revenue requirement
- But as deployment grows, at some point this could become a problem

Potential Cross-Subsidies

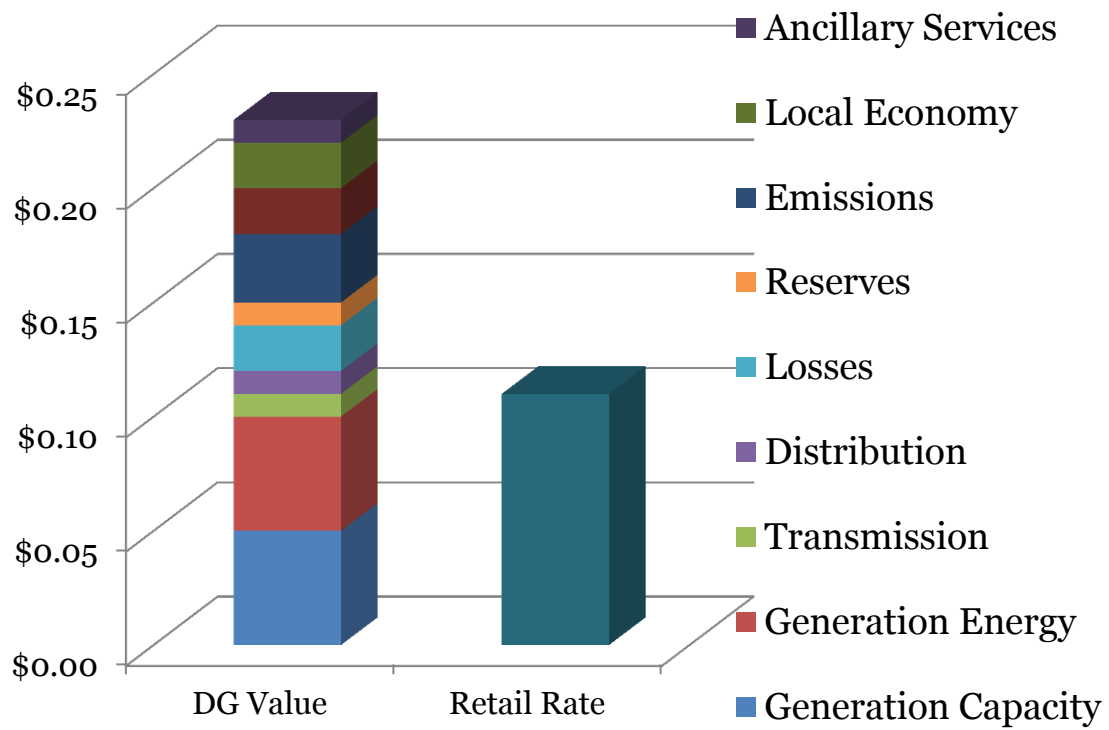
- **If value of PV < volumetric charges:**
  - Other customers subsidize PV customers
  - Under-recovery of utility's fixed costs
  - Upward pressure on rates (cross subsidy)
  - Reduced utility shareholder returns

- **If value of PV > volumetric charges:**
  - PV customers subsidize other customers
  - Suppresses PV deployment

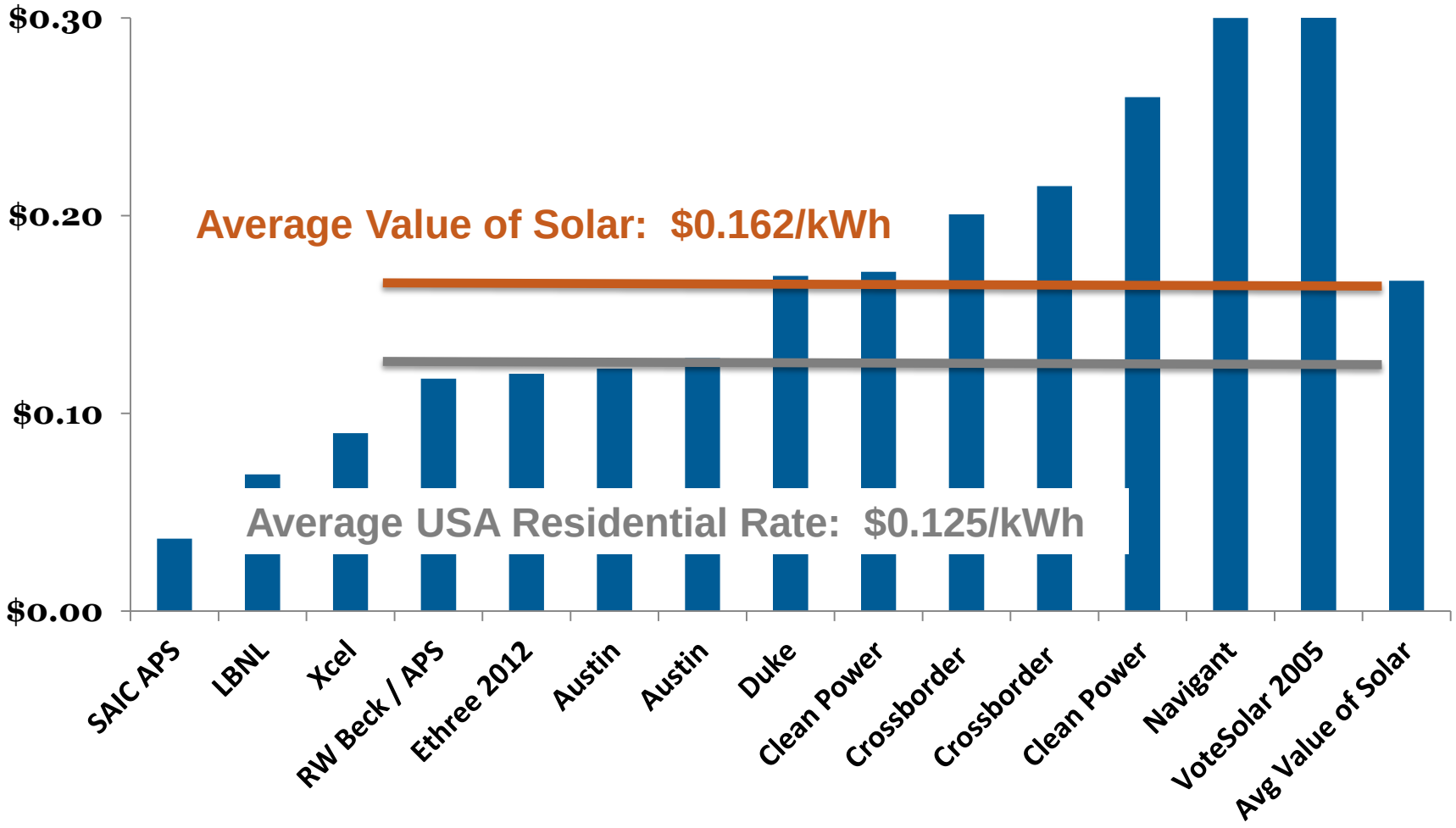
Value of Solar Tariff (VOST)

Recognize all values of solar:

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



Value of Solar Tariff



Typical Residential Rate Structures

Monthly Bill =

Fixed service charge (e.g. $6.75/month)

+

Volumetric charges (e.g., 8.000 cents/kWh)*

*NOTE: Volumetric charges may vary by time of day or season

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.

High Fixed Charges can be Regressive

Type of Charge	Unit / Usage	Typical Current Residential Tariff	High Fixed Charge	Demand Charge	Bidirectional Distribution Charge
Monthly Fixed Charge:	$/Month	$ 5.00	$ 35.00	$ 5.00	$ 5.00
Demand Charge	$/kW/Month		$ -	$ 3.00	$ -
Distribution Charge	$/kWh		$ -	$ -	$ 0.03
Off-Peak Energy	$/kWh	$ 0.145	$ 0.08	$ 0.08	$ 0.08
On-Peak Energy	$/kWh	$ 0.145	$ 0.15	$ 0.15	$ 0.15

Impact on Customer Average Bills	Average User (1,000 kWh)	$ 150.00	$ 150.00	$ 150.00	$ 150.00
	Small Use (500 kWh) Bill:	$ 77.50	$ 92.50	$ 77.50	$ 77.50
	PV Customer Total Bill	$ 5.00	$ -	$ -	$ -
	PV Customer Distribution	$ 5.00	$ 35.00	$ 35.00	$ 35.00

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.

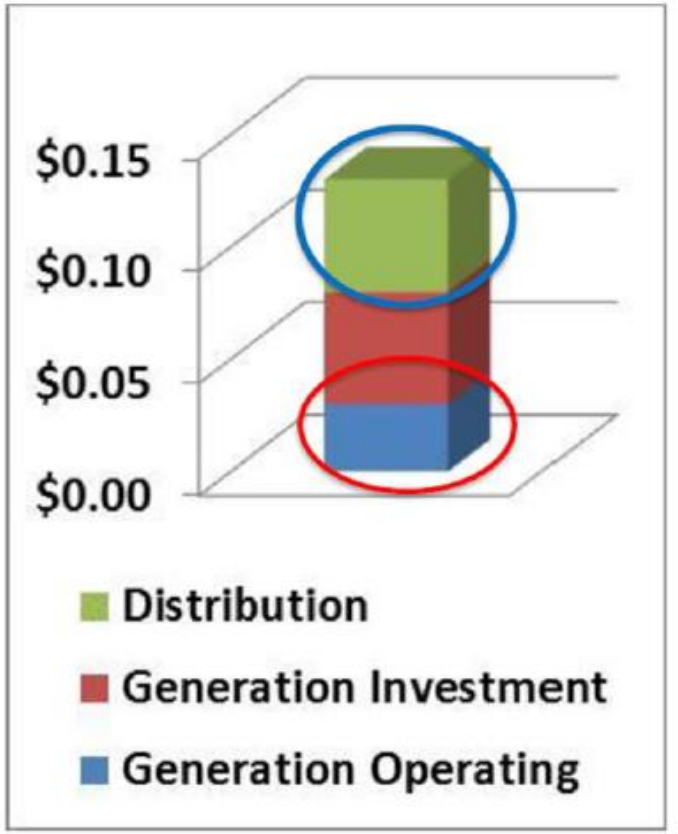
Common Utility Advocate View

Embedded Cost Perspective

- **Only the short-run avoided operating cost should be credited.**
- **At minimum, customer should pay distribution costs.**

DG customer "uses" the grid and should pay for it;

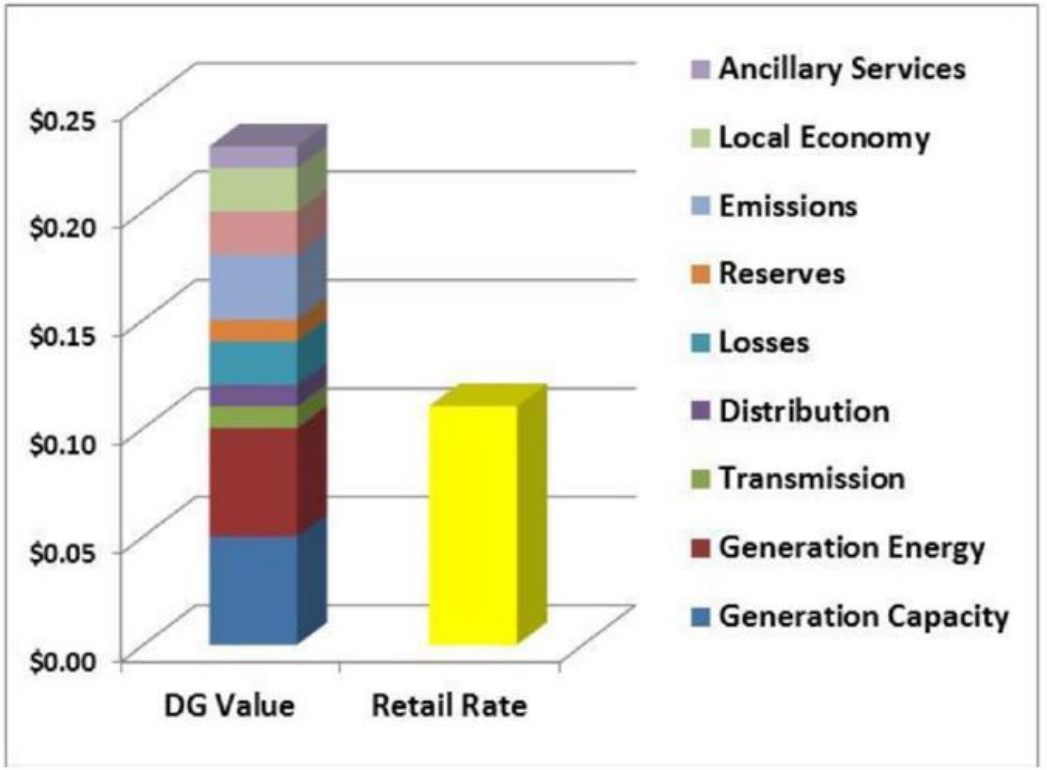
Solution: High monthly fixed charges for grid service.



Common DG Advocacy View

Marginal Cost Perspective:

- Value of distributed resource is greater than the than retail rate;
- Net-metering results in subsidy **to** the grid from innovators.



Possible Guiding Principles for Fair PV Tariffs

- PV customer should pay utility fair value for services provided by grid connection
- Utility should pay PV customer fair value for services provided by PV
- Rate design should be no more complicated than necessary
- Address any desired incentives and the impact of lost revenues separately
- Account for low income customer impacts

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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APPENDIX A

ADDITIONAL SLIDES

Illustration of Alternative Rate Designs

Type of Charge	Unit / Usage	Typical Current Residential Tariff	Option 1 Fixed Monthly Charge	Option 2: Demand Charge	Option 3: Bidirectional Distribution Charge
Monthly Fixed Charge:	$/Month	$ 5.00	$ 35.00	$ 5.00	$ 5.00
Demand Charge	$/kW/Month		$ -	$ 3.00	$ -
Distribution Charge	$/kWh		$ -	$ -	$ 0.03
Off-Peak Energy	$/kWh	$ 0.145	$ 0.08	$ 0.08	$ 0.08
On-Peak Energy	$/kWh	$ 0.145	$ 0.15	$ 0.15	$ 0.15
Average Customer Bill					
Fixed Charge	Per Customer	$ 5.00	$ 35.00	$ 5.00	$ 5.00
Demand Charge	10 kW Demand	$ -	$ -	$ 30.00	$ -
Distribution Charge	1,000 kwh total energy	$ -	$ -	$ -	$ 30.00
Off-Peak Energy	500 kWh on-peak	$ 72.50	$ 40.00	$ 40.00	$ 40.00
On-Peak Energy	500 kWh off-peak	$ 72.50	$ 75.00	$ 75.00	$ 75.00
		$ 150.00	$ 150.00	$ 150.00	$ 150.00

Each alternative produces $150/month from a customer using 1,000 kWh/month

Breakdown of Hypothetical PV Customer Bill

Rate Element	Typical Current Residential Tariff	Option 1 Fixed Monthly Charge	Option 2: Demand Charge	Option 3: Bidirectional Distribution Charge
Fixed Charge	$ 5.00	$ 35.00	$ 5.00	$ 5.00
Demand Charge	$ -	$ -	$ 30.00	$ -
Distribution Charge	$ -	$ -	$ -	$ 30.00
Off-Peak Energy	$ 72.50	$ 40.00	$ 40.00	$ 40.00
On-Peak Energy	$ (72.50)	$ (75.00)	$ (75.00)	$ (75.00)
Total Bill:	$ 5.00			
Total Distribution Service:	$ 5.00	$ 35.00	$ 35.00	$ 35.00

Assumptions: 10 kW maximum demand; 1,000 kWh total consumption, 50% on-peak; 1,000 kWh total on-site production. 500 kWh imported from grid off-peak; 500 kwh exported to grid on-peak

Valuation and Rate Design Questions for Regulators

Valuation Questions

- What is the current and expected level of PV adoption?
- What investment will be required with and without higher PV adoption?
- Are utilities positioned to measure and capture locational benefits?
- What perspectives will be evaluated?
- What sources of cost and benefit will be included in each?

Residential Rate Design Questions

- What is the direction of the subsidy in the current DG tariff under the current residential rate design?
- What is the direction for community solar/solar garden designs?
- Should the residential tariff rate design change?
- Should the DG tariff structure change?

Non-residential Rate Design Questions

- What is the direction of the subsidy in the non-residential DG tariffs and rate designs?
- Should the non-residential tariff rate design change?
- Should the non-residential DG tariff structure change?

Solar Applications:

Options for Customers

Business Models for Distributed Solar

Common Business Models

- Customer-owned model
- 3rd party leasing model
- Community and utility-led solar gardens

Innovative Business Models

- Utility-owned DG solar
- Virtual power plant operator
- Utility partnership/investment in 3rd party leasing companies
- Value added consulting services
- Energy services utility model

New utility business models may address utility concerns about lost revenues/cost-shifts.

**See the full report for more description of each of these business model options.*

Community Solar / Solar Gardens

Customers pay an upfront fee or fixed monthly payment, which entitles them to a portion of the benefits of a specific solar project.

Variety of Leadership Options

Solar gardens are being initiated by community organizations, municipalities, and utilities across the country.

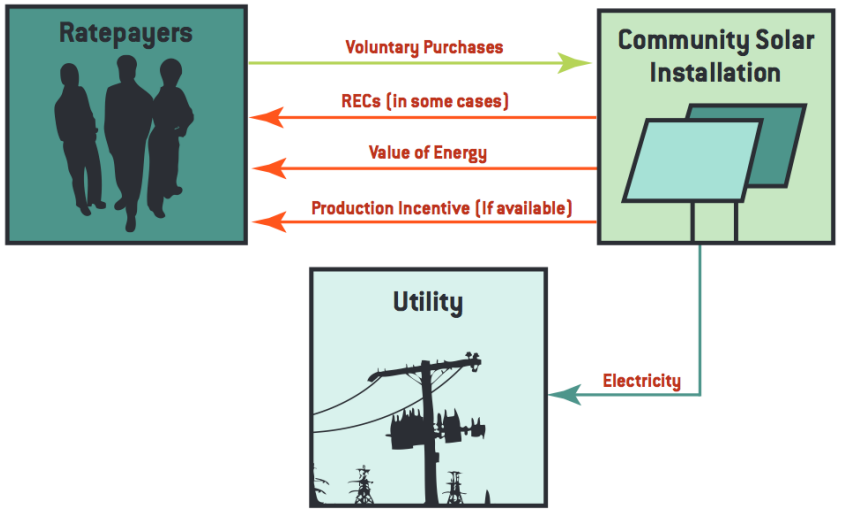
Variety of Location Options

Solar gardens can be built on brown-fields, public building rooftops, and on private or public land.

Community Solar / Solar Gardens

Benefits to Customers

- Expanded opportunities to participate in solar
- Increased rate stability
- Potential for bill savings
- Hedge against price increases



Benefits to Utility/Developer

- Customer satisfaction
- Customer engagement
- Regional economic development
- Lower incentive costs
- Meet RPS requirements
- Potential for distribution system benefits

Existing Community Solar Projects

Utility-led	Community-led
Tucson Electric (AZ)	City of Portland “Solar Forward” (OR)
Xcel Energy (CO)	Falmouth Community Solar, LLC (MA)
Delmarva Power & Light (DE)	Northern Sun Community Solar Garden (MN)
Green Mountain Power (VT)	Acorn Energy Solar One, LLC (VT)
SMUD Solar Shares (CA)	University Park Solar (D.C.)
Berea Solar Farm (KY)	Putney Community Solar Array (VT)
Florida Keys Electric Co-op (FL)	Winthrop Community Solar (WA)

http://www.sharedrenewables.org/

Community Solar Program Design Considerations

✓ Ownership Structure

- Privately-owned, Utility-owned, Third-Party Owned, Flip Structure

✓ Subscription Options

- Capacity-based – customers purchase the benefits of a certain amount of capacity (panels)
- Generation-based – customers purchase a certain number of kWh or a % of the system's generation

✓ Treatment of RECs

- Customer-retains, Utility-retains
- Are they retired?

✓ Securities Compliance

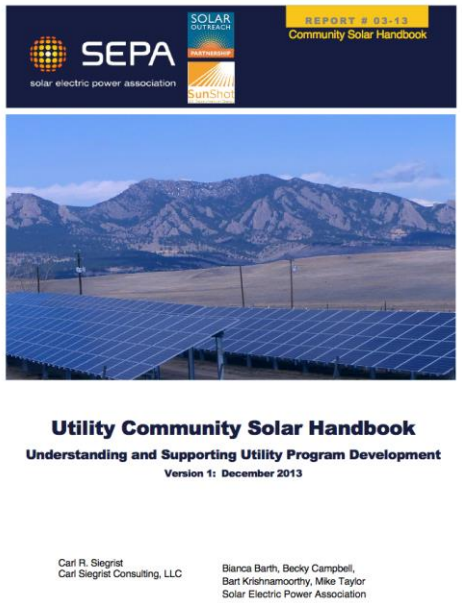
- Does the chosen program structure trigger securities issues?

✓ Eligibility for Incentives

- How can incentives be maximized?
- Are incentives considered taxable income?

✓ Pricing and Billing

Community Solar: Resources



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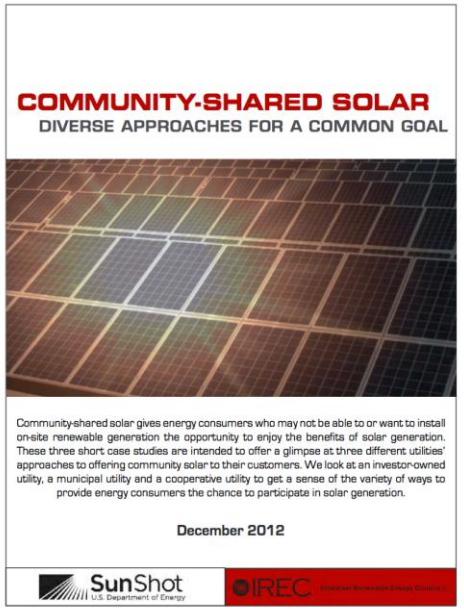

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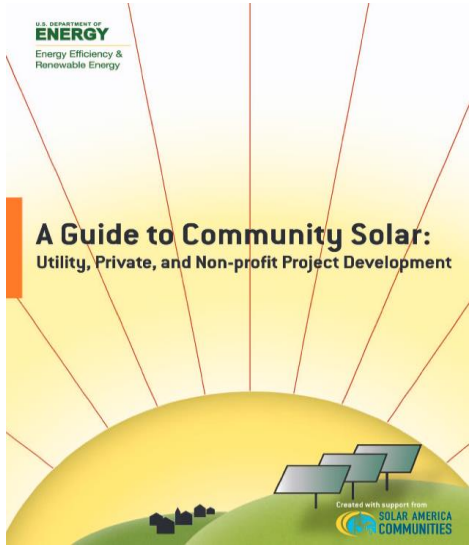

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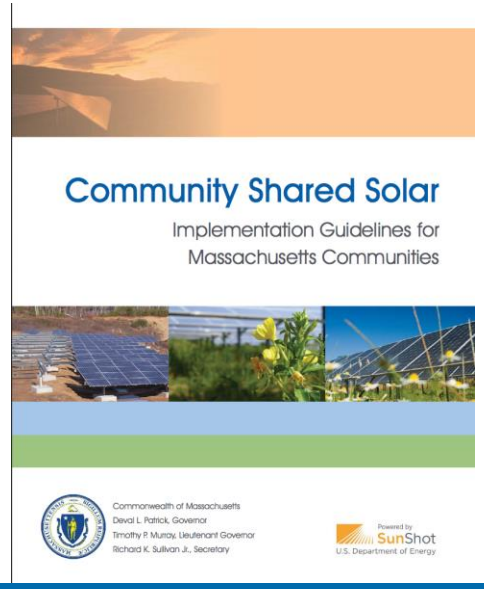

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Valuation Resources

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