Renewables Portfolio Standards in the United States:
A Status Update

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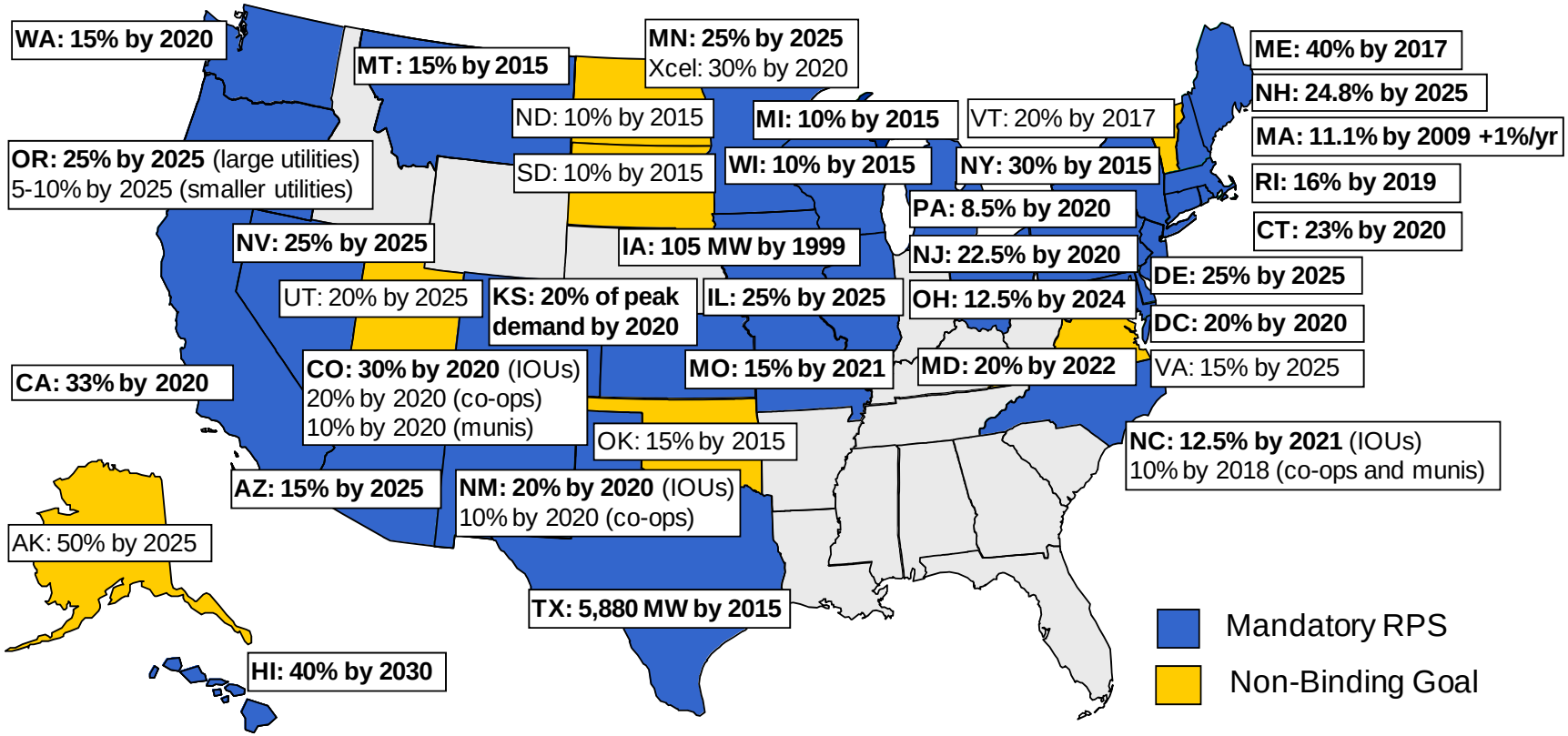
Summary of State RPS Experience-to-Date

- State RPS policies have been a significant driver for renewable energy growth in the United States and have 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 RE capacity is required to meet future RPS targets, but well in-line with pace of RE additions in recent years
- REC prices historically quite volatile and lack of long-term contracting creates challenges for market stability and project financing

RPS Policies Exist in 29 States and D.C.
7 More States Have Non-Binding Goals

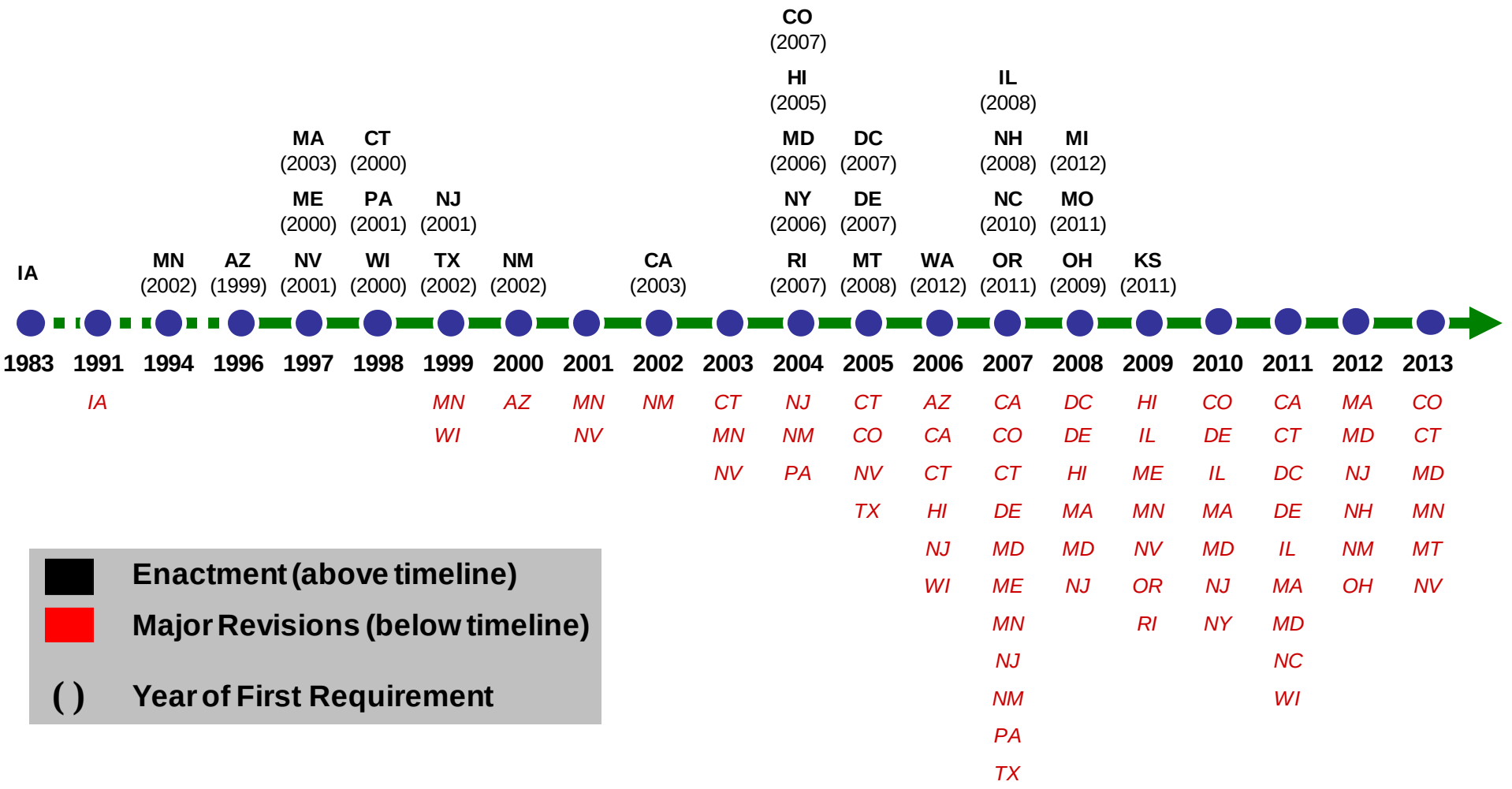
Existing State RPS Policies Apply to **55%** of Total U.S. Retail Electricity Sales in 2012



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 Is Waning, But States Continue to Hone Existing Policies

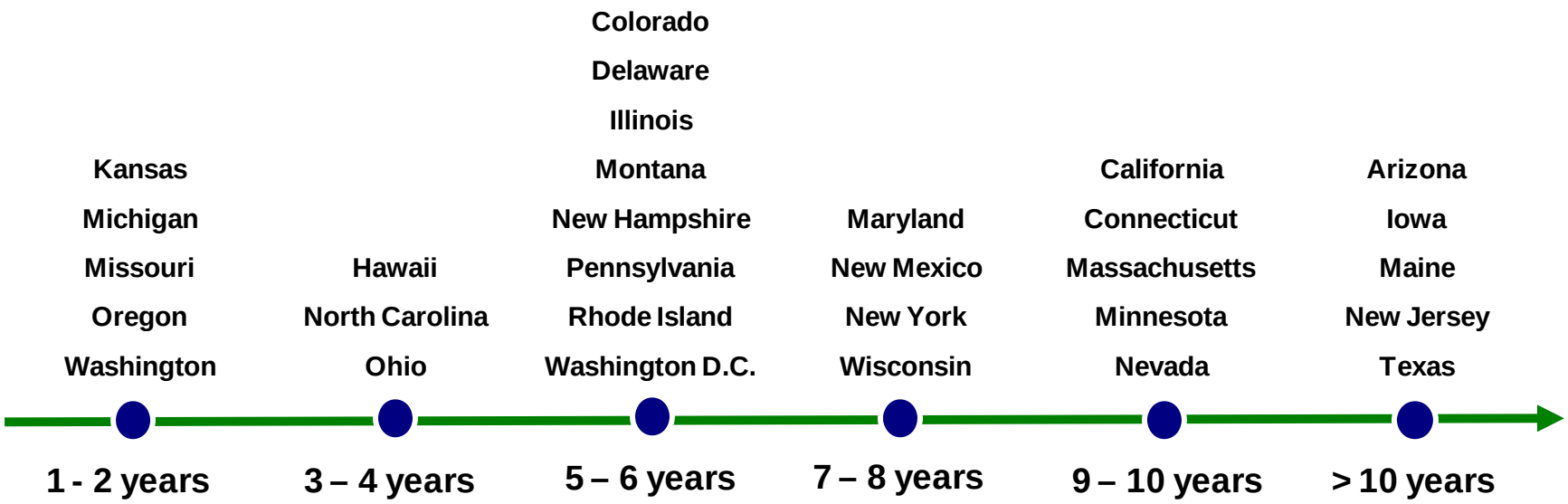


Political and Legal Challenges to RPS Policies Have Been Mounting

- 2013 legislation introduced in 6 states to repeal, reduce, delay, or freeze RPS targets
  - None of those bills have thus far passed
  - American Legislative Exchange Council (ALEC) has developed model legislation to repeal state RPS laws
  - 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)
  - Challenges to the jurisdictional authority of the PUC to enact an RPS (AZ)

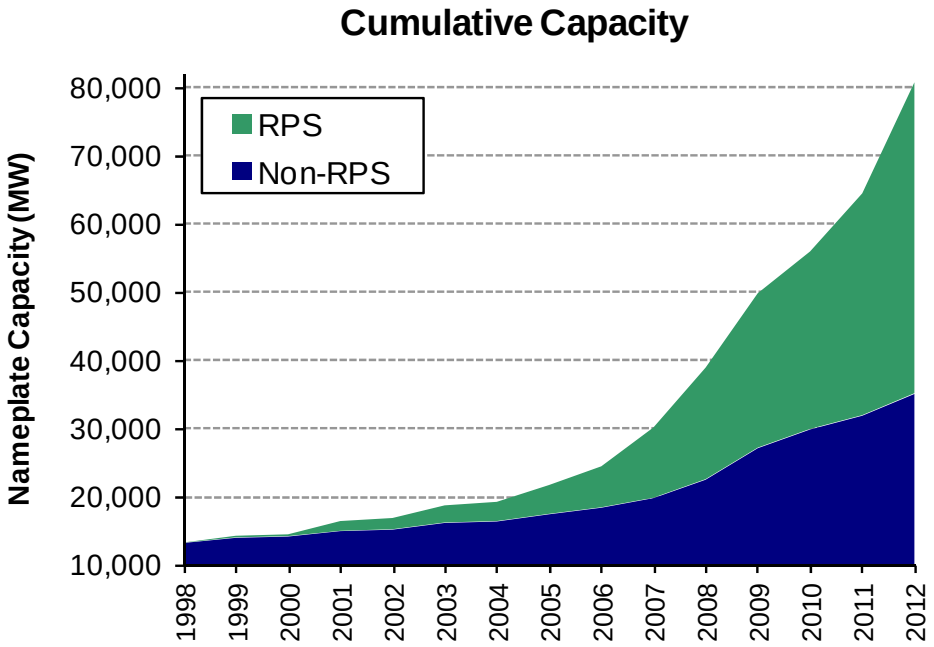
Experience with State RPS Compliance Obligations Varies Widely and is Growing

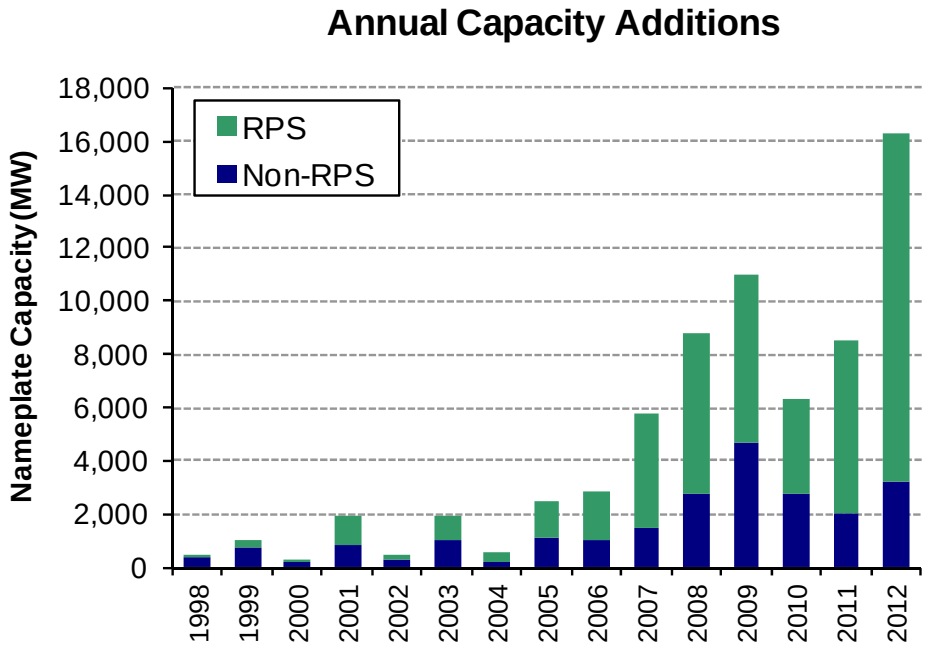
Operational Experience with State RPS Policies
(number of major compliance years completed-to-date)



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



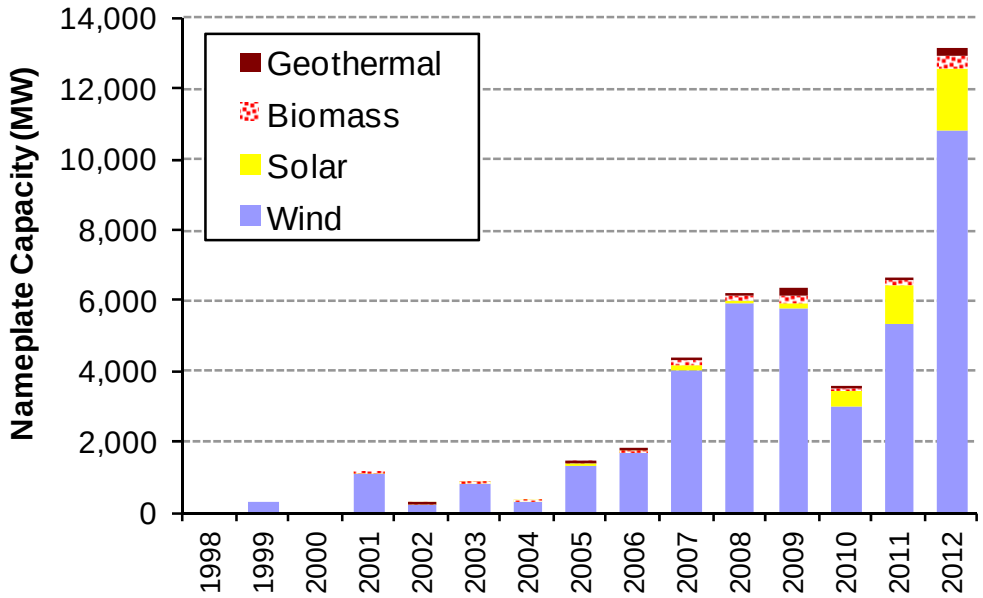


Though not an ideal metric for RPS-impact, **67%** (**46 GW**) of all non-hydro renewable capacity additions from 1998-2012 occurred in states with active/impending RPS compliance obligations

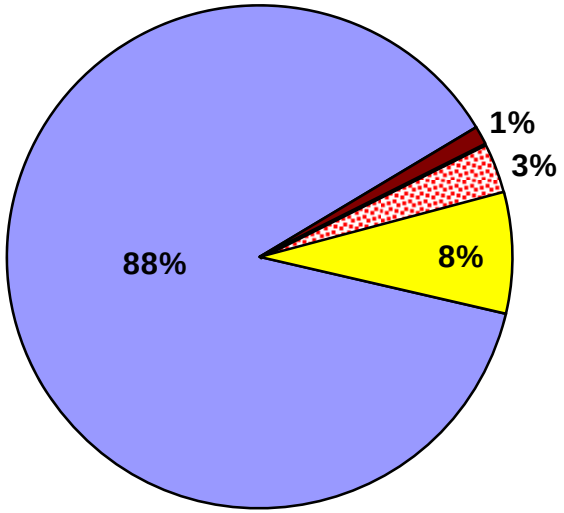
State RPS' Have Largely Supported Wind, Though Solar Has Become More Prominent

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

Annual RPS Capacity Additions



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.*

The Role of Solar in State RPS Programs Is Undergoing an Historical Shift

Technology-neutral RPS policies historically have not provided much impetus for solar due to:

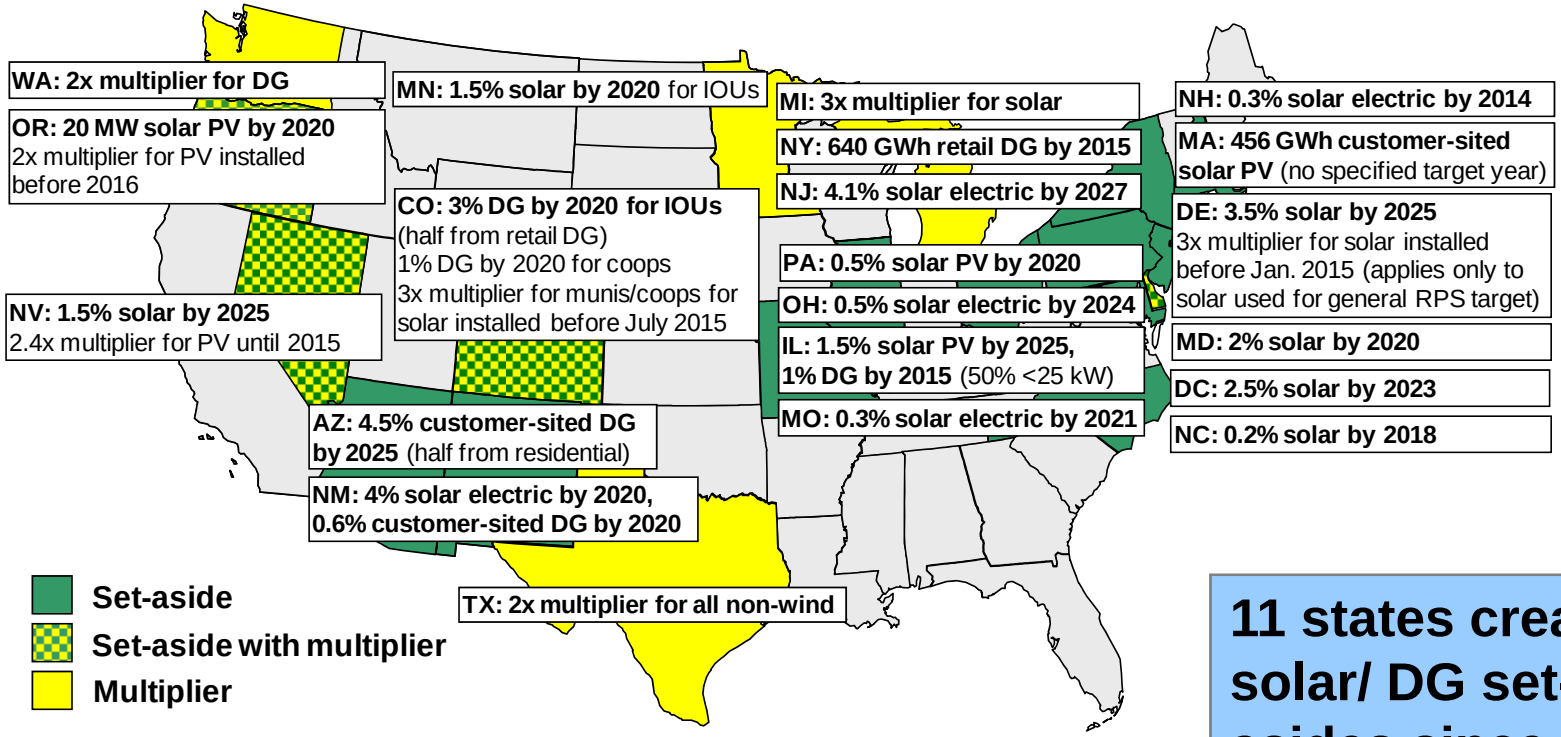
- Cost barriers: only the lowest-cost technologies can compete effectively
- Solicitation barriers: smaller projects not always able to easily participate in competitive solicitations

In recent years & going forward, RPS policies are likely to drive substantial solar additions due to:

- Improved competitiveness of solar relative to other renewables (in large part due to recent PV cost declines)
- Proliferation of solar and DG set-asides

RPS Increasingly Designed to Support Resource Diversity: Most Commonly Solar and DG

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



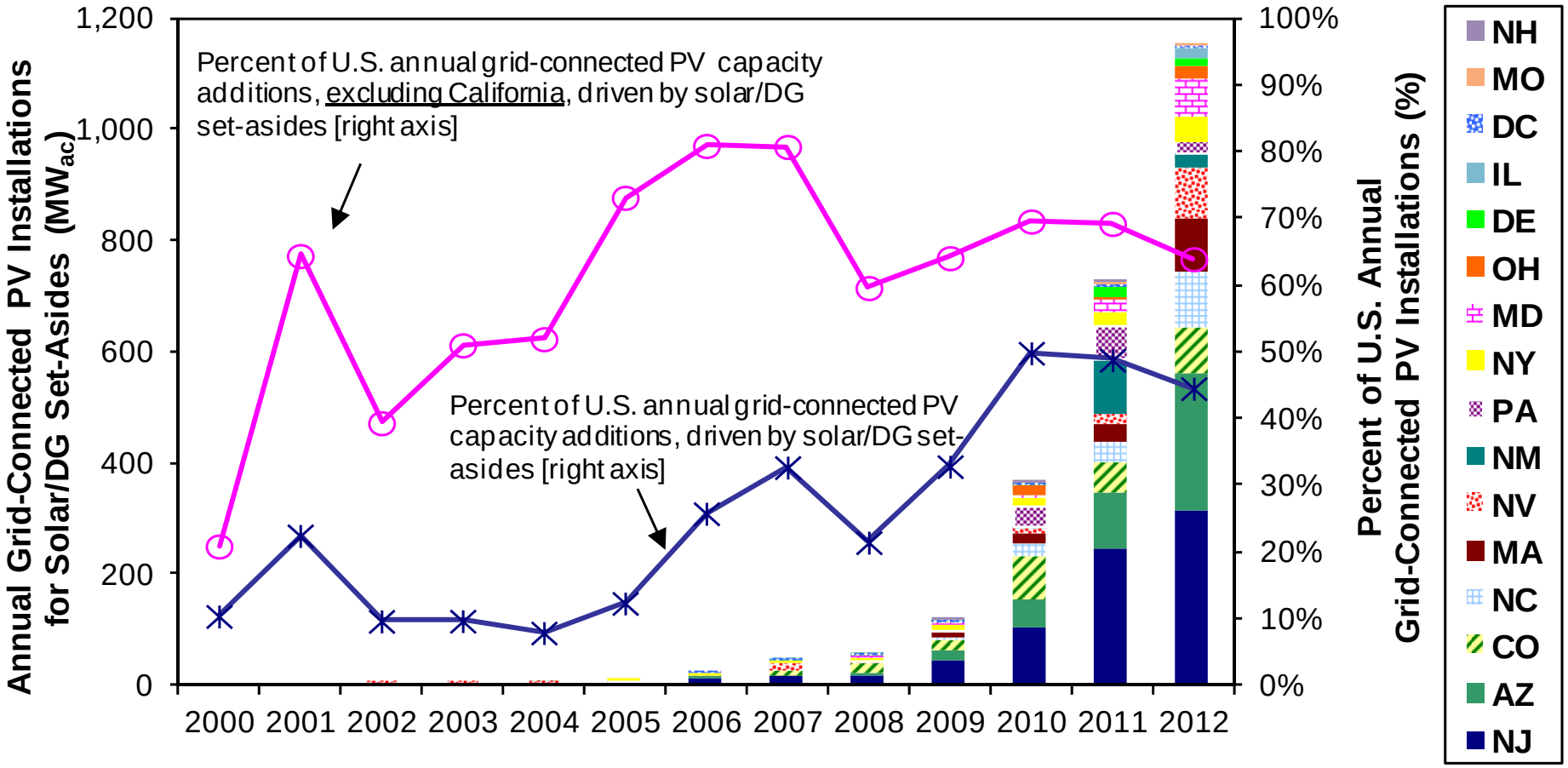
Source: Berkeley Lab

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

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

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

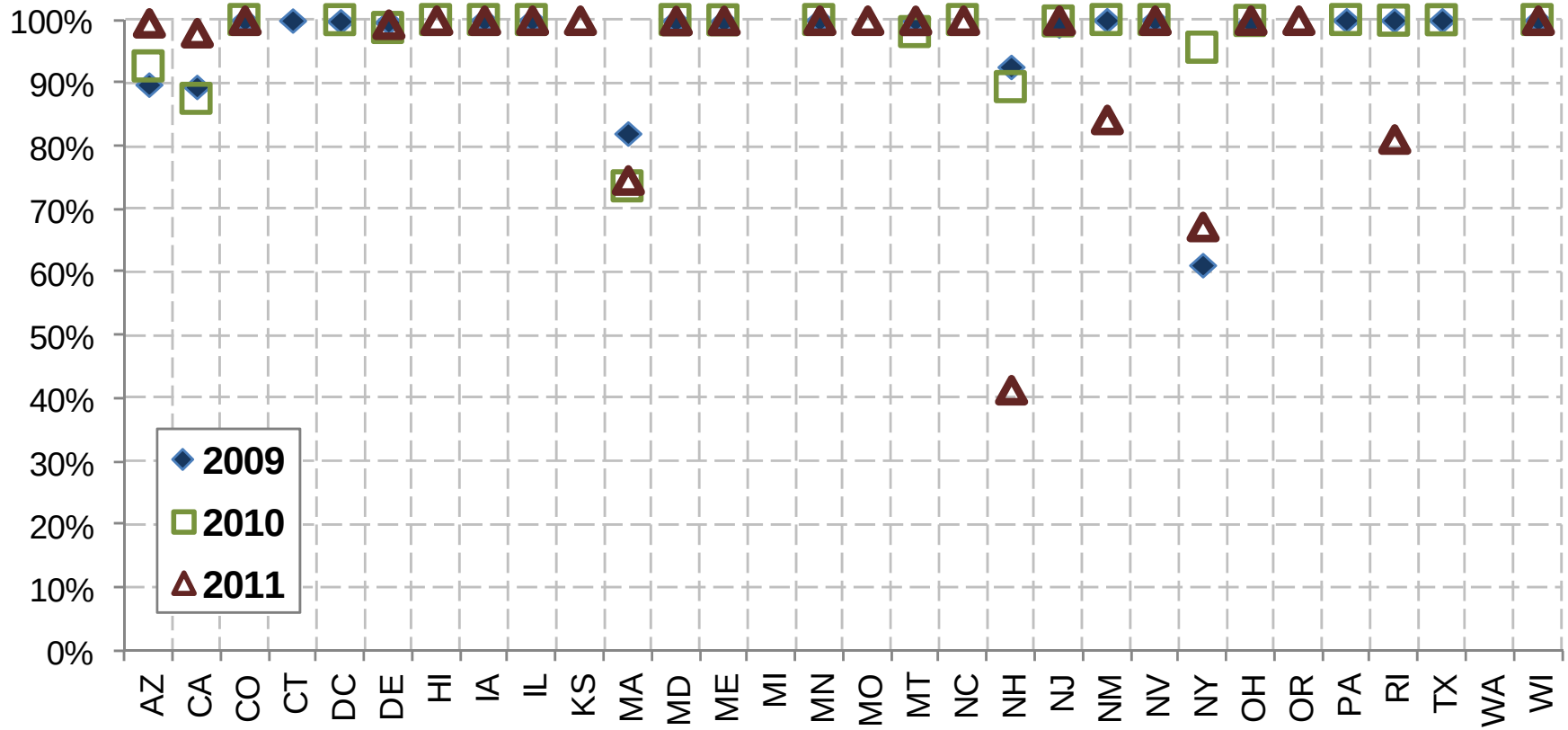
Impact of Solar/DG Set-Asides Is Growing: Drove ~50% of U.S. Solar Additions in 2010-12



Set-asides also benefiting solar-thermal electric (CSP): 1 MW (Arizona) constructed in 2006 and 64 MW (Nevada) in 2007

Targets Largely Met with Renewable Energy or RECs; Isolated Struggles Apparent

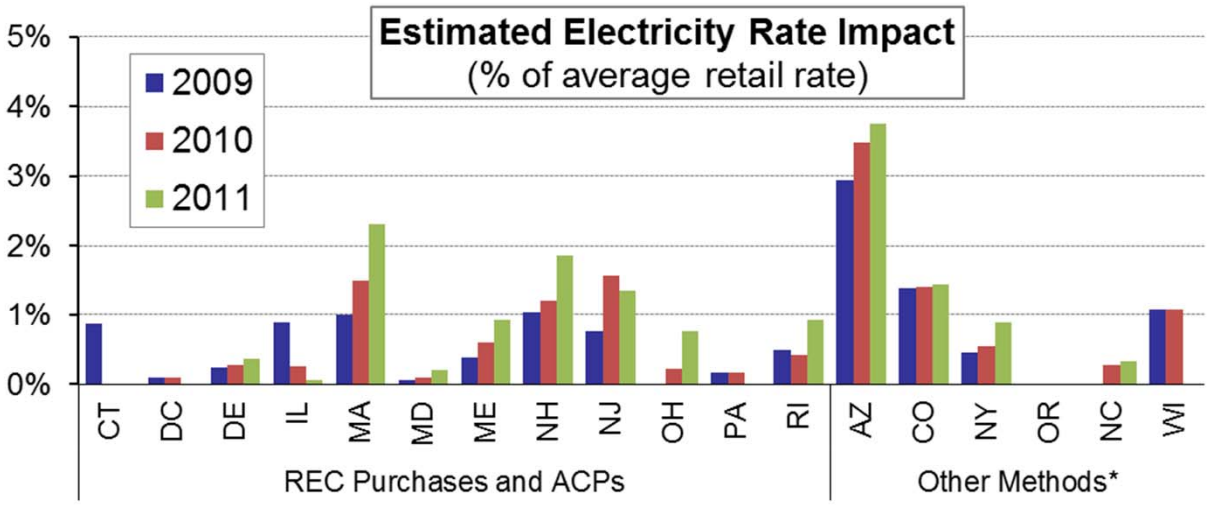
Percent of RPS Target Met with Renewable Electricity or RECs
(including available credit multipliers and banking, but excluding ACPs and borrowing)



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.

RPS Policies Have Generally Resulted in <2% Increase in Electricity Rates So Far

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



** Other Methods include utility-reported incremental costs (AZ, OR), RPS tariff rider collections (CO, NC), approved budget (NY), and PUC analysis (WI). States not included if data on incremental RPS compliance costs are unavailable (CA, IA, HI, KS, MN, MO, MT, NM, NV, TX) or if RPS did not apply in 2009-11 (MI, WA).*

Going forward, compliance costs will be impacted by increasing RPS targets, cost trajectories for wind and solar, and natural gas prices (among other factors)

- Simplified approach ignores some ratepayer costs (e.g., integration) *and* some benefits (e.g., wholesale electricity price suppression)
- Rate impacts differ with target levels, REC prices, presence of set-asides, whether up-front incentives are provided
- Little data on rate impacts for states dominated by bundled contracts

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

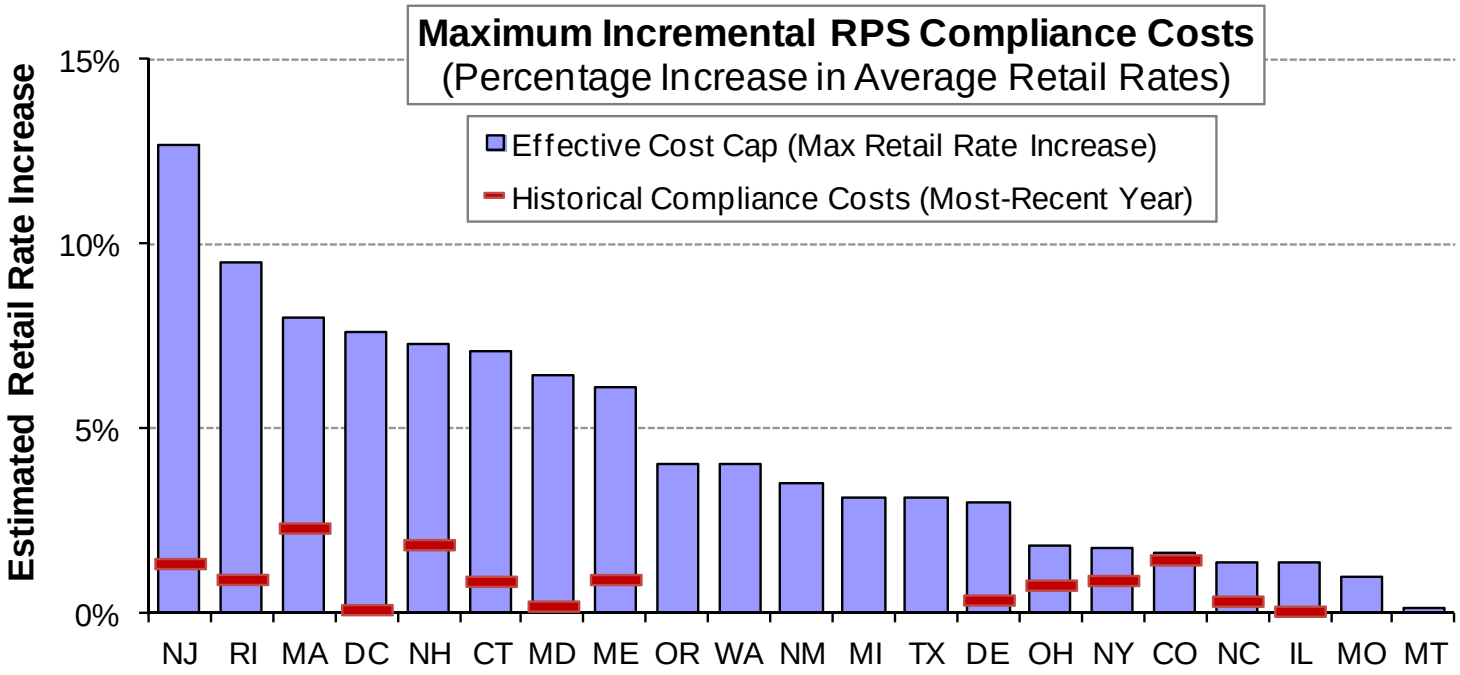
1) **ACP with automatic cost recovery:** MA, ME, NH, NJ, RI
2) **ACP with possible cost recovery:** DC, DE, MD, OR
3) **Retail rate / revenue requirement cap:** CO, KS, IL, MD, MO, NM, OH, OR, WA
4) **Renewable energy contract price cap:** MT, NM
5) **Per-customer cost cap:** MI, NC, NM
6) **Renewable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

Related/emerging cost-containment issues:

- Challenges in calculating "incremental" RPS procurement costs in order to assess whether cap is reached (especially with bundled RE contracts)
- *Force majeure* clauses can often also function as a "safety valve"

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

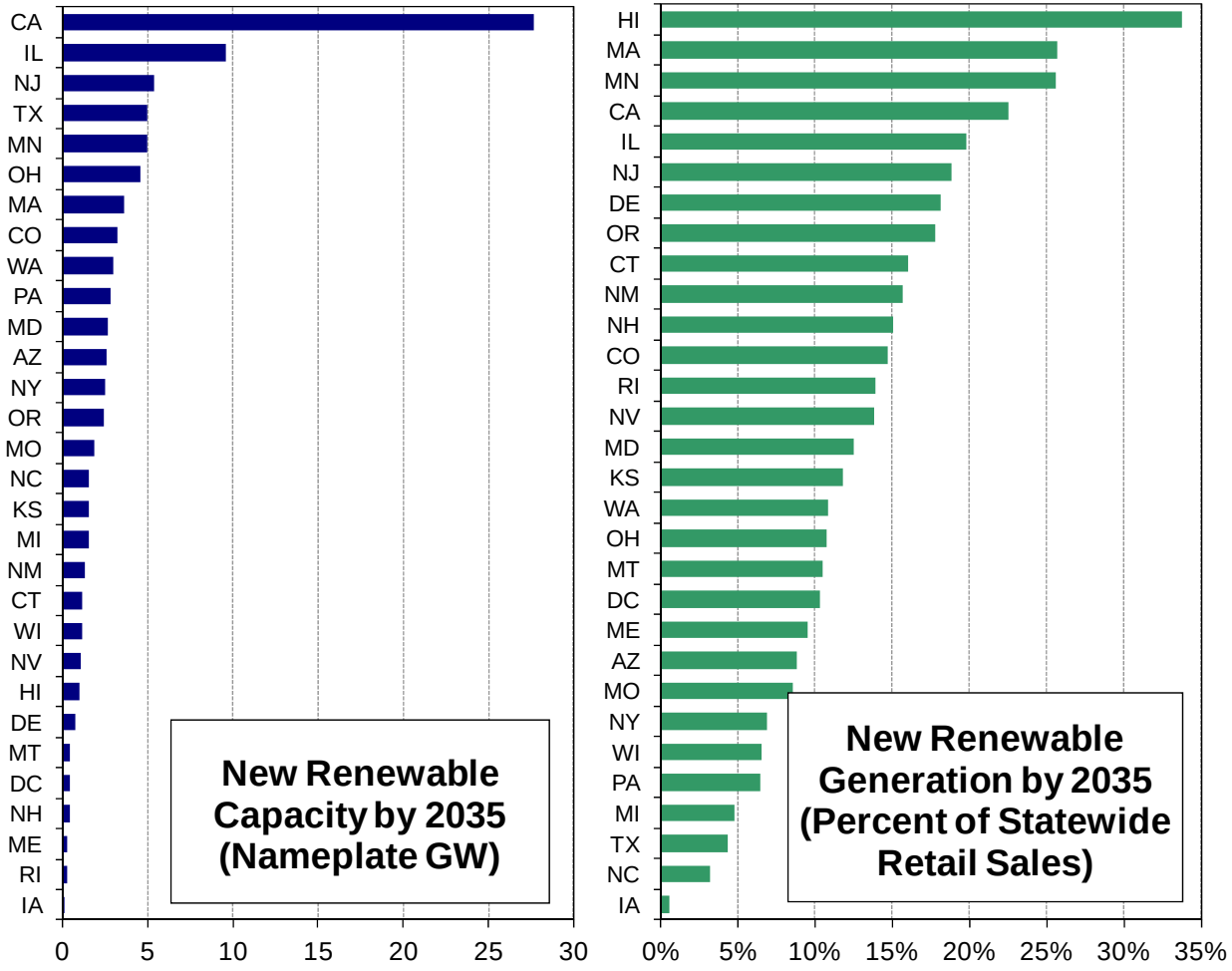
Many states cost containment mechanisms can be translated into an estimated maximum increase in retail rates



- No explicit cap on <u>incremental</u> 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

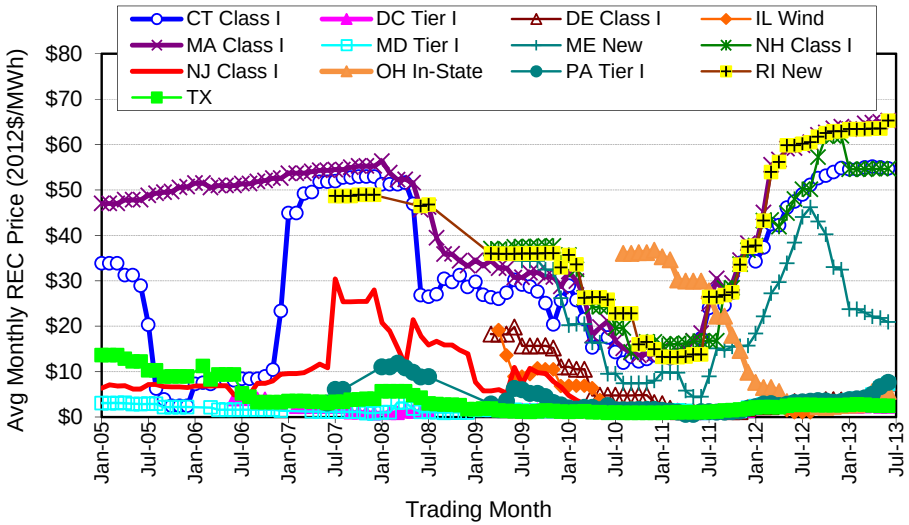


* New RE is defined based on state-specific distinctions between new vs. existing, or based on the year in which the RPS was enacted; it does not represent new renewables relative to current supply

REC Price Volatility and Lack of Long-Term Contracts Creates Financing Challenges

- Compliance in restructured markets largely occurs through short-term REC trade
- REC prices historically volatile & fragmented
- Unpredictable revenue stream challenges project financing
- States have pursued various strategies to mitigate this issue
  - Placing obligations on default providers (DE) or central agent (NY, IL)
  - Long-term contracting programs/requirements (MA, DE, NJ, RI, CT)
  - Price support mechanisms (MA)
  - REC purchases via rebate programs and standard-offer incentives

Main Tier/Class I RECs (spot market prices)



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.

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

- The outcome of ongoing and future legal and legislative challenges
- How policymakers re-tune RPS' in response to changed conditions (RE costs, gas prices, federal tax credits)
- Whether cost caps become binding (which in turn depends upon RE cost trajectories vis-à-vis natural gas)
- Efforts to address challenges associated with volatile REC prices and lack of long term contracting options
- How other related policy issues affecting RE deployment are addressed (transmission, integration, siting, net metering, etc.)

Thank You!

For further information:

LBNL renewable energy publications:
http://emp.lbl.gov/reports/re

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