



Environmental Energy Technologies Division Lawrence Berkeley National Laboratory

State RPS Policies and Solar Energy Impacts, Experiences, Challenges, and Lessons Learned

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SEIA Webinar

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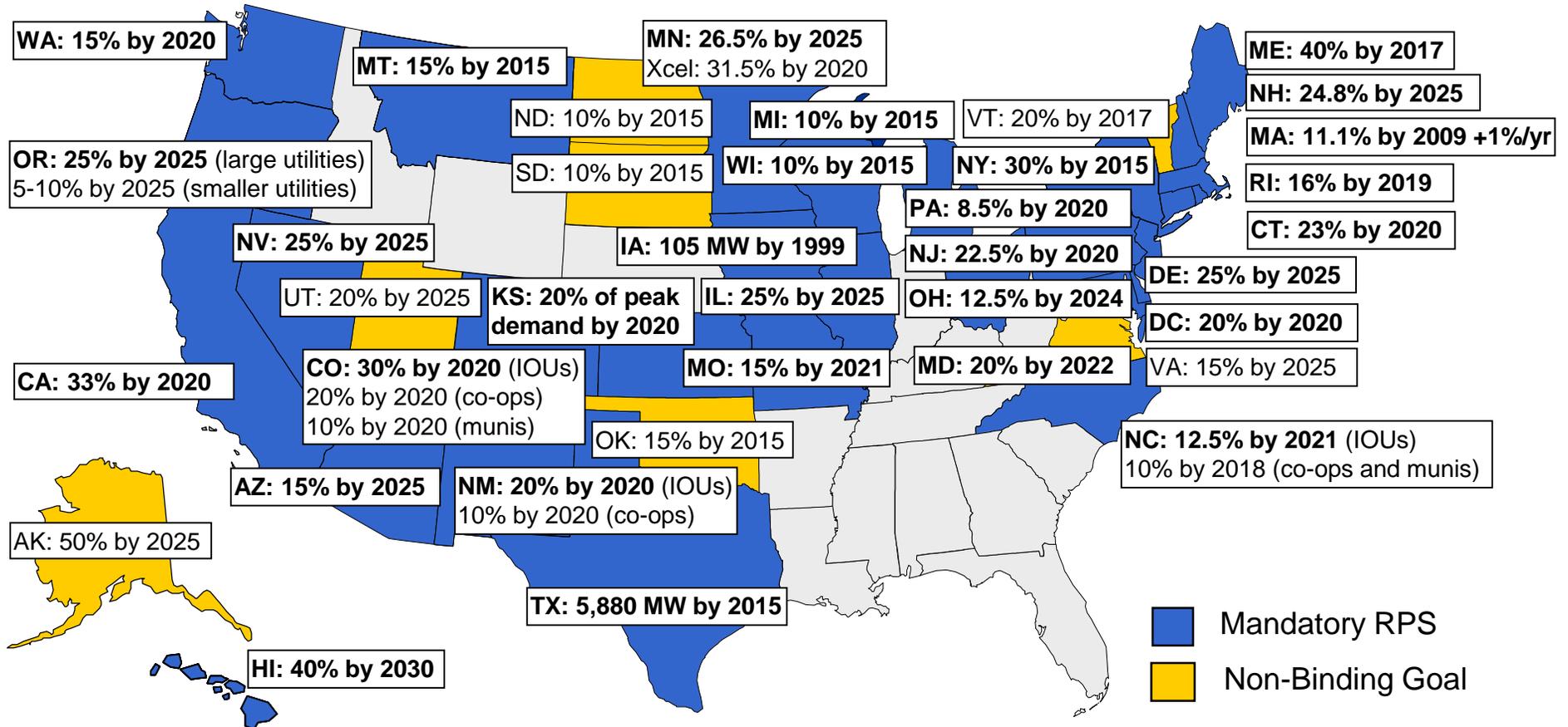
Summary of State RPS Experience-to-Date

- Subject to frequent revisions and refinements; have largely held up against recent political and legal challenges
- A significant driver for RE and solar growth
- Generally high levels of compliance
- Rate impacts have thus far remained relatively modest, though questions exist about future costs
- Significant additional RE capacity is required to meet future RPS targets, but is well in-line with pace of additions in recent years
- A diverse set of challenges exist to meeting future RPS obligations

RPS Policies Exist in 29 States and DC

7 More States Have Non-Binding Goals

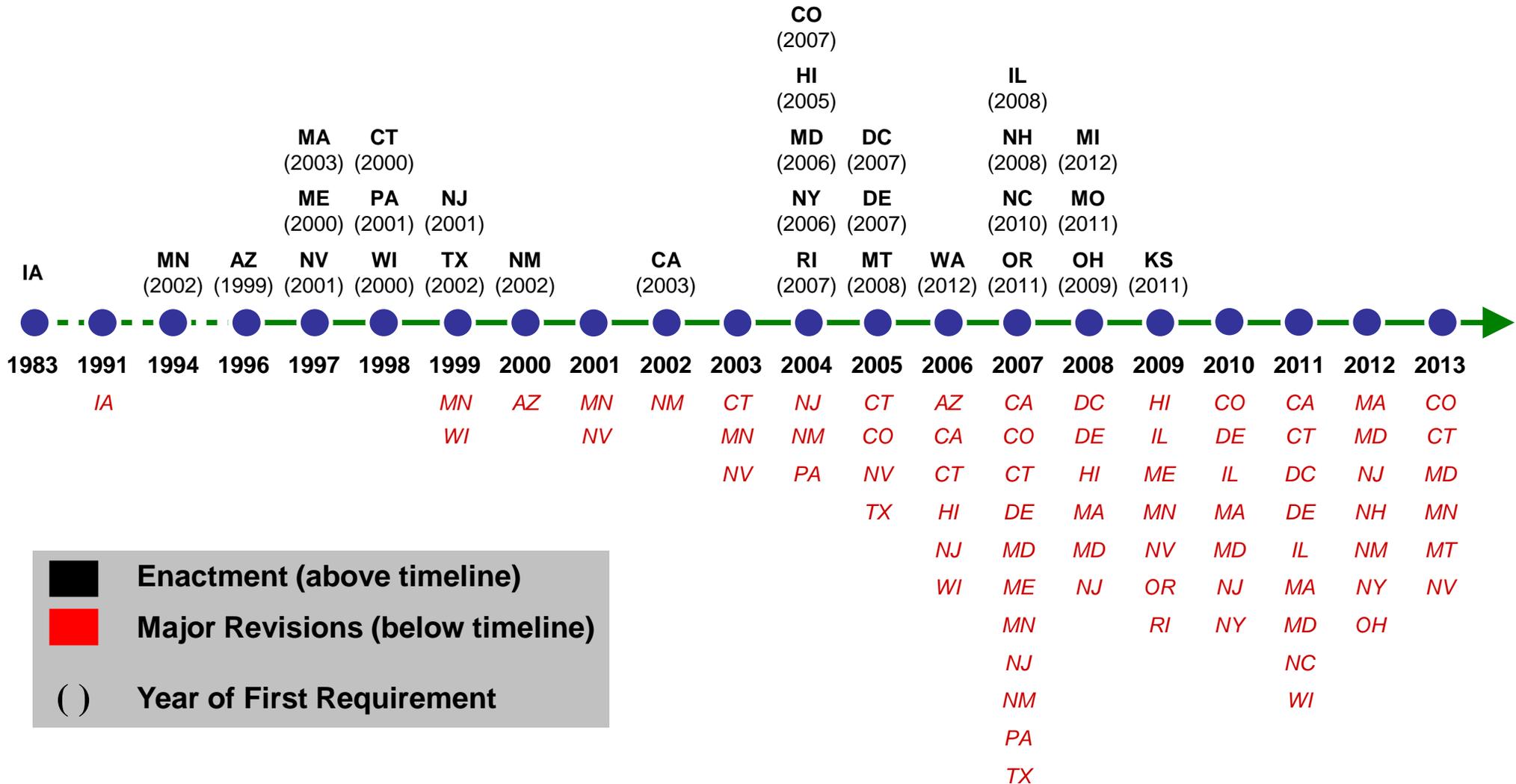
Existing State RPS Policies Apply to 55% of Total U.S. Retail Electricity Sales in 2012



Source: Berkeley Lab

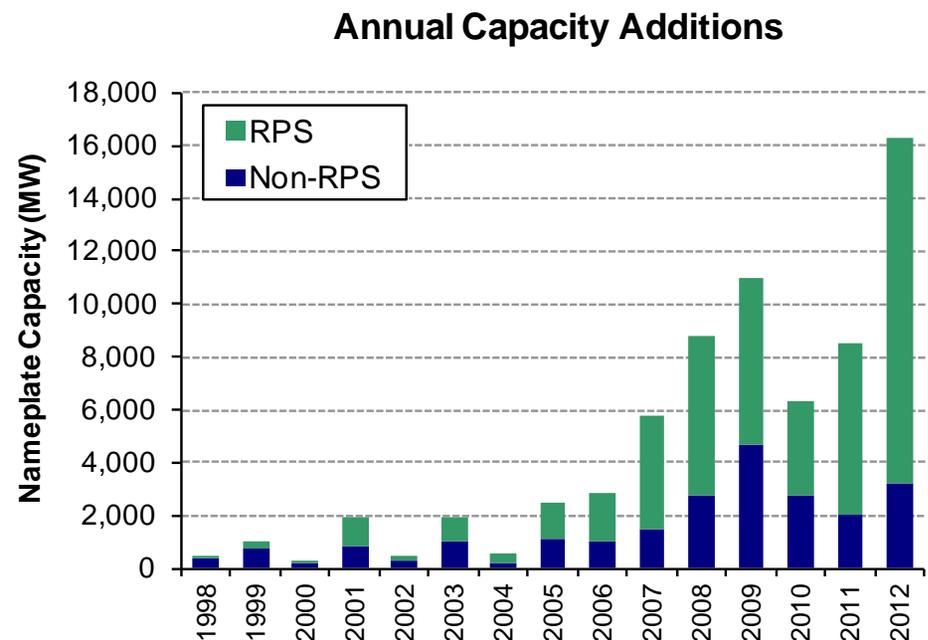
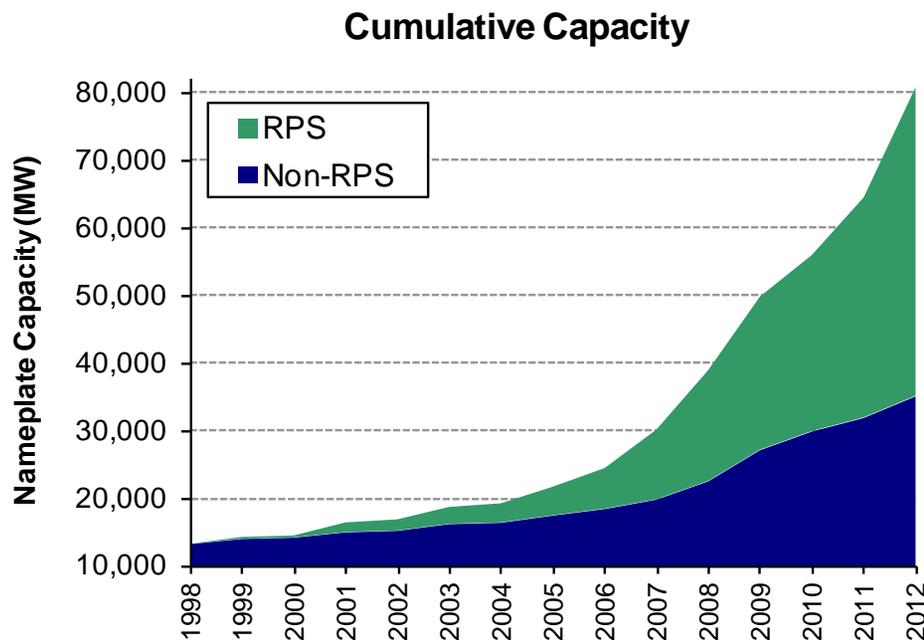
Notes: Compliance years are designated by the calendar year in which they begin. Mandatory standards or non-binding goals also exist in US territories (American Samoa, Guam, Puerto Rico, US Virgin Islands)

Enactment of New RPS Policies has Waned, but States Continue to Hone Existing Policies



State RPS Policies Appear to Have Motivated Substantial Renewable Capacity Development

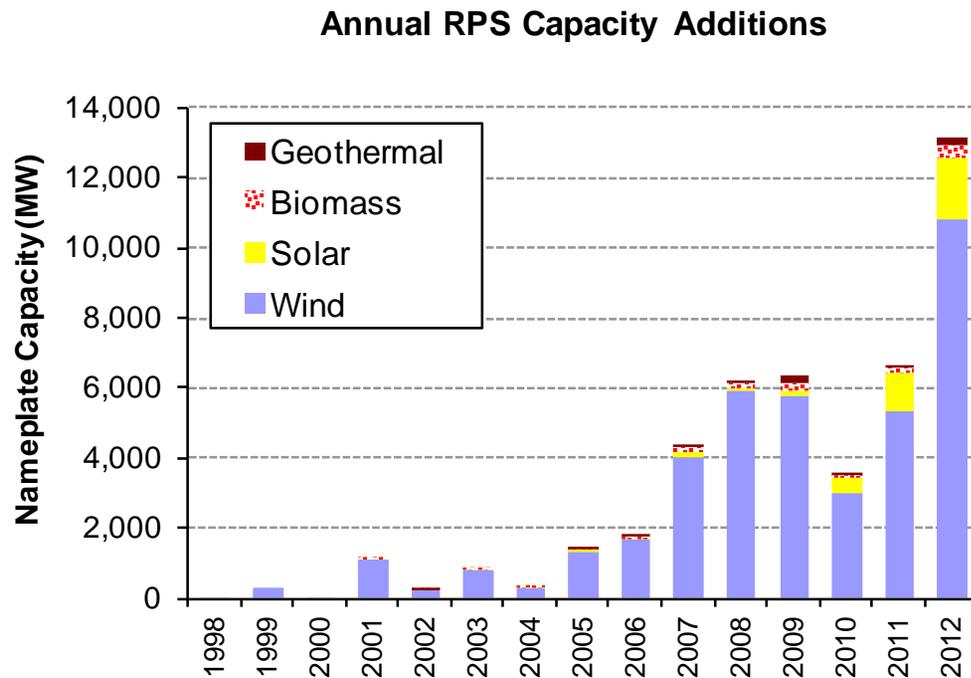
Cumulative and Annual Non-Hydro Renewable Energy Capacity in RPS and Non-RPS States, Nationally



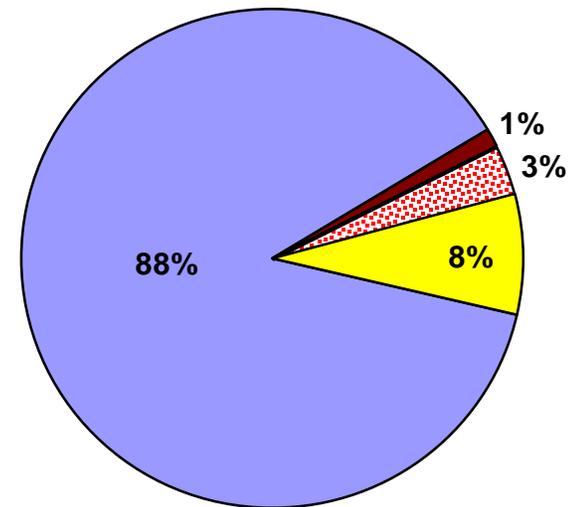
Though not an ideal metric for RPS-impact, **67% (46 GW)** of all non-hydro renewable capacity additions from 1998-2012 occurred in states with active/impending RPS compliance obligations

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

RPS-Motivated* Renewable Energy Capacity Additions from 1998-2012, by Technology Type



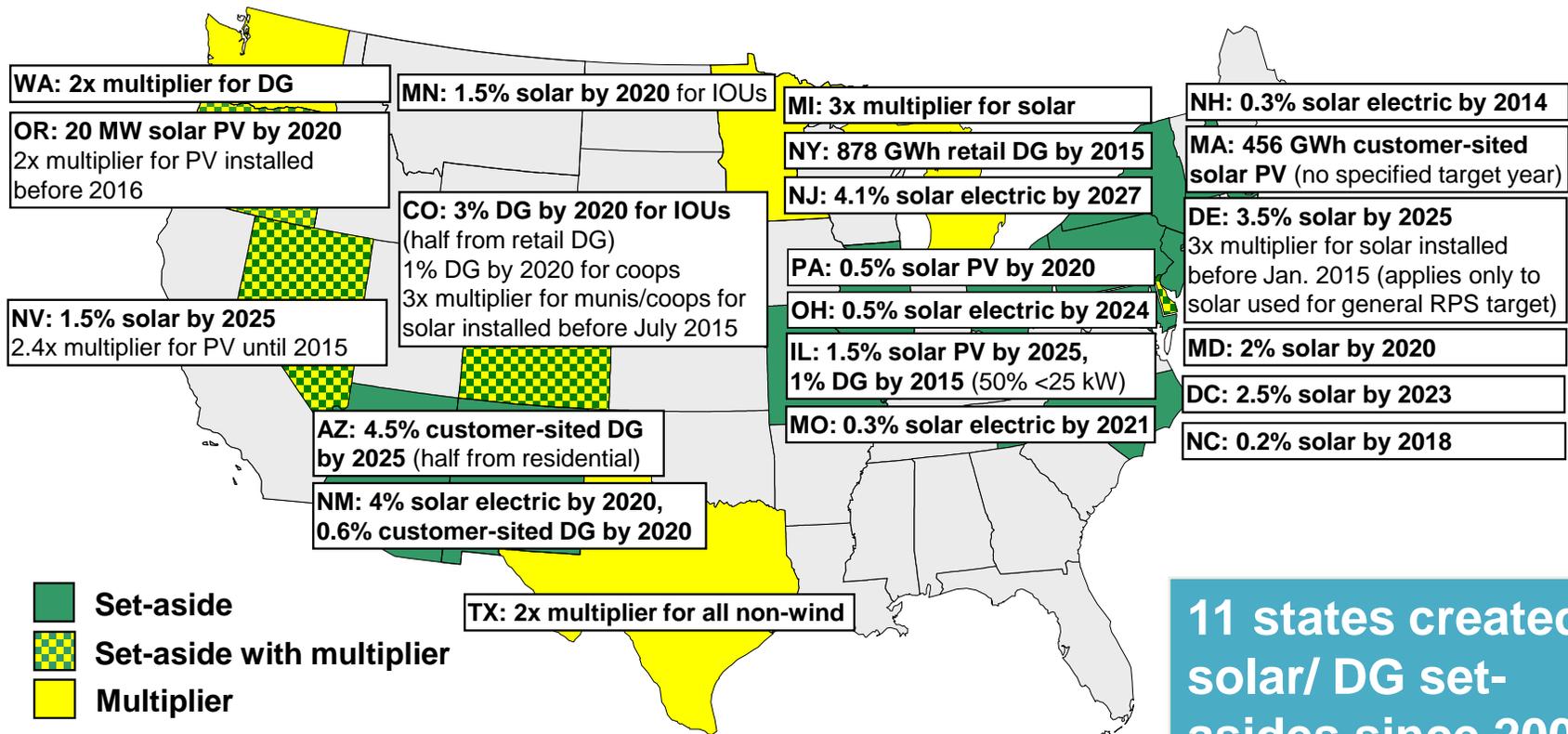
Cumulative RPS Capacity Additions (1998-2012)



* Renewable additions are counted as "RPS-motivated" if and only if they are located in a state with an RPS policy and commercial operation began no more than one year before the first year of RPS compliance obligations in that state. On an energy (as opposed to capacity) basis, wind energy represents approximately 85%, biomass 8%, solar 4%, and geothermal 3% of cumulative RPS-motivated renewable energy additions from 1998-2012, if estimated based on assumed capacity factors.

Solar and DG Set-Asides Have Become Widespread

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

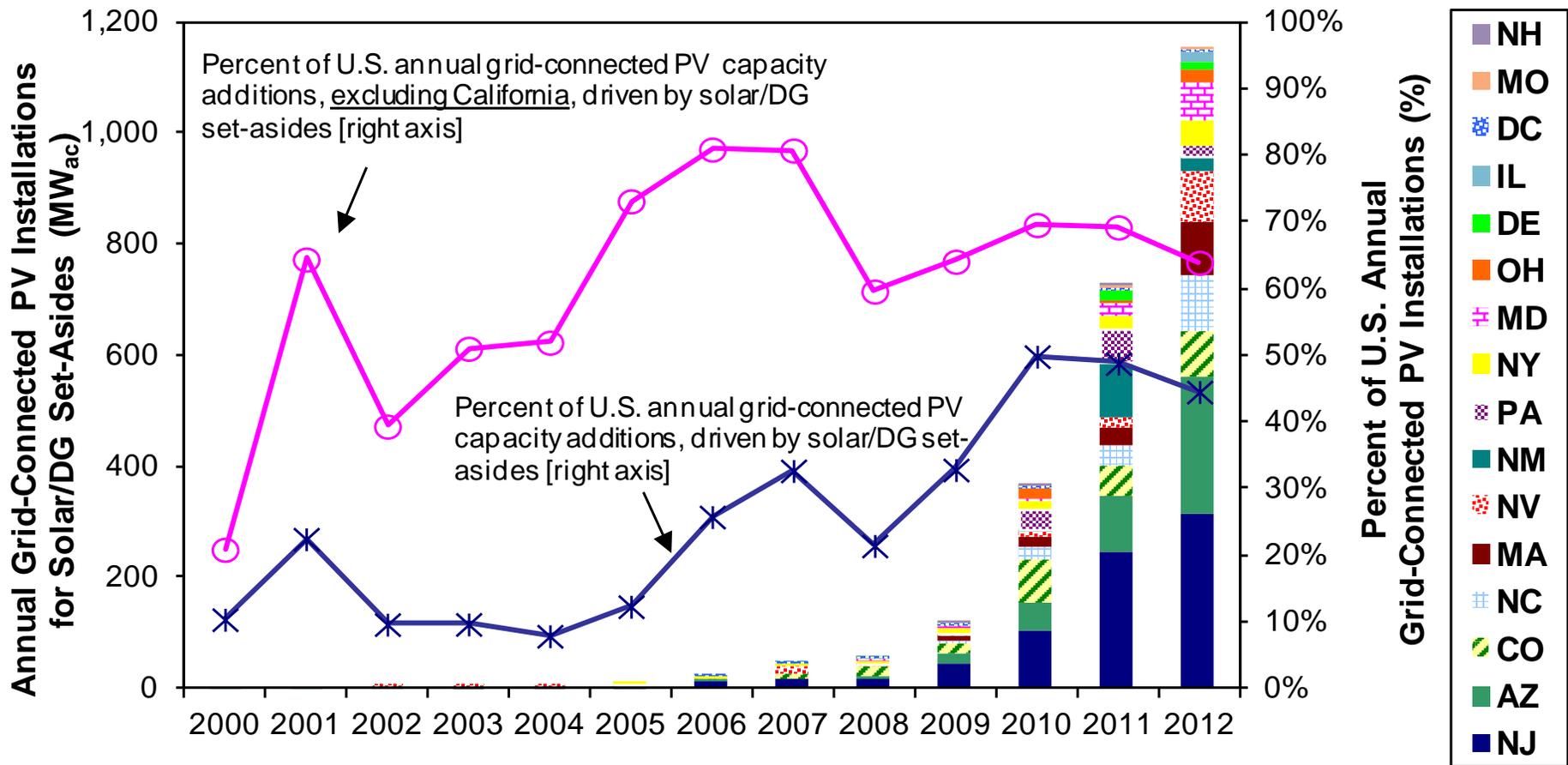


11 states created solar/ DG set-asides since 2007:
DE, IL, MA, MD, MO, MN, NC, NH, NM, OH, OR

Source: Berkeley Lab

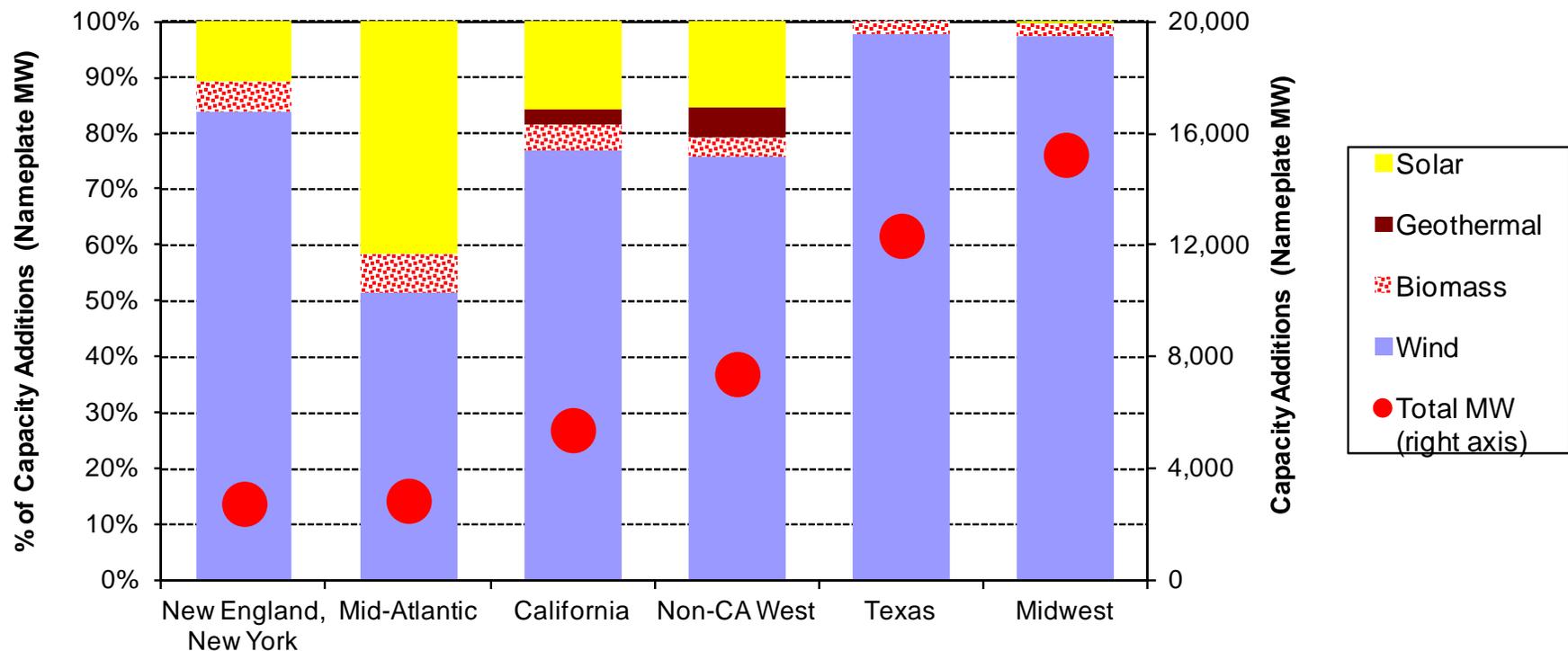
Note: Compliance years are designated by the calendar year in which they begin
Differential support for solar/DG provided via long-term contracting programs (CT, DE, NJ, and RI) and via up-front incentives/SREC payments

Impact of Solar/DG Set-Asides is Growing: Drove ~50% of U.S. PV Additions in 2010-12



Solar Share is Notably Greater in Regions with Set-Asides or Strong Solar Resource Potential

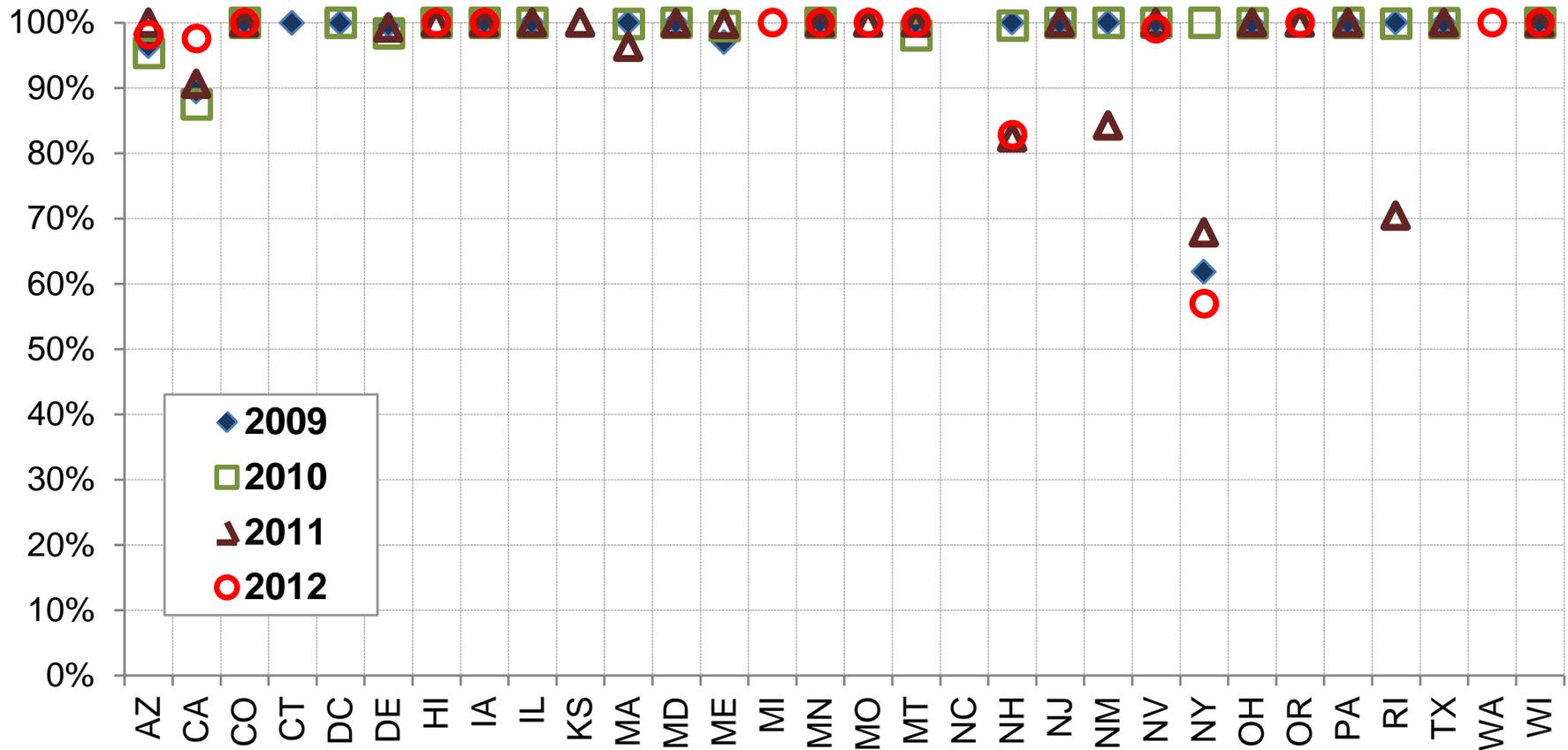
RPS-Motivated* Renewable Energy Capacity Additions from 1998-2012, by Region and Technology Type



*Renewable additions are counted as "RPS-motivated" if and only if they are located in a state with an RPS policy and commercial operation began no more than one year before the first calendar year of RPS compliance obligations in the host state.

Main Tier RPS Targets Largely Achieved; Isolated Struggles Apparent

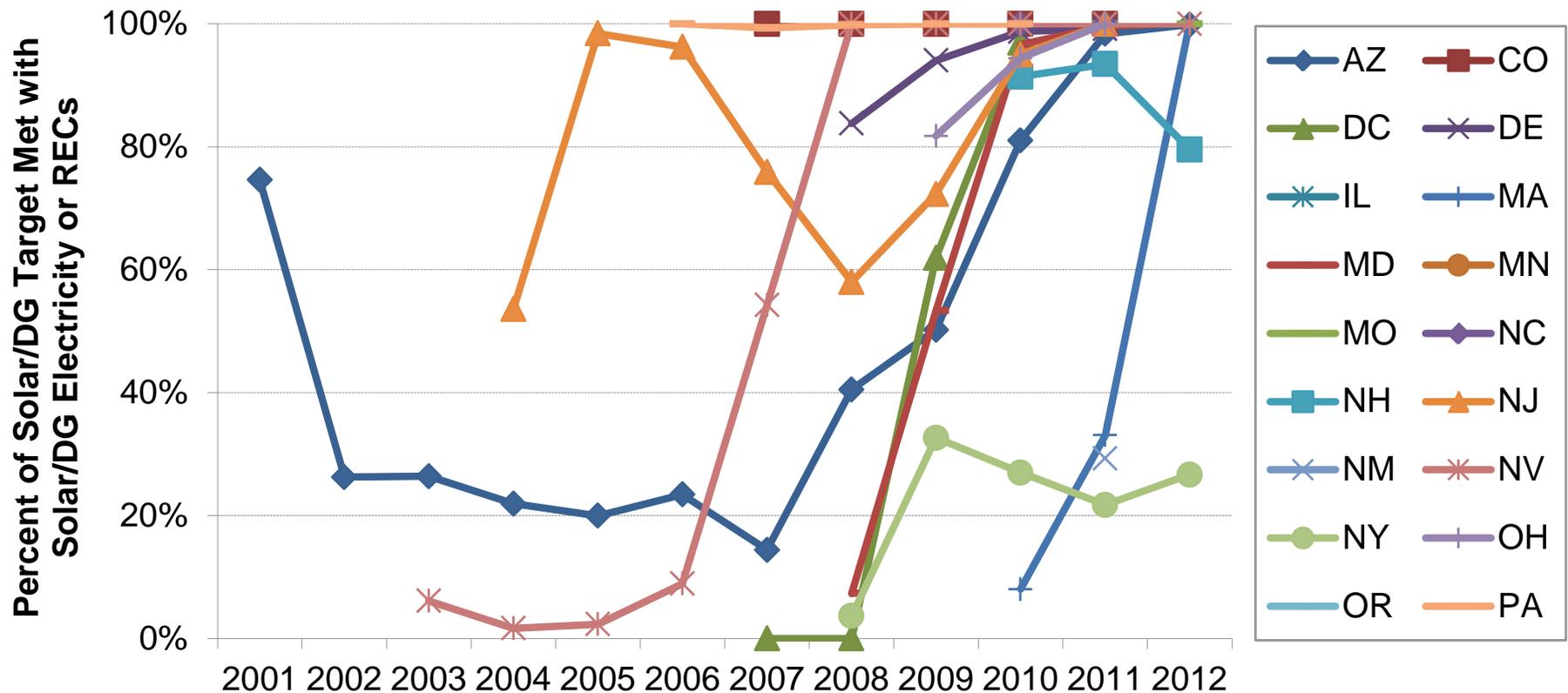
Percent of Main Tier RPS Target Met with Renewable Electricity or RECs
(including available credit multipliers and banking, but excluding ACPs and borrowing)



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.

Achievement of Solar/DG Set-Aside Targets Has Steadily Increased in Most States

Percent of Solar/DG Set-Aside Target Met with Solar/DG Electricity or SRECs
(including available credit multipliers and banking, but excluding ACPs and borrowing)

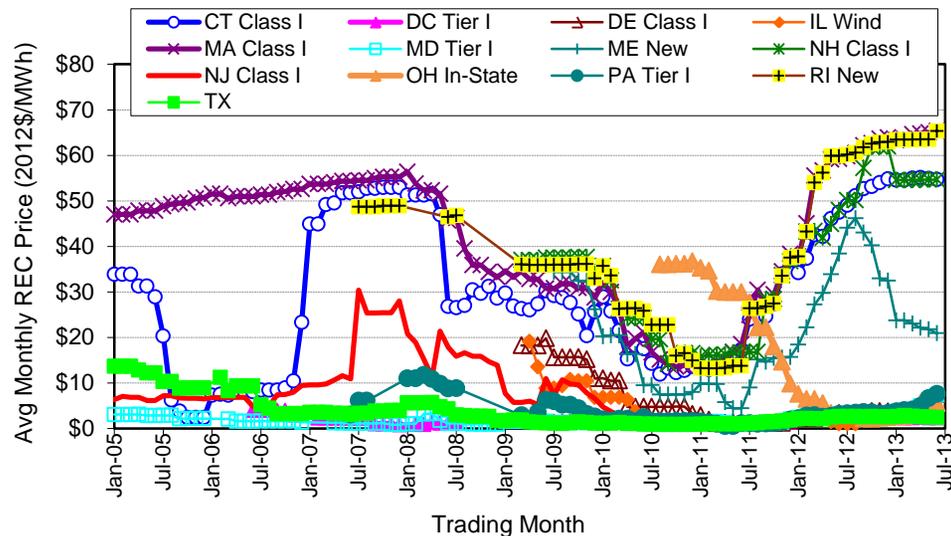


Note: "Percent of Solar/DG Target Met with Solar/DG Electricity or RECs" excludes ACPs but includes applicable credit multipliers. In cases where this figure is below 100%, suppliers may not have been technically out of compliance due to solar ACP compliance options, funding limits, and force majeure provisions.

REC Pricing Reflects Current Supply-Demand Balance; Exhibits Continued Volatility

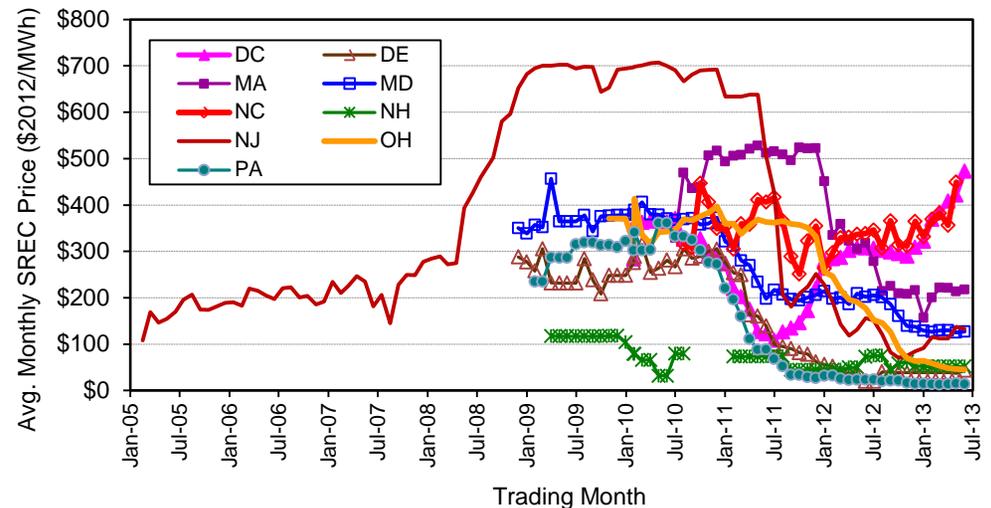
- Rising Class I REC prices in Northeastern states reflect tightening supply, while pricing in Mid-Atlantic states remain low
- Sinking SREC prices in recent years, across most markets, show persistent over-supply

Main Tier/Class I RECs



Sources: Evolution Markets (through 2007) and Spectron (2008 onward). Plotted values are the last trade (if available) or the mid-point of Bid and Offer prices, for the current or nearest future compliance year traded in each month.

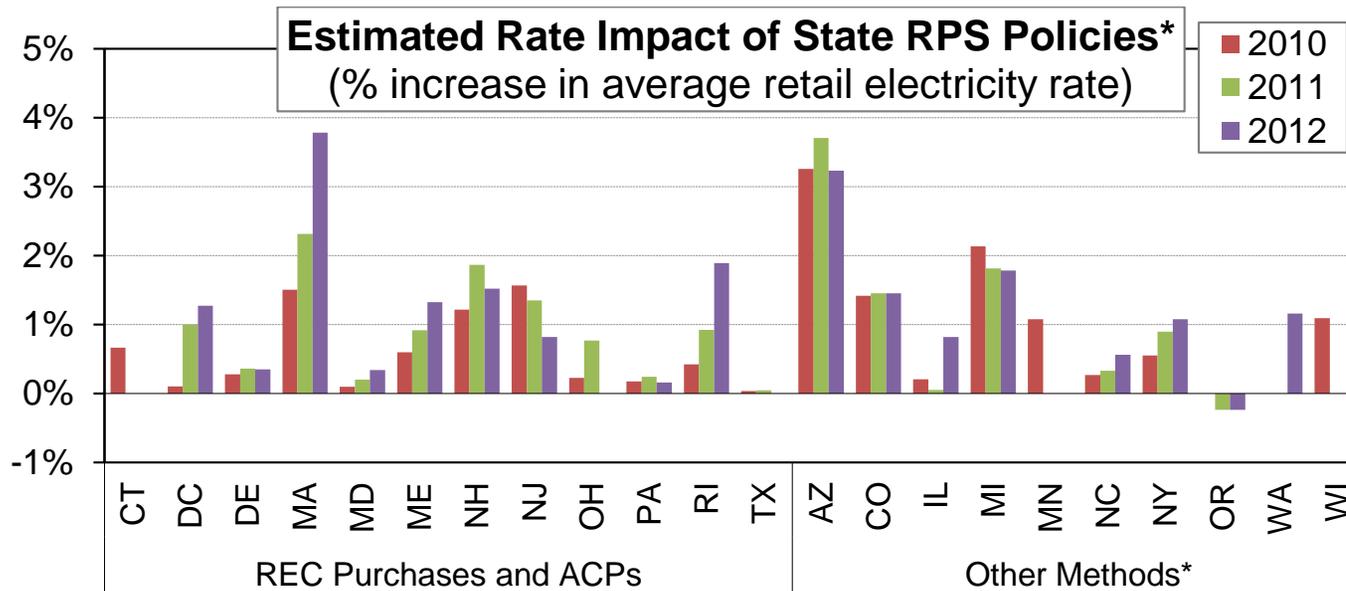
SRECs



Sources: Spectron, SRETrade, 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 SREC prices for the current or nearest future compliance year traded in each month.

Rate Impacts of State RPS Policies Have Thus Far Been Generally 'Modest' (<2%)

Translating REC prices or other available data on net incremental costs into retail rate impacts yields the results shown below



* Other Methods for estimating rate impacts include RPS surcharge collections (AZ, CO, MI, NC), budget (NY), utility-reported incremental costs (OR, MN, WA), PUC analysis (IL, WI). States omitted if data on RPS incremental costs are unavailable (CA, IA, HI, KS, MO, MT, NM, NV).

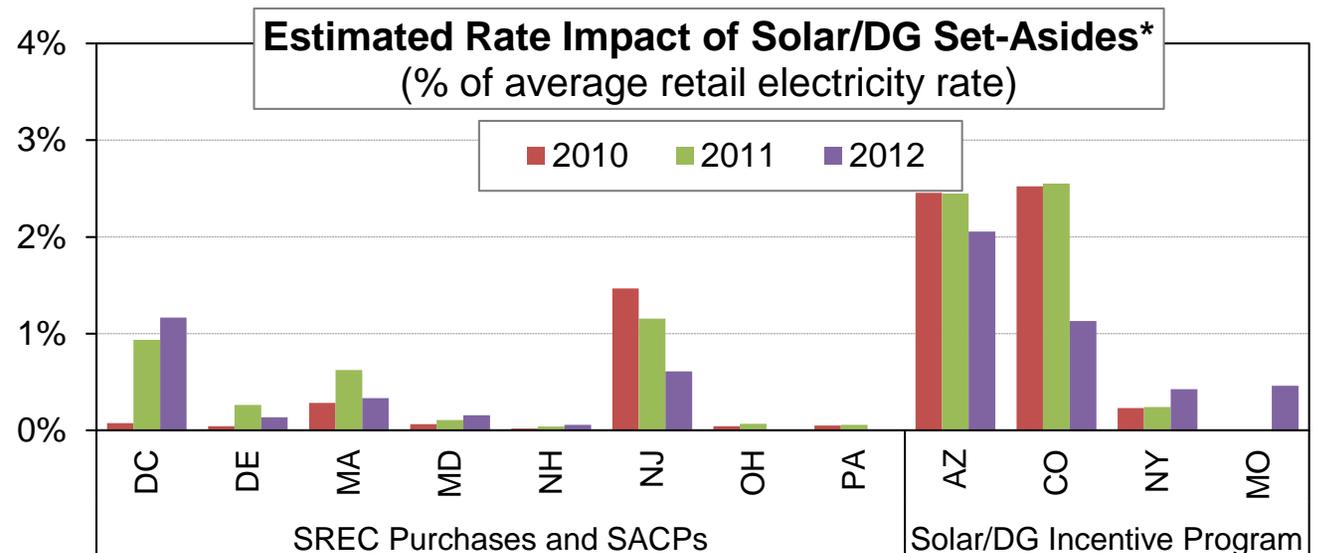
- Simplified approach ignores some ratepayer costs (e.g., integration) and benefits (e.g., wholesale electricity price suppression)
- Limited/mixed data for states dominated by bundled contracts
- Rate impacts vary with target levels, REC prices, presence of set-asides, procurement mechanisms

Future compliance costs will be impacted by increasing RPS targets, changes to fed. tax incentives, and trajectories of RE costs and natural gas prices (among other factors)

Rate Impacts of Solar/DG Set-Asides Vary and Were Tempered by SREC Price Declines in 2012

The rate impacts of solar/DG set-asides can be estimated using SREC prices or data on incentive program expenditures

- Rate impacts vary with target levels and SREC prices
- Incentive programs tend to “front-load” set-aside costs
- Rate impacts in 2012 fell in many states due to decline in SREC prices or incentive levels, in spite of increasing targets

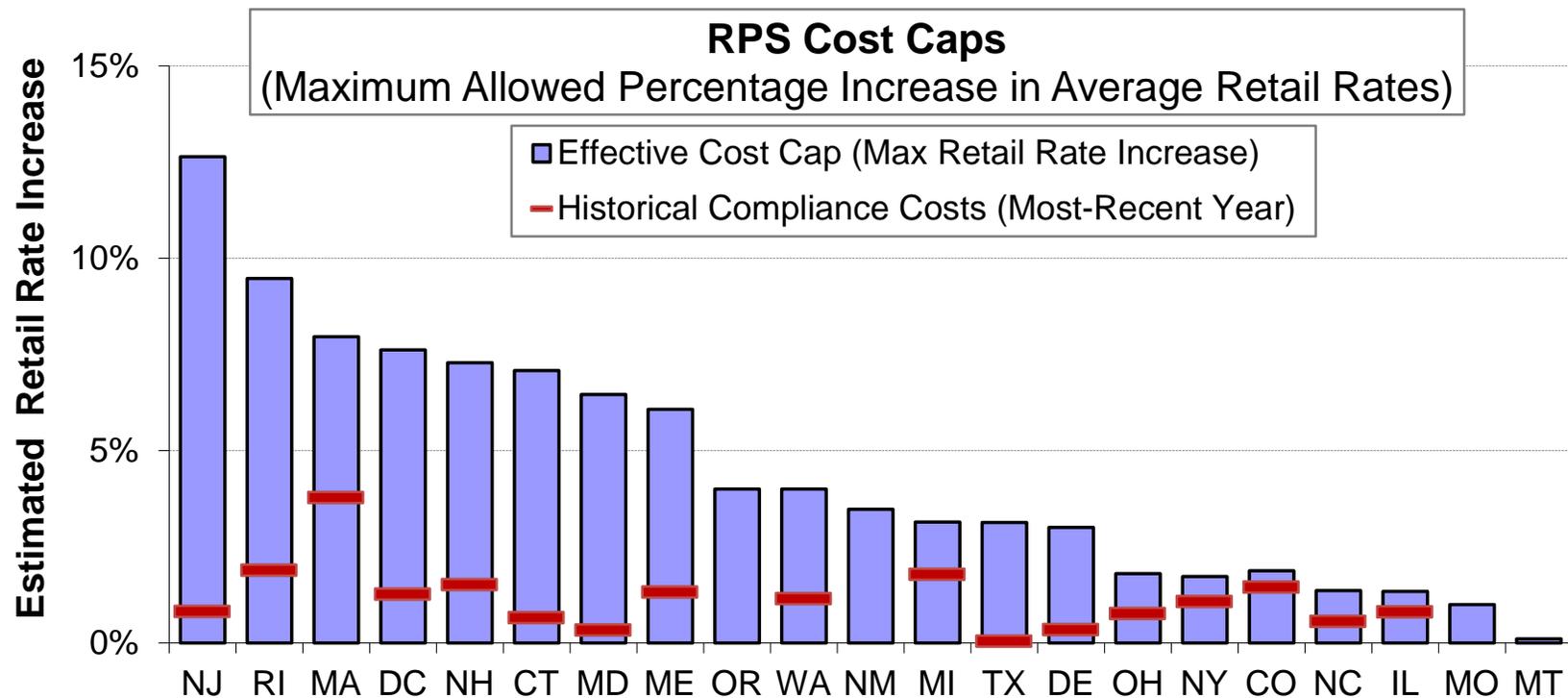


*States omitted from the figure if data on incremental costs of solar/DG set-aside are unavailable (IL, MN, NC, NM, NV, OR). Data for CO represent Xcel Energy's calculated incremental cost of all resources used to meet DG set-aside.

Set-Aside targets are still in the early phases of ramping up; will increase by a factor of 5 by 2020

Most States Have Capped Rate Impacts Well Below 10% (13 States Below 5%)

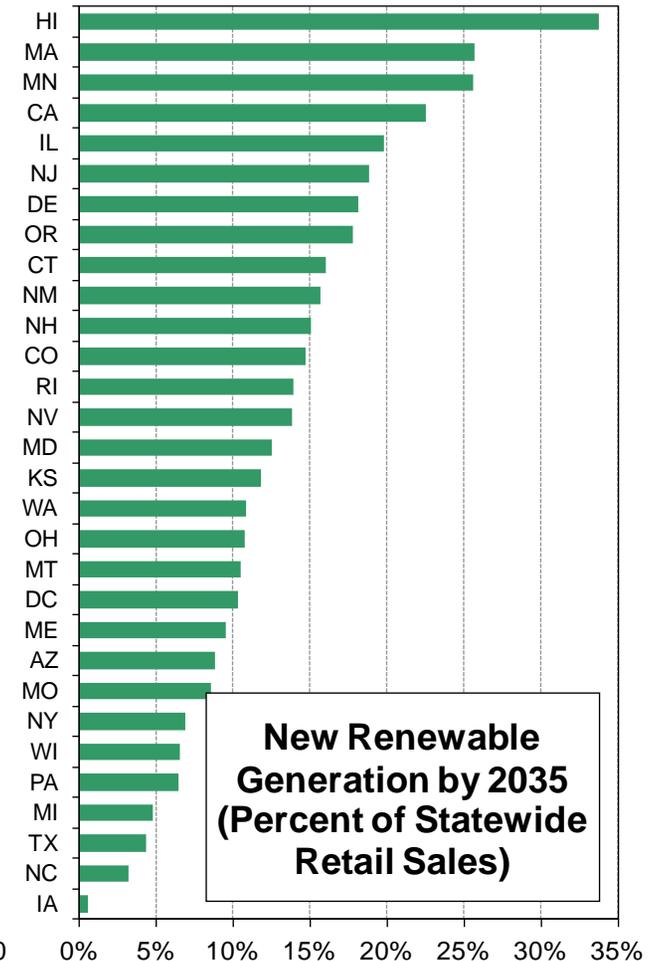
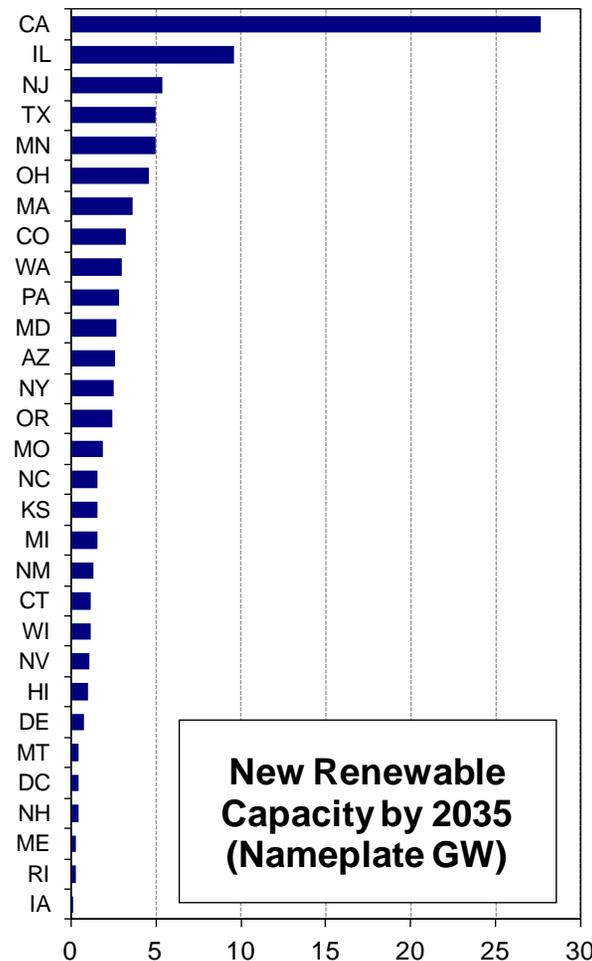
Many states' cost containment mechanisms can be translated into an equivalent maximum increase in average retail rates



No explicit cap on incremental compliance costs in 9 states (AZ, CA, IA, KS, HI, MN, NV, PA, WI), though KS caps gross revenue requirements and CA is currently developing its cost containment mechanism

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

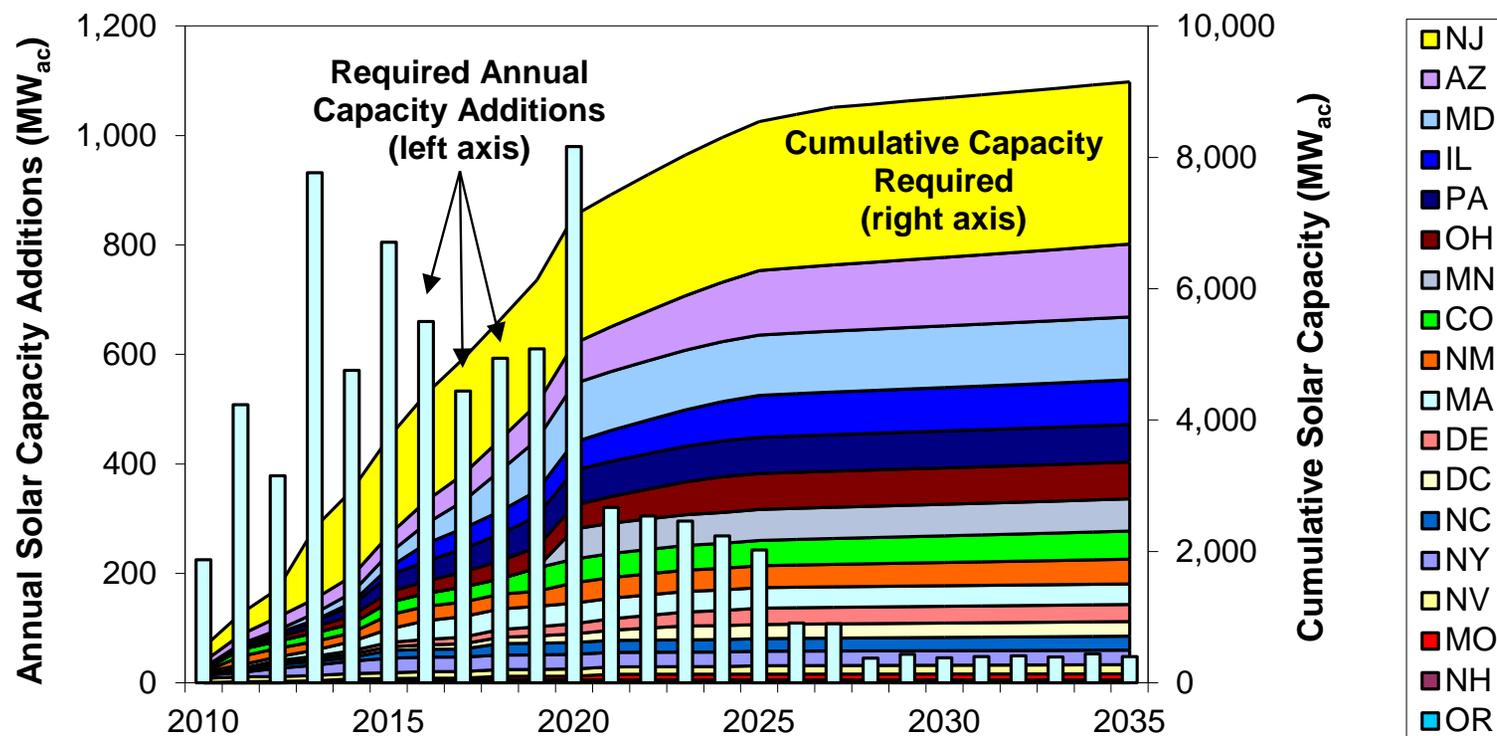
- **94 GW** of “New RE” required by 2035, if full compliance is achieved
- Equates to roughly **3-5 GW/yr** through 2020 and **2-3 GW** through 2035
- By comparison, RPS-driven RE additions have ranged from **6-13 GW/yr** in all but one year since 2008



* New RE is defined based on state-specific distinctions between new vs. existing, or based on the year in which the RPS was enacted; it does not represent new renewables relative to current supply

Solar Market Growth is on Pace to Meet Future Solar/DG Set-Aside Requirements

- Cumulative capacity requirement grows to **9,200 MW** by 2035
- Required average annual solar capacity additions of **700 MW/yr** through 2020, tapering off thereafter
- By comparison, set-aside PV additions reached 1,200 MW in 2012



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

- The outcome of ongoing and future legislative and legal challenges
- Whether cost caps become binding
- The ever-present possibility of federal energy legislation
- How policymakers re-tune RPS' in response to changing market conditions
- Continued efforts to address challenges associated with volatile REC prices and limited availability of long-term contracts in restructured retail electricity markets
- How other related issues and barriers affecting RE deployment are addressed (transmission, integration, siting, EPA/environmental regulations, net metering, etc.)

Thank You!

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