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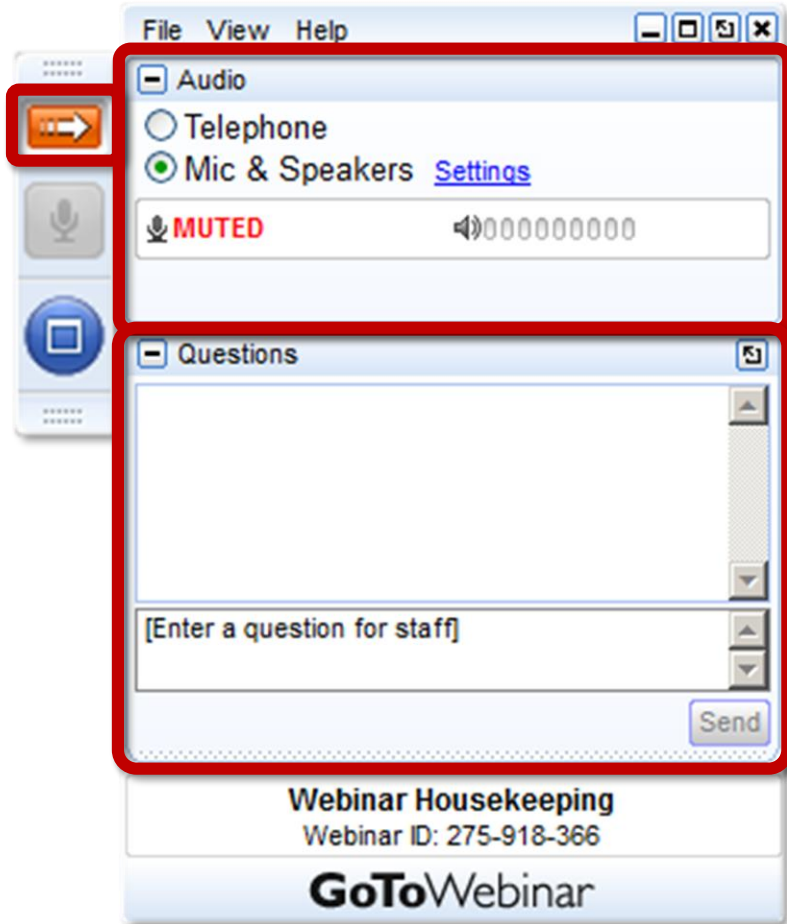
# Net Energy Metering, Distributed Solar Valuation, and Rate Design

Hosted by  
Warren Leon, Executive Director, CESA

April 9, 2019



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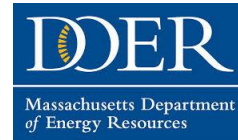
# CleanEnergy States Alliance



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Innovation is in our nature.



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District of Columbia  
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Alaska Center for Energy and Power

# Webinar Speakers

- **David Meyer**, Senior Advisor, Office of Electricity, US Department of Energy
- **Steve Fine**, Vice President, Distributed Grid Strategy, ICF
- **Tom Stanton**, Principal Researcher for Energy and Environment, National Regulatory Research Institute
- **Warren Leon**, Executive Director, Clean Energy States Alliance (moderator)





U.S. DEPARTMENT OF  
**ENERGY**

Office of  
Electricity



## **DOE's Report to Congress on Net Energy Metering (NEM)**

David Meyer, Office of Electricity  
Presentation to CESA Webinar, April 9, 2019

# Congress' Direction to DOE

**Congress said: ... [C]onduct a study that would “determine the costs and benefits of net metering and distributed solar generation to the electrical grid, utilities, and ratepayers.”**

**DOE decided to gather information for its report in two ways:**

- 1. It initiated a public Request for Information (RFI), to obtain input from individuals and stakeholder groups who are interested in NEM.**
- 2. It engaged ICF, Inc. to prepare a detailed review of 15 recent NEM-related cost-benefit studies.**

# DOE's Report

DOE submitted its report to Congress in February 2019 in the form of a 10-page letter. The report highlighted seven conclusions:

1. NEM was widely adopted by states as a simple way to reimburse solar customer/generators who feed their excess electricity into the grid.
2. Multiple studies have found that basic NEM tariffs (paying solar customers at retail rate for electricity sent to the grid) results in cost-shifting between non-solar customers and solar customers.
3. Basic NEM tariffs do not provide effective incentives for solar customers to maximize the value of the electricity they generate.
4. NEM-based PV programs can also have significant operational impacts at the utility or grid level as its penetration increases.

# DOE's Report (cont.)

5. Distributed solar generation can provide a number of important benefits.

DOE noted that ICF's study found 18 different categories of possible value categories in its review of 15 recent studies. The magnitudes of the values tend to be very location-specific. ICF's figure is shown at right.

		Arkansas - Crossborder Energy 2017	Nevada - E3 2016	Louisiana - Acadia Consulting Group 2015	South Carolina - E3 2015	Mississippi - Synapse 2015	Vermont - VT Public Service Dept 2014	Washington DC - Synapse 2017	Georgia - Southern Company 2014	Hawaii - Clean Power Research 2015	Maine - Clean Power Research 2015	Oregon - Clean Power Research 2015	Minnesota - Clean Power Research 2015	Utah - Clean Power Research 2015	New York - NY BCA Framework 2014	California - Juba Framework 2014	Total
<b>Utility System Impacts</b>																	
G	Avoided Energy Generation	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	15
	Avoided Generation Capacity	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	15
	Avoided Environmental Compliance	•	•			•	•	•	•	•	•	•	•	•	•	•	10
	Fuel Hedging	•			•	•	•	•	•	•	•	•	•	•	•	•	9
	Market Price Response	•				•	•	•	•	•	•	•	•	•	•	•	6
	Ancillary Services		•		•	•	•	•	•	•	•	•	•	•	•	•	8
T	Avoided Transmission Capacity	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	15
	Avoided Line Losses	•	•		•	•	•	•	•	•	•	•	•	•	•	•	11
D	Avoided Distribution Capacity	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	14
	Avoided Resiliency & Reliability	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	5
	Distribution O&M	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	4
	Distribution Voltage and Power Quality	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	6
C	Integration Costs	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	13
	Lost Utility Revenues	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	7
	Program and Administrative Costs	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	7
<b>Societal Impacts</b>																	
S	Avoided Cost of Carbon	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	8
	Other Avoided Environmental Costs	•	•			•	•	•	•	•	•	•	•	•	•	•	9
	Local Economic Benefit	•	•			•	•	•	•	•	•	•	•	•	•	•	3

Included	•
Included/represented in another category	•
Discussed but not monetized/quantified	o
For NY, included in VDER Phase One	o



# DOE's Report (cont.)

6. As a result of the impacts noted above as well as other impacts, many states have either phased out “NEM 1.0” in favor of one or another NEM-successor regulatory approach or framework, or are considering such actions.
7. DOE recognizes that the line between State and Federal jurisdiction over net metering transactions could shift.



we are



# Review of Recent Cost-Benefit Studies Related to Net Metering and Distributed Solar

**Steve Fine**

Vice President, Distributed Grid Strategy

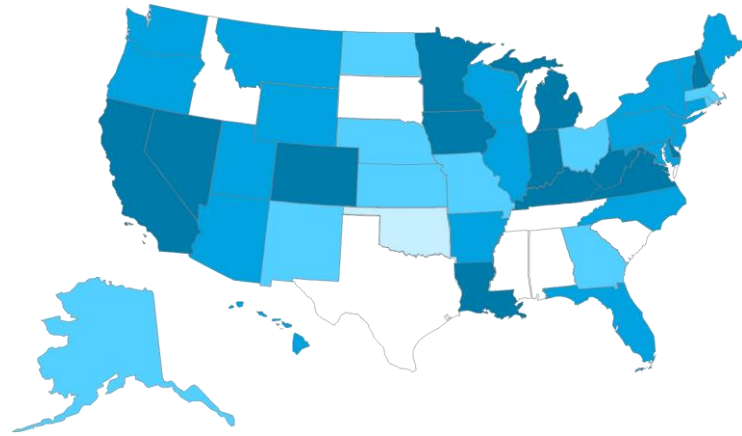
April 9, 2019

# Purpose and Objective

- Commissioned by DOE
- Analyze 15 recent cost-benefit studies related to net metering (NEM) and distributed solar.
- Highlight key issues and emerging trends
  - Cost-benefit categories
  - Methodological choices
  - Overall findings
- Focused on value studies (not rate design, tariffs, or alternative forms of compensation)



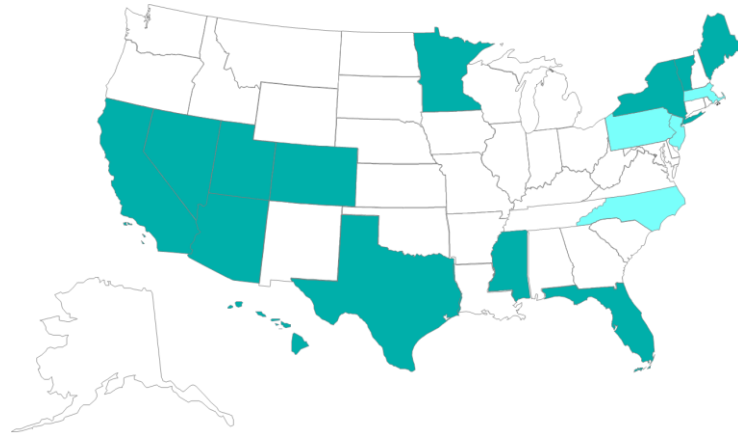
# Illustration of Evolution from NEM to More Locational Cost-Benefit Analysis



	NEG at retail rate (or above); credits do not expire
	NEG at retail rate at first, then credits expire or are reduced
	NEG at less than retail rate
	NEG at \$0
	No uniform or statewide mandatory net metering rule

**Net-Energy Metering**

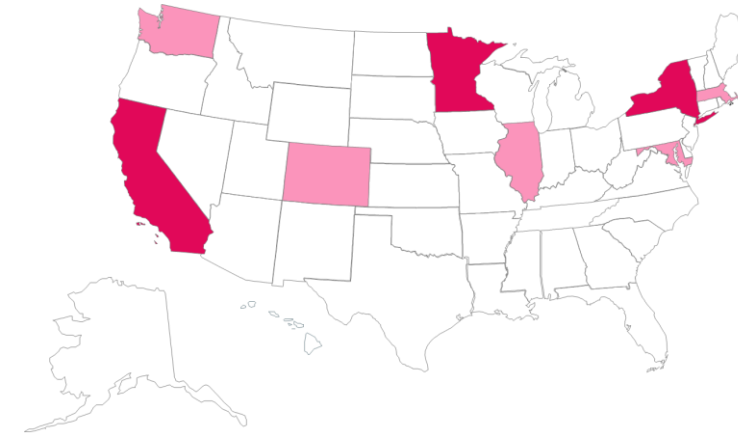
**2015**



	State PUC VOS Study
	Independent VOS Study

**Value of Solar**

**2016**



	Distribution Resource Planning Proceeding
	Distribution Resource Planning Proposal

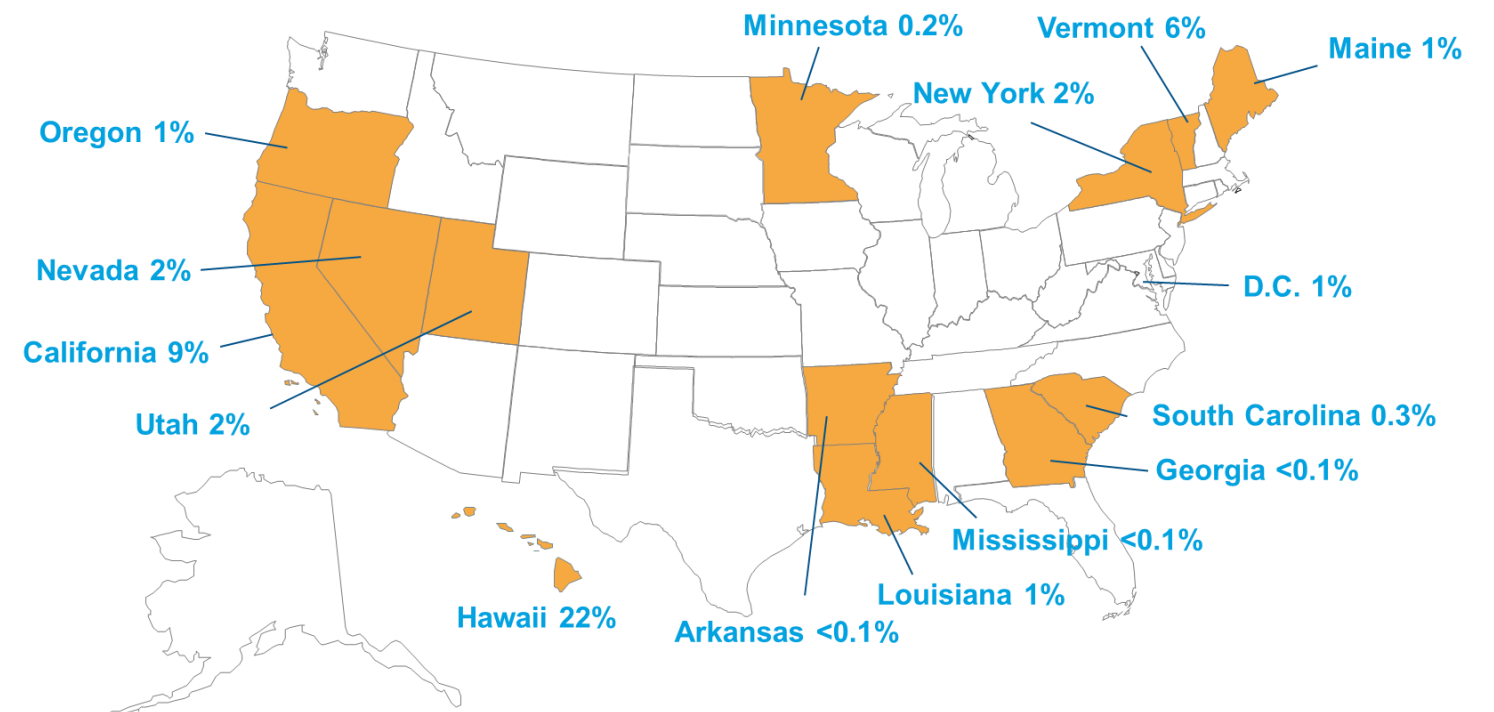
**Distribution Resource Planning**

**2017**

# Selecting Studies to Analyze

- 15 studies from 15 states
- Narrowed from list of 40+ relevant studies
- Criteria guiding study selection:
  - Report identifies a set of value categories that applies to distributed PV
  - Released in 2014 or later
  - Studies from different regions of the country
  - Studies from jurisdictions with different amounts of PV adoption
  - Prepared by different research firms or utilities
  - Includes studies sponsored or commissioned by different organizations (e.g., utility commissions, utility companies, consumer advocates, environmental groups)

Geographic diversity of studies and estimated PV Penetration, 2016





# 15 Studies Included in Review

State	Year	Study Sponsor	Prepared by
Arkansas	2017	Sierra Club	Crossborder Energy
District of Columbia	2017	Office of the People's Counsel	Synapse Energy Economics
Georgia	2017	Southern Company	Southern Company
California	2016	California Public Utility Commission (CPUC)	CPUC/Energy and Environmental Economics (E3)
Nevada	2016	State of Nevada Public Utilities Commission	E3
New York	2016	New York Public Service Commission (PSC)	NY Department of Public Service (DPS) Staff
Hawaii	2015	Interstate Renewable Energy Council	Clean Power Research
Louisiana	2015	Louisiana Public Service Commission	Acadian Consulting Group
Maine	2015	Maine Public Utility Commission	Clean Power Research
Oregon	2015	Portland General Electric	Clean Power Research
South Carolina	2015	South Carolina Office of Regulatory Staff	E3
Minnesota	2014	Minnesota Department of Commerce	Clean Power Research
Mississippi	2014	Public Service Commission of Mississippi	Synapse Energy Economics
Utah	2014	Utah Clean Energy	Clean Power Research
Vermont	2014	Public Service Department (PSD) Staff	VT PSD

# Grouping Studies into 3 Types

## NEM Cost-Benefit Analysis

Evaluate costs and benefits of a traditional NEM program; study whether NEM is creating a cost-shift to non-participating ratepayers.

**6** Studies Reviewed

## Value of Solar/NEM Successor

Discuss alternatives to NEM; consider options for new compensation rates that go beyond traditional net metering.

**7** Studies Reviewed

## DER Value Frameworks

Reflect elements of regulatory activities that seek a more precise approach and use a framework that can be applied to other DERs.

**2** Studies Reviewed

# ICF's Analytical Approach to Study Review



# Key Observations

1. Studies represent an **evolution of approaches** to solar value analysis.
2. Overall value depends substantially on **which costs and benefits are included** and monetized in a study.
3. Approaches to **defining the value categories** and methods for quantifying them vary across studies and affect the results.
4. The **perspective** from which value is assessed affects which value categories are included and how they are quantified.
5. Studies use a **range of input assumptions** for factors that influence results (such as marginal unit displacement, solar penetration, integration costs, externalities, and discount rates).

# Value Categories

- Most common (all 15 studies)
  - Avoided energy generation
  - Avoided generation capacity
  - Avoided transmission capacity
- Least common (5 or fewer studies)
  - Distribution O&M
  - Avoided resilience and reliability
  - Economic development
- Integration Costs
  - Lack of transparency
- Societal Values
  - Lack of agreement

Value Category		Benefit (+) or Cost (-)	# of Studies Addressing this Category
<b>Utility System Impacts</b>			
G	Avoided Energy Generation	+	15
	Avoided Generation Capacity	+	15
	Avoided Environmental Compliance	+	10
	Fuel Hedging	+	9
	Market Price Response	+	6
	Ancillary Services	+/-	8
T	Avoided Transmission Capacity	+	15
	Avoided Line Losses	+	11
D	Avoided Distribution Capacity	+	14
	Avoided Resiliency & Reliability	+	5
	Distribution O&M	+/-	4
	Distribution Voltage and Power Quality	+/-	6
C	Integration Costs	-	13
	Lost Utility Revenues	-	7
	Program and Administrative Costs	-	7
<b>Societal Impacts</b>			
S	Avoided Cost of Carbon	+	8
	Other Avoided Environmental Costs	+	9
	Local Economic Benefit	+	3



# A Standardized Framework to Value DER

- The “**right**” valuation framework comes down to state-specific policy goals and local grid needs.
- Standardization (common set of value categories, agreed-upon definitions) **could improve** valuation practices
- A **shared starting point** is needed; framework can allow for variables that account for changing factors.
- Efforts underway to develop **a standard model to address other DERs**
  - Extending the cost-effectiveness principles used to assess energy efficiency in the National Standard Practice Manual.

# Comprehensive Matrix and Review Results

		Arkansas - Crossborder Energy 2017	Nevada - E3 2016	Louisiana - Acadian Consulting Group 2015	South Carolina - E3 2015	Mississippi - Synapse 2014	Vermont - VT Public Service Dept 2014	Washington D.C. - Synapse 2017	Georgia - Southern Company 2017	Hawaii - Clean Power Research 2015	Maine Clean Power Research 2015	Oregon - Clean Power Research 2015	Minnesota - Clean Power Research 2014	Utah - Clean Power Research 2014	New York - BCA Framework 2016 + VDER Phase One	California - LNBA Framework 2016	Total
<b>Utility System Impacts</b>																	
G	Avoided Energy Generation	●	●	●	●	●	●	●	○	○	●	○	○	●	○	○	15
	Avoided Generation Capacity	●	●	●	●	●	●	●	○	○	●	○	○	●	○	○	15
	Avoided Environmental Compliance	●	●		●	●		●	○		●	○		●		○	10
	Fuel Hedging	●			●	●		●		○	●	○	●	●			9
	Market Price Response	●					●	●		○	●						6
	Ancillary Services		●		●	○		○	○								8
T	Avoided Transmission Capacity	●	●	●	●	●	●	●	○	○	●	○	○	●	○	○	15
	Avoided Line Losses	●	●		●	●	●	●	○			○		●	○	○	11
D	Avoided Distribution Capacity	●	●	●	●	●	●	●		○	○	○	○	●	○	○	14
	Avoided Resiliency & Reliability	○				○		○							○	○	5
	Distribution O&M			●					○						○	○	4
	Distribution Voltage and Power Quality								○	○	○	○		○	○		6
C	Integration Costs	●	●	●	●			●			●						13
	Lost Utility Revenues	●	●	●	●	●	●										7
	Program and Administrative Costs		●	●	●	●	●										7
<b>Societal Impacts</b>																	
S	Avoided Cost of Carbon	●					●	●		○	●		○		○	○	8
	Other Avoided Environmental Costs	●	●			○		○		○	●		○		○	○	9
	Local Economic Benefit	●				○		○									3

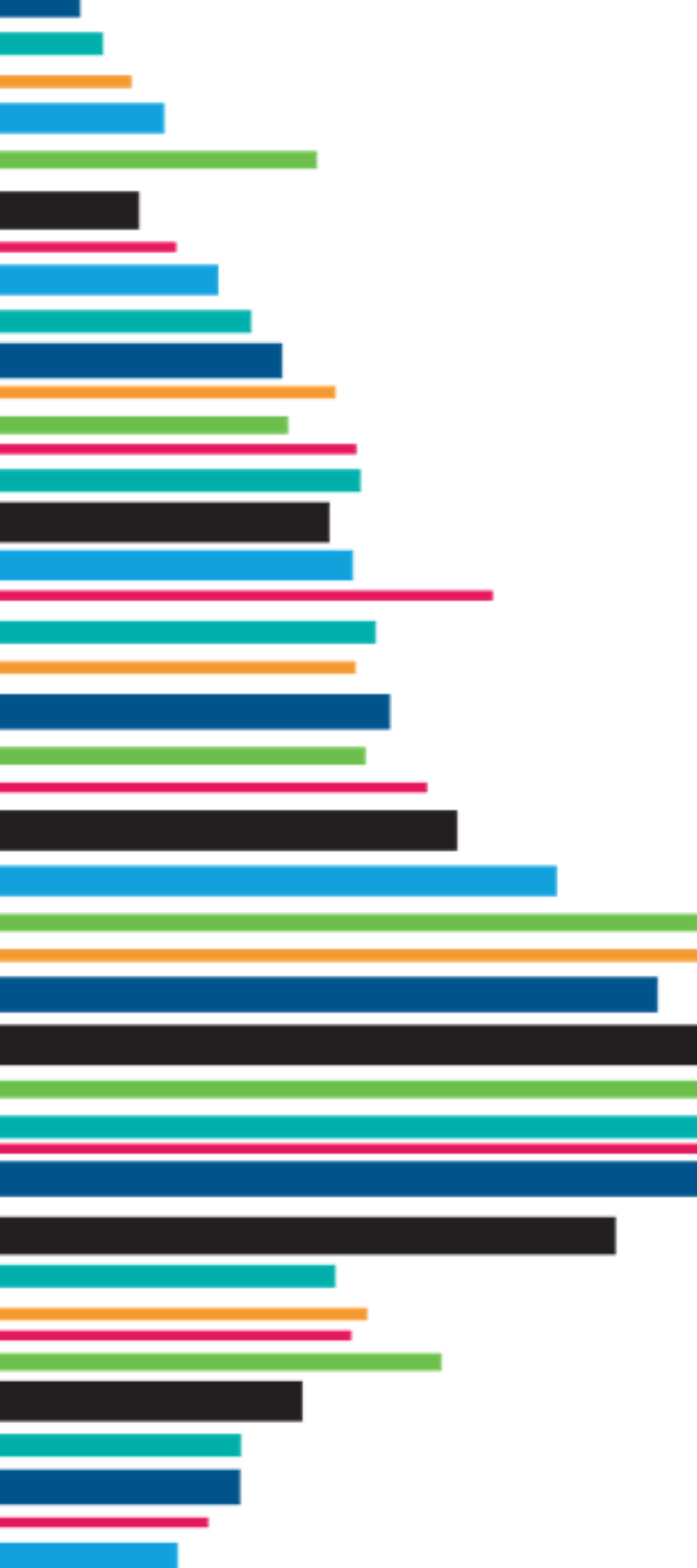
- Included ●
- Included/represented in another category ●
- Discussed but not monetized/quantified ○
- For NY, included in VDER Phase One ○





# Final Takeaways

- **Still evolving, with room to go**
- **Challenge of Valuing D – locationally and over time**
- **Workability of locationally variable tariff design**
- **Tensions between administratively determined tariff vs. market based rates (dynamic, transactive markets)**
- **Seeing this play out in practice – particularly around NWAs and their evolution**



[The Hunt for the Value of Distributed Solar](#)

[Review of Recent Cost-Benefit Studies Related to Net Metering and Distributed Solar,](#)

[How Locational Value Is Transforming Energy Policy Across the U.S.](#)

[Missing Links in the Evolving Distribution Markets](#)

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# NEM 2.0 and Successor Tariffs: Which States are Doing What?

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Clean Energy States Alliance Webinar  
Net Energy Metering, Distributed Solar Valuation, and Rate Design  
April 9, 2019

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Principal Researcher – Energy and Environment  
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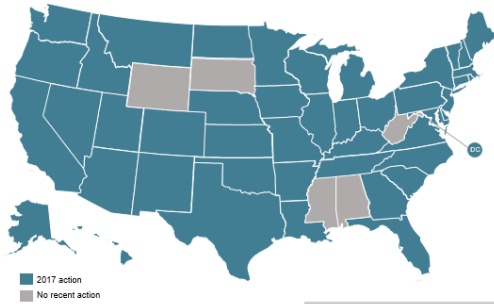


## Review of State Net Energy Metering and Successor Rate Designs



# NEM changes are well underway...

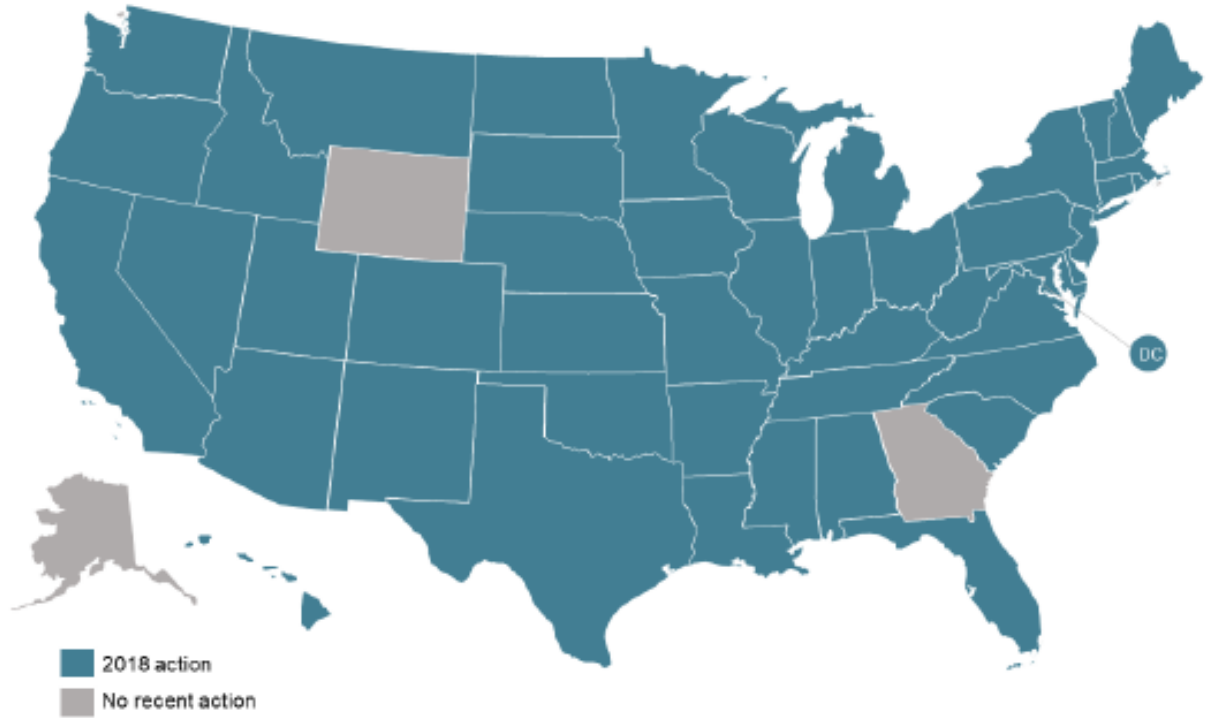
2017 Action on DG Compensation, Rate Design, & Solar Ownership Policies



45 States + DC took action on distributed solar policy and rate design during 2017



Figure 3. 2018 Action on Net Metering, Rate Design, & Solar Ownership Policies



**Summary:  
Almost all  
states have  
at least some  
recent action  
on NEM issues.**



# Is timing everything?

## What is driving these changes?

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- State policies, including NEM program caps, trigger reviews in many jurisdictions
- Issue framing and utility “playbook” (2013 EEI report, authored by Kind), about disruptive technology, fairness, and possible cross subsidies
- Utilities are generally facing flat or slightly declining sales, aging equipment, needs for new investments
- Changing market conditions, especially for distributed solar PV and more recently for battery storage, trigger utility concerns



# Perceptions of market conditions are the big drivers of policy changes

Market Model Name	Price Support	Transitional	Price-competitive
General market condition	Uneconomic	Pre-economic	Grid-competitive
B/C ratio <sup>1</sup>	$B < C$ , slow if ever ROI	$B \approx C$ , modest ROI or payback under optimistic scenarios	$B > C$ , patient ROI, reasonable payback under many scenarios
LCOE to VDER comparison	$LCOE > VDER$	$LCOE = VDER$	$LCOE < VDER$
Other relevant support policy impacts	Low	Medium	High
Types of adopters <sup>2</sup>	True believers, Innovators	Early adopters	Early majority
Market share for DER <sup>3</sup>	~1% or fewer customers	~1 to 2.5%	>2.5%
DG, NEM growth rates <sup>4</sup> (customers or capacity)	< 1/3 per year	1/3–2/3 per year	Annual doubling or more
Trend in total utility sales levels	Growing or flat	Growing, flat, or declining	Flat or declining
Time pressure for regulatory actions	Low	Medium	High

Source: Author's construct based on Taylor, McLaren, et al. 2015 (NREL/TP-6A20-62361) and adapted from Rogers 2003, *Diffusion of Innovations, Fifth Edition*.

1 The benefit/cost (B/C) ratio takes into account utility rates and includes as benefits available support policies, like financial incentives, plus any other costs DER can avoid.

2 Adopter types from Rogers 2003.

3 Market share characterizations shown are the author's construct based on Rogers 2003 and observations of NEM growth reported by U.S. Energy Information Administration.

4 DG, NEM growth rates depicted here are the author's construct, based on personal observations and published solar market data. Depending on the purpose for analysis, growth rates might be measured in terms of cumulative capacity or numbers of customers.



# Exploring the market conditions

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- The time pressure for changing NEM depends on how fast DER options are spreading and how those changes are affecting utility revenues, and perceptions of the time pressure differ greatly among interested parties
- Some DER markets are heavily influenced by government support policies, both regulatory and non-regulatory, including financial supports such as grants, loans, and tax credits or exemptions
- As DER supplies increase, marginal benefits gradually approach the average cost
- There are strong causal links among the general market condition, the relationship between LCOE and VDER, the types and numbers of adopters attracted, achievable market share, and annual growth rates



NRRI Report No. 19-01 notes (p. 3):

- “NEM [is being described] as a program that was inherently causing cross-subsidies to be paid by non-participating customers to participating customers.”
- And, there are “...widespread perceptions that NEM programs, originally intended to support nascent markets for marginally cost-effective solar PV, have served their purpose and the time has come to replace them with cost-based or value-based tariffs.”
- “...customers who supply some of their own power by self-generating are still making extensive use of the... utility grid... .”
- “... regulatory treatment should appropriately compensate NEM customers for the services they are producing and delivering.”



# Seven Major Topics Included in NRRI Review of State Actions

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- Comprehensive reviews of rate designs for customers with distributed generation. In 2017 alone:
  - 12 states were already working on comprehensive grid-modernization rate reviews;
  - 7 states on solar-plus-storage rate design studies; and,
  - 3 states on TOU rates for EM customers.
- Changing credit rates for excess generation delivered to the utility grid (~30 states)
- Increasing fixed charges (decisions in 35 states, for ~100 utilities so far)
- Adding demand or standby charges to rates that had none (13 states)
- Treating customers with distributed generation as a new customer class (proposals from >20 utilities in 13 states, but only a few approved)
- Providing for DG owned by third-parties (26 States + DC), utilities (12 states), or both (8 states)
- Enabling community solar projects (18 states)



# Summary of State Actions

Policy Types	Vertically Integrated States
	Restructured States
NEM 2.0 or NEM Successor Tariff <sup>1</sup>	AZ, CA, HI, ID, IN, LA, MI, NV, UT, VT
	CT, DC, MA, ME, NY
Changing credit rates for excess generation	AZ, CA, GA, HI, IN, KS, LA, MT, NC, NH, NV, SC, UT, WI
	ME, NY, OH, TX
Increasing (decreasing) customer fixed-charges <sup>2</sup>	AL, AK, AR, AZ, (CO), FL, HI, ID, IN, KS, KY, MI, MN, MO, ND, NM, NV, OK, SC, SD, TN, WA, WI, WV
	(CT), DC, DE, MA, NH, NJ, (NY), OH, PA, RI, TX
Assigning demand-charges or stand-by charges	AL, AR, AZ, CA, KS, NC, NM, SC, UT
	MA, NH
Creating a separate customer class for DG	IA, ID, KS, MT, NV
	TX
Providing for third-party or utility-owned DG	AZ, FL, GA, LA, MO, NC, NM, SC, UT, VA, VT
	DC, NY, RI, TX
Adding provisions for community solar <sup>3</sup>	CA, CO, HI, MN, NC, OR, VA, VT, WA
	CT, DC, DE, IL, MA, MD, ME, NH, NJ, NY, RI

Source: NCSU CETC *50 States of Solar* report series, 2015 through 2018.

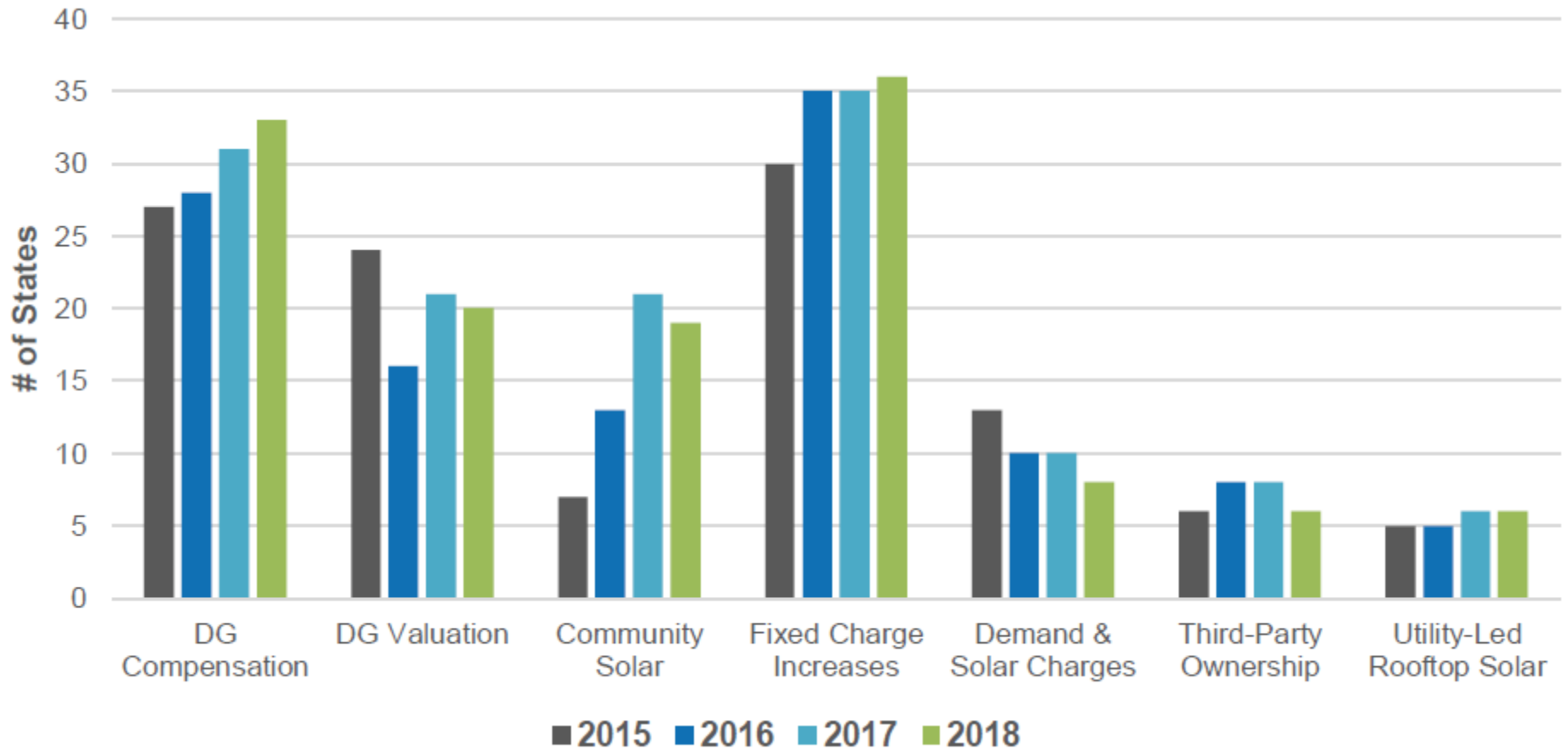
<sup>1</sup> See Figure 2, p. 12.

<sup>2</sup> In these instances, the decisions result from specific regulatory commission orders and affect individual utility companies.

<sup>3</sup> See Figure 4, p. 37. Several states have provisions for community solar programs that treat participants as virtual or remote net metering customers. Listed here are those states where legislation provides for community solar programs. Many more states have one or more active community solar projects, but as yet have no statewide law or rules: Most often, those projects were proposed by individual utility companies and approved by state regulatory commissions (or, for those utilities that are not state regulated, were approved by their municipal or cooperative regulatory bodies). See Stanton and Kline 2016.



# Major state actions tracked 2015–2018





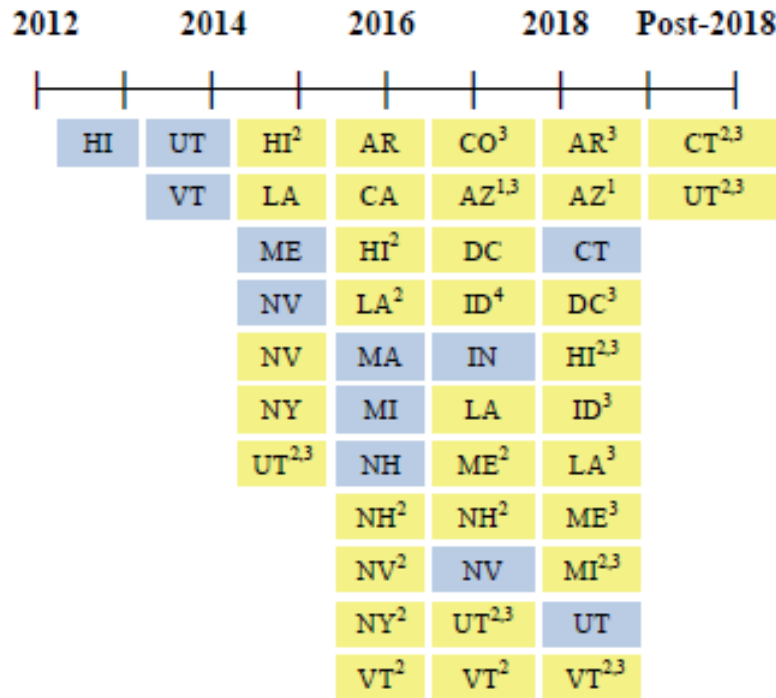
# Guidance from the NARUC Manual on DER Rate Design and Compensation

- It is important for jurisdictions to determine the level and pace of adoption of DERs before deciding what, if any, policy reforms are needed. Before taking any reform actions, policymakers should request and review data, analyses, and studies for their own jurisdictions. Policy reforms that are rushed and not well thought out can have unintended consequences, including creating volatile business conditions of boom and bust cycles for DER businesses. It is necessary to understand how current policies and... associated growth rates in DER adoption are affecting: (a) utility system costs and revenues; (b) DER business models; and, (c) costs and benefits that accrue to different DER technologies and services. Once those factors are well understood, policy makers can consider changes in rate designs, along with any changes in other support policies. (NRRI 19-01, pp. 6-7)

- States already engaged in replacing NEM:
  - Vertically integrated: AZ, CA, HI, IN, MI, UT
    - ✦ Nevada started, then 2017 legislation reinstated NEM, for now
  - Restructured: CT, ME
- Typical rate design principles apply:
  - No cross subsidies from non-participants
  - Utilities recover full cost of service
  - “Full” assessment of benefits and costs



# Timeline of 17 States plus DC, Adopting NEM Successor Tariffs



**KEY:** Law Commission Order

- Notes:**
- <sup>1</sup> Indicates a decision affecting only one or more individual utility companies.
  - <sup>2</sup> Indicates additional state legislative or regulatory actions, subsequent to the enabling laws or rules.
  - <sup>3</sup> Indicates pending regulatory decisions.
  - <sup>4</sup> Idaho does not have statewide NEM legislation. The Idaho PUC has directed individual regulated utility companies to file NEM tariffs.





## Early state decisions vary widely (1)

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- Arizona – NEM ending, changing to avoided cost based on 5-year average cost of utility-scale solar, plus T&D adder. Separate rate class for rooftop solar. New NEM Rules are being drafted.
- California – NEM successor includes: minimum bills; non-residential NEM customers pay applicable fixed charges; NEM customers pay all non-bypassable charges on kWh of inflow; residential customers shall take service under any TOU rate available to them; both virtual NEM and NEM aggregation continue. Virtual NEM can now be paired with storage. 2018 amendments extend NEM to disadvantaged communities.
- Hawaii – Participating customers can choose a customer-self-supply option with no credits for grid export, or one of two additional tariff options: (1) “smart export” for solar plus storage systems; or, (2) “controllable grid-supply” with advanced inverter functions enabled and subject to utility control. Compensation for energy exports under both options is set below the retail rate.

## Early state decisions vary widely (2)

- Idaho – Will treat self-supply customers as a separate rate class. The Commission is “open to the possibility” that non-exporting customers might be removed from NEM.
- Indiana – NEM closes by July 2022 or when 1.5% aggregate cap is reached. Then credit will be at 1.25 times the avoided cost rate, defined by law as “the average marginal price of electricity paid by the electricity supplier during the most recent calendar year.” Utilities will file proposed avoided cost rates not later than March 1, 2021, and “may request... recovery of energy delivery costs attributable to serving customers that produce distributed generation.”
- Louisiana – new NEM compensates NEG at the utility’s avoided cost rate; however, the Commission may also approve an alternative, such as seasonal avoided cost rates or average avoided cost rates adjusted for avoided line losses and daytime, on peak generation.”

## Early state decisions vary widely (3)

- Maine – adopted a buy-all, sell-all rate. Netting of T&D costs will gradually reduce to zero by 2025. Legislature says: “[N]et energy billing [shall] fairly and transparently allocate the costs and benefits of distributed generation to all customers, allow participation by all customers and create a sustainable platform for future growth of distributed generation to the benefit of all ratepayers.”
- Massachusetts – 2016 law provides “...continued support of solar power generation and a transition to a stable and equitable solar market at a reasonable cost... .” After solar capacity reaches 1,600MW<sub>dc</sub>, “market” NEM credits apply. Compensation will vary by capacity block, declining by 4% as each block is filled.
- New York – Switching to VDER “value stack,” with “locationally-granular prices.” Phase 2 proceedings will work towards: equal compensation for reduced consumption and injected generation; and, consider grid access charges, nonbypassable fees, or other methods... .”



## Early state decisions vary widely (4)

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- Utah – 2018 law ends existing NEM on 1 January 2036. A “transition program” is in place now, pending a determination of the compensation rate for exported power. The Commission has directed Rocky Mountain Power to continue load research studies, gathering data from samples of residential and commercial customers for up to 12 months, beginning in the 2019 calendar year.
- Vermont – Has adopted a “revised net metering program,” where compensation is based on a statewide average residential rate and customers receive “credit adjusters” based on REC ownership and installation site, with extra credit for “appropriate and beneficial” sites. In Vermont, net metering applications are submitted to the Commission, and the Commission determines whether to grant a required Certificate of Public Good, before net metering commences.

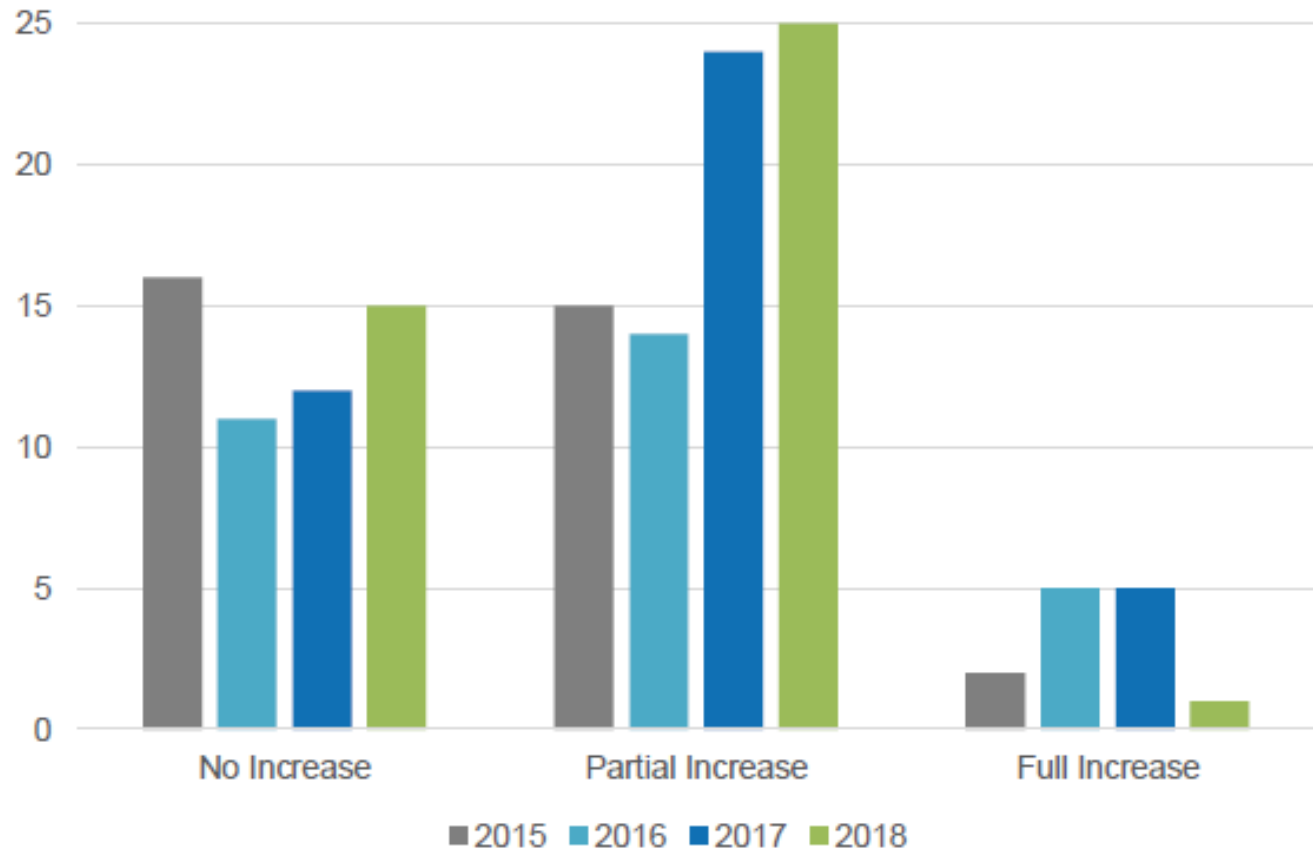
# Summary of fixed-charge changes

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- Since 2014, ~125 utilities have asked for fixed charge increases, and decisions were made for ~100 of them
- 25 utilities asked for increases of \$1–2 per month; 40 asked for \$3–6; 25 asked for >\$6–10; 10 asked for >\$10.
- In half the cases, regulators approved partial increases, including less than \$1 per month in 15 decisions; another 15 ranged from \$1–<\$2; 16 ranged from \$2 to \$3.50; and only four raised the previous fixed charges by \$5 or more per month
- In about a dozen cases, the utility’s requested increase was approved in full
- In recent cases in Colorado, Connecticut, Nevada, and New York, fixed charges were reduced



# Fixed charge decisions, 2015-18



Note: This chart excludes decisions made by municipal and cooperative utilities to increase residential fixed charges. These decisions are included in Figure 12.

# Summary of demand-charge changes

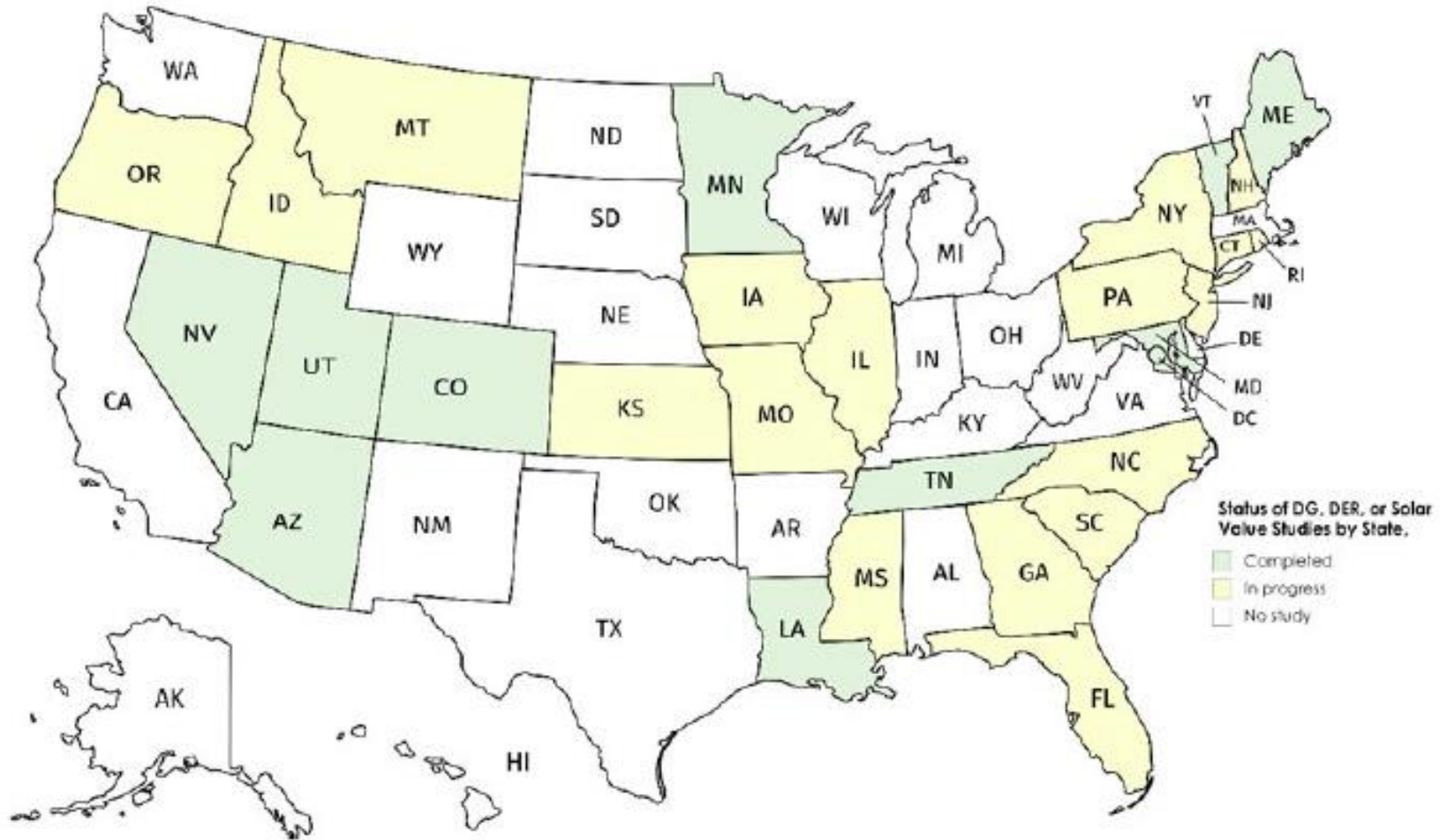
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- 15 states have made decisions about demand charges: Arizona; California; DC; Kansas; Montana; Nevada; New Hampshire; New Mexico; North Carolina; Oklahoma; South Carolina; South Dakota; Tennessee; Texas; and Utah
- Most common is a “grid-access” fee, per kW of installed DG capacity
- Kansas Commission approved a charge based on customer demand during system peak hours
- New Massachusetts law establishes new requirements for demand-charge design
- New Mexico Commission ended a standby charge for Xcel Energy customers, but plans a rulemaking to address standby charges



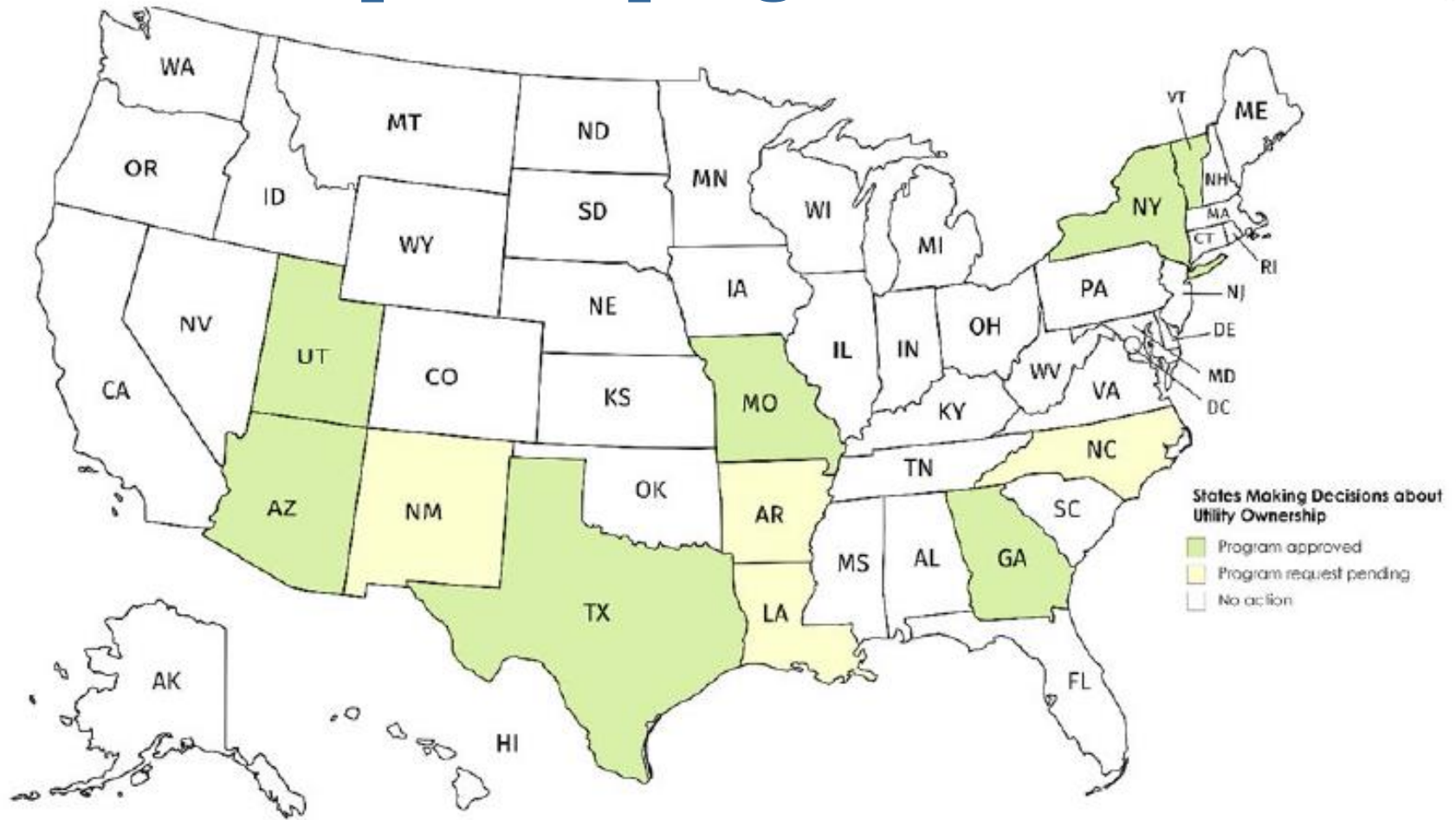


# 28 States plus DC are completing “value-of” studies (VOS, VDG, VDER)





# States authorizing utility-led rooftop solar programs, 2014-2018



Source: NCSU-CETC, *50 States of Solar* report series, 2015-2018.

# What might future studies address?

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- How do NEM rate changes affect the adoption rates for DER?
- Are DG and DER emerging into uninhibited market growth?
- How big are potential community-solar markets? What kinds of offerings work best for low- and middle-income participants?
- What can we learn about the class usage patterns for DG?  
How do the class usage patterns affect utility costs of service?
- Are studies of VOS, VDER, and utility costs of service measuring the right benefits and costs? Are they measuring all of them? And are the measuring methods valid and reliable?
- Can specific ensembles of DERs produce multiple benefits for multiple customers, the utility system as a whole, and society at large? What policy changes are needed to enable them?



## Appendix 1:

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- Supplemental slides



# What is NRRI?

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- The National Regulatory Research Institute (NRRI) was founded in 1976 by the National Association of Regulatory Utility Commissioners (NARUC). NRRI serves as a research arm to NARUC and its members, the utility regulatory commissions of the 50 US states and District of Columbia.
- NRRI's primary mission is to serve state utility regulators by producing and disseminating relevant, high-quality research that provides the analytical framework and practical tools necessary to improve their public interest decision-making.

# Brief intro: Tom Stanton

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- Tom Stanton is Principal Researcher, Energy and Environment, at NRRI, where he has worked since fall 2010. Mr. Stanton's work for NRRI includes state public policy research papers about all kinds of distributed and renewable energy resources. A life-long Michigan resident, Tom worked for 10 years at the Michigan Energy Office and over 22 years at the Michigan Public Service Commission. Mr. Stanton earned a B.A. in Communications and M.A. in Journalism, both from Michigan State University, and an M.S. in Public Administration from Western Michigan University.

## Three disclaimers and a note...

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- Ideas presented are my own, and are not necessarily those of the NRRI Board of Directors or other NRRI staff. NRRI is always open to discussing ideas for improving our work, and we welcome suggestions about research topics for NRRI to address.
- We have attempted to review all relevant legislation and commission orders, but that is a constantly moving target: Any mistakes and omissions are our responsibility.
- Note: If we use unfamiliar acronyms, please ask...





## ...and a huge thank you

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- Thanks are due to Autumn Proudlove and the staff at the North Carolina Clean Energy Technology Center. We could not have done this project without their ongoing, extensive work to gather and summarize state activities.



## Appendix 2:

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- Brief summaries of actions in 10 states studied

Download NRRI 19-01 Appendix from  
<http://nrri.org/download/appendix-nem-policies>





# Actions in Vertically Integrated States

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- Moving away from traditional NEM, but at different speeds and in some different directions



# Arizona

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- A 2016 **value-of-solar** hearing set methods for calculating export rates for DG. Export rates will stay level for 10 years from the time of interconnection, then vary annually.
- **NEM Successor Policy:** Optional TOU or demand-based rate for new APS DG customers (August 2017), with time-varying rates for all non-DG and new customers after 1 May 2018.
  - Previous DG customers grandfathered in full-retail NEM for 20 years from date of interconnection with APS.
  - New DG customers will be eligible for 4 different rate designs, some including grid-access fees. Bill offsets will vary based on customer usage patterns, and DG system size, orientation, and production.
- 2017 **fixed-charge increases** for residential customers of three utilities: APS to \$13, TEP to \$13.00, and UniSource to \$15/month.



# Georgia

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- Request for a **value-of-solar** proceeding in 2014.
- Legalized **third-party ownership** in 2015.
- Approved a renewable cost benefit (RCB) methodology in 2016, for utility-scale systems.
- Expanded the RCB methodology to include BTM systems, up to 250 kW, effective August 2017.
- Approved a motion for Georgia Power to construct and rate-base up to 3 MW of customer-subscribed solar net energy billing (NEB) in 2016, and added 5 MW more in 2018.



# Hawaii

- **NEM successor tariffs** approved in 2015, with grandfathering of pre-existing NEM customers. New DG tariff choices:
  - Grid-supply NEB with credits based on avoided cost, with capacity caps on grid-supply (reached in 2016); or,
  - Self-supply, with no credit for grid exports.
- Phase II started December 2016, addressing several technical and market issues. Docket No. 2014-0192.
- 2017 Revisions to NEM-replacement tariffs:
  - Smart-export option for solar plus storage; and,
  - Controllable grid supply option.
- 2017 requests for **fixed-charge increases** and increased **minimum bills** are pending.
- **Community solar**: 2015 legislation with final rules issued in December 2017. Allows utility ownership if 50% LMI participation.





# Minnesota (Part 1)

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- 2013 legislation called for determining the **value-of-solar**, including: energy and its delivery, generation capacity, transmission capacity, transmission and distribution line losses, and environmental value. MN-PUC approved the VOS methodology in April 2014.
  - Regulated utilities could apply for commission approval to use the VOS as an alternative to net metering. That has not happened, but could in the future: The MN legislature has established the VOS as the alternative for regulated utilities if, at some time in the future, they decide not to net meter.
- Multiple utilities have asked for **fixed-charge increases**.
  - In 2017, the Minnesota legislature removed MN-PUC oversight of fixed charges for cooperative and municipal electric utilities.



# Minnesota (Part 2)

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- 2013 “**community solar gardens**” law passed.
- Xcel Energy’s program was approved by MN-PUC in 2014, and amended in 2015.
  - By the end of 2015, Xcel had applications for over 1,500 solar gardens, representing over 1,400 MW in total capacity.
  - By March 1, 2018, Xcel had 80 CSG projects (295 MW) already in commercial operation and active applications for an additional 295 projects (498 MW); 194 projects (381 MW) are already in the design & construction phase.
  - An MN-PUC Order directed that, starting in 2017, all Xcel CSG applications filed after 2016 are to be compensated at the VOS rate, which is presently very close to the residential retail rate.
  - Starting with 2018 filings, VOS is slated to include location-specific avoided-distribution capacity values. The Commission determined that more information is needed to determine those values, and directed the Department of Commerce to lead a stakeholder process on this, over the coming months.



# Vermont

- A 2014 law increased utility NEM program caps from 4 to 15% of peak capacity, and directed regulators to develop an **NEM replacement tariff**.
- Revised NEM 2.0 rules took effect in July 2017:
  - No cap on total NEM program capacity; 500 kW cap on individual systems;
  - Virtual NEM allowed.
  - 10-year grandfathering period for NEM systems that predated NEM 2.0;
  - Credits are based on a weighted-average statewide residential retail rate of \$0.1491/kWh (or, the applicable retail rate applies if it is lower);
  - Incentive payments, which are subject to biennial PUC review, include:
    - ✦ Siting on “preferred sites” (e.g. on roofs, brownfields, landfills, or parking lots), which earns a bonus credit of \$0.01/kWh for 10 years; and,
    - ✦ Customers selling their RECs to the utility earn credits of \$0.03/kWh for 10-years, or customers can retain their RECs but their credit payment will be permanently reduced by \$0.03/kWh.



## Actions in Restructured States

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- Four of the five jurisdictions have started **comprehensive grid-modernization** proceedings



## District of Columbia

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- June 2015 “Modernizing the Distribution Energy Delivery System for Increased Sustainability” (MEDSIS) **Grid-Mod Docket**. Staff report January 2017.
- New rules effective January 2018, include definitions of: customer generator; battery; back up generation; energy storage; microgrid; and, smart inverter.
- **Value of solar study** delivered by DC Office of People’s Council in May 2017. PSC order is pending.
- Commission policy is to move residential distribution rates away from volumetric (kWh) rates, toward rates based more on **customer and demand charges**.



## Illinois (Part 1)

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- December 2016 Law provides:
  - 50% of RPS solar carve-out will come from DG, **community solar** (virtual net metering), and solar brownfield redevelopment projects
  - Illinois “Solar for All” program includes incentives for: community solar serving LMI customers; on-site projects for non-profits and public facilities; and, low-income DG. Incentives to customer.
- Illinois Power Agency procures RE and allocates RECs for all state regulated utilities, and a competitive bid process for low-income community solar. A plan under the 2016 law, filed late 2017, now awaits ICC approval.
- One municipal utility board (Springfield) approved a partial **fixed charge increase** in March 2017

- March 2017 resolution **comprehensive GridMod** docket (**NextGrid**) includes:
  - (1) new-tech deployment and grid integration,
  - (2) electricity markets,
  - (3) customer and community participation,
  - (4) regulatory, environmental, and policy issues,
  - (5) metering, communications, and data,
  - (6) reliability, resiliency, and cyber security, and
  - (7) ratemaking
- **Solar-value study**; final due in mid-2019



## New Hampshire (Part 1)

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- June 2017 NH-PUC **NEM 2.0** Order:
  - Monthly netting for systems 100 kW or smaller, with credits equal to energy charge plus transmission service plus 25% of the distribution charge, and grandfathering through 2040.
  - **DER valuation study** started in Docket DE 16-576, with a PUC-staff status report filed December 2017.
- Pilot programs started by the June 2017 Order include:
  - **TOU pilot** for both DG and non-DG customers;
  - **Real-time pricing pilot** for one municipal utility; and,
  - **Non-wires alternatives pilot** for stressed locations on utility distribution systems.





## New Hampshire (Part 2)

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- January 2016 Order approves **third-party PPAs & leasing** without regulation as public utilities or competitive electric power suppliers. (Vivant solar).
- Two utilities' **fixed charge increases** approved in full in 2016, based on settlement agreements.
- A utility's request for a **residential demand charge** deferred until the DER valuation docket is complete.
- A law passed in 2017 will enable LMI **community solar** projects, details forthcoming in Docket 17-172. 15% of LMI support will come from dedicated Renewable Energy Funds.
- **Comprehensive grid-mod** effort is underway.



## New York (Part 1)

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- “Reforming the Energy Vision” (REV) is a comprehensive **grid-modernization** proceeding, continuing from 2014 through the present.
  - A collaborative process is now underway to consider new rate design structures for mass market customers (residential and small commercial).
  - Those new rates are slated to take effect January 1, 2020.
- Six NY utilities requested **fixed-charge increases** in 2014 and 2015, but all were denied by the Commission.
- National Grid has **utility rooftop solar programs**, working cooperatively with major solar company partners.
  - National Grid committed \$100 million to reach ~100,000 homes.
  - National Grid and SunRun will co-own 200MW of rooftop solar.



## New York (Part 2)

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- New York PSC established **community net metering** in 2015 (Case 15-E-0082).
  - Beginning March 2017, new community solar, remote net-metered, and large distributed energy projects will use the Phase I Value Stack VDER tariff, which includes credits for energy (based on LMP), capacity, environmental benefits, and demand reduction.
  - In December 2017, New York Staff published a proposal, now pending, for **low-income community DG** programming.
  - As of late 2017, remote net metering and small demand or large commercial on-site solar generation now receives competition via the Phase I Value Stack. In February 2018, the Commission increased the project size cap from 2MW to 5MW in Case 15-E-0571 – Phase One Project Cap Size and Other Findings Order.



## Texas

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- Multiple Texas utilities requested and received at least partial **fixed-charge increases** in 2014–2016, and a couple more 2017 requests are pending.
- Southwestern Electric Power Company proposed and Texas PUC approved:
  - adding an \$8/month “administrative fee” to DG customers; and,
  - changing the distributed renewable generation tariff to compensate excess generation at “avoided cost” rather than retail.
- In a settlement approved December 2017 in Texas PUC Docket No. 46831, El Paso Electric is implementing new DG rate choices including minimum monthly bills, a time-of-use rate with slightly lower minimum bills, or an experimental demand charge rate.

# Thank you for attending our webinar

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