



Environmental Energy Technologies Division Lawrence Berkeley National Laboratory

Renewables Portfolio Standards in the United States: A Status Update

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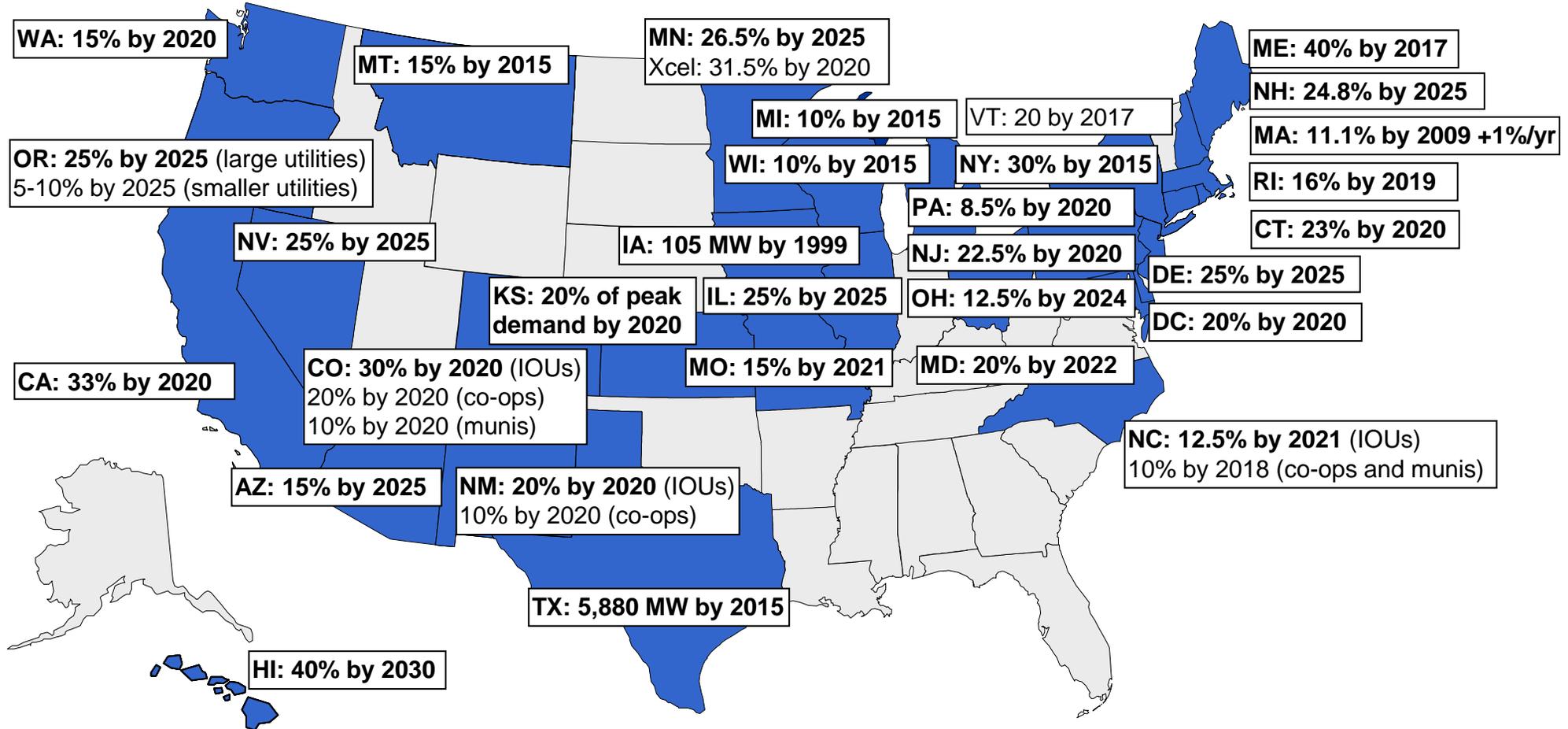
Renewable Energy Markets 2014

December 4, 2014

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RPS Policies Exist in 29 States and DC

Apply to 56% of Total U.S. Retail Electricity Sales



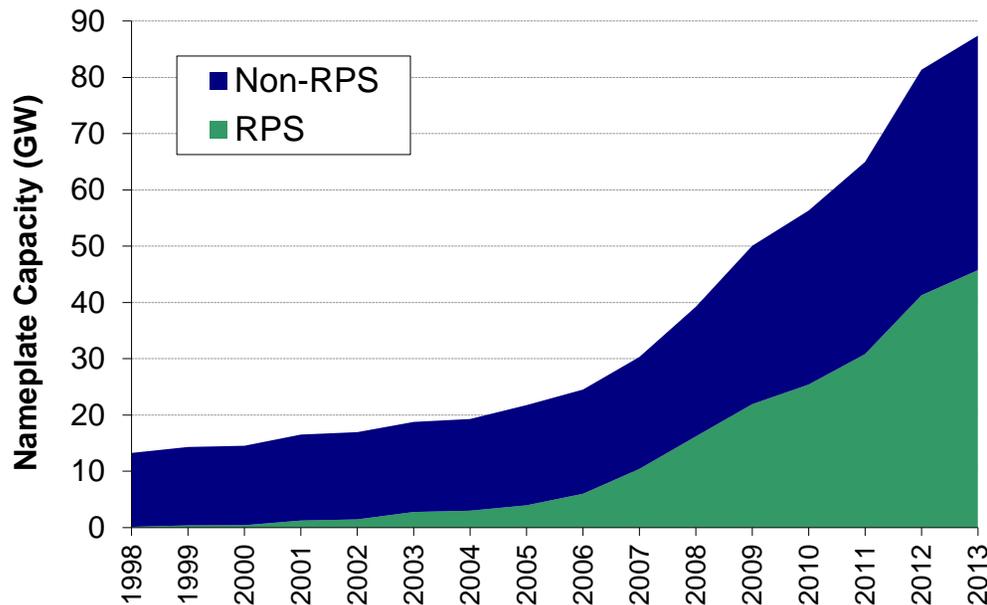
Source: Berkeley Lab

Notes: Compliance years are designated by the calendar year in which they begin. Mandatory standards or non-binding goals also exist in US territories (American Samoa, Guam, Puerto Rico, US Virgin Islands)

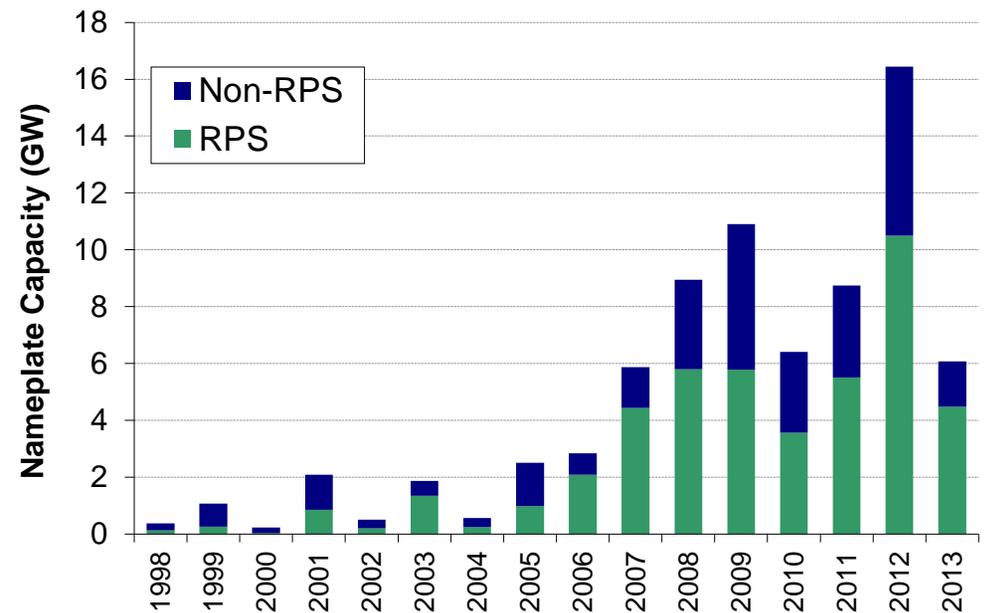
A Substantial Portion of RE Capacity Additions Have (At Least Partially) Been Driven by RPS

U.S. Non-Hydro Renewable Energy Capacity

Cumulative Non-Hydro RE Capacity



Annual Non-Hydro RE Capacity Additions

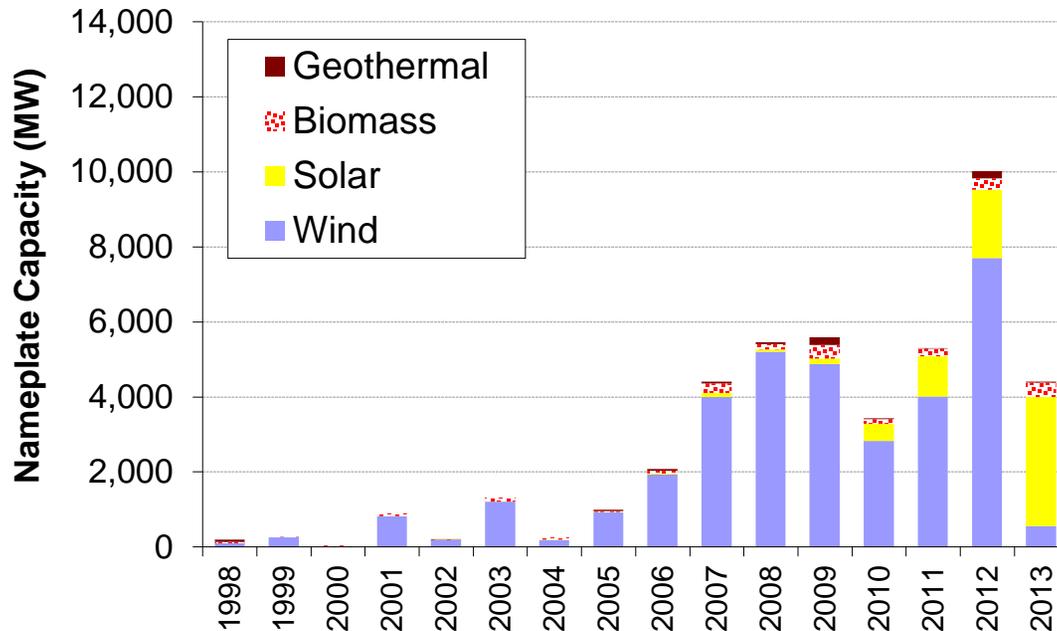


Of the 75 GW of non-hydro renewable capacity additions from 1998-2013, 61% (46 GW) serve entities with RPS obligations

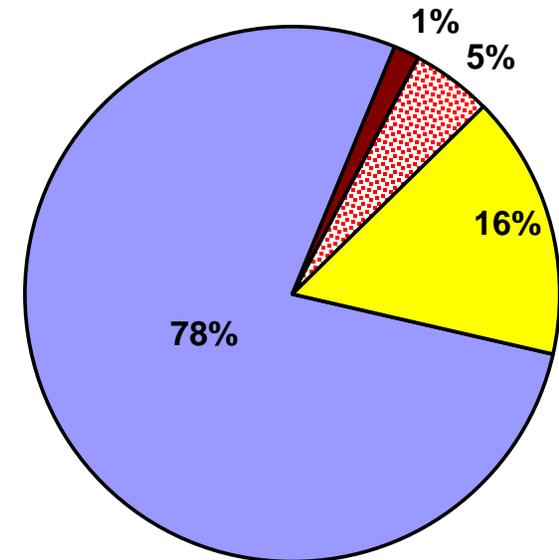
State RPS' Have Largely Supported Wind, Though Solar Has Become More Prominent

RPS-Related* Renewable Energy Capacity Additions from 1998-2013, by Technology Type

Annual RPS Capacity Additions



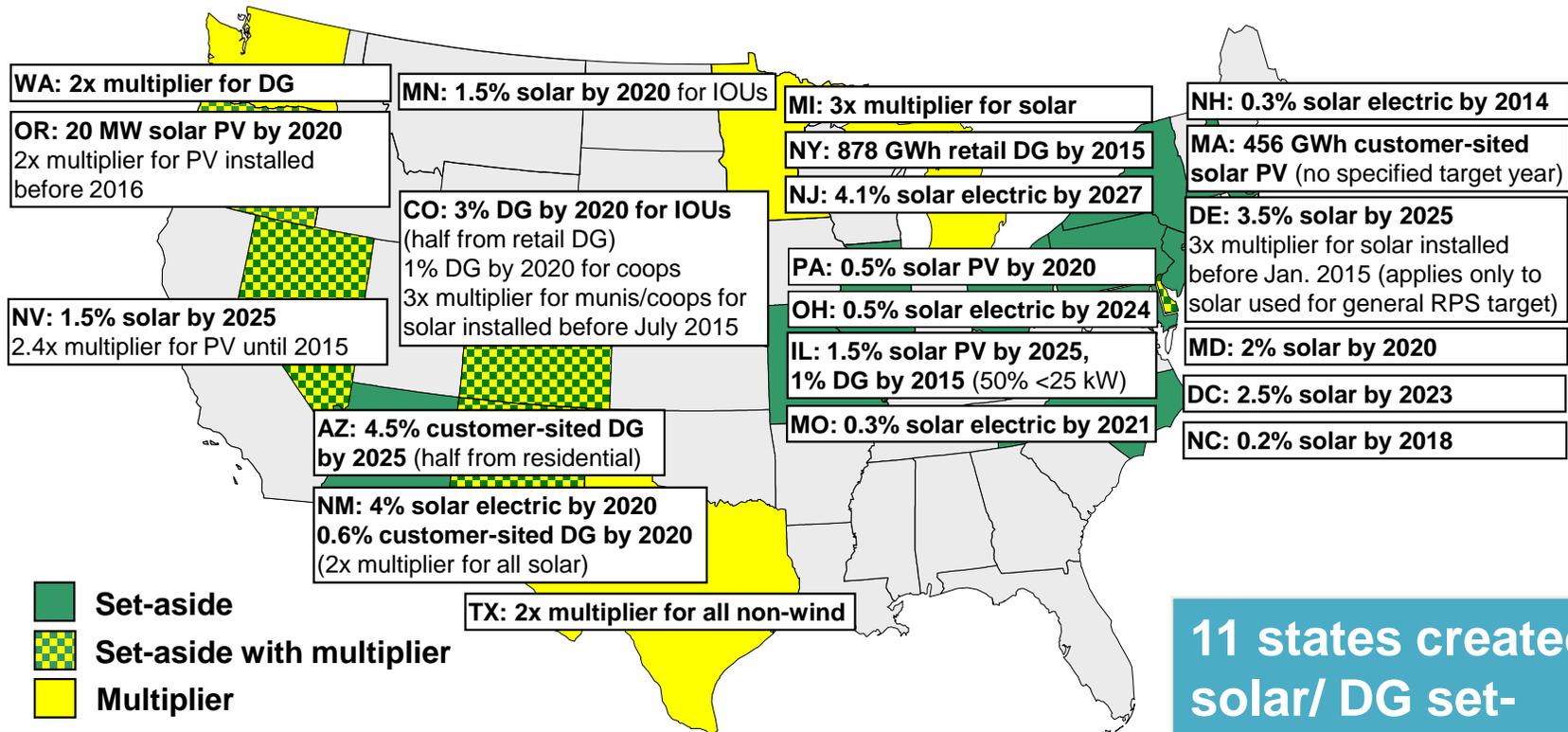
Cumulative RPS Capacity Additions



* Renewable additions are counted as "RPS-related" if and only if the entity receiving RECs from the project is subject to RPS obligations, and the project commenced operation after enactment of the RPS. On an energy (as opposed to capacity) basis, wind energy represents approximately 76%, biomass 12%, solar 8%, and geothermal 4% of cumulative RPS-related renewable energy additions, if estimated based on assumed capacity factors.

More than Half of All RPS Programs Have a Solar or DG Set-Aside

17 states + D.C. have solar or DG set-asides, sometimes combined with credit multipliers; 3 other states only have credit multipliers



Source: Berkeley Lab

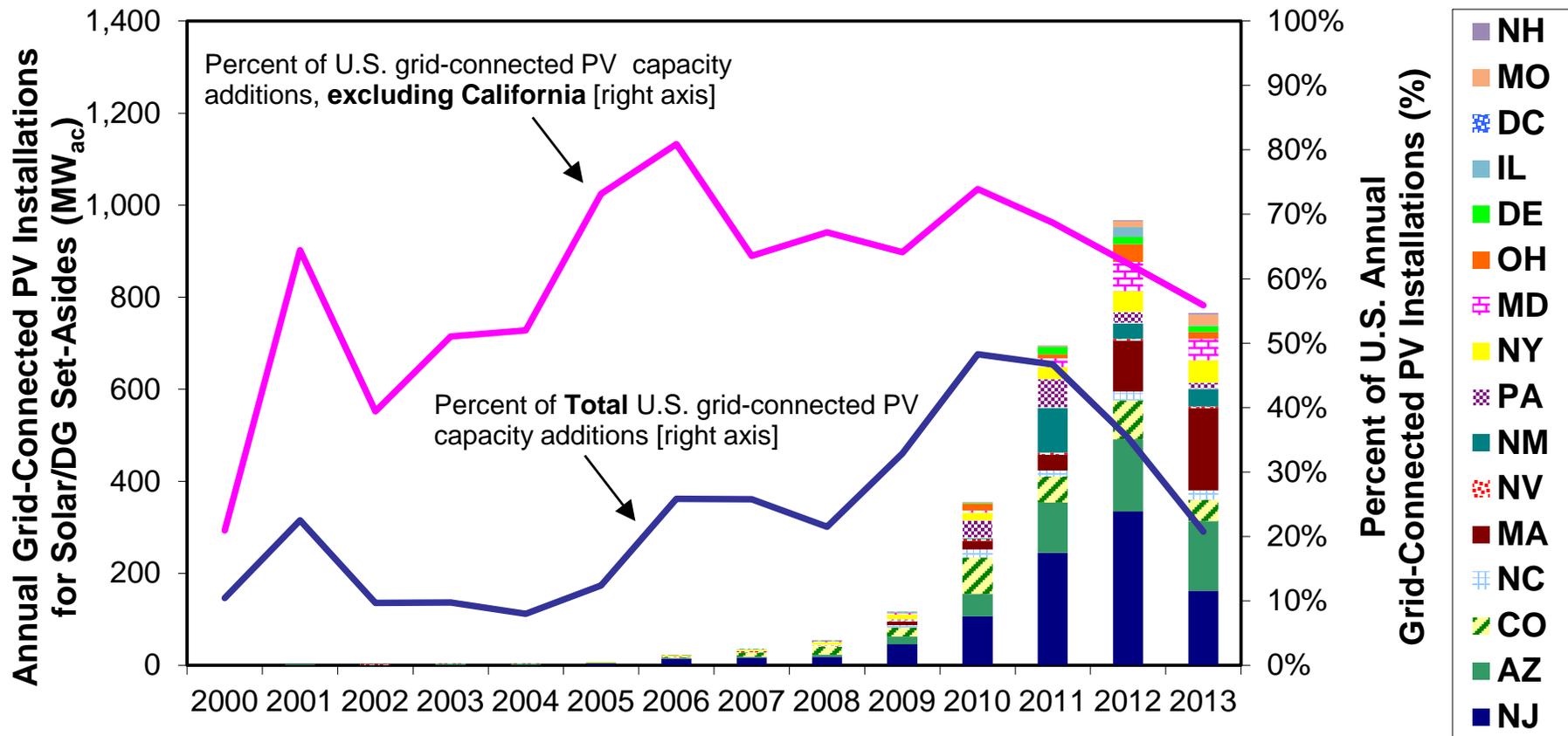
Note: Compliance years are designated by the calendar year in which they begin

Differential support for solar/DG also provided via long-term contracting programs (CT, DE, NJ, RI) and via up-front incentives/SREC payments

11 states created solar/ DG set-asides since 2007:
DE, IL, MA, MD, MO, MN, NC, NH, NM, OH, OR

Impact of Solar/DG Set-Asides is Substantial: 60-80% of Non-CA PV Additions Since 2005

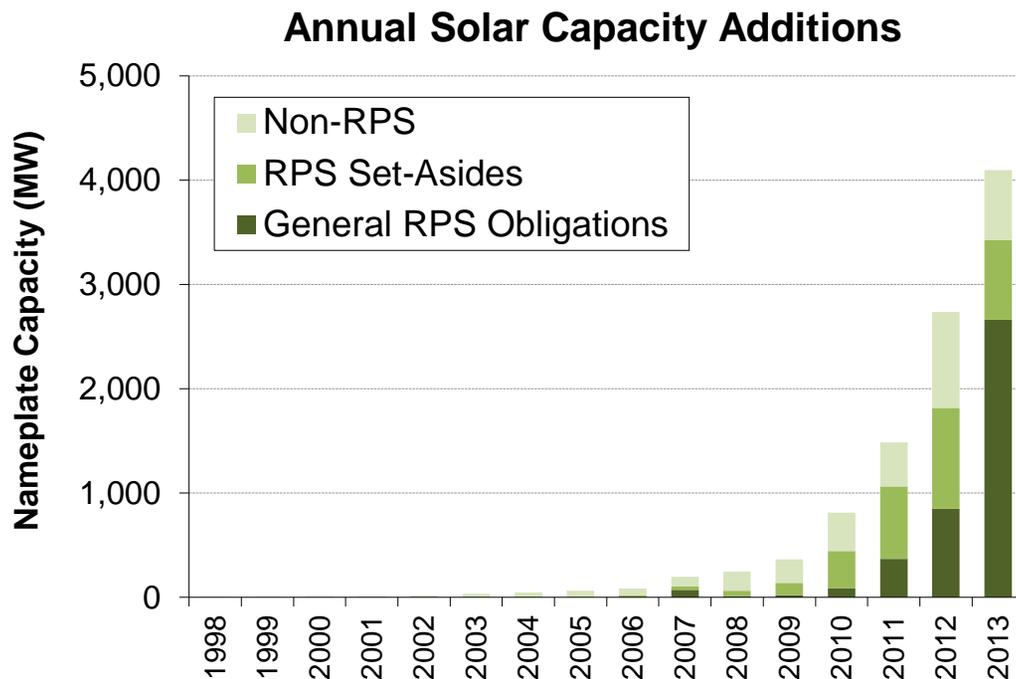
Dip in set-aside capacity additions in 2013 reflects depressed SREC pricing and reduced or eliminated incentives in a number of states



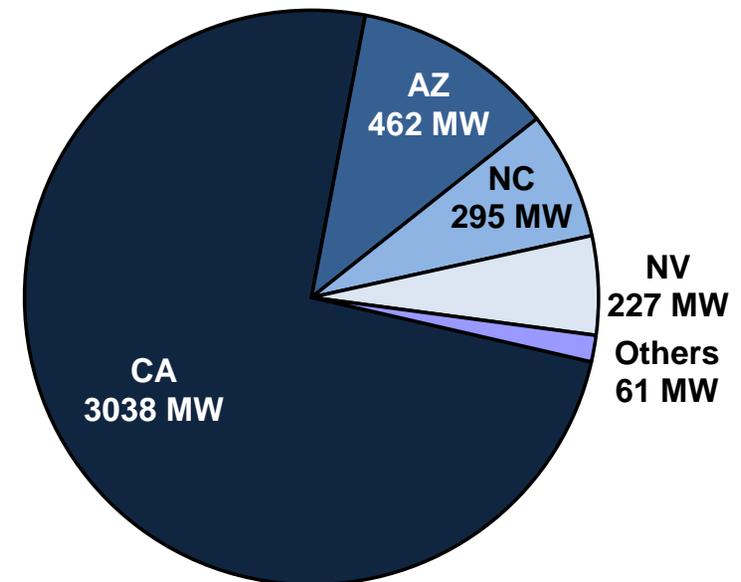
*PV capacity additions are attributed to the solar/DG set-aside only if installation occurred no more than one year before commencement of set-aside compliance obligations in the host state and if eligible for the set-aside and not applied towards general RPS obligations.

General RPS Obligations Also Driving Significant Solar Additions in California and Elsewhere

Sizable number of large solar projects (9 PV + 2 CSP, 100-300 MW each) added to meet general RPS obligations in CA & AZ in 2013



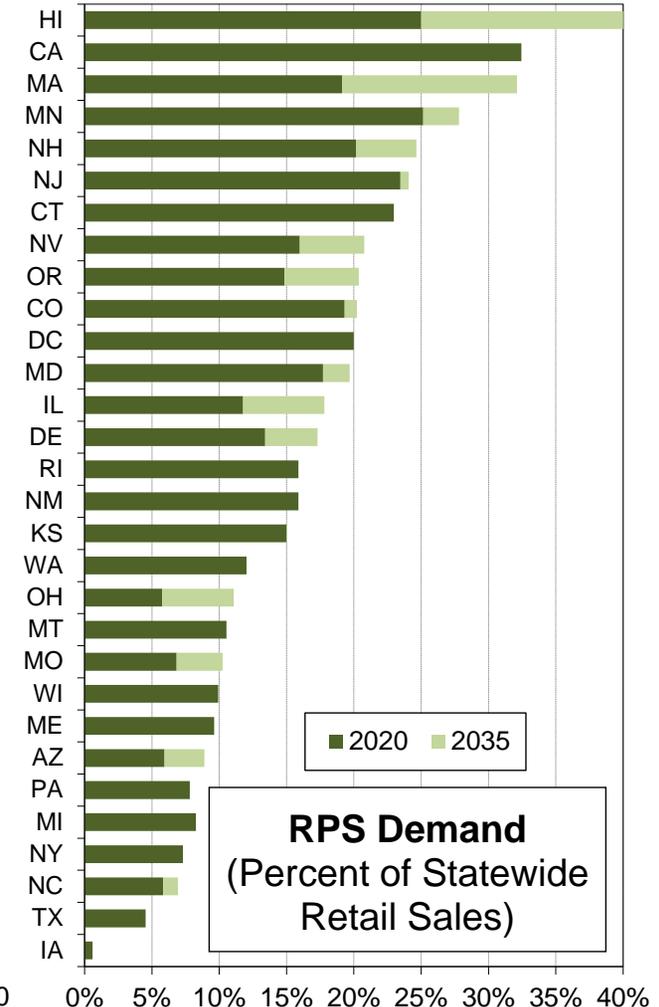
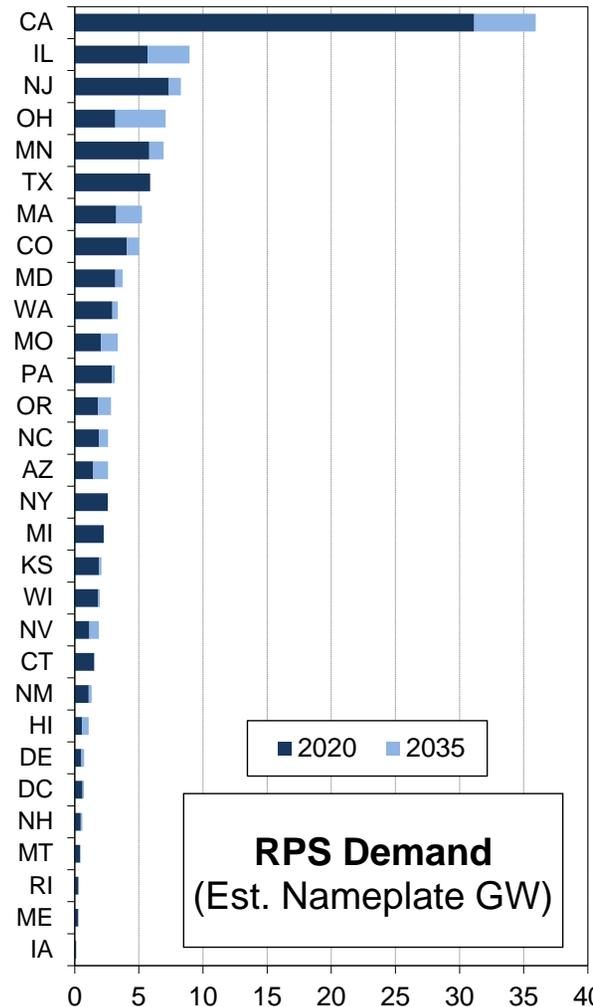
Solar for General RPS Obligations



Substantial solar capacity in excess of set-aside requirements also built and applied towards general obligations in NC and NV

Future RPS Requirements are Sizable, But Within Recent RE Growth Rates

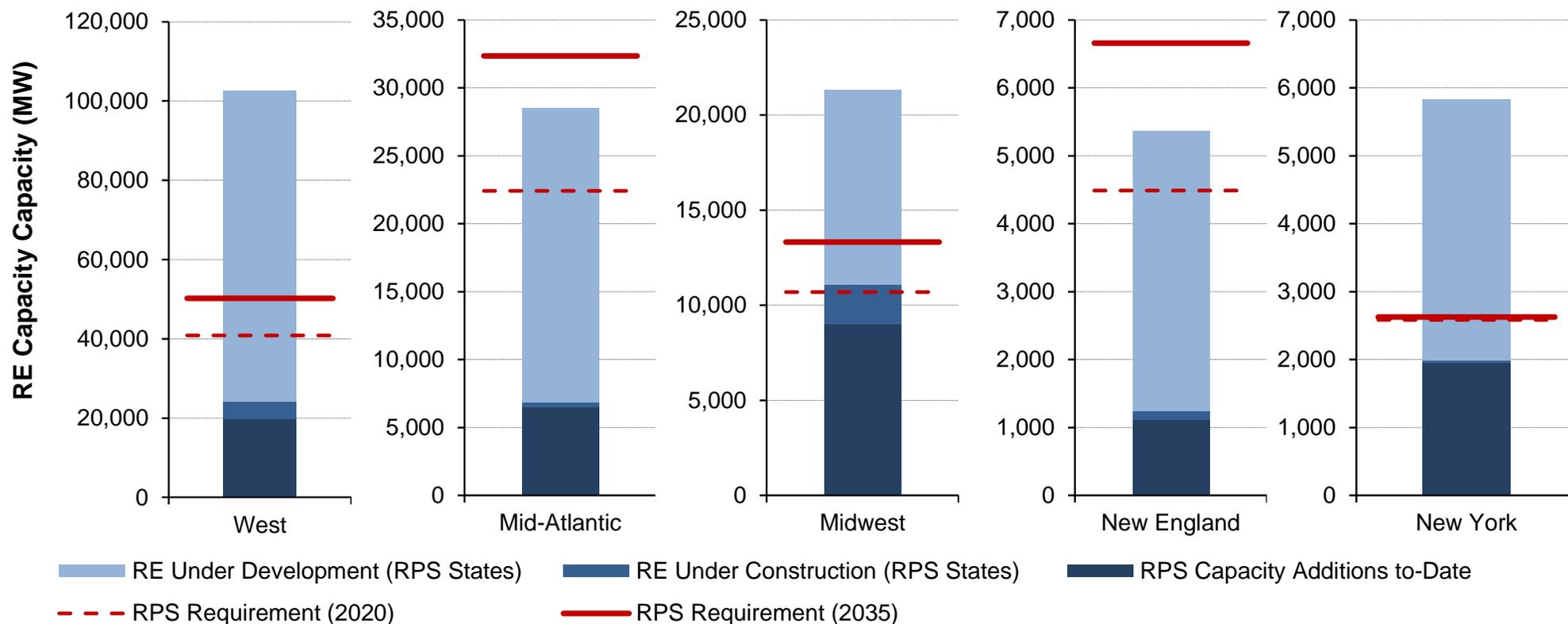
- 98 GW of RE capacity required by 2020 (123 GW by 2035) to meet RPS requirements
- Depending on availability of existing RE capacity, will require incremental build of 3-7 GW/yr. through 2020 and 1-2 GW/yr. thereafter
- By comparison, RPS-driven additions averaged 6 GW/yr. since 2008 (10 GW/yr. for all RE)



Note: Values shown in figures represent required renewable capacity beyond what was supplied to each state at the time its RPS was enacted. The values do not represent incremental renewables required relative to current supply.

RE Currently Under Development May Be Enough to Meet Future RPS Demand in Some Regions

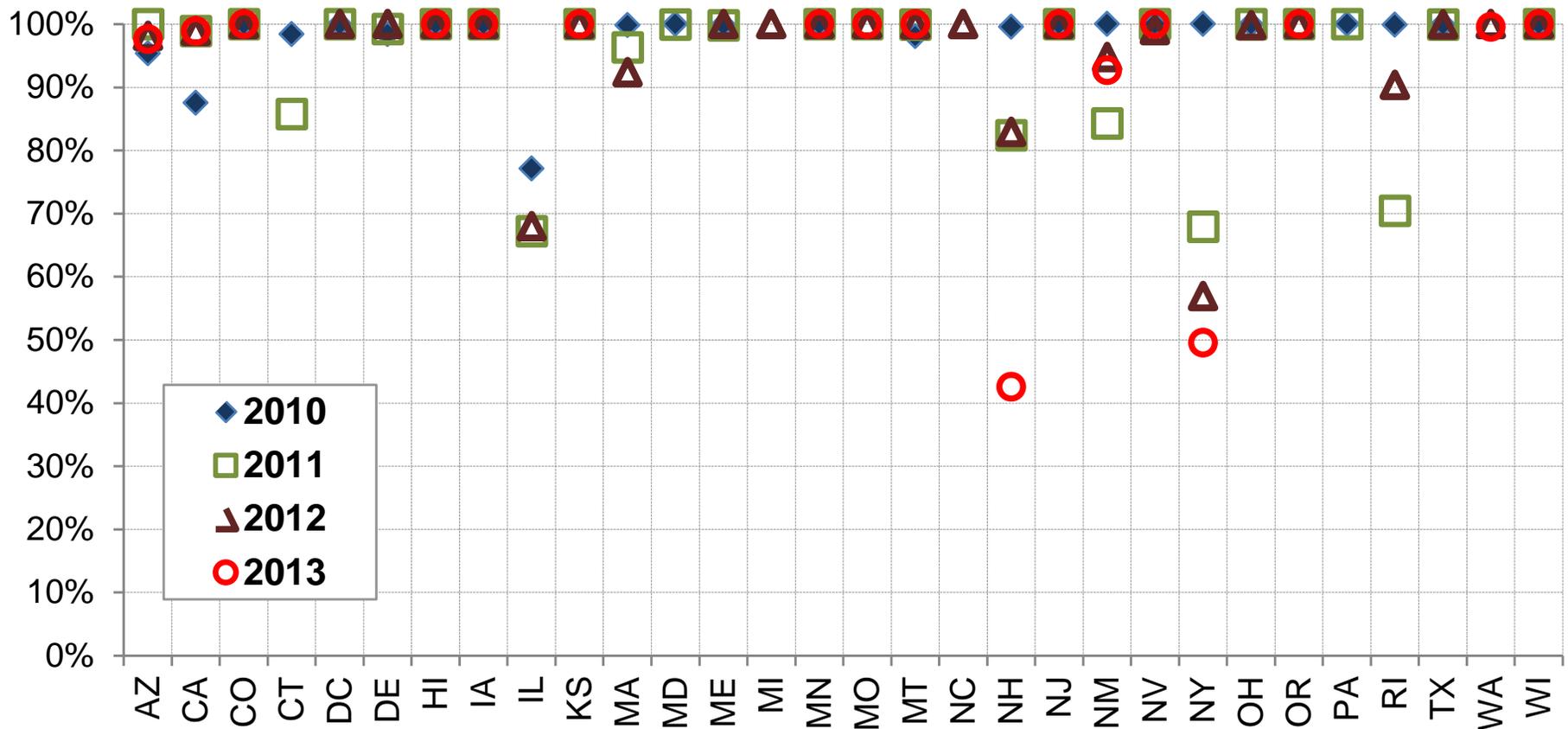
Future RPS Requirements Compared to Current RPS Supply plus New RE Capacity Under Construction and Under Development



Notes: RE under development and under construction refer only to RPS states within each region and therefore do not include additional new RE from other states in the region or from outside the region. RPS requirements in MW terms reflect regionally specific assumptions about RPS resource mix and capacity factors. Data source for RE Under Construction and Under Development: SNL Energy.

Compliance with RPS Targets Has Generally Been Strong

Percent of Main Tier RPS Target Met with Renewable Electricity or RECs
(including available credit multipliers and banking, but excluding ACPs)

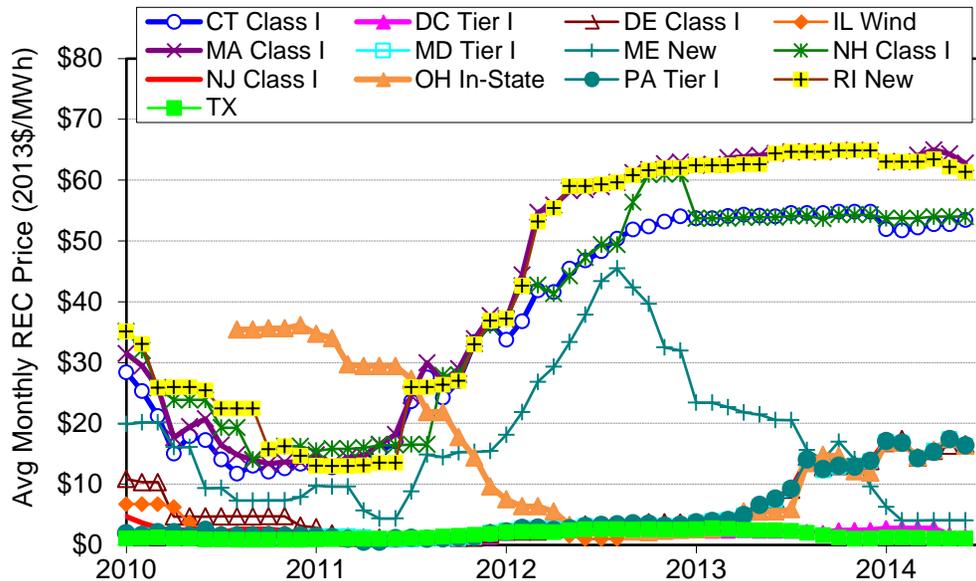


Note: Percentages less than 100% do not necessarily indicate that "full compliance" was not technically achieved, because of ACP compliance options, funding limits, or force majeure events.

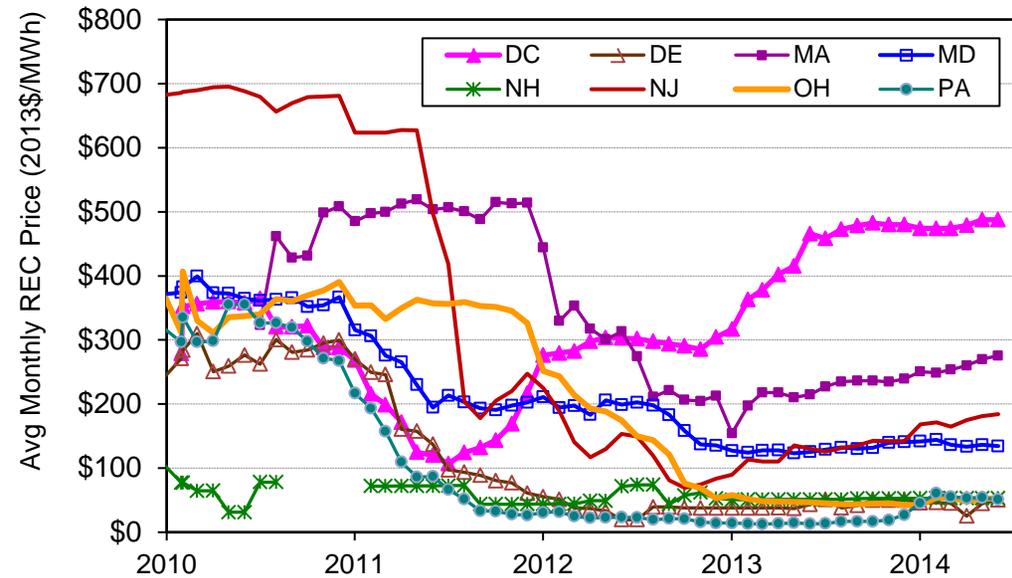
REC Prices in Compliance Markets Vary with Supply-Demand Balance

- Rising Class I REC prices in Northeastern states reflect tightening supply, while pricing in Mid-Atlantic states and TX remain low
- Depressed SREC prices in most states show enduring over-supply of solar, muting the cost impacts of rising set-aside targets

Main Tier/Class I RECs



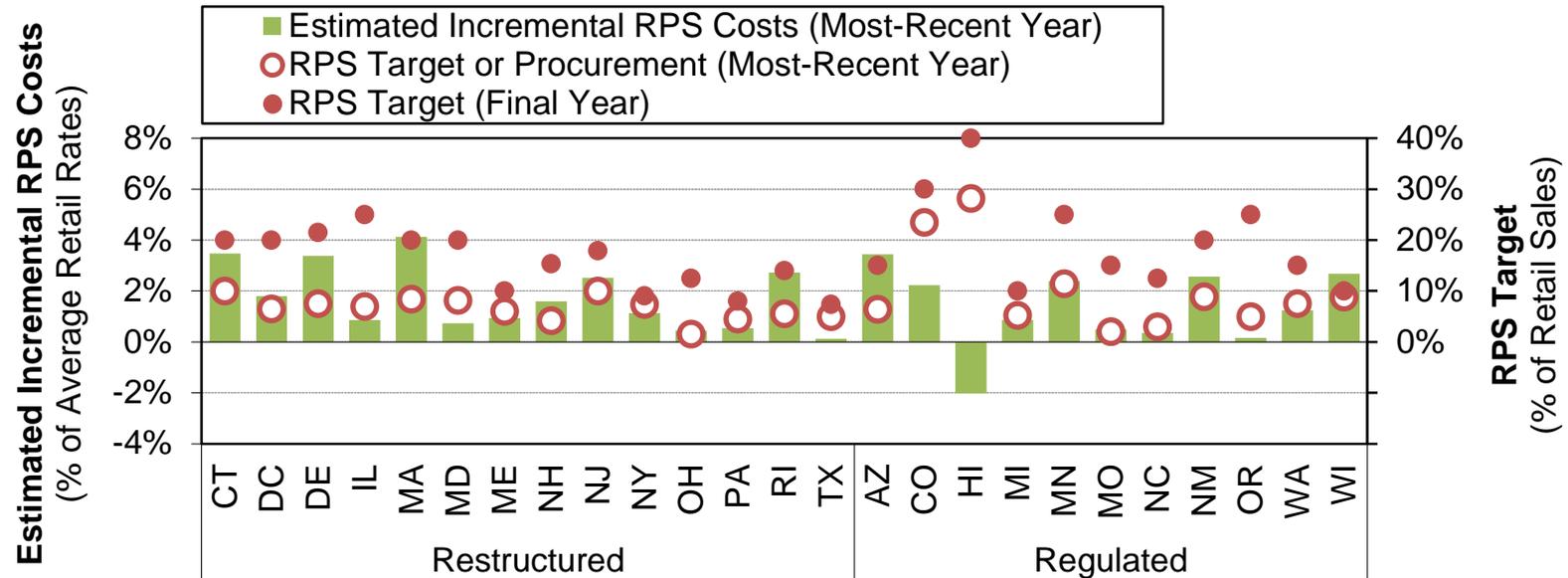
SRECs



Sources: Spectron, SRECTrade, Flett Exchange, PJM-GATS, and NJ Clean Energy Program. Depending on the source used, plotted values are either the mid-point of monthly average bid and offer prices, the average monthly closing price, or the weighted average price of all RECs transacted in the month, and generally refer to REC prices for the current or nearest future compliance year traded in each month.

RPS Compliance Costs Thus Far Low, But Face Upward Pressure from Rising Targets

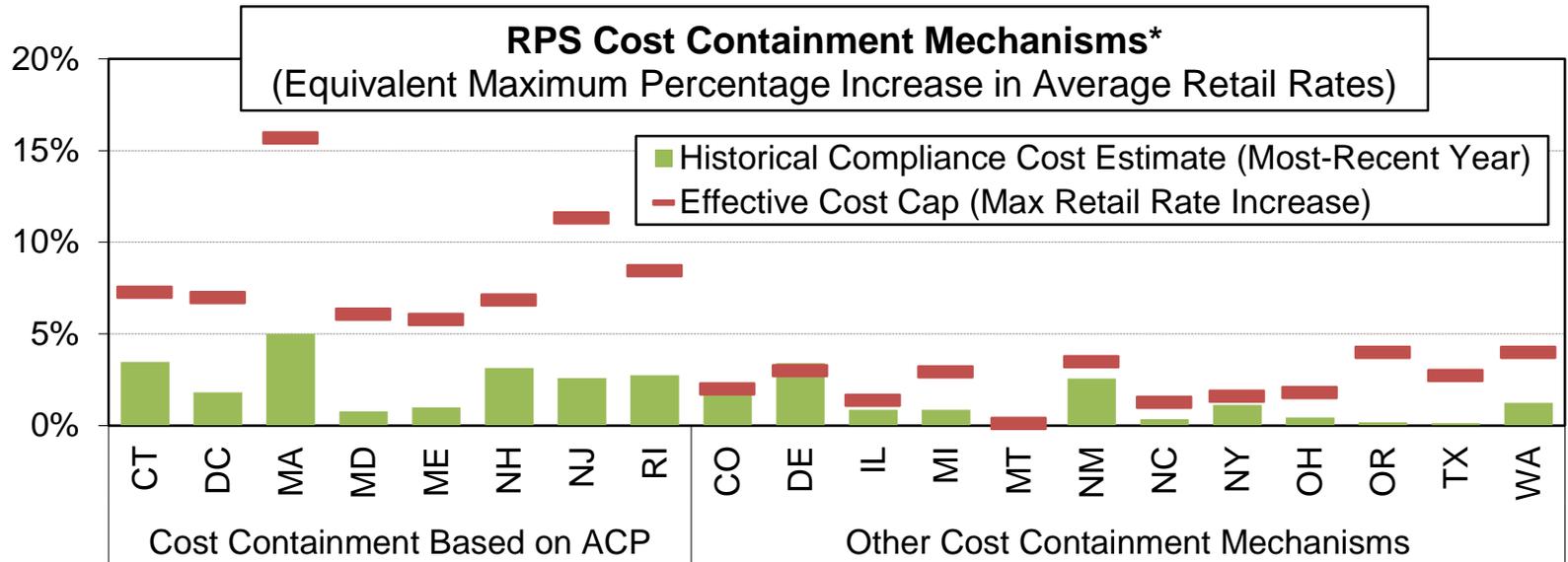
- RPS compliance costs have been equal to less than 3% of average retail rates in most states
- Costs have risen as targets ramp up
- Final-year RPS targets (closed circles) constitute, on average, roughly a three-fold increase in RPS obligations compared to most-recent year targets (open circles)
- Future RPS costs will depend on many factors: RE technology costs, natural gas prices, federal tax incentives, environmental regulations, and RPS cost caps



* For most states shown, the most-recent year RPS cost and target data are for 2012 or 2013. MA does not have single terminal year for its RPS; the final-year target shown is based on 2020. Excluded from the chart are those states without available data on historical incremental RPS costs (CA, KS, HI, IA, MT, NV). The values shown for RPS targets and costs exclude any secondary RPS tiers (e.g., for pre-existing resources). For most regulated states, data for the most-recent historical year reflect actual RPS procurement percentages in those years.

Most States Have Capped Rate Impacts Below 10% and Many Below 5%

The figure compares each state's "effective" cost cap with actual costs for the most-recent year



* For states with multiple cost containment mechanisms, the cap shown here is based on the most-binding mechanism. MA does not have a single terminal year for its RPS; the calculated cost cap shown is based on RPS targets and ACP rates for 2020. "Other cost containment mechanisms" include: rate impact/revenue requirement caps (DE, KS, IL, NM, OH, OR, WA), surcharge caps (CO, MI, NC), renewable energy contract price cap (MT), renewable energy fund cap (NY), and financial penalty (TX). Excluded from the chart are those states currently without any mechanism to cap total incremental RPS costs (AZ, CA, IA, HI, KS, MN, MO, NV, PA, WI), though some of those states may have other kinds of mechanisms or regulatory processes to limit RPS costs.

- Where ACPs used, they generally cap costs at 6-9% of average retail rates
- Among states with some other form of cost containment, effective cost caps are more restrictive (1-4%) and have already become binding in several states

The Future Role and Impact of State RPS Programs Will Depend On...

- ➔ The outcome of ongoing and future legislative and legal challenges
- ➔ Outcome of EPA carbon emissions regulations
- ➔ Whether cost caps become binding (which in turn depends on RE costs, gas prices, PTC/ITC, etc.)
- ➔ How other related issues and barriers affecting RE deployment are addressed (transmission, integration, siting, net metering, etc.)
- ➔ How policymakers re-tune RPS' in response to all of the above and to changing market conditions more generally

Thank You!

For further information:

LBL RPS publications and resources:

rps.lbl.gov

LBL renewable energy publications:

emp.lbl.gov/reports/re

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