RAP® Energy solutions for a changing world

Value of Solar and Grid Benefits Studies

Alternative Approaches and Results

2014-2016 Era

EUCI NEM Workshop

Presented by Jim Lazar

July 21-22 2016

The Regulatory Assistance Project (RAP)®

About RAP

- RAP is a global non-profit that works with utility regulators and policymakers in the transition of the power sector.
- Based in Vermont
- Offices in Beijing, Brussels, and Delhi

About Jim Lazar

- Economist based in Olympia, Washington
- RAP Senior Advisor (since 1998)
- Expert witness in over 30 jurisdictions on rate design, resource planning, and energy efficiency.
- Author of **Electricity Regulation in the US: A Guide,** and 11 other handbooks

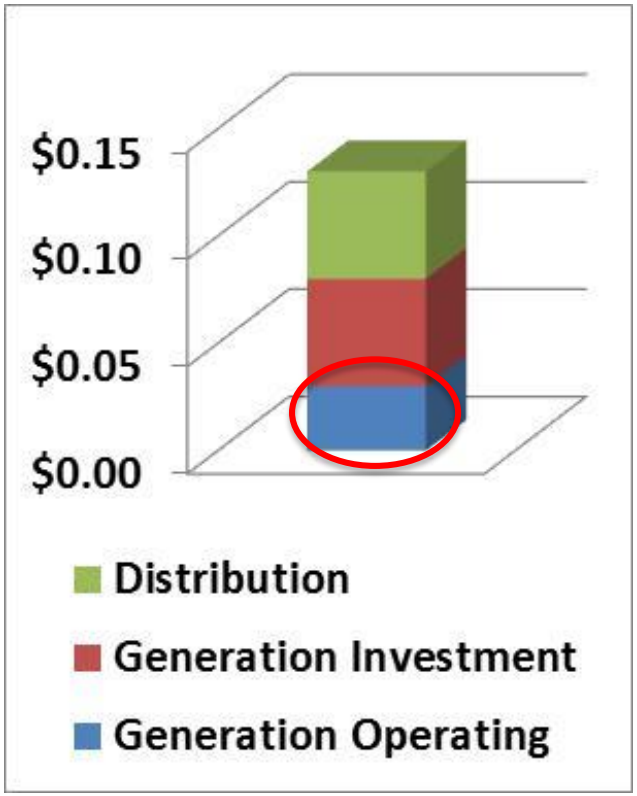
Overview of Net Metering and Value of Solar Ratemaking

- Net-Metering:
  - Simple
  - No new metering required
  - Typically not TOU based
  - Considered an infant-industry subsidy by many
- Value of Solar Analysis
  - Can be narrow (short-run) or broad in scope

Two Views of Cost Recovery

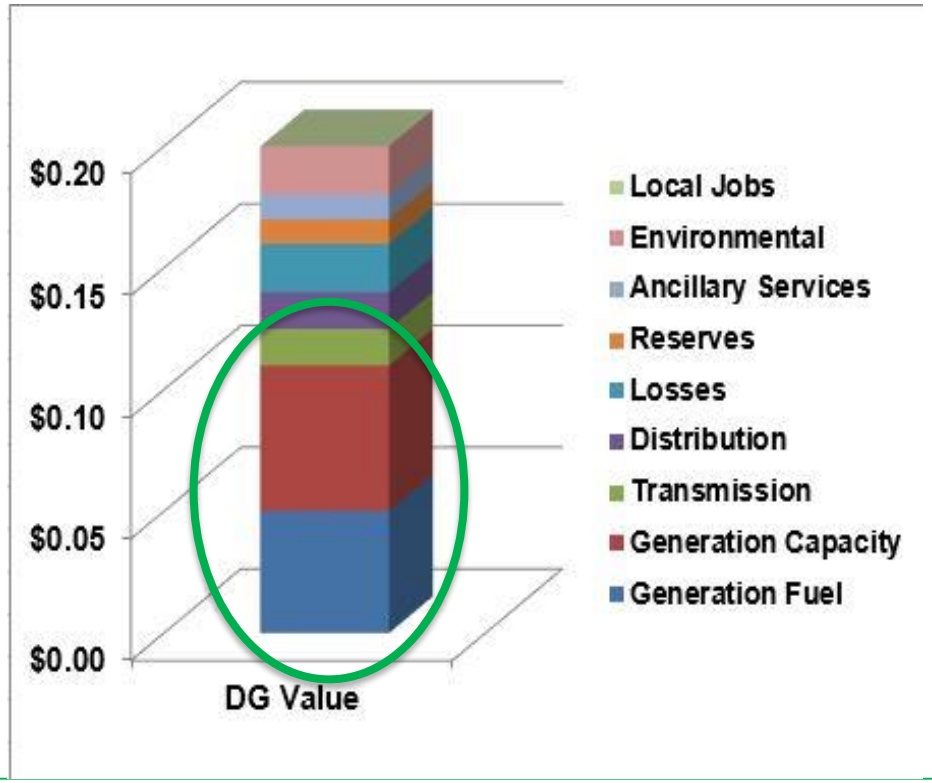
Traditional Utility View

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



Solar Advocate View

- Value of distributed resource is greater than the than retail rate;



Range of Solar Valuation Studies

- Narrow studies
  - Short-run cost savings from solar additions
- Long-Run studies
  - Generation capacity and energy value
- Broad Utility Sector Studies
  - Generation, transmission, distribution, and other utility system values.
- Extensive Societal Studies
  - Utility system and societal benefits

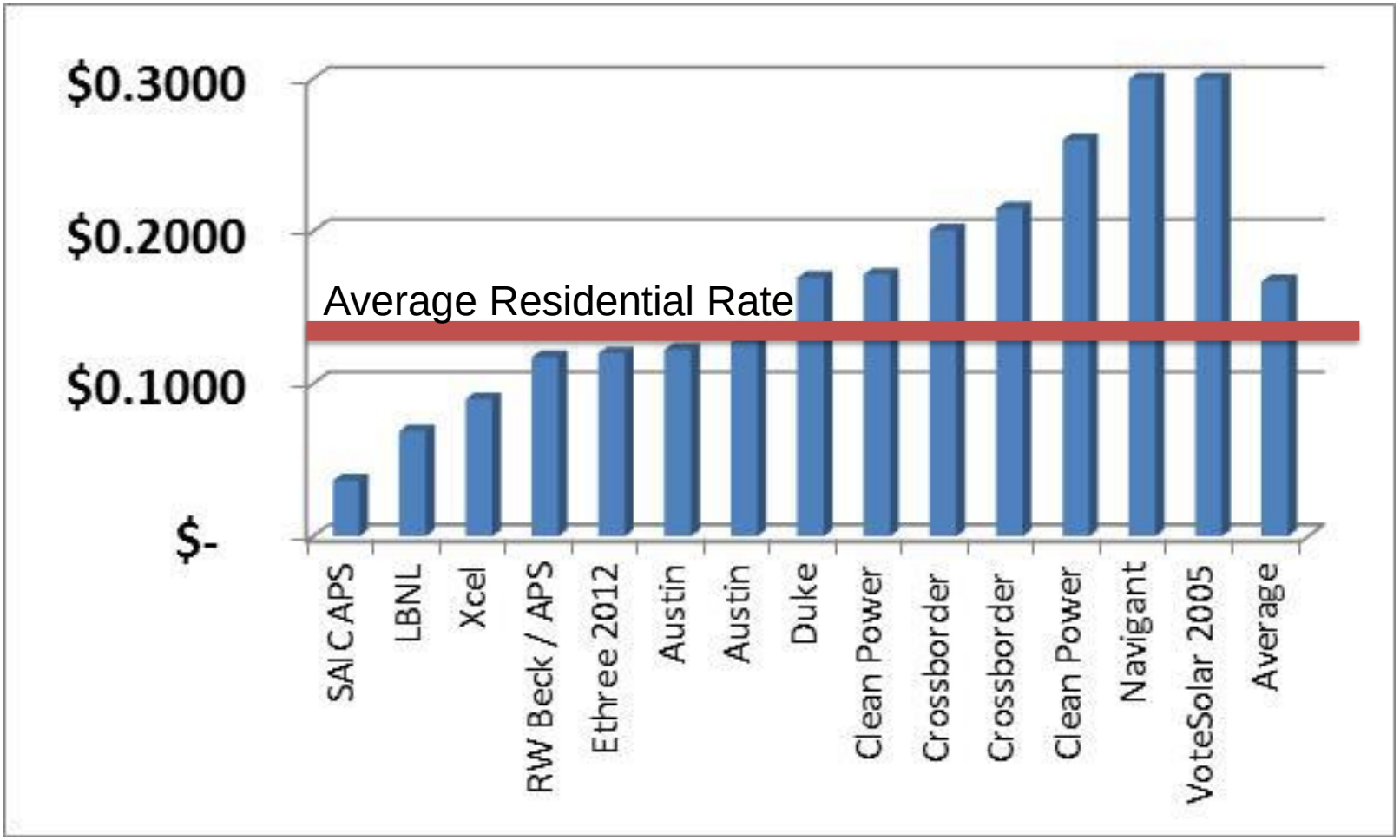
Categories of Costs Considered

Type	Variable	Capital	Externalities	Societal
Narrow	X			
Long-Run	X	X		
Broad Utility	X	X	x	
Extensive	X	X	X	X

Some Costs Treated Very Differently

- Production Capital Costs
- Transmission Capital Costs
- Distribution Capacity Credit
- Marginal or Average Line Losses
- Current or Future Environmental Costs
- Fuel Cost and Fuel Supply Risk
- Macroeconomic Effects

RMI Survey Of Multiple Studies: Average: $.1672/kWh

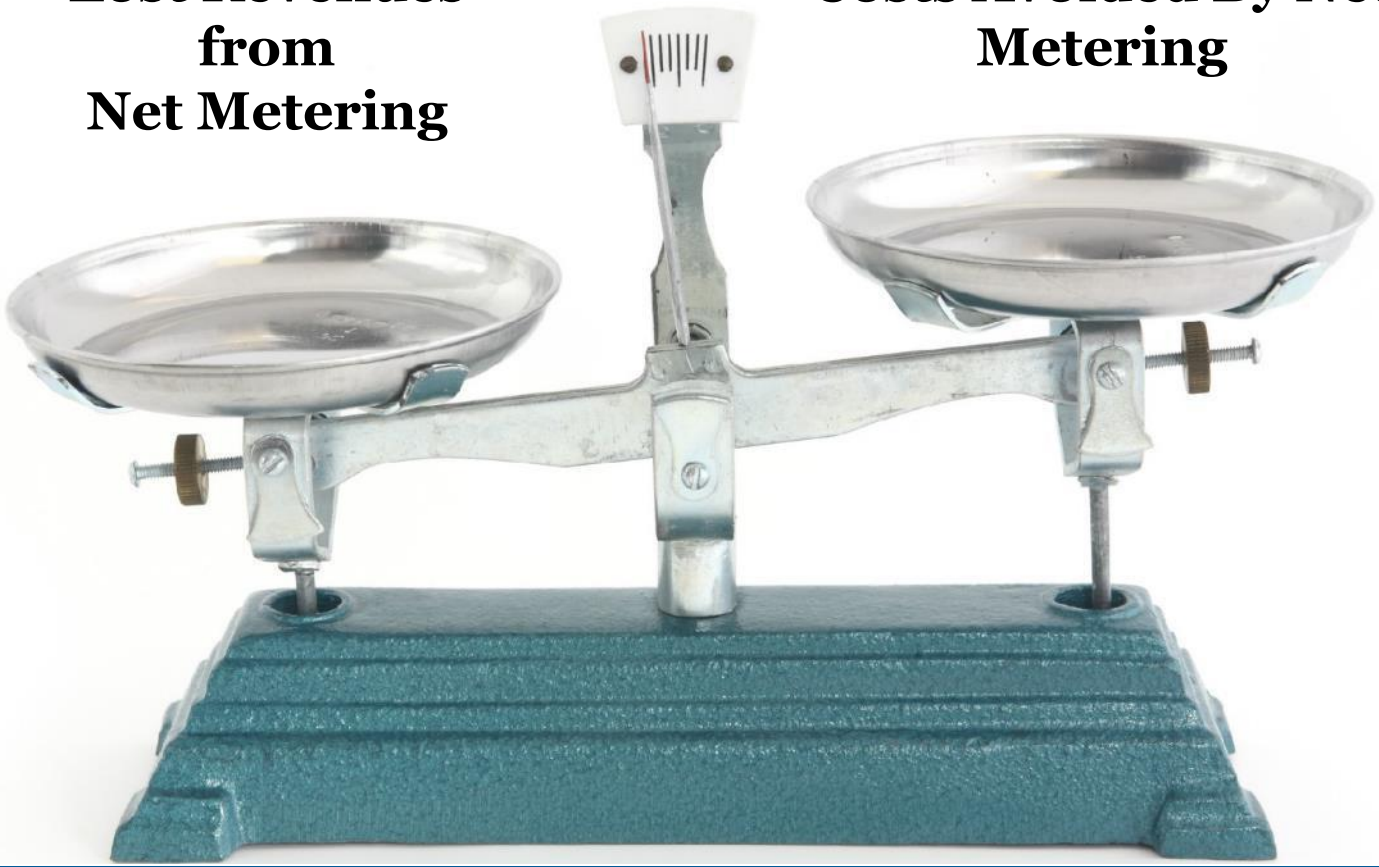


Traditional Ratemaking

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

Narrow Studies

- Consider short-run marginal cost avoidance only
  - Fuel and purchased power
  - Line losses
  - Out of pocket environmental compliance
- Some look only at power supply

Example Narrow Study
NV Energy 2015

- Used Promod to determine hourly avoided costs.
- Cost Categories
  - Customer
  - Facilities (services and transformers)
  - Demand (circuits)
  - No transmission benefits
  - Generation capacity and energy costs

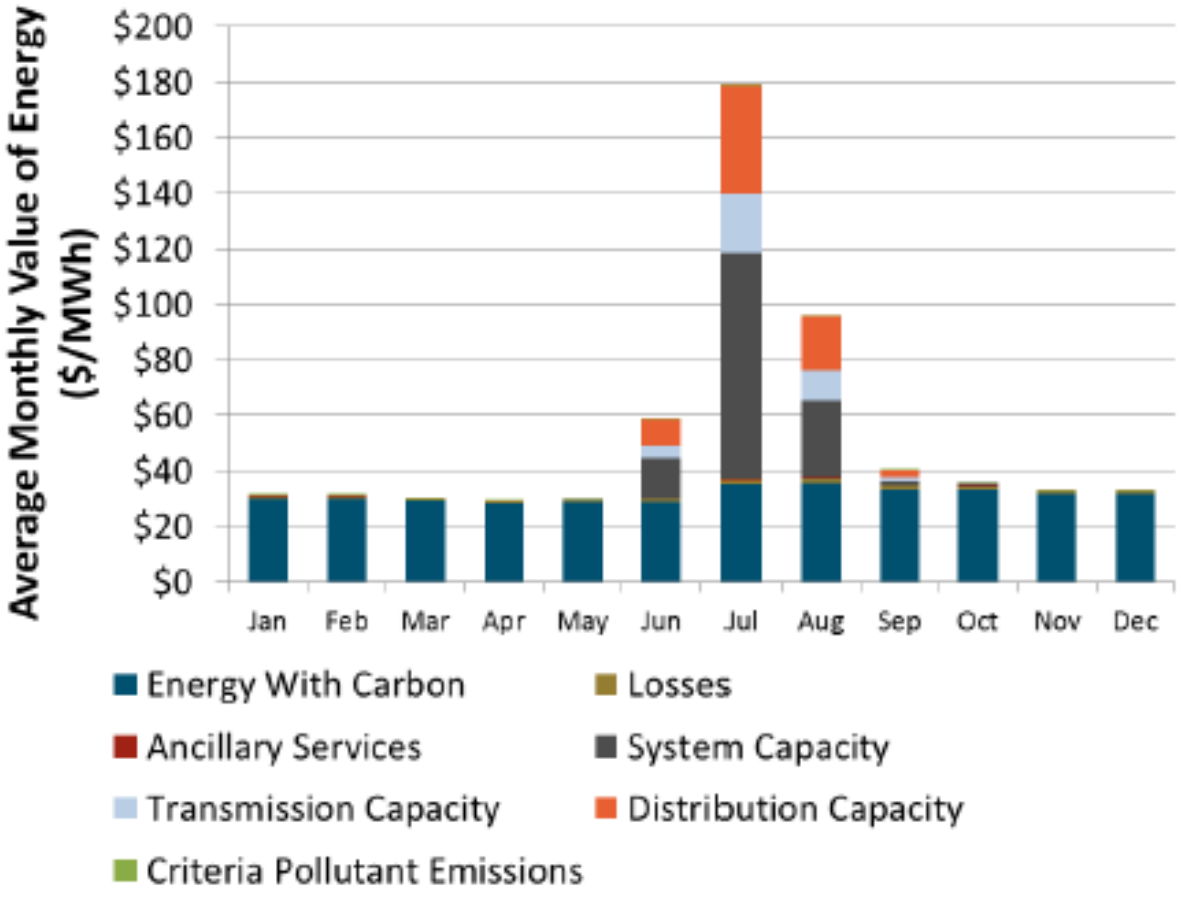
Result of NV Energy Study

- Dramatic increase in fixed charge
- Proposed residential “maximum demand” charge
- Dramatic reduction in energy charge.
- PUC rejected demand charge in favor of higher fixed charge for NEM customers.
- TOU energy charge retains generation and transmission capacity costs.

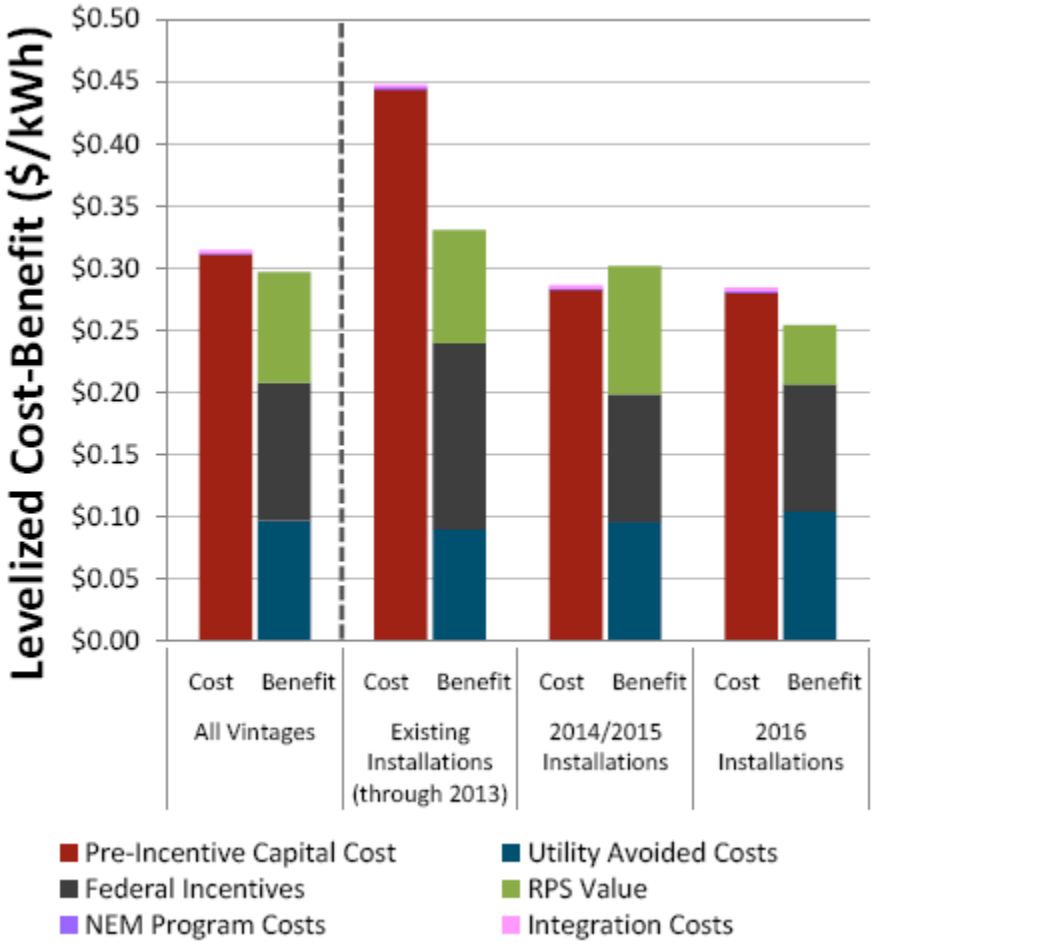
Long-Run Studies
E3 for Nevada

- Generation capacity
- Transmission capacity
- Distribution capacity
- Losses
- Ancillary services
- Criteria pollutants
- Avoided RPS Costs

Long-Run Studies
E3 for Nevada



Long Run Studies: E3 for Nevada Costs and Benefits Very Close



Broad Utility Sector Studies

- Mississippi (Synapse)
- Maine (Clean Power Research)
- Austin
- Minnesota (State Energy Office)

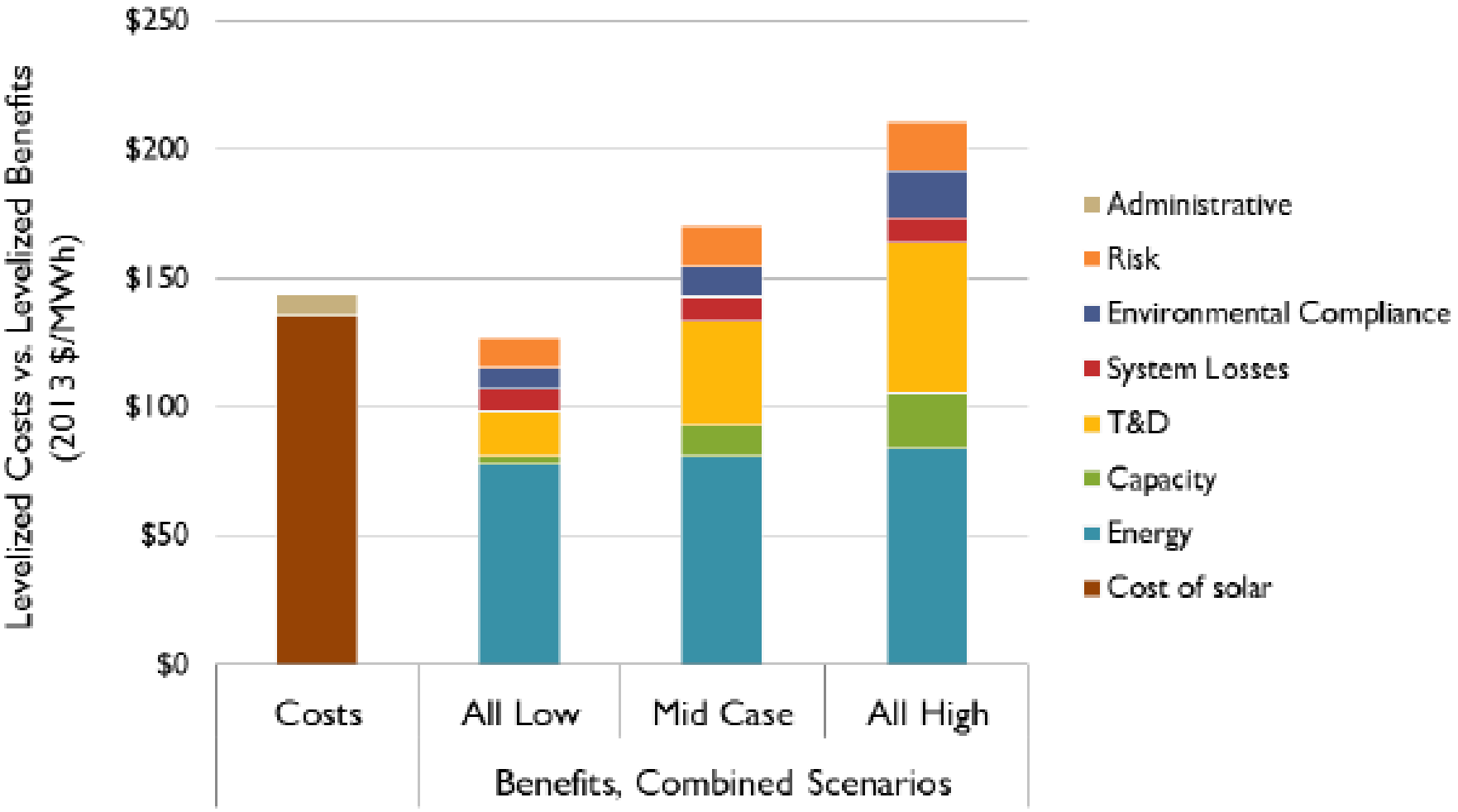
Broad Utility Sector Studies Synapse for Mississippi

Avoided Costs	Description
Avoided Energy	All fuel, variable operation and maintenance emission allowance costs and any wheeling charges associated with the marginal unit
Avoided Capacity	Contribution of distributed generation to deferring the addition of capacity resources, including those resources needed to maintain capacity reserve requirements
Avoided Transmission and Distribution Capacity	Contribution to deferring the addition of transmission and distribution resources needs to serve load pockets, far reaching resources, or elsewhere
Avoided System Losses	Preventing energy lost over the transmission and distribution lines to get from centralized generation resources to load
Avoided RPS Compliance	Reduced payments to comply with state renewable energy portfolio standards
Avoided Environmental Compliance Costs	Avoided costs associated with marginal unit complying with various existing and commonly expected environmental regulations, including pending CO_2 regulations
Market Price Suppression Effects	Price effect caused by the introduction of new supply on energy and capacity markets
Avoided Risk (e.g., reduced price volatility)	Reduction in risk associated with price volatility and/or project development risk
Avoided Grid Support Services	Contribution to reduced or deferred costs associated with grid support (aka ancillary) services including voltage control and reactive supply
Avoided Outages Costs	Estimated cost of power interruptions that may be avoided by distributed generation systems that are still able to operate during outages
Non-Energy Benefits	Includes a wide range of benefits not associated with energy delivery, may include increased customer satisfaction and fewer service complaints

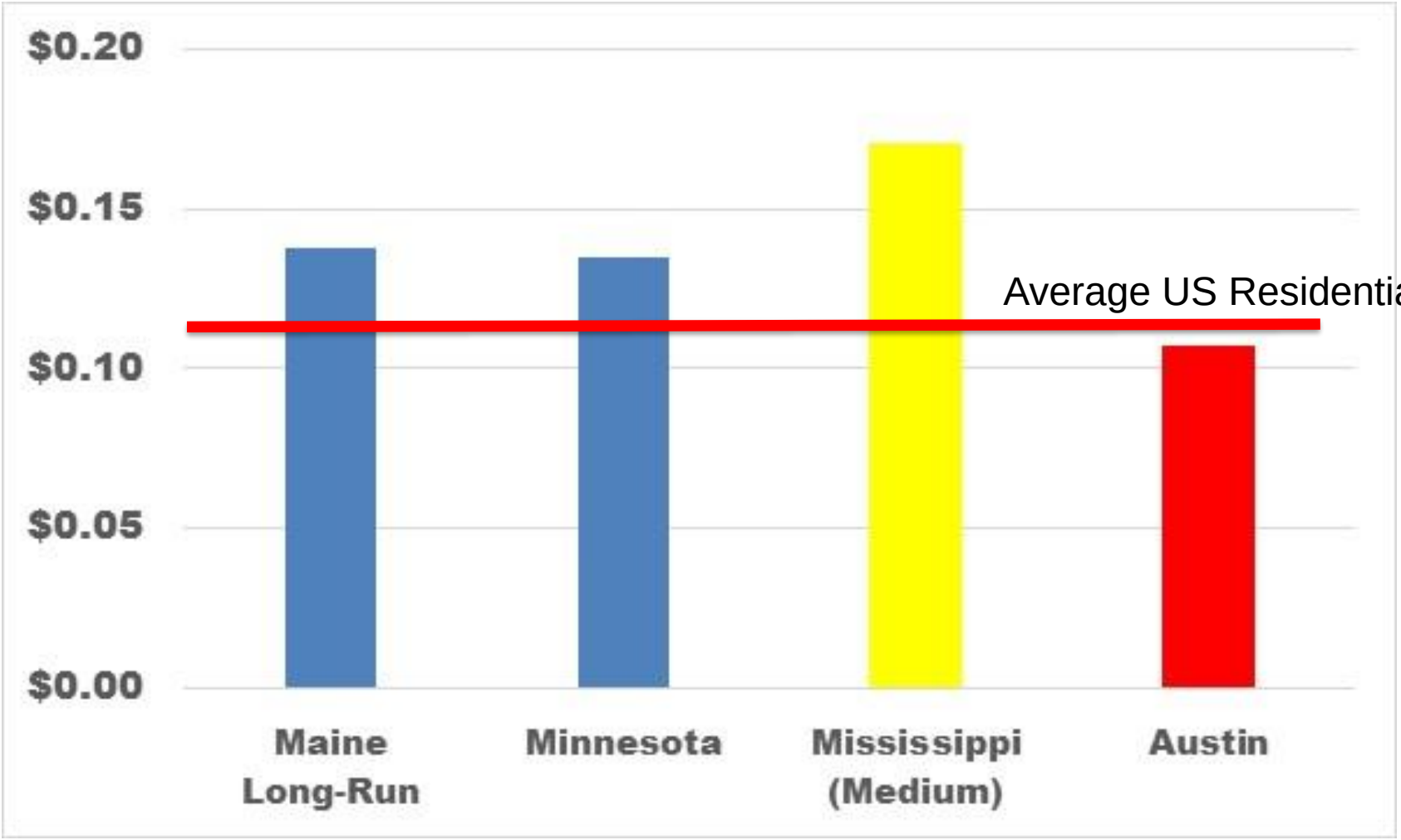
Broad: Synapse/MS vs Long-Run: E3 Nevada

- Included in E3
  - Generation
  - Transmission
  - Distribution
  - Losses
  - Avoided RPS
- Not Included in E3
  - Solar admin costs
  - Market Price Effects
  - Price Risk
  - Grid Support Services
  - Outage costs
  - Non-energy benefits

Mississippi Results



Broad Utility Sector Studies



Expansive Societal Studies

- Consider values in addition to those in the utility revenue requirement
  - Environmental benefit including future carbon costs
  - Local economic development
  - Value of energy independence
- Often show significant value generated for public even with full net-metering.

Expansive Study: Crossborder Energy / Colorado

Benefits to PSCo Ratepayers	Fully Valued	Undervalued	Not Included
Energy			
Avoided energy (including fuel)	✓		
Avoided T&D line losses	✓		
Capacity			
Avoided generation capacity		✓	
Avoided T&D capacity and fixed O&M		✓	
Grid support services			✓
Financial			
Fuel Hedging	✓		
Avoided RPS or renewables costs			✓
Grid security and resiliency			✓
Environmental			
Air pollutants (NO_x, SO_x, PM, & CO_2)		✓	
Reduced water usage in power production			✓
Avoided land costs for generation or T&D			✓
Societal benefits (not direct ratepayer benefits)			
Job creation benefits			✓
Economic development, including local taxes			✓
Avoided health impacts			✓

Expansive Study: Colorado

Benefit / (Cost)	Low Gas		Base Gas		High Gas	
	$/MWh	*%*	*$/MWh*	*%*	*$/MWh*	*%*
Avoided Energy Costs	35.80	*24%*	52.10	*31%*	76.10	*39%*
Fuel Hedge Value	6.60	*4%*	6.60	*4%*	6.60	*3%*
Avoided Emissions	27.40	*18%*	27.40	*16%*	27.40	*14%*
Avoided Generation Capacity	50.60	*34%*	50.60	*30%*	50.60	*26%*
Avoided Distribution	6.00	*4%*	6.00	*4%*	6.00	*3%*
Avoided Transmission	18.00	*12%*	18.00	*11%*	18.00	*9%*
Avoided Line Losses	4.70	*3%*	6.20	*4%*	8.30	*4%*
(Solar Integration Costs)	(0.50)		(1.80)		(4.40)	
Subtotal	148.60	*100%*	165.10	*100%*	188.60	*100%*
10% Adder for Societal Benefits	14.90		16.50		18.90	
Total Net Benefits / (Costs)	**163.50**		**181.60**		**207.50**	

Observations

- The answer you get depends on the question you ask.
  - Long-run vs. Short-run
  - Utility direct effects only?
  - Utility direct and future effects?
  - All societal effects
- Valuation of risk and environmental costs have a significant impact.

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 sector. 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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