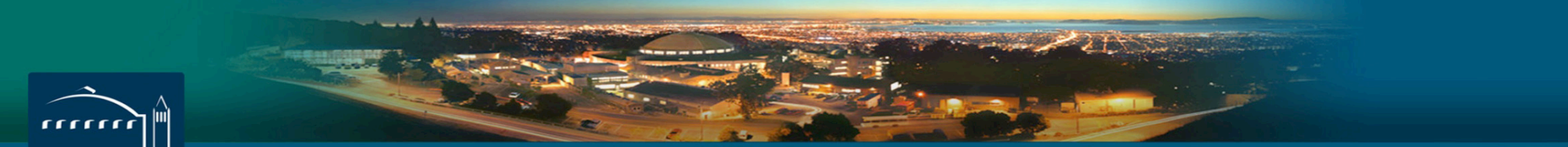

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Net metering and rate reforms for distributed solar

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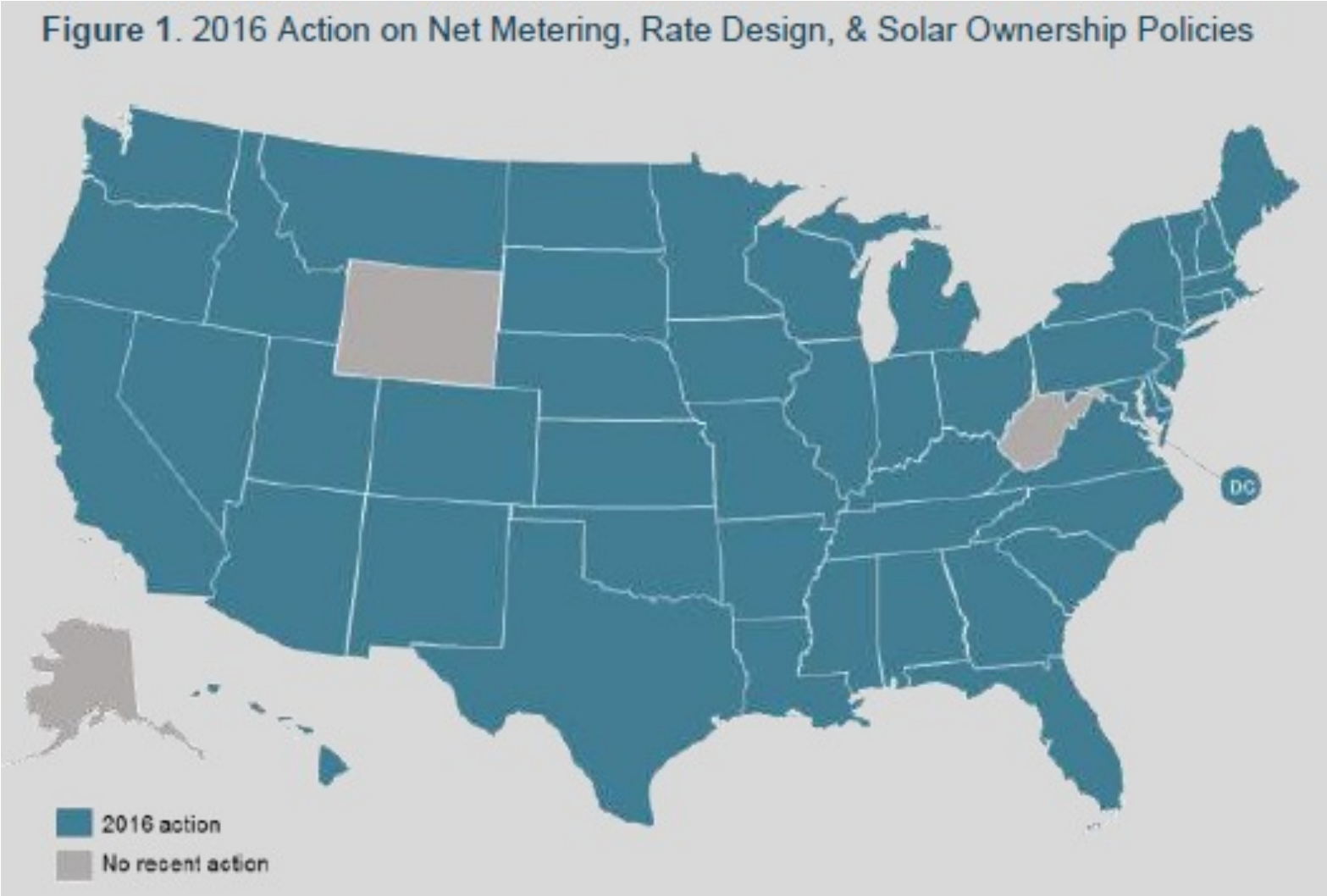
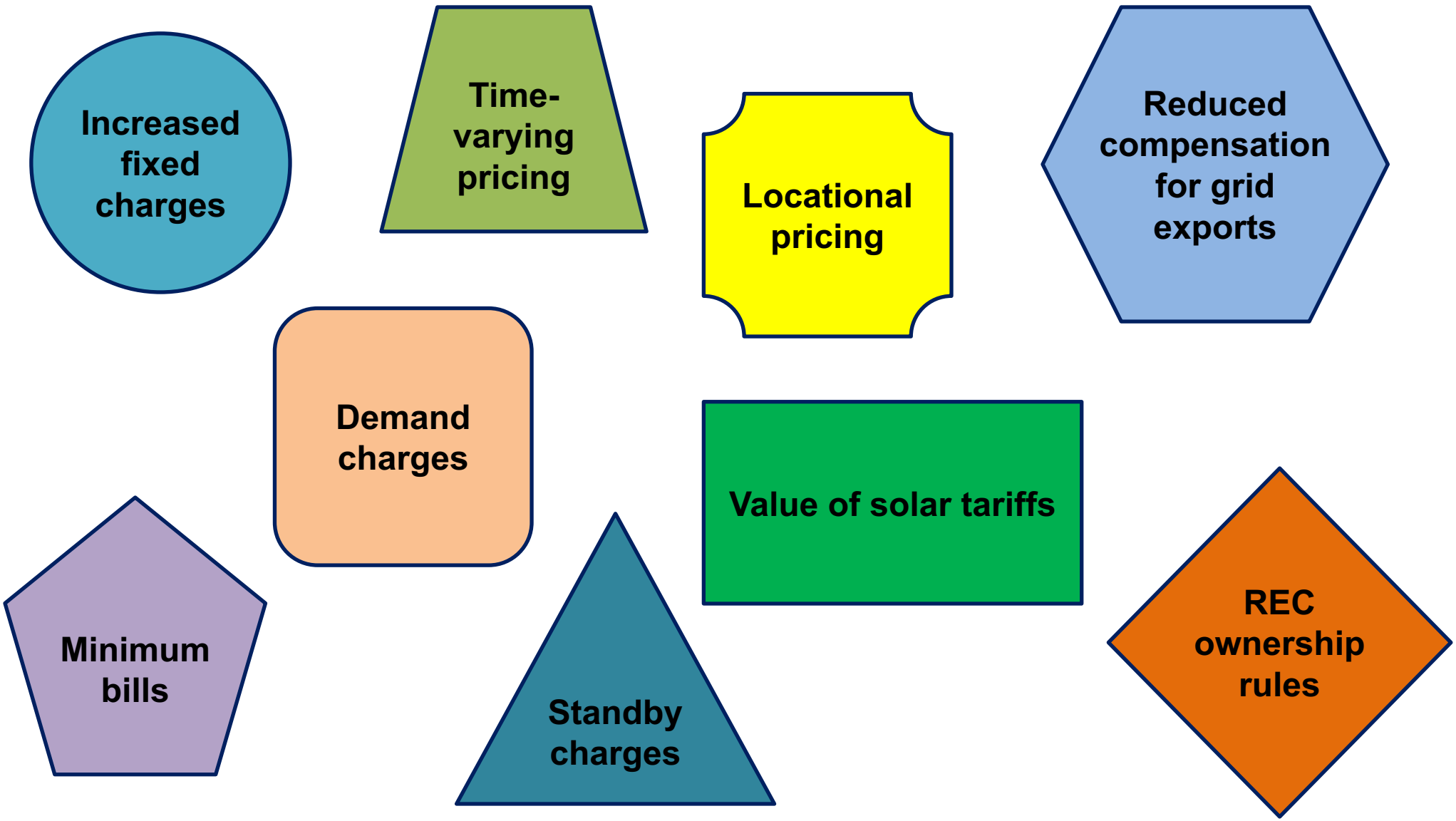
SunShot U.S. Department of Energy

Net metering and rate reforms have proliferated



Source: NC Clean Energy Technology Center and Meister Consultants, 2017. "The 50 States of Solar: 2016 Policy Review and Q4 Quarterly Report"

These reforms come in many shapes and sizes



The motivations for net metering and rate reforms vary

- **Cost-shifting/rate impacts**
- Utility shareholder impacts
  - revenue erosion
  - lost earnings opportunities
- Economic efficiency

The size of any solar cost-shift is a function of 3 things

1. The amount of rooftop solar on the utility system
2. How solar customers are compensated
3. The value of solar to the utility

$$\%\ \boldsymbol{Change\ in\ Retail\ Electricity\ Price} = \underset{\textcircled{1}}{Penetration} \times \left[\frac{\underset{\textcircled{2}}{Solar\ Comp.Rate}}{CoS} - \frac{\underset{\textcircled{3}}{VoS}}{CoS} \right]$$

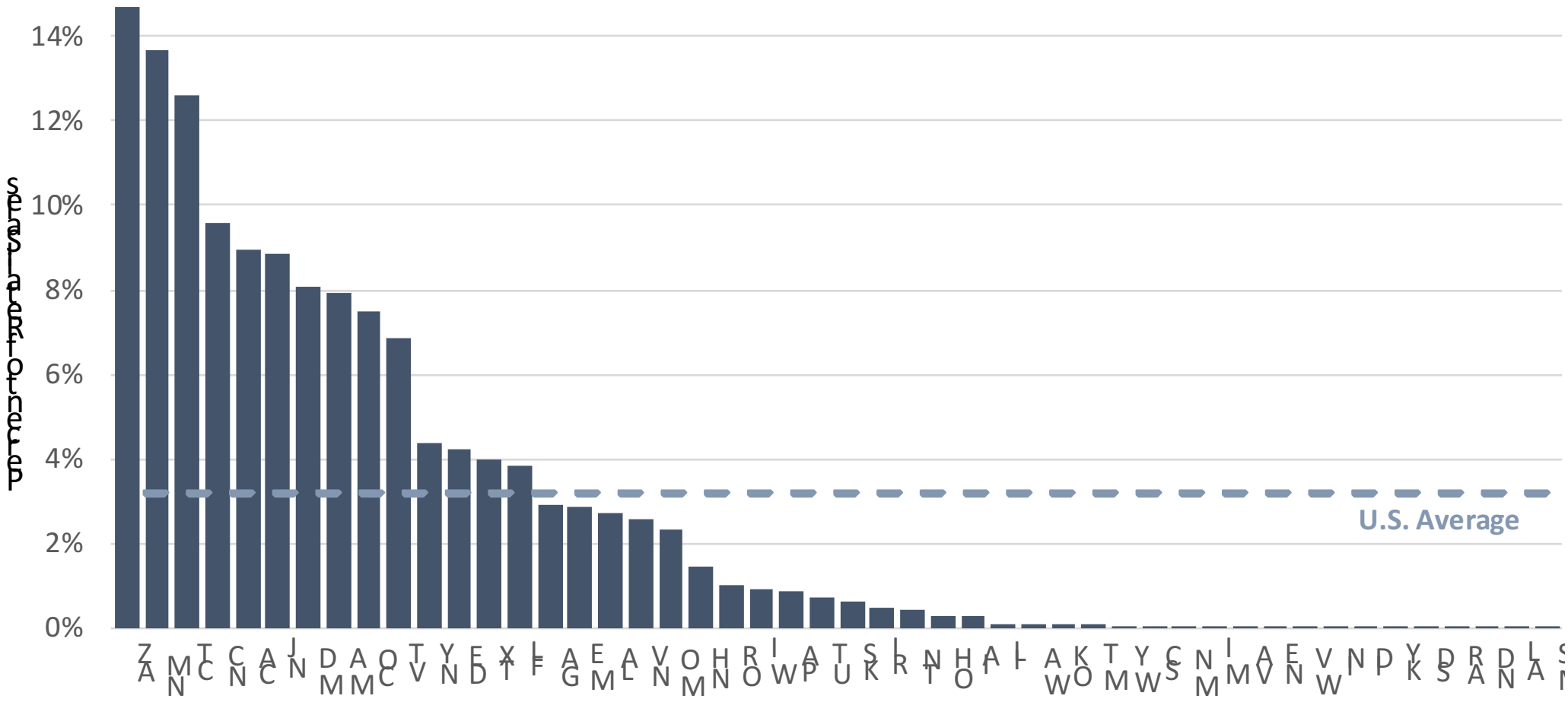
For most utilities, rooftop solar penetration is quite low

- Current rooftop solar = ~0.5% of total U.S. electricity generation
- A handful of utilities have surpassed 5% or 10%
- But the majority haven't even reached 0.05%

Even under the most pessimistic assumptions, any cost-shift at this penetration level would be imperceptible

Penetration in most states projected to remain <1% through 2030

Projected rooftop solar penetration levels in 2030
(from NREL 2016 Standard Scenarios Report)



Value of solar studies show widely varying results

Most fall within a range of 50-150% of utility cost-of-service (CoS)

Summary of Recent VoS Studies

Region	Author (Year)	VoS (2015 cents/kWh)		VoS/CoS	
		Core	Core+	Core	Core+
Arizona (APS)	SAIC (2013)	3.7	n/a	31%	n/a
Arizona (APS)	Crossborder Energy (2013a)	24.6	n/a	204%	n/a
Arizona (APS)	Crossborder Energy (2016)	16.9	18.9	144%	161%
California	E3 (2013)	n/a	14.6	n/a	98%
California	Crossborder Energy (2013b)	11.0	20.2	74%	135%
Colorado (PSCo)	Xcel (2013)	7.2	8.4	71%	83%
Maine	Clean Power Research (2015)	13.8	24.3	106%	185%
Massachusetts	Acadia (2015)	15.9	23.2	93%	136%
Mississippi	Synapse (2014)	14.6	17.4	148%	176%
Nebraska	Lincoln Electric System (2014)	3.8	n/a	47%	n/a
Nevada	E3 (2014b)	n/a	13.1	n/a	134%
Nevada	SolarCity/NRDC (2016)	10.3	11.2	109%	118%
North Carolina	Crossborder Energy (2013c)	11.6	12.9	122%	136%
PJM Region	Clean Power Research (2012)	7.5	17.6	51%	121%
Tennessee Valley Authority	TVA (2015)	6.9	7.3	73%	77%
Texas (Austin Energy)	Clean Power Research (2013a)	9.1	11.2	90%	111%
Texas (San Antonio)	Clean Power Research (2013b)	13.3	16.0	143%	173%
Utah	Clean Power Research (2014)	8.3	11.9	97%	139%
Vermont	VT Public Service Dept. (2014)	n/a	24.4	n/a	163%

Effect of rooftop solar on electricity prices is generally quite small compared to other issues

Net-Metered PV: Impact at *current penetration levels*, across a range of VoS assumptions, with purely volumetric rates

Net-Metered PV: Impact at *projected 2030 pen. level*, across a range of VoS assumptions, with purely volumetric rates

Net-Metered PV: Impact at *10% penetration*, across a range of VoS assumptions, with purely volumetric rates

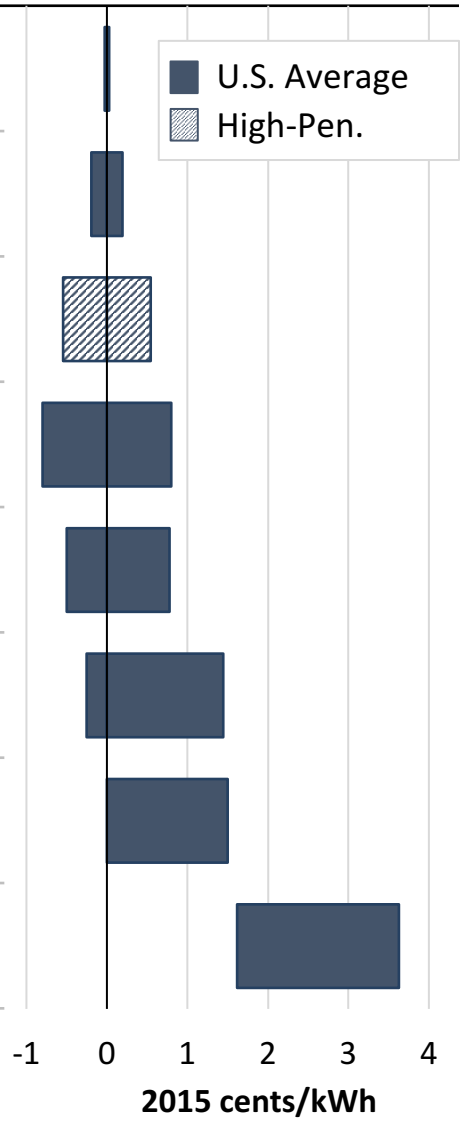
Energy Efficiency: Impact of projected 2015-2030 EE savings, if avoided costs are valued at the same rate as solar

Natural Gas: Range in retail electricity price across 10th/90th percentile gas price confidence intervals for 2030

RPS: Impact in 2030 across low and high cost scenario assumptions

Carbon: Impact of CPP in 2030 across multiple studies, each considering multiple implementation scenarios

CapEx: Gross impact of electric-industry CapEx through 2030, across range of CapEx trajectories and WACC

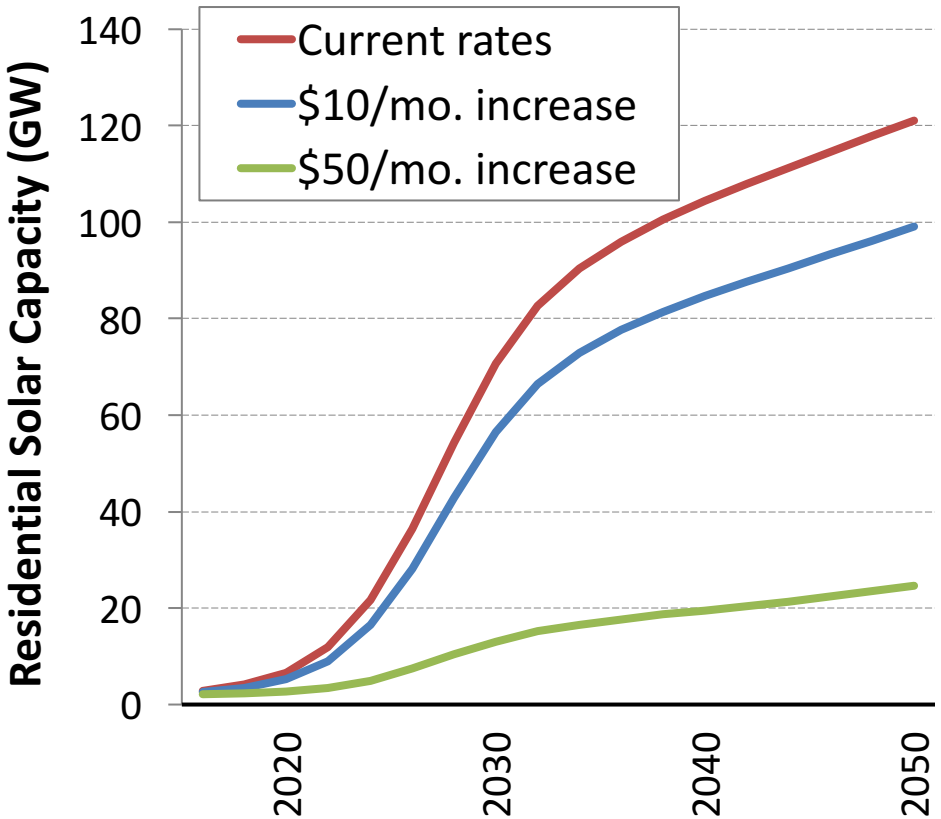


Rate impacts of net metered solar at three penetration levels

Other issues that also impact rates

At the same time, some rate reforms could severely throttle the rooftop solar market

Projected Cumulative U.S. Residential PV Capacity with Increased Fixed Charges



For example, a $50/month fixed customer charge, would reduce residential solar growth by ~90%

Retail-rate and NEM reforms are not the only tool in the toolkit

- Retail rate and NEM reforms generally aim to reduce compensation to solar customers
- **Necessarily a zero-sum game**
- Other strategies can address some of the same concerns (about ratepayer equity, utility financial health, and economic efficiency), but potentially in a less contentious manner

Other approaches to addressing concerns about the financial impacts of rooftop solar growth

Strategies	Examples/Tactics
Facilitate higher-value deployment	• time-varying, locational, or unbundled attribute pricing • enhanced utility system planning • community solar • utility ownership and financing of distributed solar • distribution network operators, services-driven utilities
Broaden customer access to solar	• community solar • utility ownership and financing of distributed solar
Align utility profits and earnings with distributed solar growth	• decoupling and other ratemaking reforms to reduce regulatory lag • utility ownership and financing of distributed solar • performance-based incentives • distribution network operators • services-driven utilities

Concluding thoughts

- Cost-shift from distributed solar is negligible for most utilities, simply by virtue of low penetration levels
- If the policy objective is keeping rates low, other issues generally offer much bigger bang for the buck
- As a general matter, economic efficiency provides a more compelling rationale for rate and NEM reforms
- If the utility financial impacts from distributed solar are significant, consider the broader array of potential solutions before defaulting to particular rate/NEM reforms

For Further Information

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