



Environmental Energy Technologies Division Lawrence Berkeley National Laboratory

Renewables Portfolio Standards in the United States: A Status Update

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**State-Federal RPS Collaborative
National Summit on RPS**

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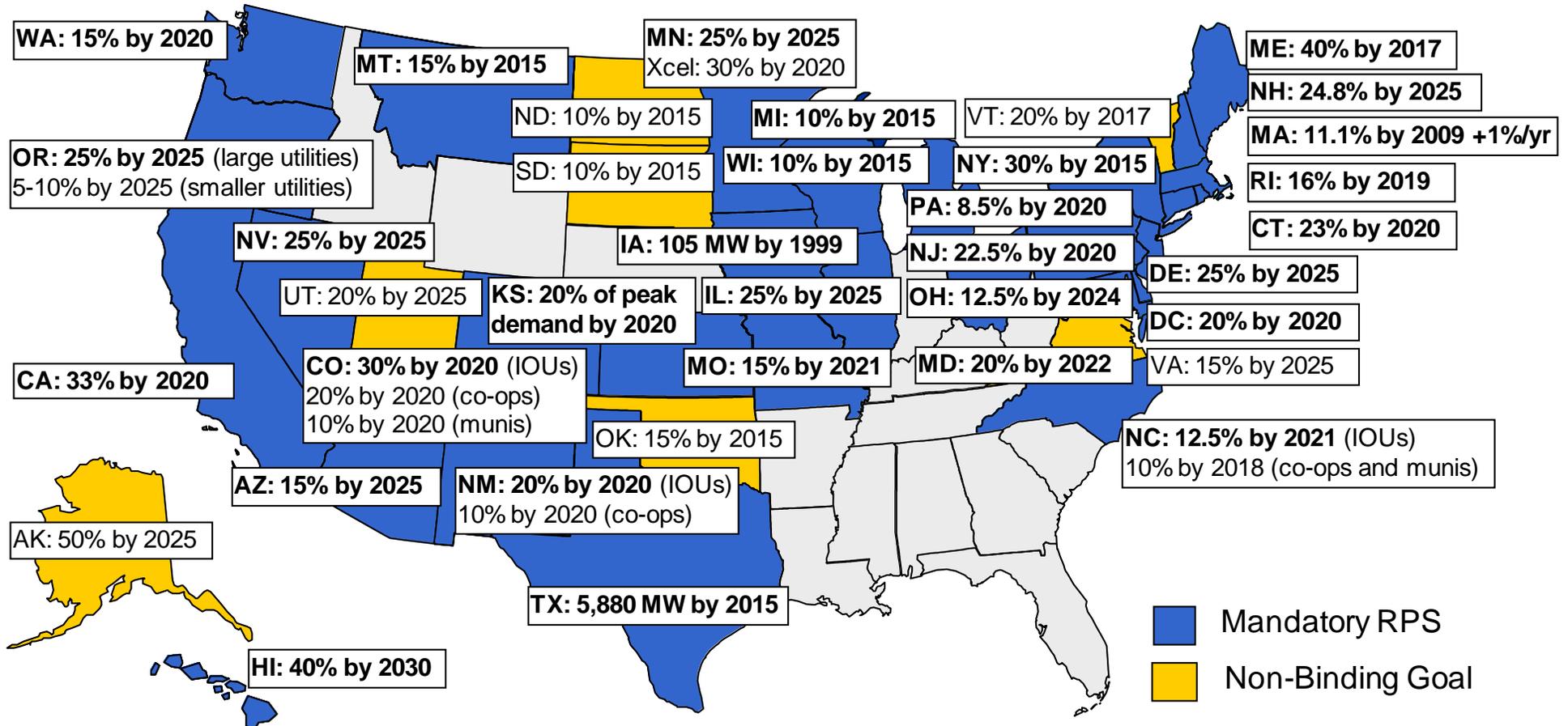
Summary of State RPS Experience-to-Date

- State RPS policies have been a significant driver for renewable energy growth in the United States and have largely held up against recent political challenges
- Generally high levels of compliance achieved thus far
- Compliance costs have thus far remained relatively modest, though questions exist about future costs
- Significant solar and other RE capacity is required to meet future RPS targets, but is well in-line with pace of additions in recent years
- Significant challenges nevertheless exist to meeting future RPS obligations (e.g., managing REC price volatility, transmission, integration, siting)

RPS Policies Exist in 29 States and DC

7 More States Have Non-Binding Goals

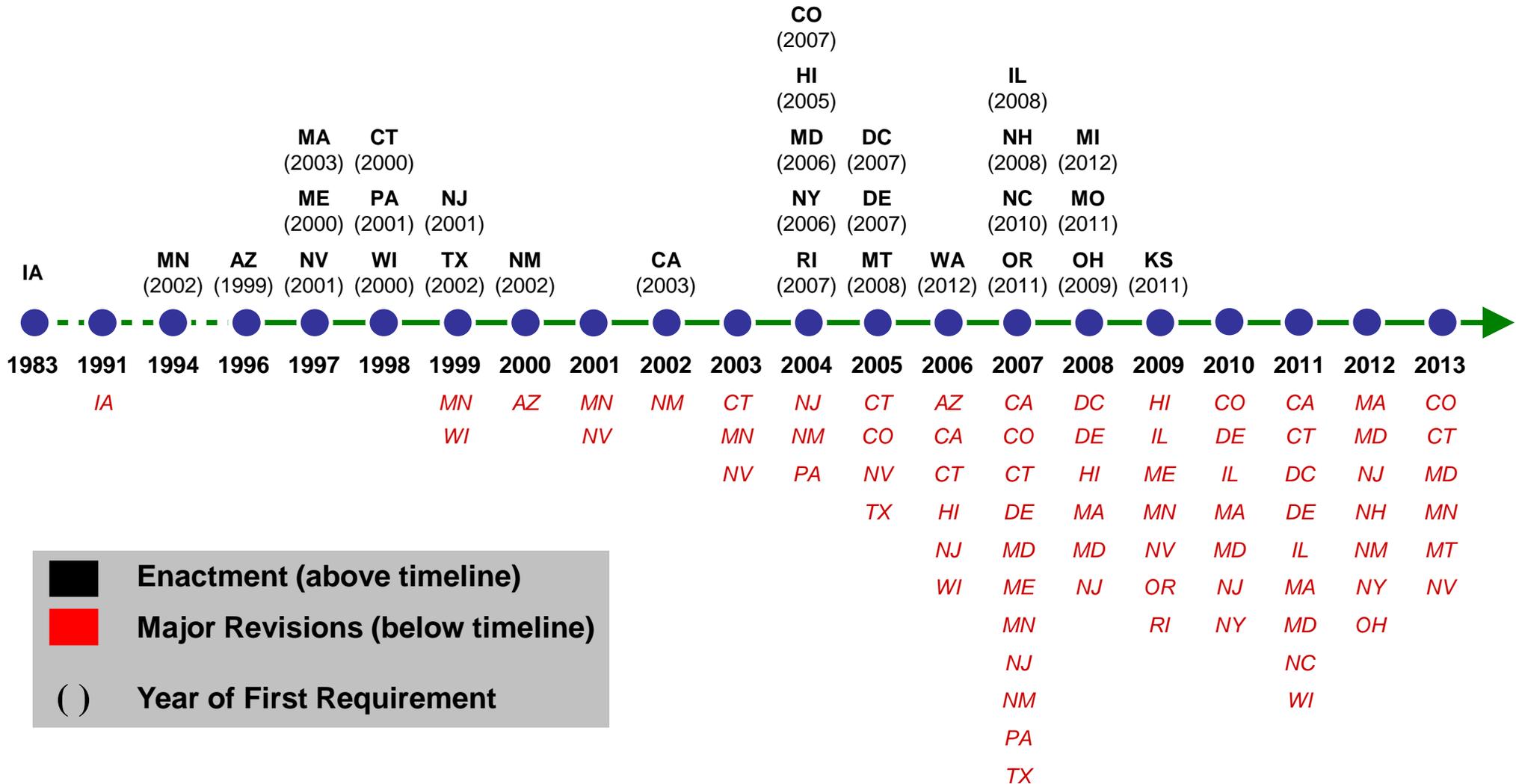
Existing State RPS Policies Apply to 55% of Total U.S. Retail Electricity Sales in 2012



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



Major RPS Revisions in 2013

- **CO:** Raised overall RPS target for rural electric cooperatives from 10% to 20% and created DG set-aside; extended eligibility to GHG-neutral coal mine methane and pyrolysis of MSW
- **CT:** Increased maximum size threshold for hydroelectric facilities to qualify for Class I resources, from 5 MW to 30 MW, subject to various limitations
- **MD:** Created off-shore wind set-aside (2.5% by 2017)
- **MN:** Created a solar set-aside (1.5% by 2020) for IOUs
- **MT:** Created exemption for utilities serving fewer than 50 customers
- **NV:** Phases out energy efficiency allowance and multiplier for PV and places limits on banking of excess RECs

General Trends in Recent RPS Revisions

- Expanding and revising resource eligibility (waste-to-energy, hydropower, biomass co-firing, solar thermal)
- Increased stringency of RPS purchase targets
- Adoption of resource-specific set-asides and acceleration or increase in targets
- Honing solar set-aside provisions
 - Eligibility rules (size, location, etc.)
 - Solar ACP schedules
 - Procurement mechanisms (contracting, auctions)
- Efforts to address REC oversupply/volatility and lack of long-term contracting opportunities in restructured markets

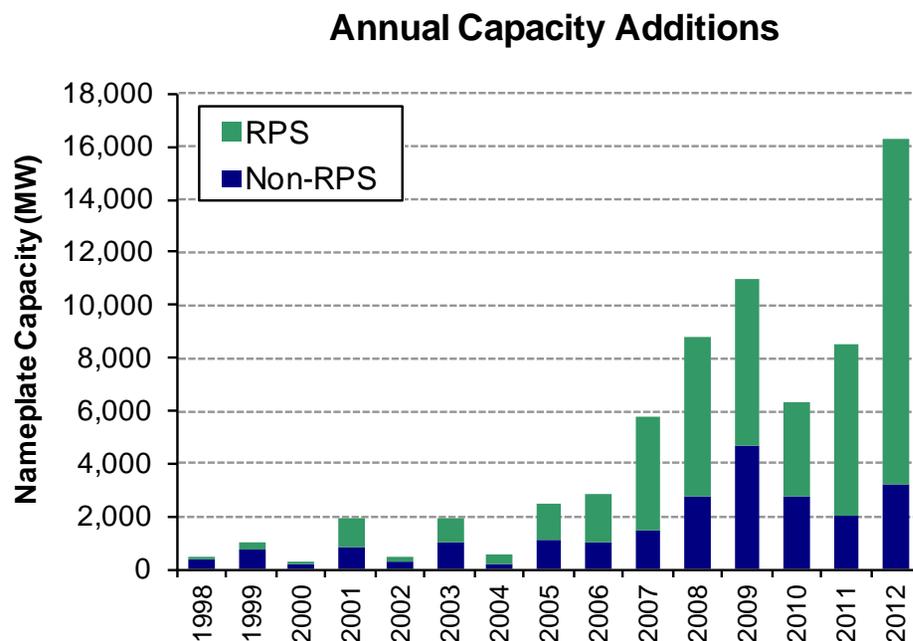
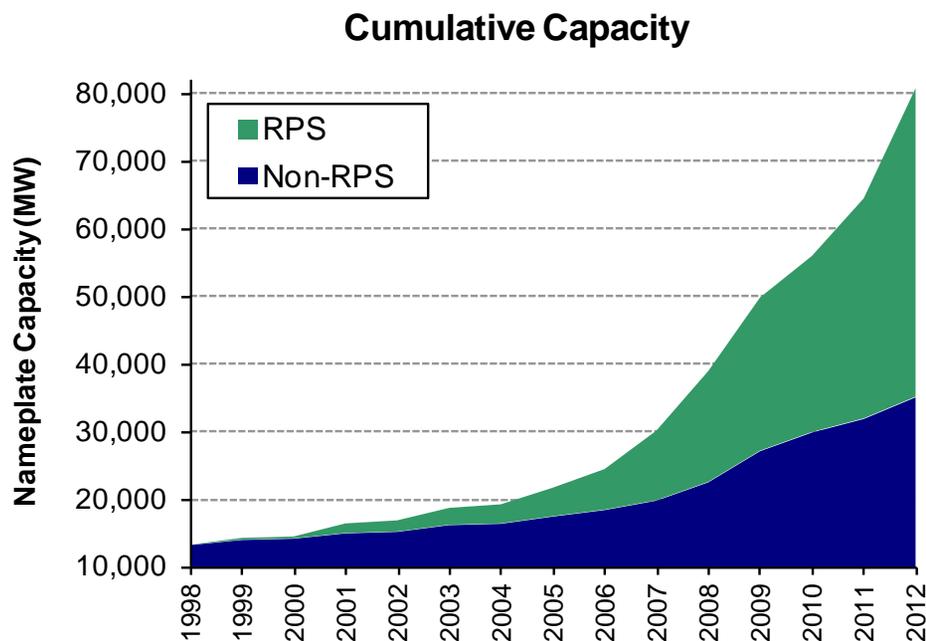
Experience with State RPS Compliance Obligations Varies Widely and is Growing

Operational Experience with State RPS Policies
(number of major compliance years completed-to-date)



State RPS Policies Appear to Have Motivated Substantial Renewable Capacity Development

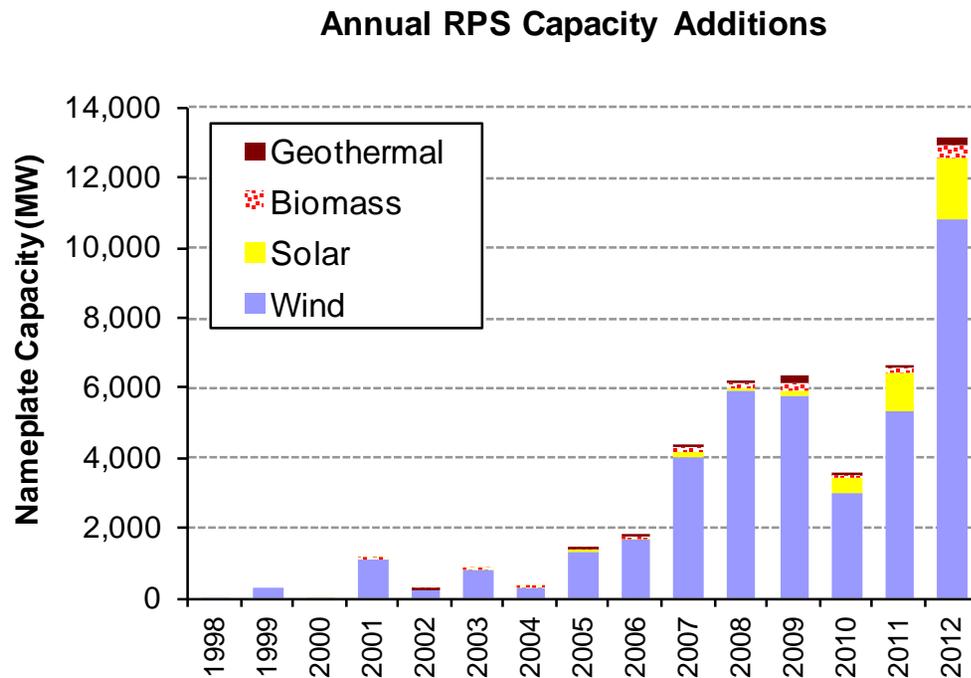
Cumulative and Annual Non-Hydro Renewable Energy Capacity in RPS and Non-RPS States, Nationally



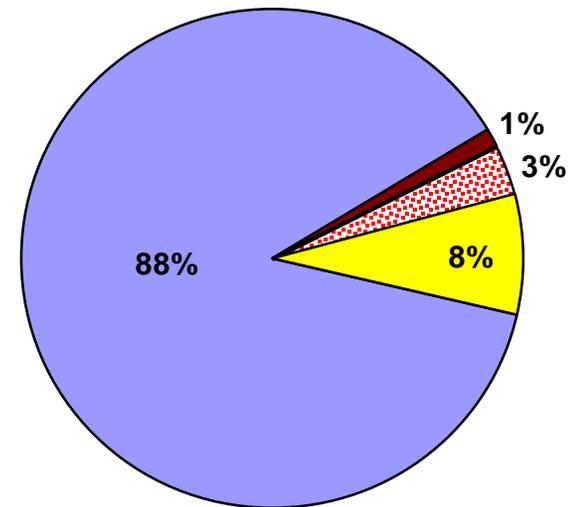
Though not an ideal metric for RPS-impact, **67% (46 GW)** of all non-hydro renewable capacity additions from 1998-2012 occurred in states with active/impending RPS compliance obligations

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

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



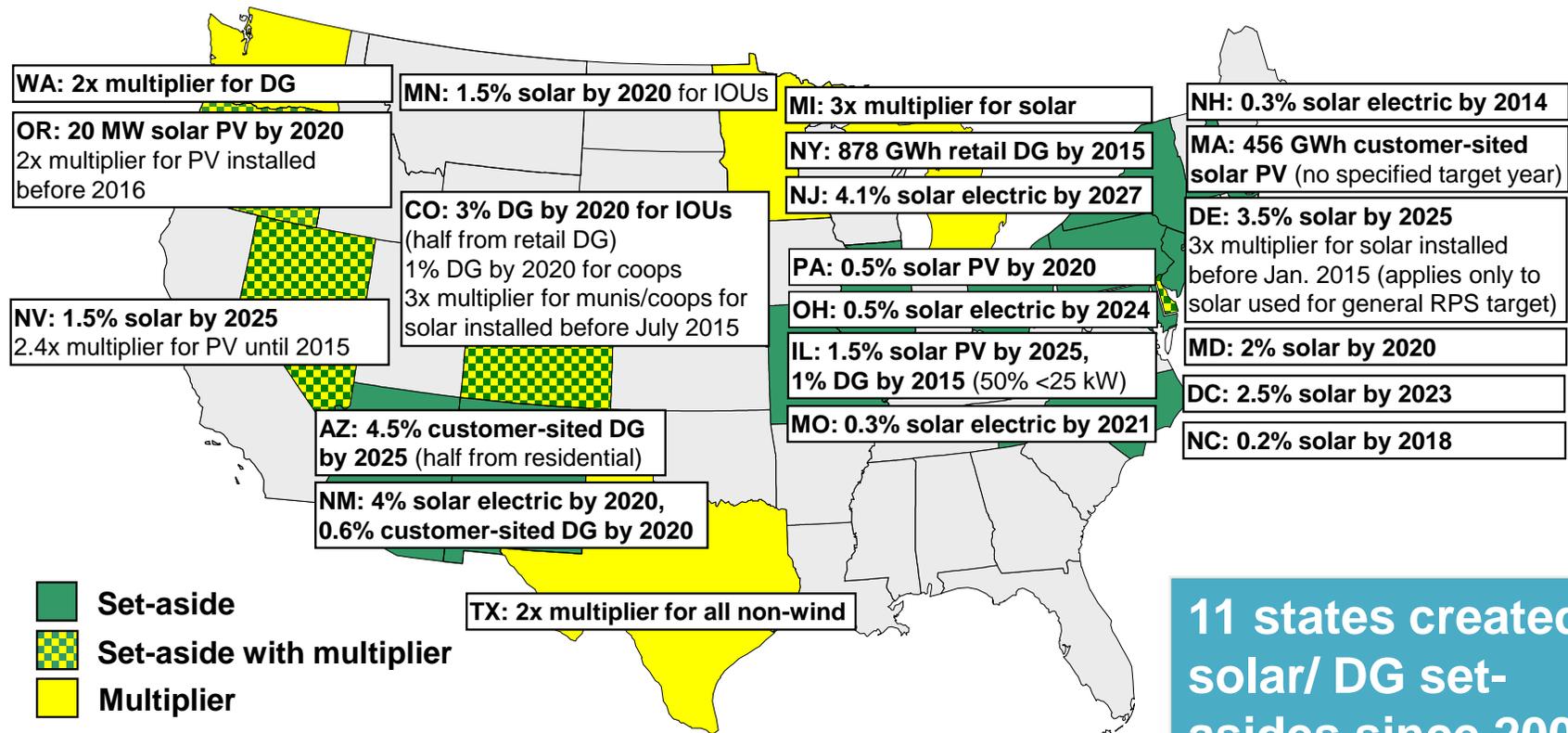
Cumulative RPS Capacity Additions (1998-2012)



* 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



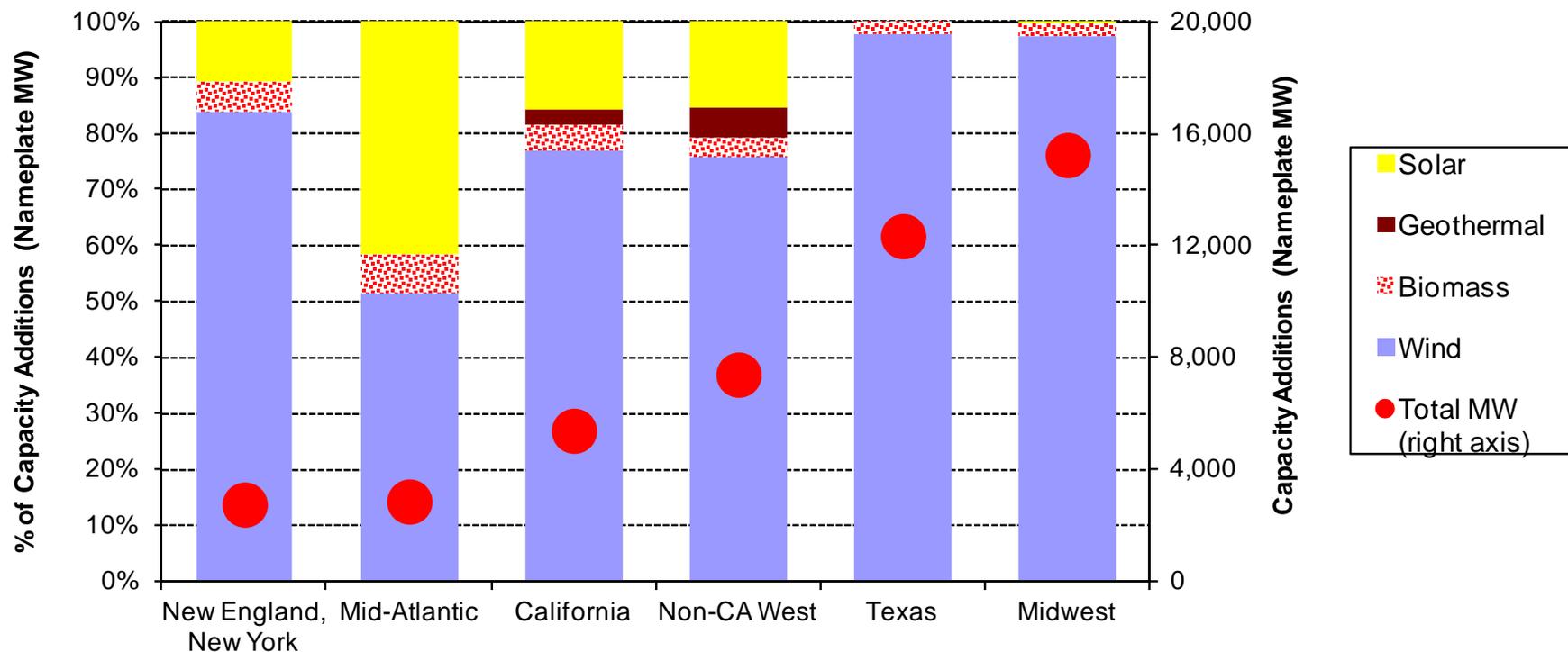
11 states created solar/ DG set-asides since 2007:
DE, IL, MA, MD, MO, MN, NC, NH, NM, OH, OR

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

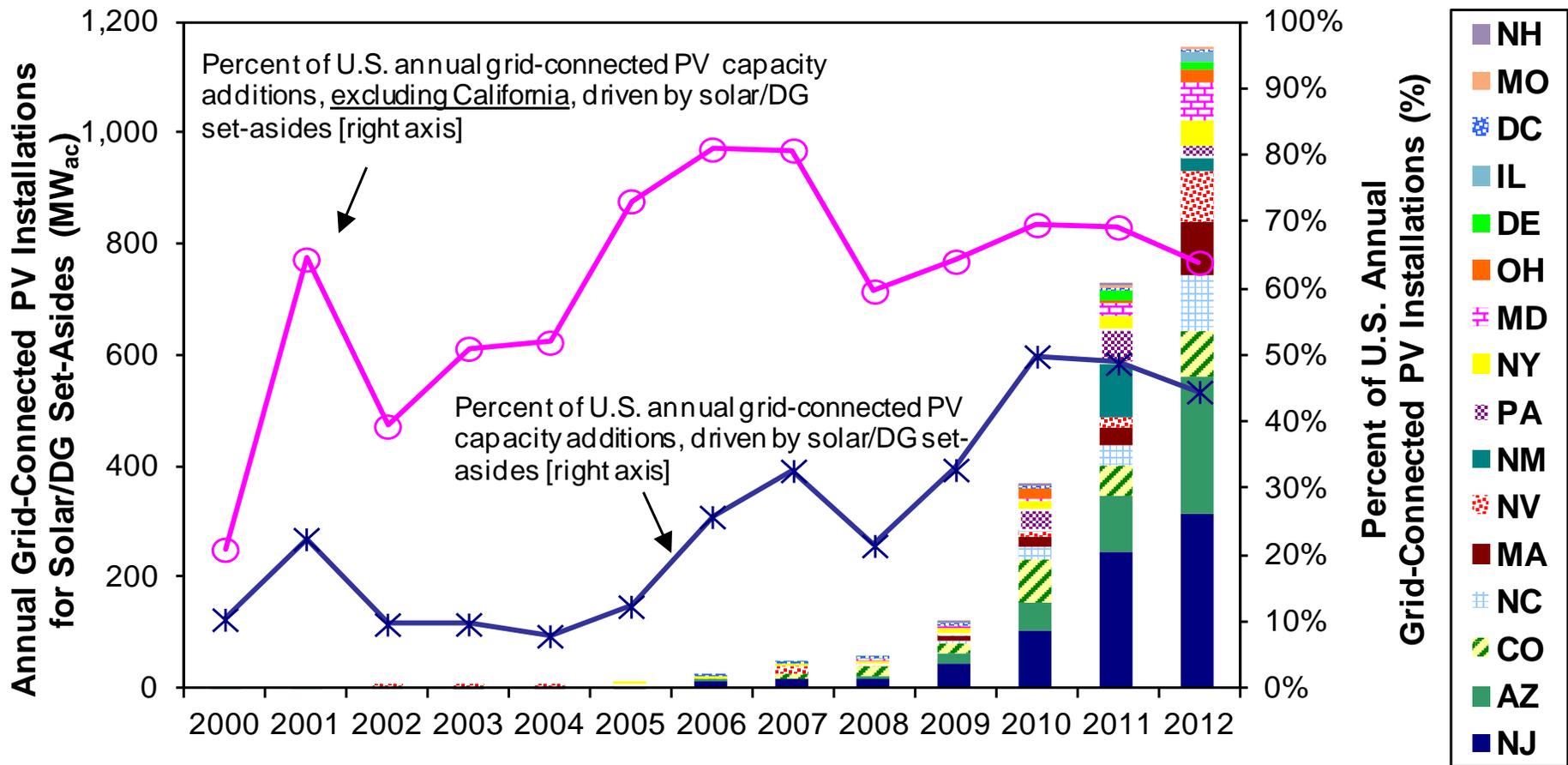
Solar Share is Notably Greater in Regions with Set-Asides or Strong Solar Resource Potential

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.

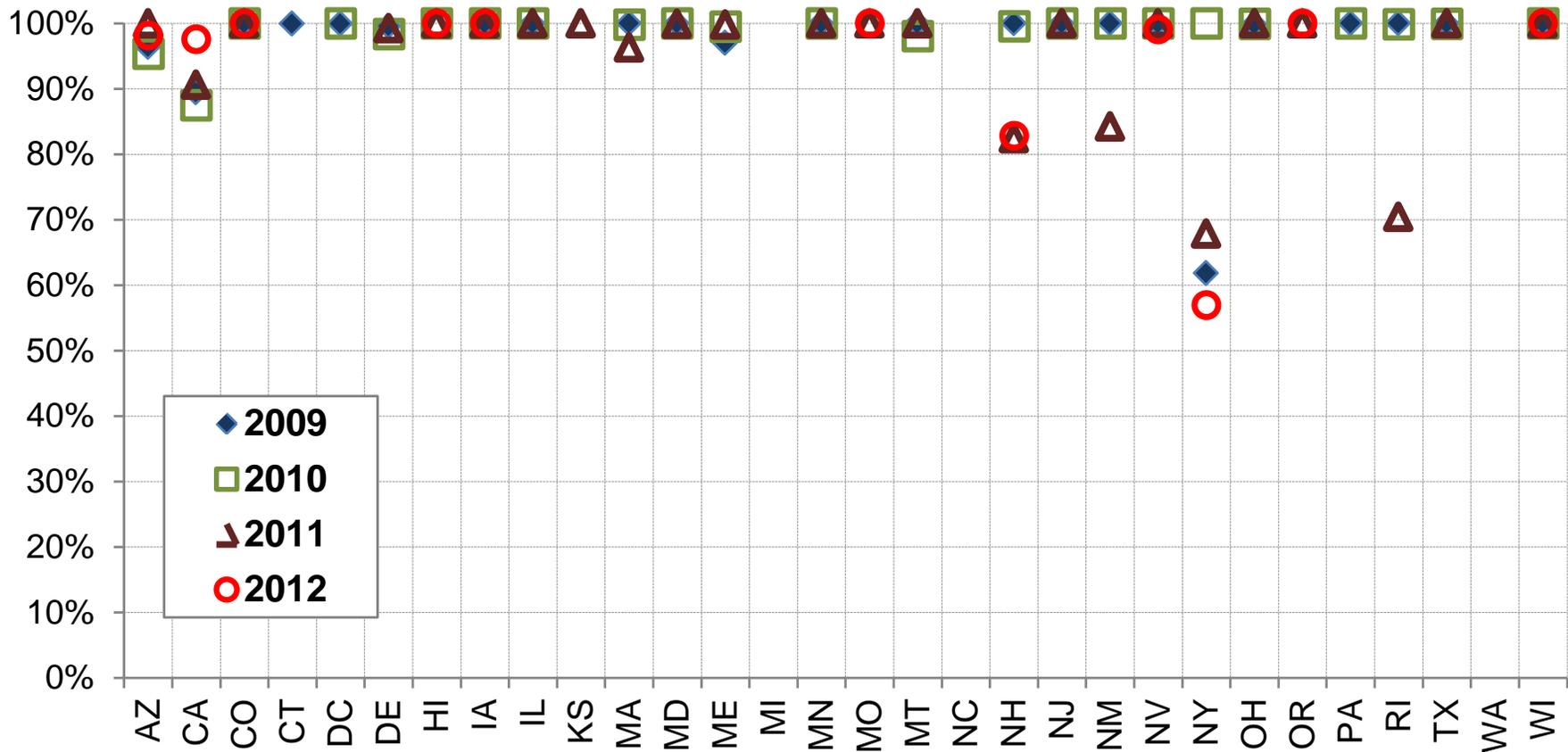
Impact of Solar/DG Set-Asides is Growing: Drove ~50% of U.S. PV Additions in 2010-12



General RPS obligations also driving significant solar additions in California and Southwest

Main Tier RPS Targets Largely Achieved; Isolated Struggles Apparent

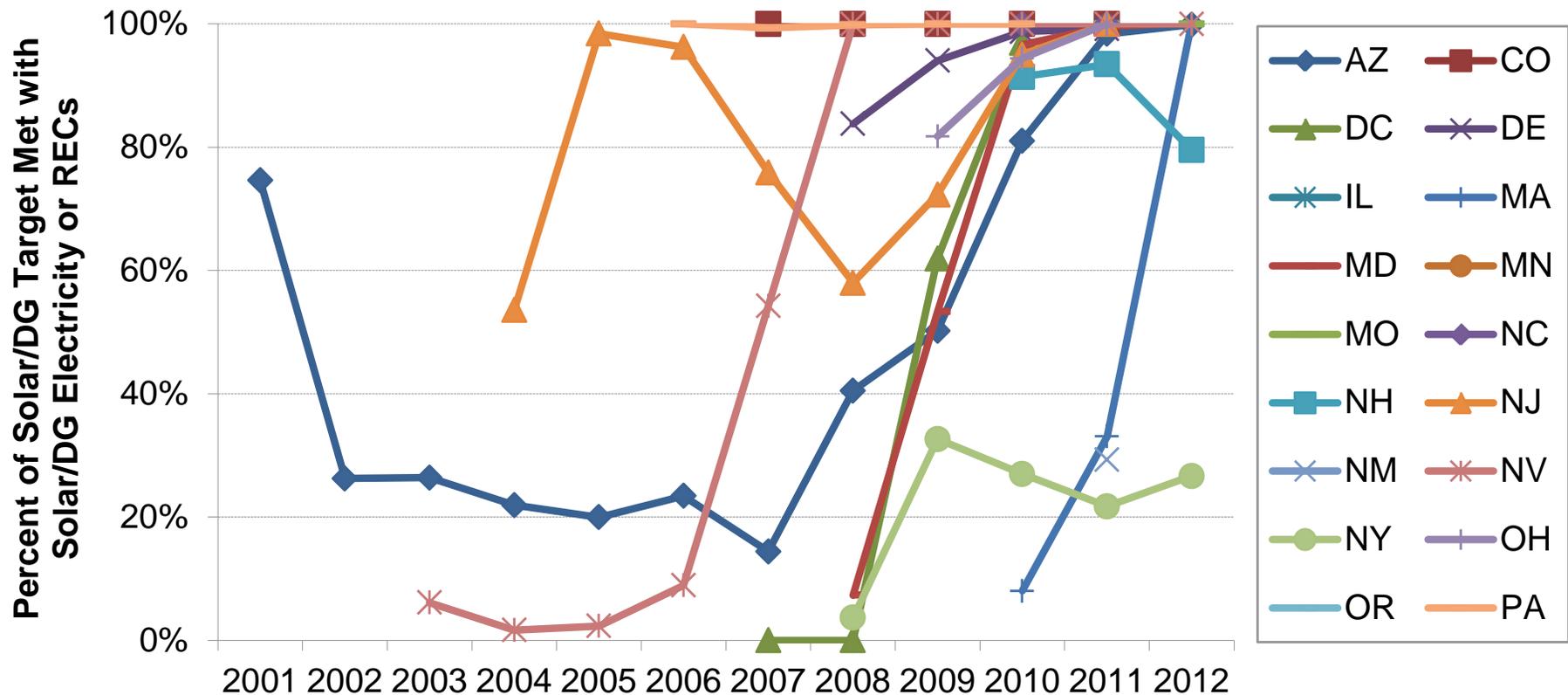
Percent of Main Tier RPS Target Met with Renewable Electricity or RECs
(including available credit multipliers and banking, but excluding ACPs and borrowing)



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)

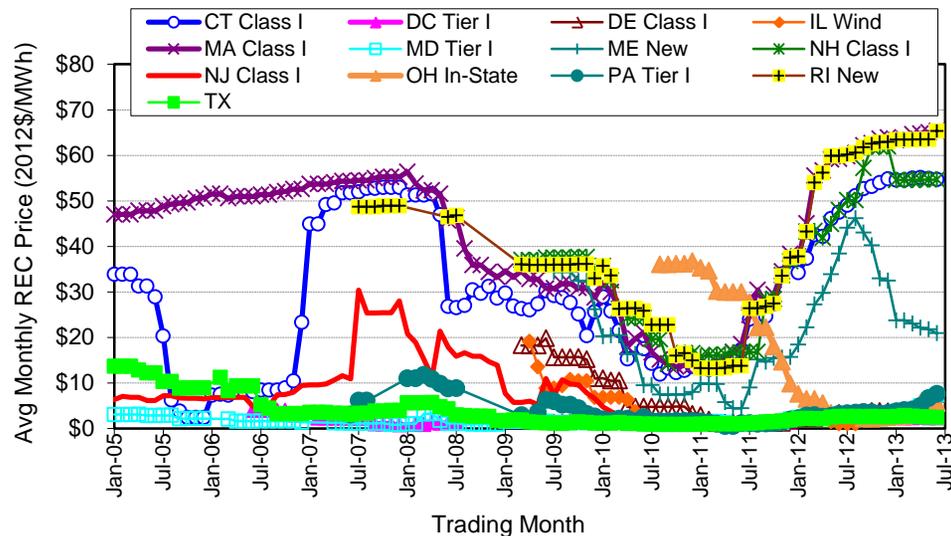


Note: "Percent of Solar/DG Target Met with Solar/DG Electricity or RECs" excludes ACPs but includes applicable credit multipliers. In cases where this figure is below 100%, suppliers may not have been technically out of compliance due to solar ACP compliance options, funding limits, and force majeure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

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

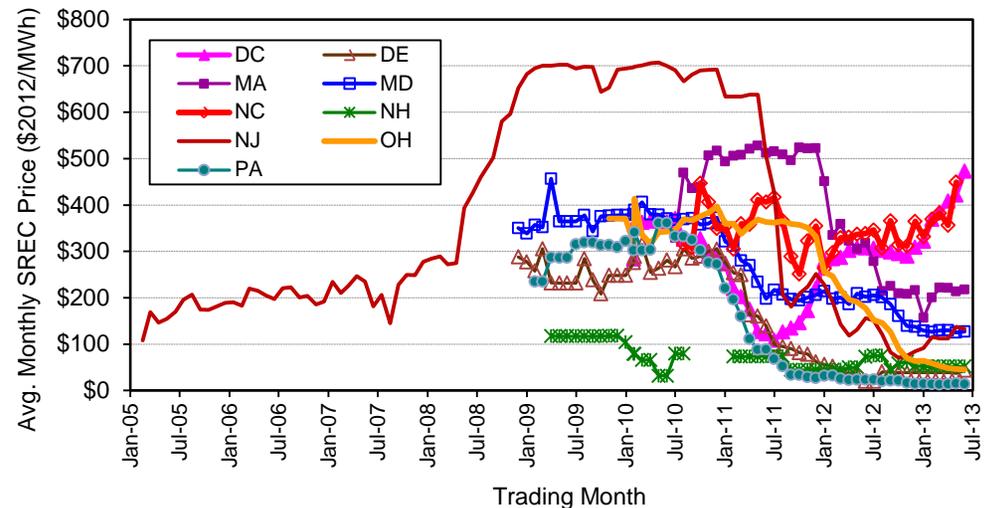
- Rising Class I REC prices in Northeastern states reflect tightening supply, while pricing in Mid-Atlantic states remain low
- Sinking SREC prices in recent years (across most markets) show enduring over-supply

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.

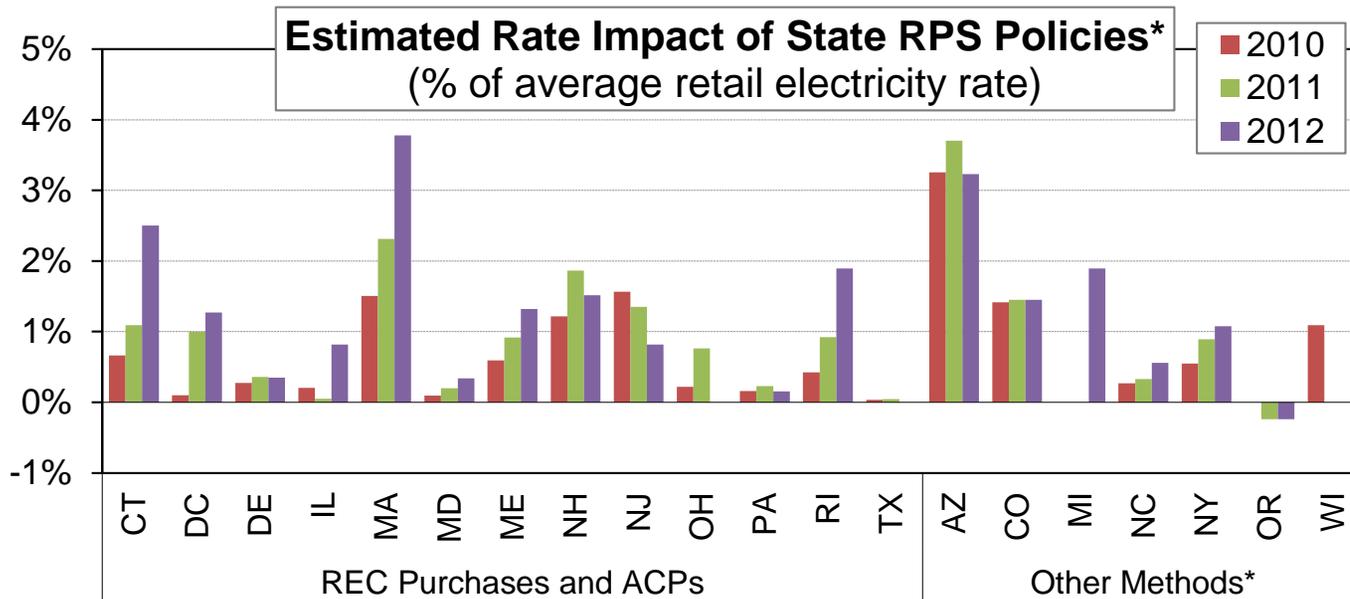
SRECs



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 utility-reported incremental costs (OR), RPS tariff rider collections (AZ, CO, MI, NC), approved budget (NY), and PUC analysis (WI). States omitted if data on incremental RPS compliance costs are unavailable (CA, IA, HI, KS, MN, MO, MT, NM, NV, TX, WA).

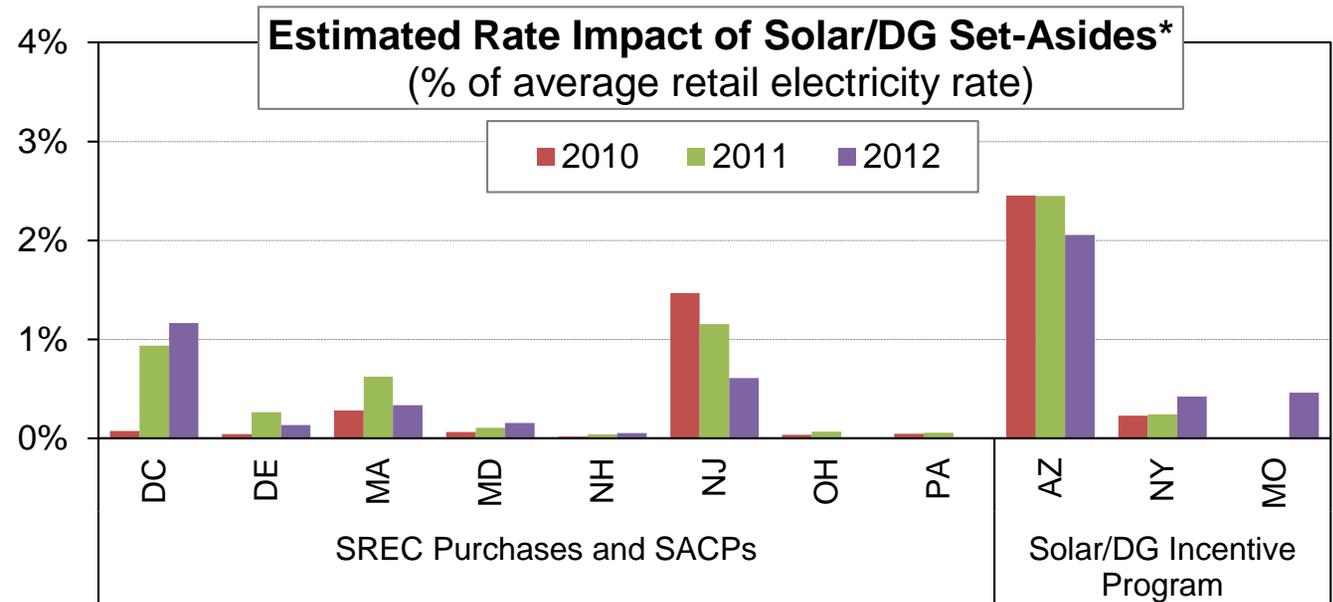
- Simplified approach ignores some ratepayer costs (e.g., integration) and benefits (e.g., wholesale electricity price suppression)
- Limited/mixed data for states dominated by bundled contracts
- Rate impacts vary with target levels, REC prices, presence of set-asides

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, in spite of increasing targets

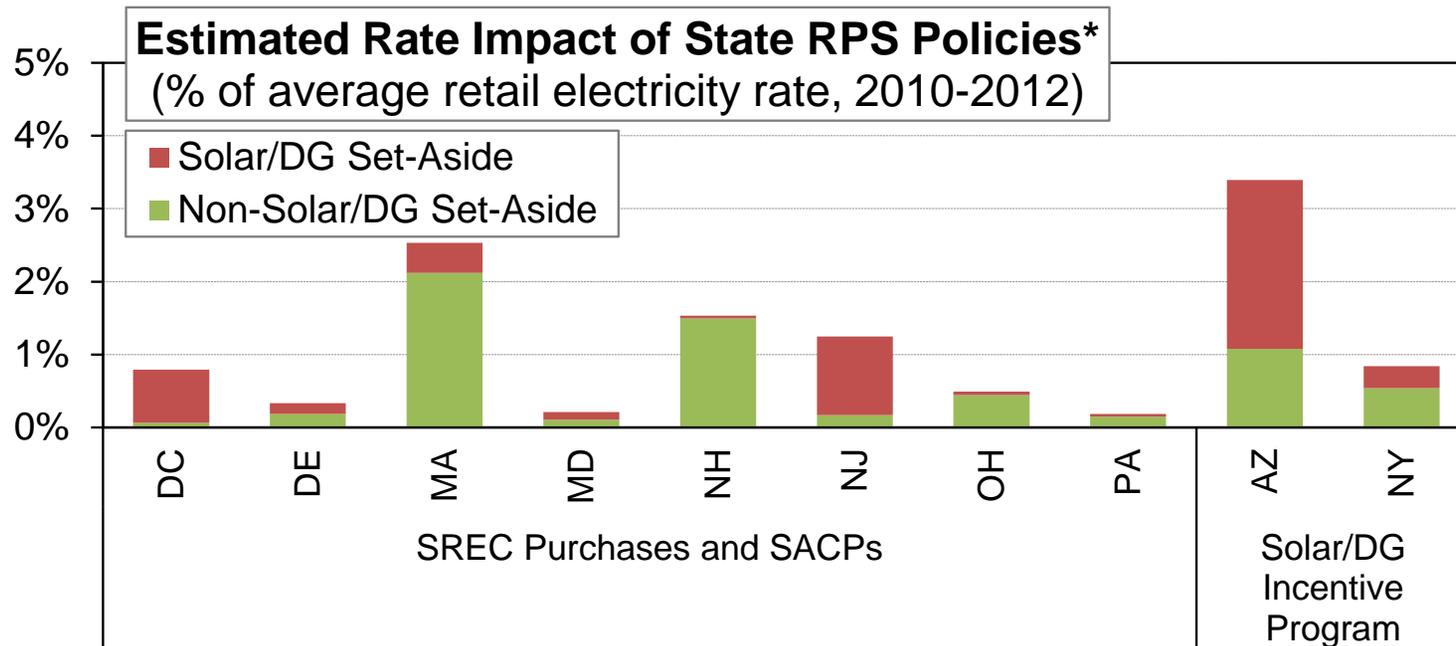


*States omitted from the figure if data on incremental costs of solar/DG set-aside are unavailable (CO, IL, MN, NC, NM, NV, OR).

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

Solar/DG Set-Asides Represent a Large Share of Total RPS Rate Impacts in Some States

Average RPS rate impacts over 2010-2012 can be segmented into Solar/DG Set-Aside and Non-Solar/DG Set-Aside impacts

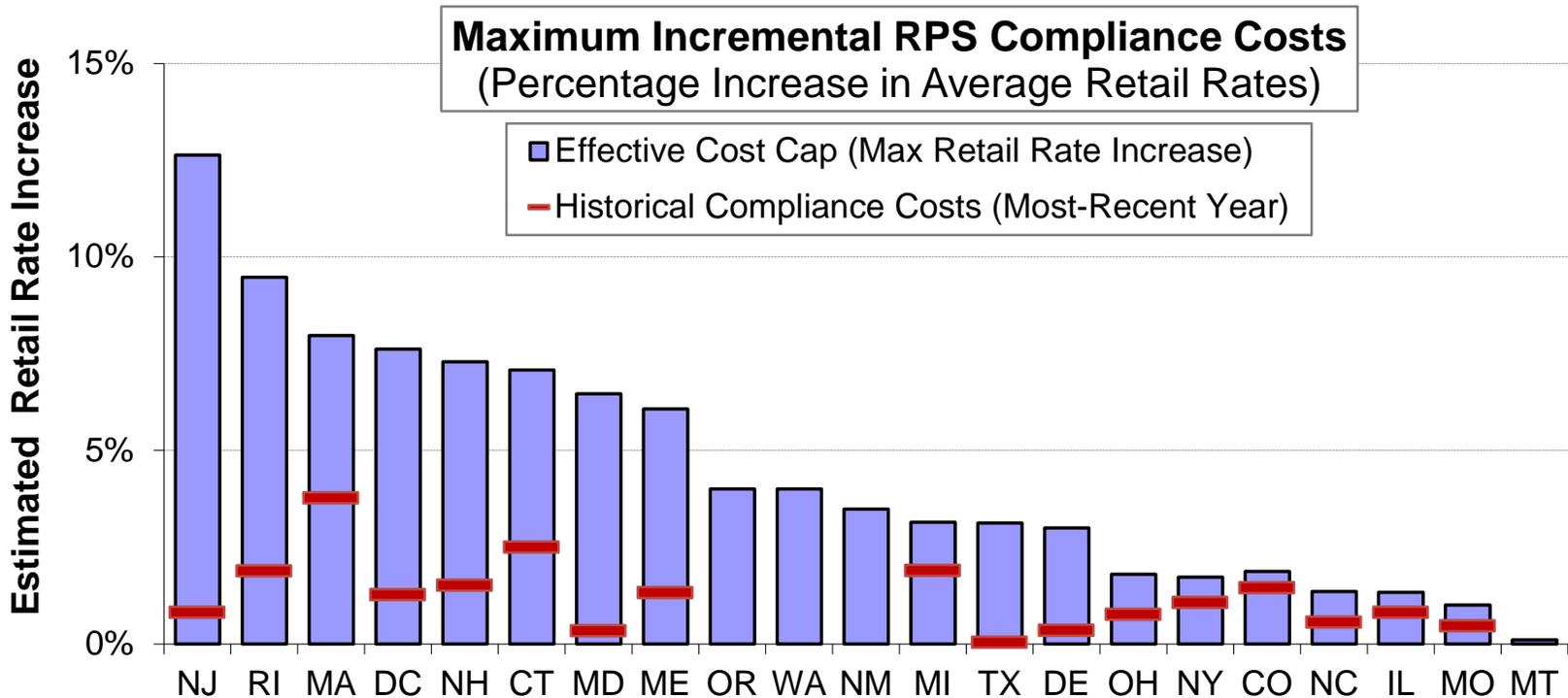


* Results are based on average rate impacts over the 2010-2012 period, using however many years of compliance data are available. States omitted from the figure if data on incremental costs are unavailable (CO, IL, MN, MO, NC, NM, NV, OR).

Overall RPS rate impacts may increasingly be driven by solar/DG set-aside costs as targets rise

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

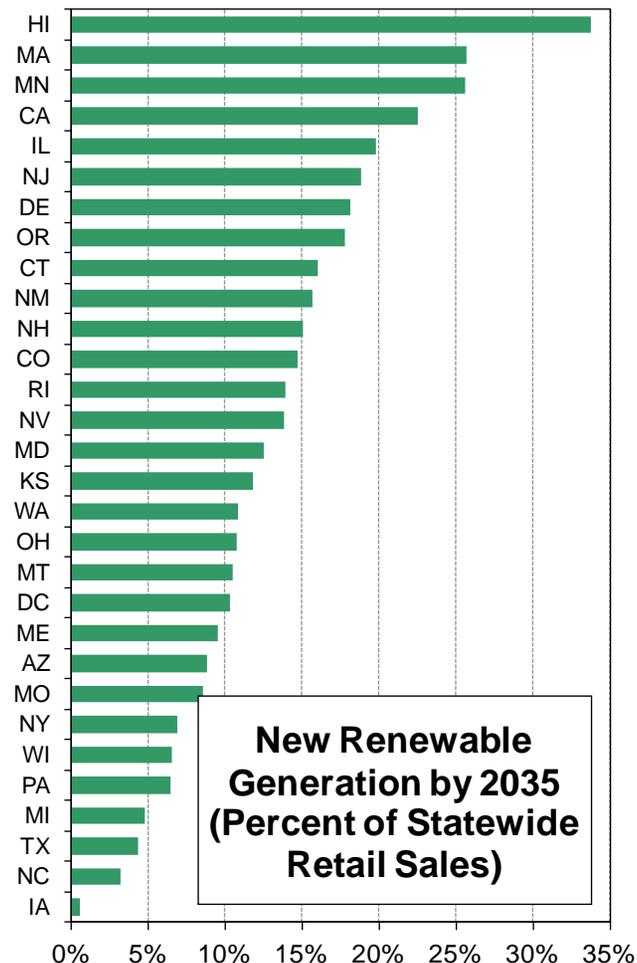
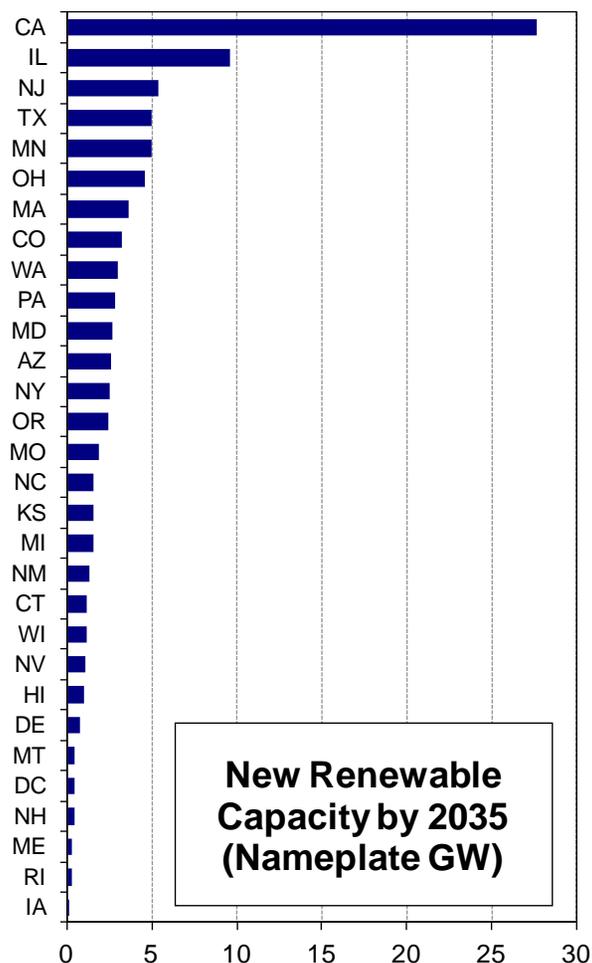
Many states' cost containment mechanisms can be translated into an estimated maximum increase in retail rates



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

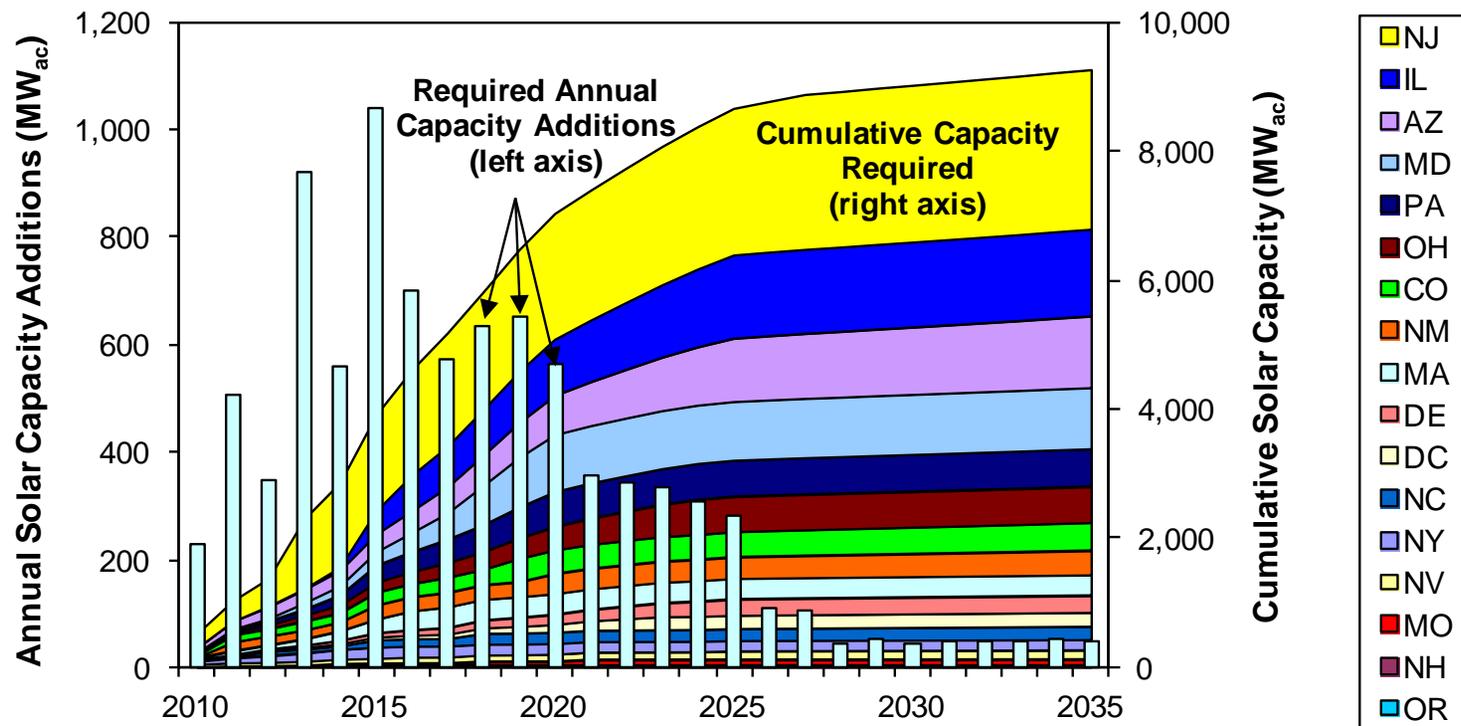
- **94 GW** of “New RE” required by 2035, if full compliance is achieved
- Equates to roughly **3-5 GW/yr** through 2020 and **2-3 GW** through 2035
- By comparison, RPS-driven RE additions have ranged from **6-13 GW/yr** in all but one year since 2008



* 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 **9,300 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 policy issues and barriers affecting RE deployment are addressed (transmission, integration, siting, EPA/environmental regs, net metering, etc.)

Thank You!

For further information:

LBL RPS publications and resources:

rps.lbl.gov

LBL renewable energy publications:

<http://emp.lbl.gov/research-areas/renewable-energy>

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Political and Legal Challenges to RPS Policies Have Been Mounting

- Legislation to repeal, reduce, delay, or freeze RPS targets introduced in many states over the past several years
 - American Legislative Exchange Council (ALEC) developed model legislation to repeal state RPS laws
 - None of those bills have thus far passed
- Other legislation has sought revisions that would “weaken” RPS policies (e.g., by expanding eligibility for large/existing hydro)
- Legal issues also raised in court cases & regulatory proceedings
 - Commerce Clause issues, often tied to geographic eligibility rules (MA, MI, CO, CA, MO, MN)
 - Challenges to the jurisdictional authority of the PUC to enact an RPS (AZ)

Given Uncertainty in Future Costs, Cost Caps of Various Designs are Common

- 1) ACP with automatic cost recovery: MA, ME, NH, NJ, RI
- 2) ACP with possible cost recovery: DC, DE, MD, OR
- 3) Retail rate / revenue requirement cap: CO, KS, IL, MD, MO, NM, OH, OR, WA
- 4) Renewable energy contract price cap: MT, NM
- 5) Per-customer cost cap: MI, NC, NM
- 6) Renewable energy fund cap: NY
- 7) Financial penalty may serve as cost cap: CT, HI, OH, PA, TX

Emerging cost-containment issues

- Standardizing definitions and methodologies
 - How to define net costs (Costs/benefits to whom? What benefits to “net” out? What costs to count?)
 - Data availability and transparency
 - Calculating incremental costs with bundled RE contracts
- Drivers for RPS costs going forward
 - Growth in RPS targets (set-aside targets especially)
 - RE technology costs
 - Gas prices