

Renewables Portfolio Standards in the United States: A Status Update

Galen Barbose

Lawrence Berkeley National Laboratory

2012 National Summit on RPS

Washington D.C.

December 3, 2012

Presentation Outline

- 1) Overview of State RPS Landscape
- 2) Impacts on Renewables Development
- 3) Compliance Experience and Related Issues and Challenges

What Is a Renewables Portfolio Standard?

Renewables Portfolio Standard (RPS):

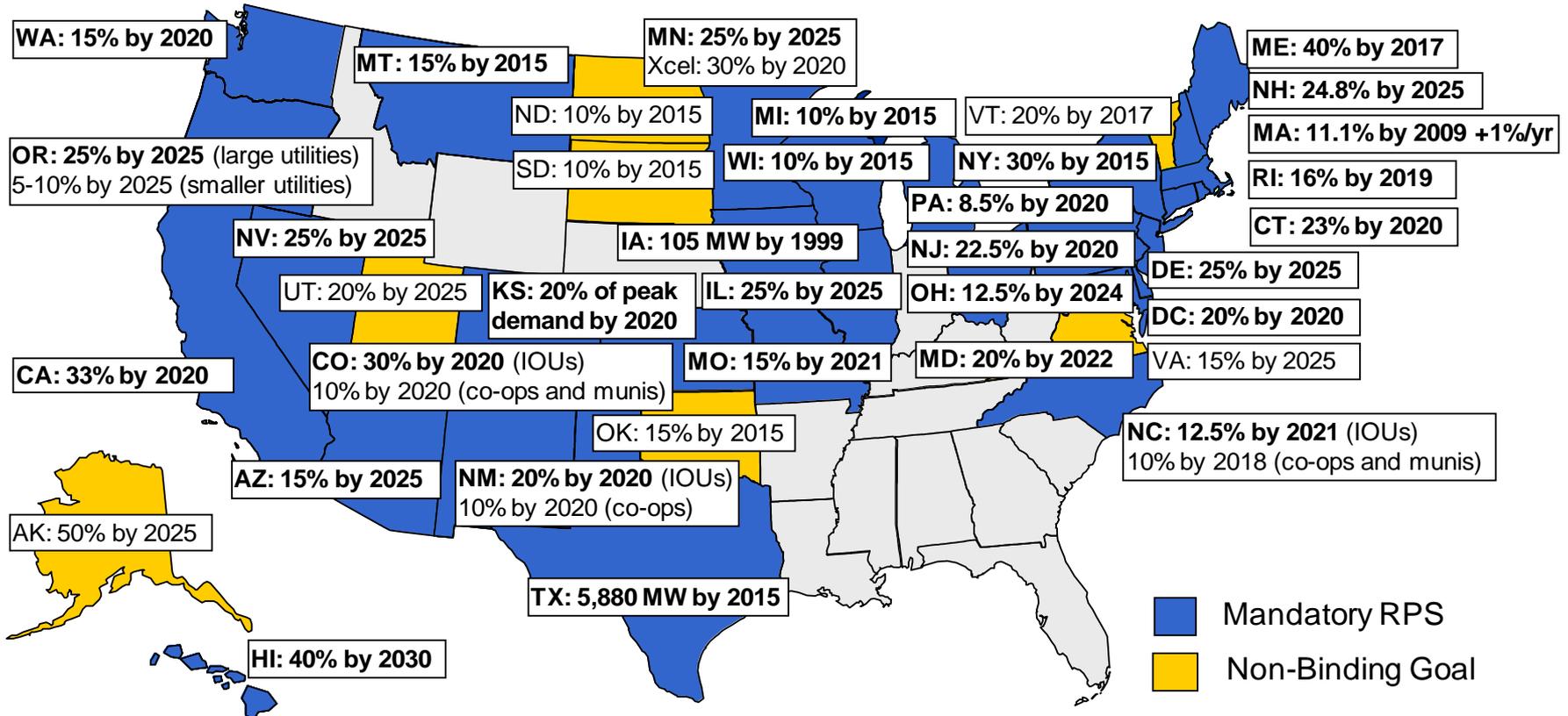
- A requirement on retail electric suppliers...
- to supply a minimum percentage or amount of their retail load...
- with eligible sources of renewable energy.

Typically backed with penalties of some form

Often accompanied by a tradable renewable energy credit (REC) program, to facilitate compliance

Never designed the same in any two states

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



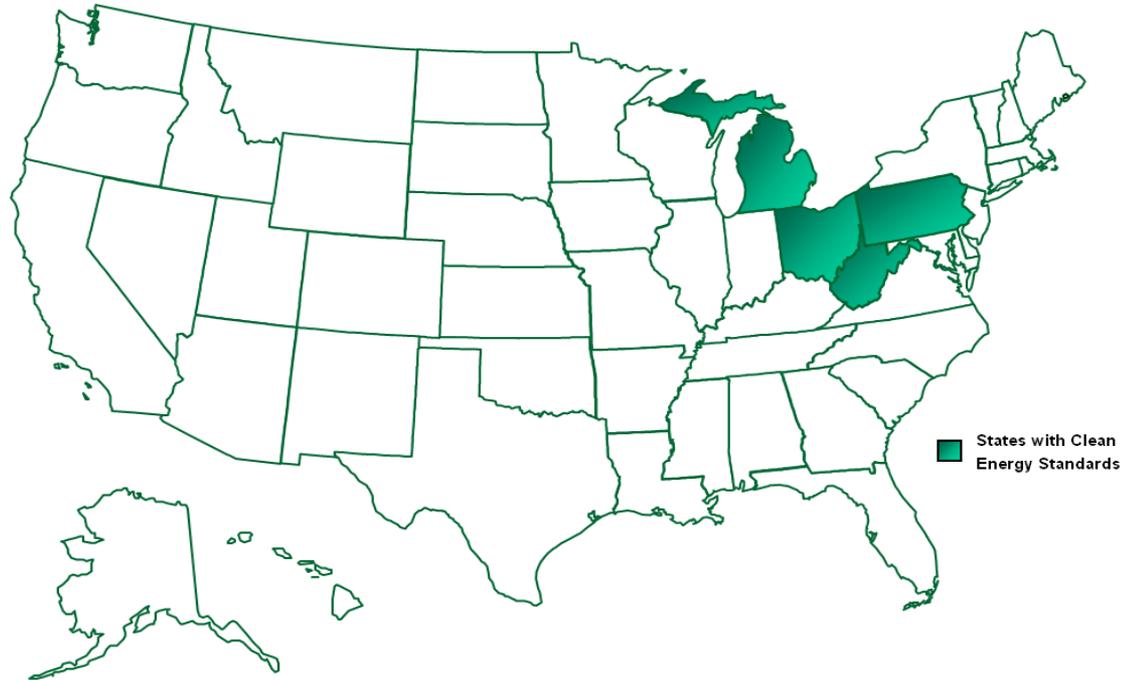
Source: Berkeley Lab

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)

Most policies established through state legislation, but some initially through regulatory action (NY, AZ) or ballot initiatives (CO, MO, WA)

Several States Have Adopted Broader Clean Energy Standards or Efficiency Standards

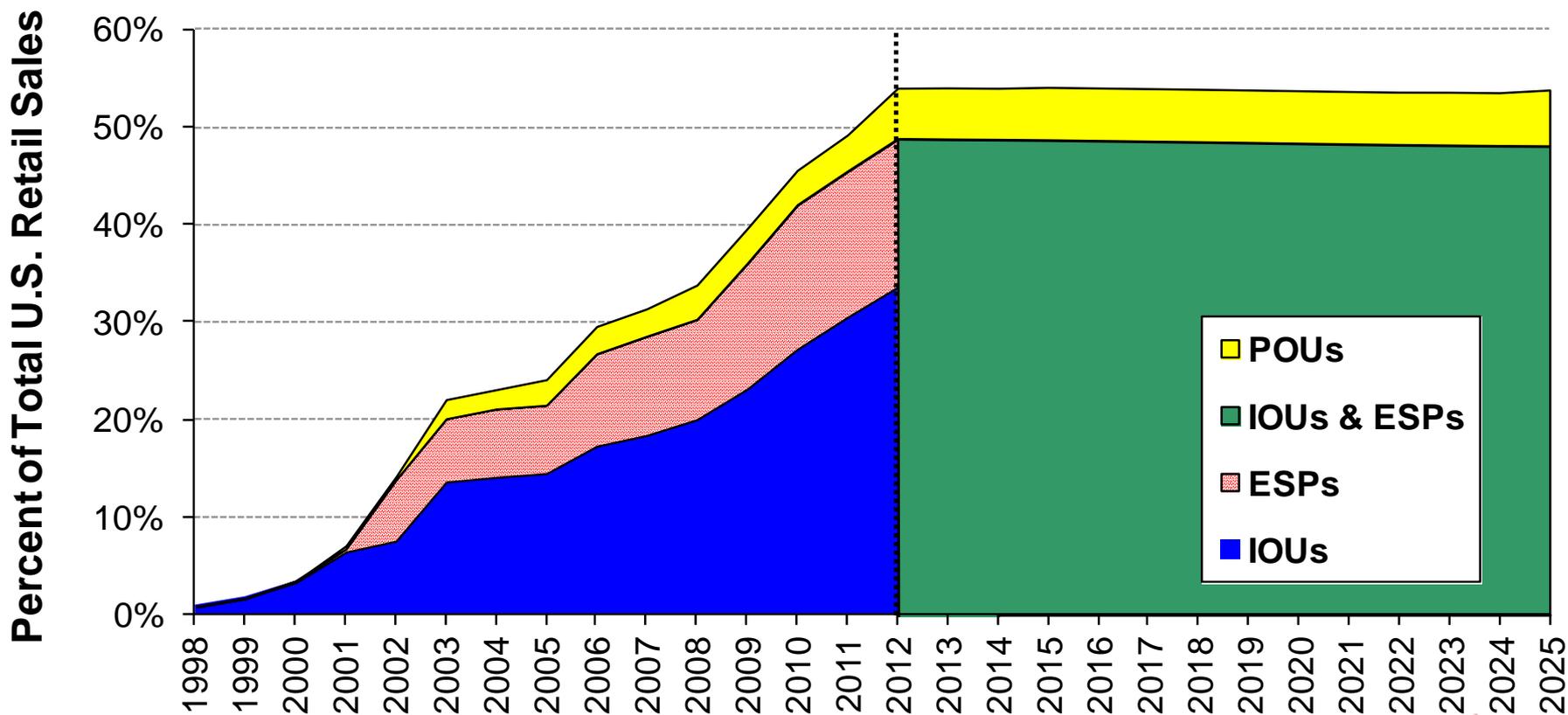
- Clean energy standards (CES') adopted in parallel to RPS (MI, OH, PA) or in lieu of an RPS (WV)
- IN has a voluntary clean energy goal
- Many states have adopted stand-alone energy efficiency (EE) resource standards or allow EE to qualify within an RPS or CES



Source: NREL

Existing RPS' Apply to 54% of Total U.S. Retail Electricity Sales in 2012

U.S. Electrical Load with Active State RPS Obligations (Historical and Projected)

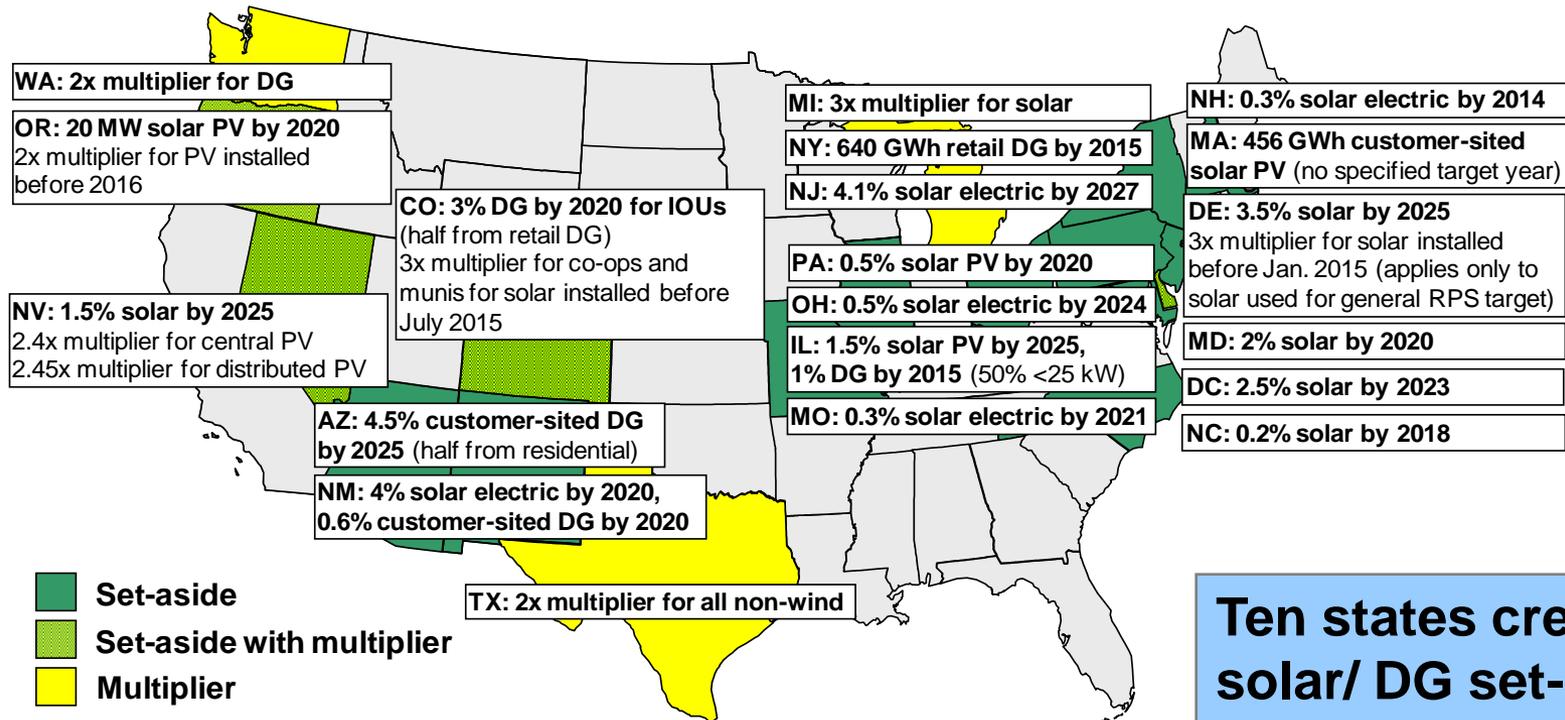


State RPS Policies Feature Significant Design Differences

- Renewable purchase targets and timeframes
- Entities obligated to meet RPS, and use of exemptions
- Eligibility of different renewable technologies
- Whether existing renewable projects qualify
- Treatment of out-of-state generators
- Whether technology set-asides or other tiers are used
- Use of credit multipliers for favored technologies
- Allowance for RECs, and REC definitions
- Methods to enforce compliance
- Existence and design of cost caps
- Compliance flexibility rules, and waivers from compliance
- Contracting requirements and degree of regulatory oversight
- Compliance filing and approval requirements
- Compliance cost recovery
- Role of state funding mechanisms

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

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



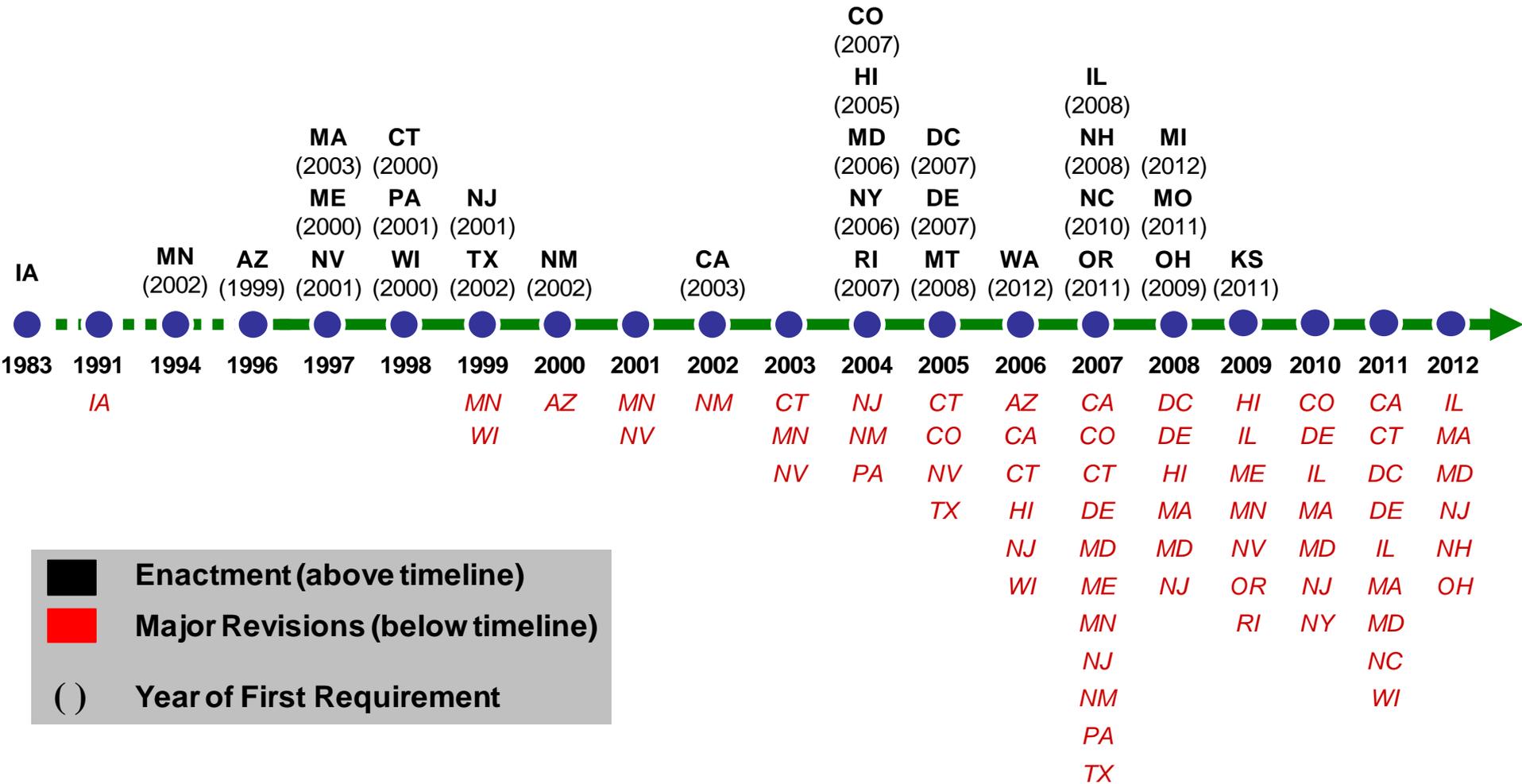
Source: Berkeley Lab

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

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

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

Enactment of New RPS Policies Is Waning, But States Continue to Hone Existing Policies



State-Specific RPS Developments (2011-2012)

- CA: Increased/extended RPS to 33% by 2020 with specified limits on unbundled RECs and firmed/shaped products
- CT: Introduced long-term REC contracting program for small renewables
- DC: Increased solar set-aside; adopted declining SACP schedule; restricted solar set-aside eligibility to projects <5 MW connected to DC distribution system
- DE: Transferred compliance obligation to regulated distribution service provider; created long-term SREC contracting program
- IL: Created DG set-aside with procurement by IPA under multi-year contracts
- MA: Adopted 10-year declining SACP schedule with 5% annual reductions, and tightened biomass eligibility rules
- MD: Accelerated solar set-aside, and expanded solar set-aside eligibility to include solar water heating; expanded Tier 1 eligibility to include waste-to-energy and several others
- NC: Expanded eligibility to include direct load control/demand response
- NJ: Accelerated solar set-aside; established 15-year SACP schedule; extended SREC lifetime
- NH: Created carve-out for thermal energy resources; reduced Class I targets while increasing targets for Class III and IV; reduced ACPs for most tiers; loosened Class I eligibility rules
- OH: Expanded eligibility to include waste energy recovery and several specific cogeneration plants
- WI: Expanded eligibility to include new large hydropower

General Trends in Recent RPS Revisions

- Expanding resource eligibility (waste-to-energy, hydropower, biomass co-firing, solar thermal)
- Increased stringency of RPS purchase targets (though momentum has slowed)
- Adoption of resource-specific set-asides (though momentum there has also slowed)
- Honing solar set-aside provisions
 - Eligibility rules (size, location, etc.)
 - SACP schedules
 - Contracting mechanisms
- Efforts to address REC oversupply/volatility (especially SRECs – e.g., by accelerating or increasing targets)

Political and Legal Challenges to RPS Policies Have Been Mounting

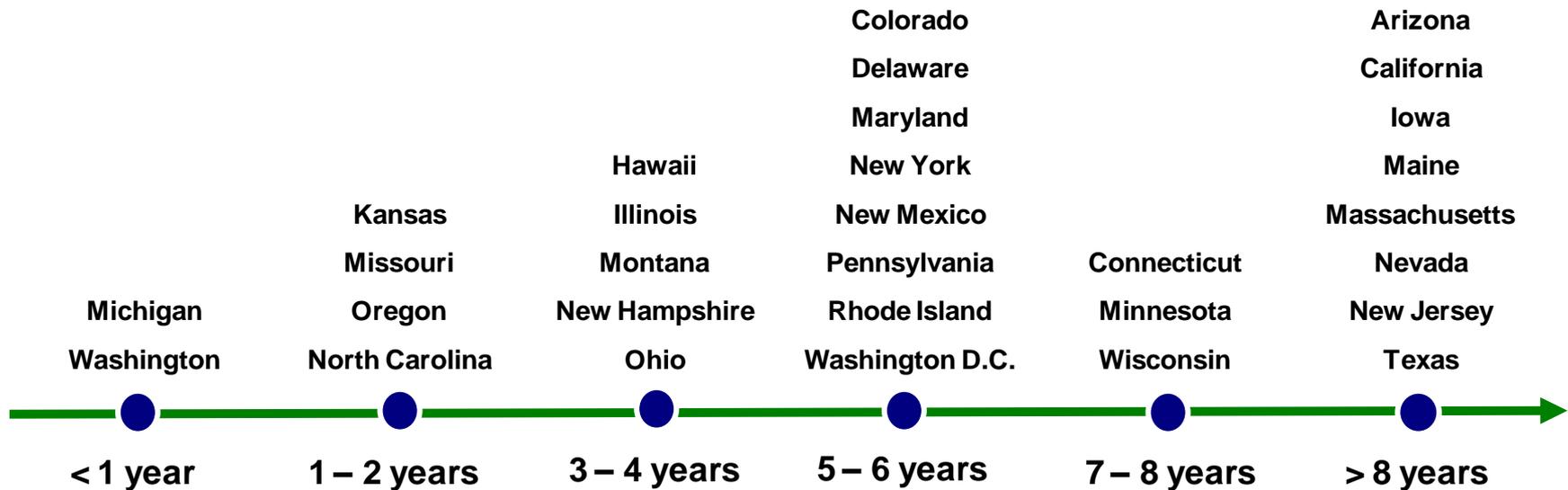
- Legislation in roughly ten states was introduced in 2011-2012 to repeal or roll-back RPS policies
 - None of these efforts have succeeded to-date
- While other legislation has sought revisions that may result in a “weakening” RPS policies
 - E.g., by expanding eligibility, reducing ACPs
- Legal issues have also been raised in court cases and regulatory proceedings
 - Commerce Clause issues, often tied to geographic eligibility rules (MA, CO, CA, MO)
 - Challenges to the jurisdictional authority of the PUC to enact an RPS (AZ)

Presentation Outline

- 1) Overview of State RPS Landscape
- 2) Impacts on Renewables Development**
- 3) Compliance Experience and Related Issues and Challenges

Experience with State RPS Compliance Obligations is Growing

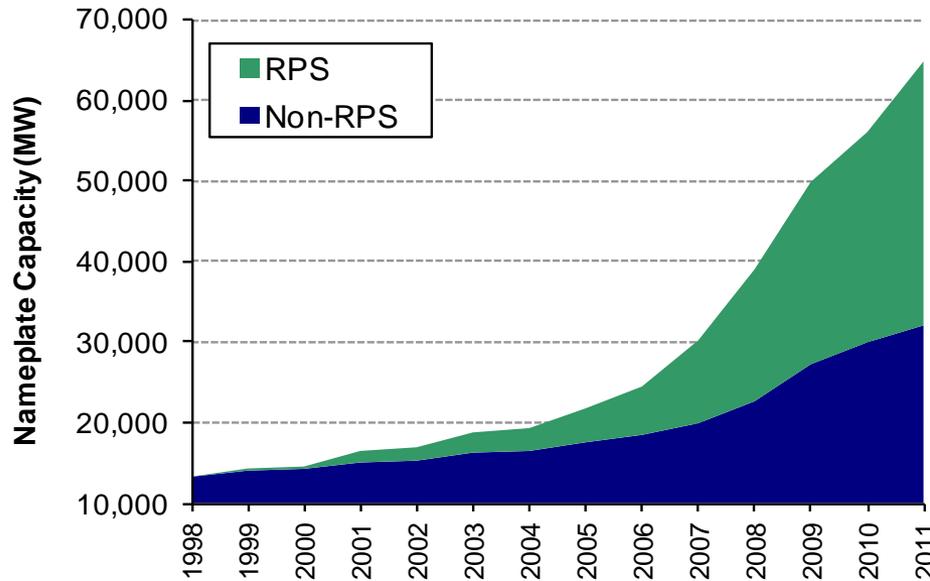
Operational Experience with State RPS Policies (number of major compliance years completed-to-date)



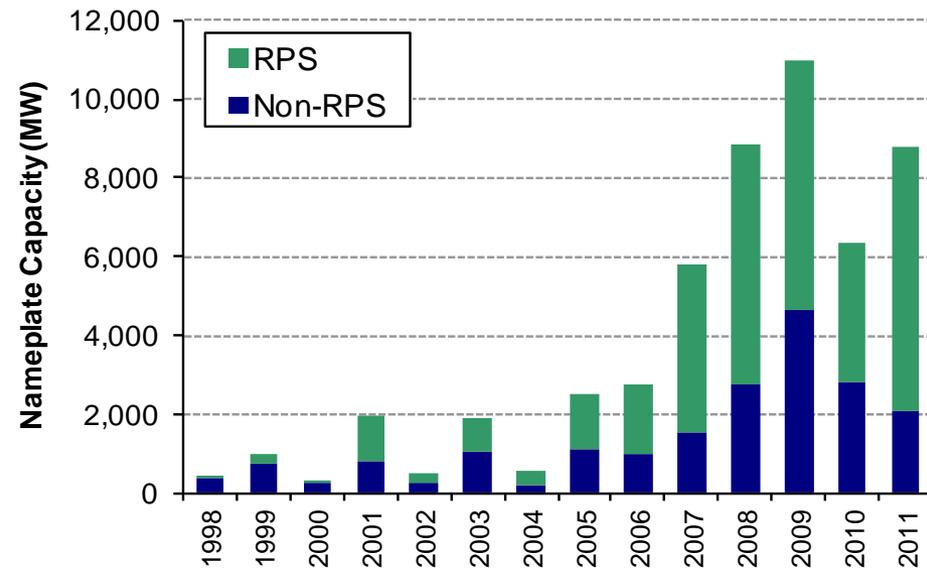
State RPS Policies Appear to Be Motivating Substantial Renewable Capacity Development

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

Cumulative Capacity



Annual Capacity Additions

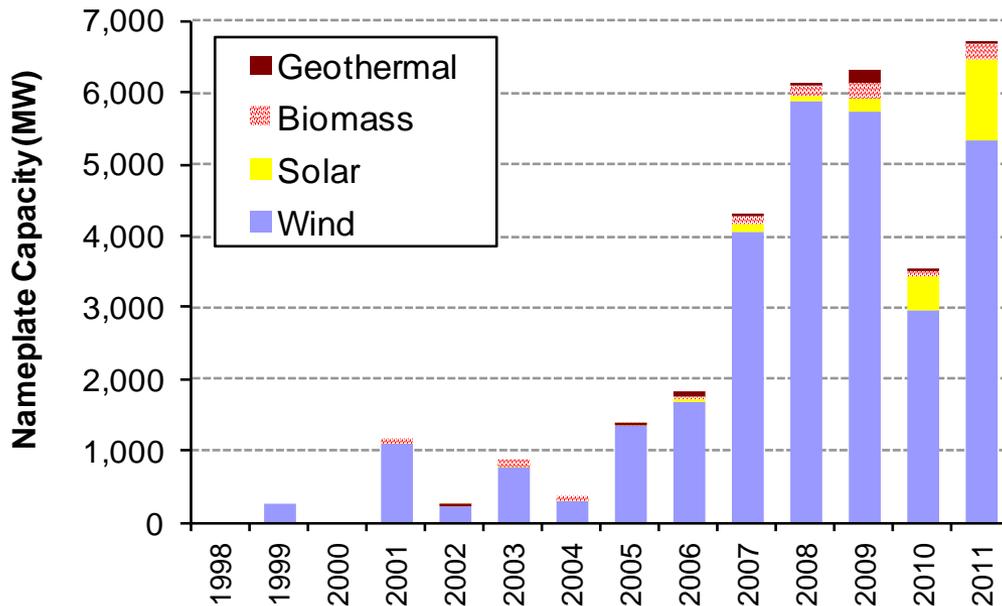


Though not an ideal metric for RPS-impact, 63% of the 53 GW of non-hydro renewable additions from 1998-2011 (**33 GW**) occurred in states with active/impending RPS compliance obligations

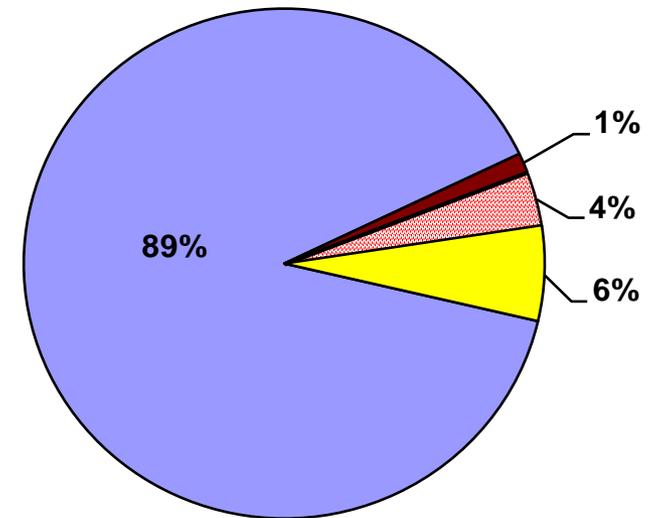
State RPS' Have Largely Supported Wind, Though Solar Has Become More Prominent

RPS-Motivated* Renewable Energy Capacity Additions from 1998-2011, by Technology Type

Annual RPS Capacity Additions



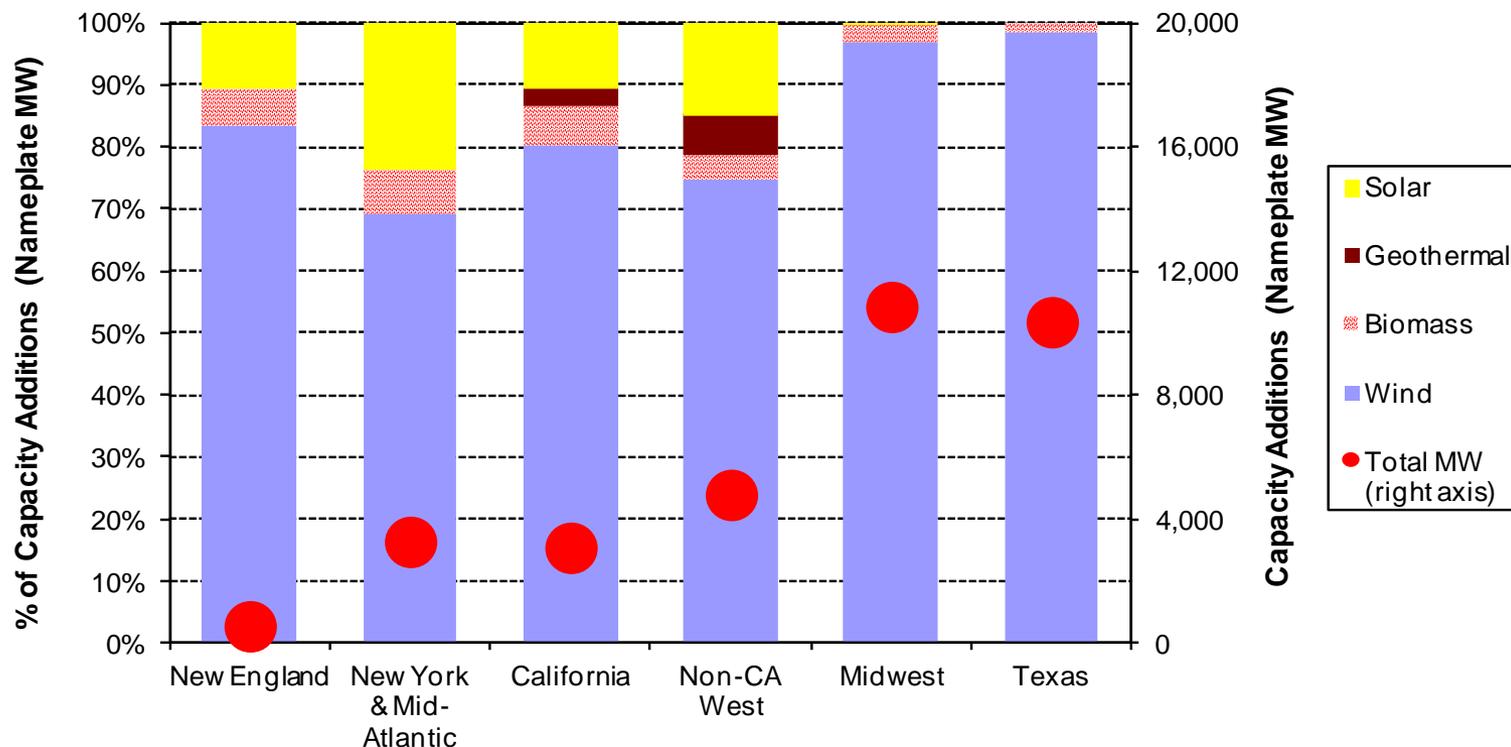
Cumulative RPS Capacity Additions (1998-2011)



* 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 86%, biomass 8%, geothermal 3%, and solar 3% of cumulative RPS-motivated renewable energy additions from 1998-2011, if estimated based on assumed capacity factors.

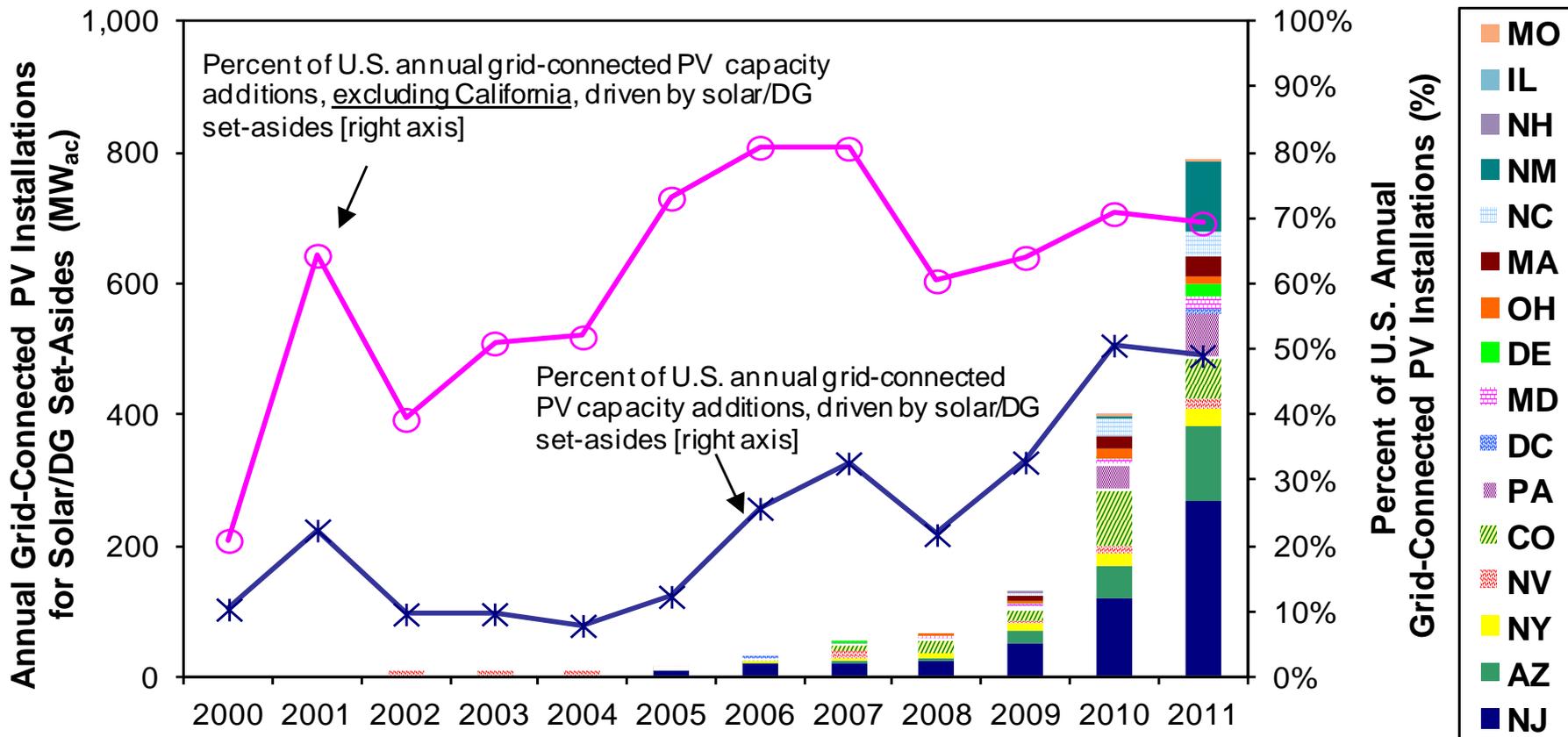
RPS Resource Diversity Is Greater in Some Regions, but Still Remains Limited

RPS-Motivated* Renewable Energy Capacity Additions from 1998-2011, 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: 1,500 MW_{ac} PV from 2000-2011



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

Solar Becoming An Increasingly Competitive Resource for General RPS Obligations

Wind facing increased competition in California from solar; same is true elsewhere in SW and, to a lesser extent, in other regions

Increased competition driven by price reductions for utility-scale solar, as well as by relative ease of siting and delivery

More than 20 GW of contracts with new renewable generators signed in California since 2002*

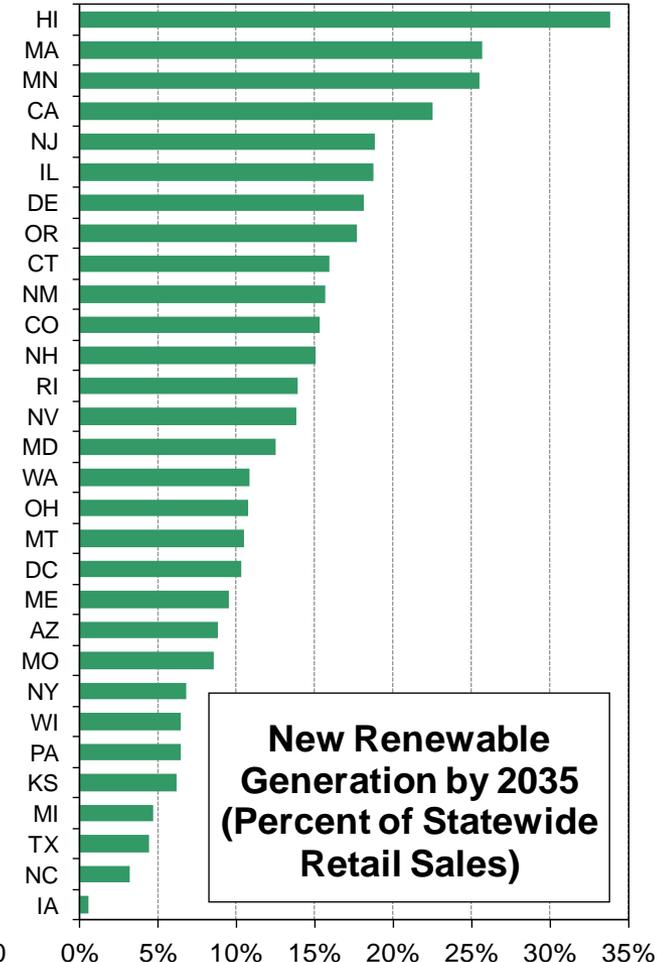
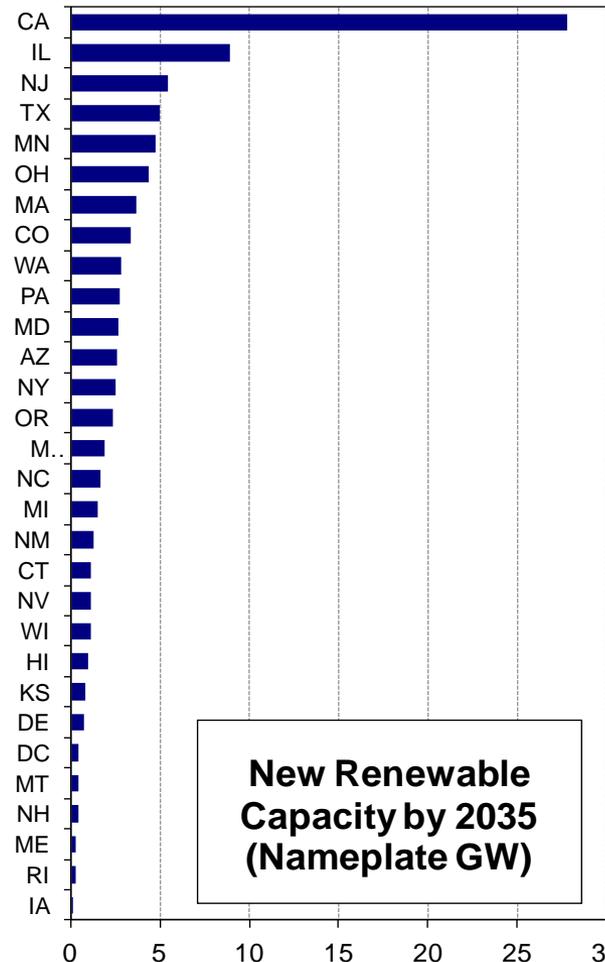
Wind	46%
Solar	49%
Geothermal	1%
Biomass/MSW	3%
Small hydro	<1%

**Based on CPUC RPS contract database for IOUs and analysis of contract announcements by POUs*

Future Impacts of Existing RPS Policies Are Projected To Be Relatively Sizable

~93 GW of new* RE by 2035, if full compliance is achieved
(**102 GW** including voluntary goals)

6% of projected generation in 2035;
32% of projected load growth from 2000-2035



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

State RPS, and Proposed Federal RPS, Require Fewer RE Additions than Experienced in 2008-11

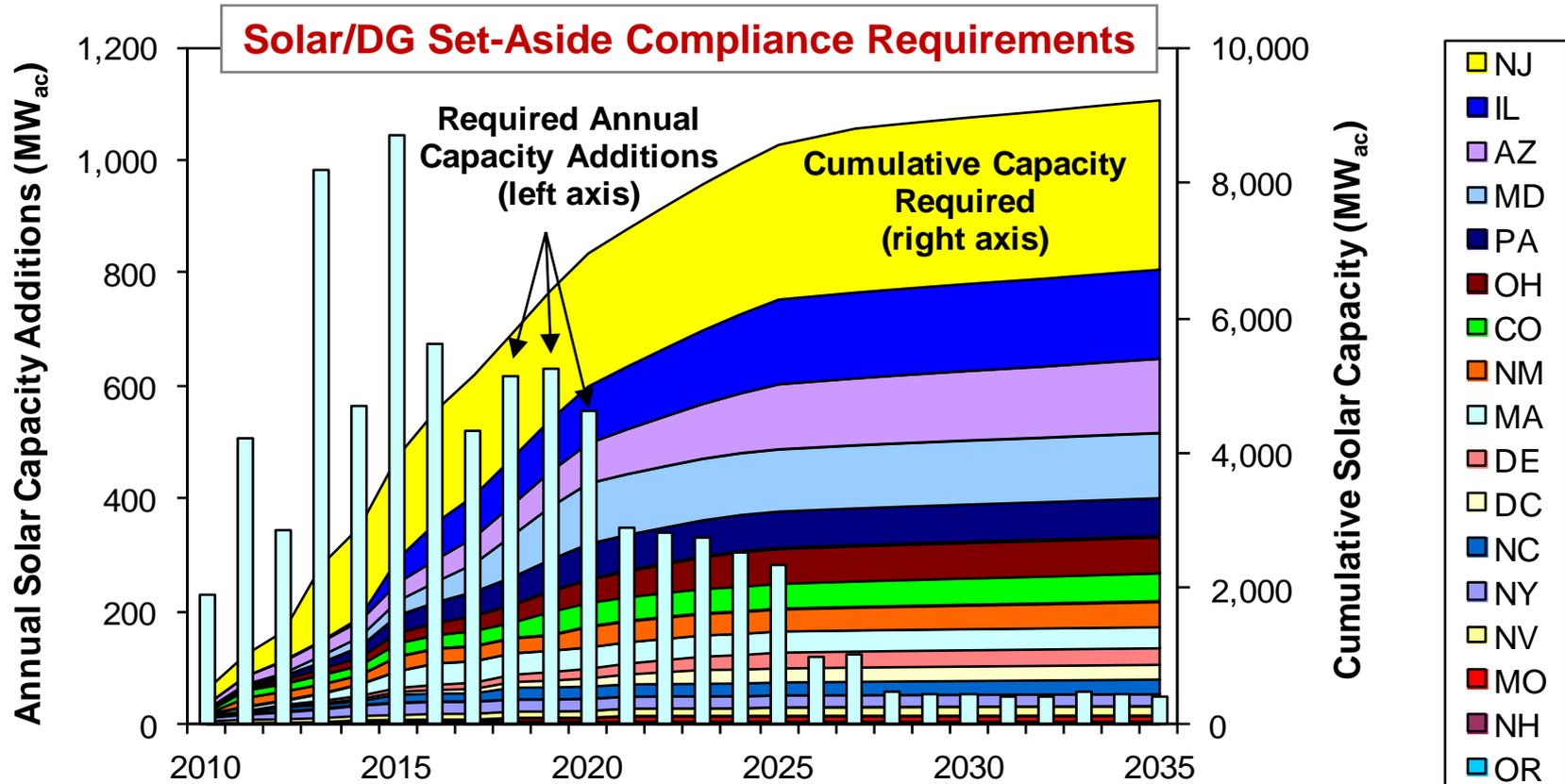
Recent RE capacity additions vs. RE additions required to meet current state RPS policies and proposed Federal RPS

Recent Renewable Capacity Additions (2008-2011)	6-11 GW/yr
Average Annual Renewable Capacity Additions (2012-2020)	
State RPS Requirements	4-5 GW/yr
Proposed Federal RPS (Bingaman 2010) + State RPS	4-11 GW/yr

- ➔ Continued growth at 2008-11 rate exceeds level required to meet state RPS'; would be sufficient to meet the most recent Federal RPS proposal
- ➔ Federal clean energy standards (CES) could yield more or less RE capacity than historical growth, depending on the specific proposal
- ➔ New/increased state RPS policies appear less likely going forward in near term (policy weakening possible)
- ➔ Demand from non-RPS markets (green power, IRP, least cost) needed to maintain 2008-11 installation rate

Future Impacts of Solar/DG Set-Asides Are Also Projected To Be Substantial

- Cumulative capacity requirement grows to **8,500 MW** by **2025**
- Required average annual solar capacity additions of **750 MW/yr** from 2012-15, **450 MW/yr** from 2016-25

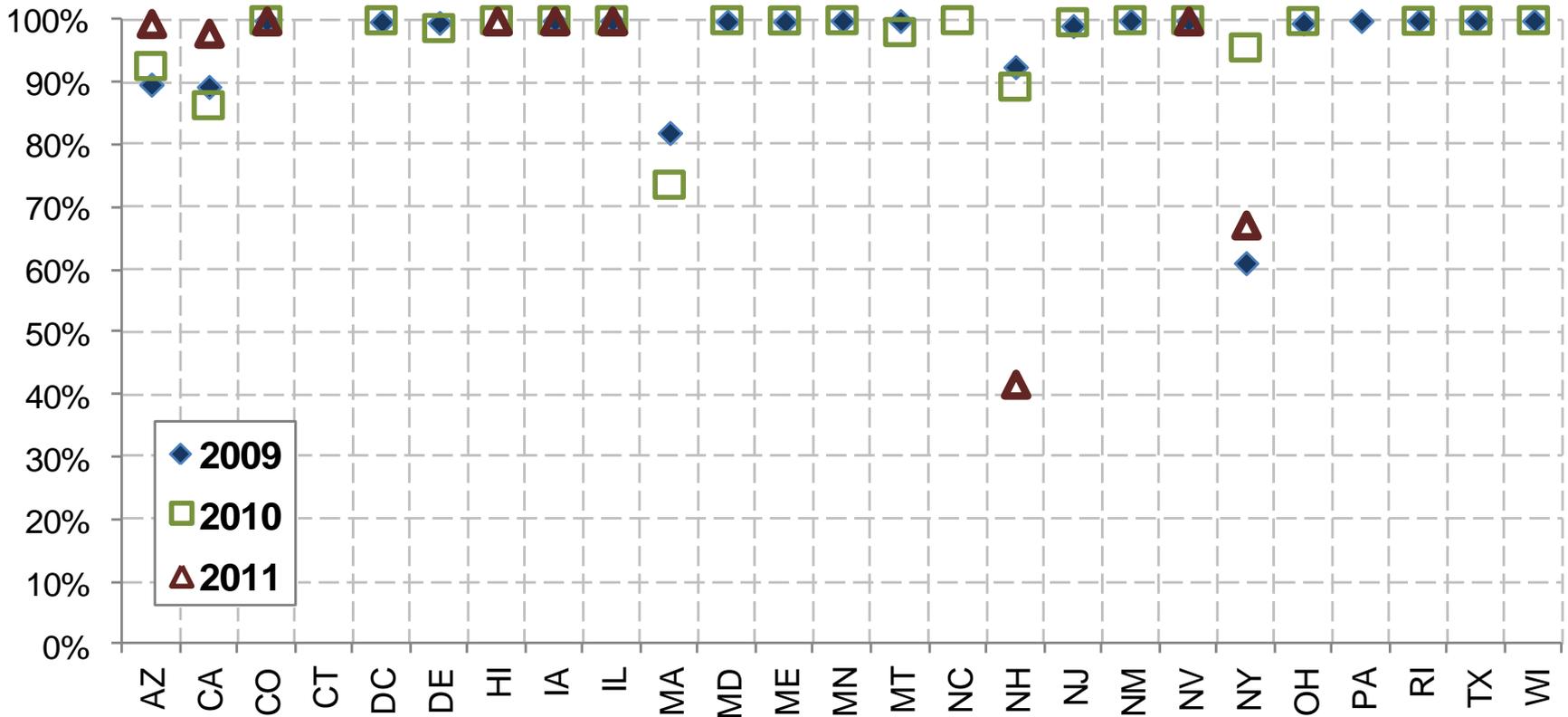


Presentation Outline

- 1) Overview of State RPS Landscape
- 2) Impacts on Renewables Development
- 3) Compliance Experience and Related Issues and Challenges

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)

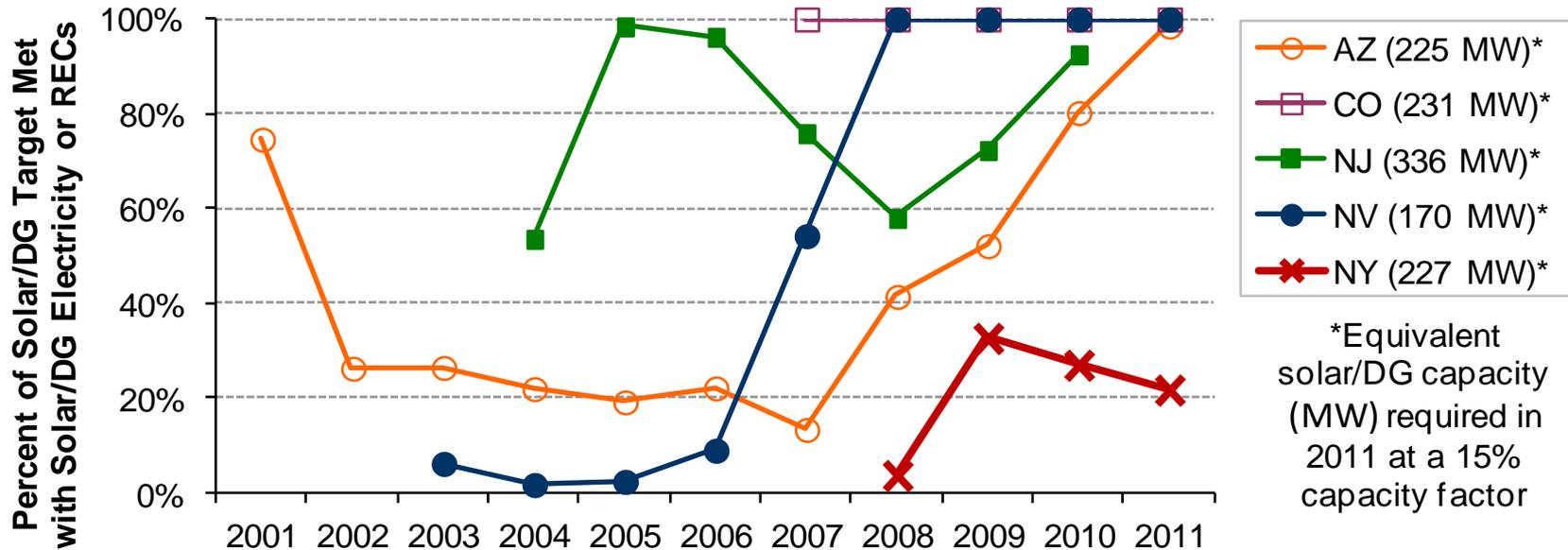


Note: Percentages less than 100% do not necessarily indicate that “full compliance” was not technically achieved, because of ACP compliance options, funding limits, or force majeure events.



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

States with Large (>150 MW) Solar/DG Targets in 2011



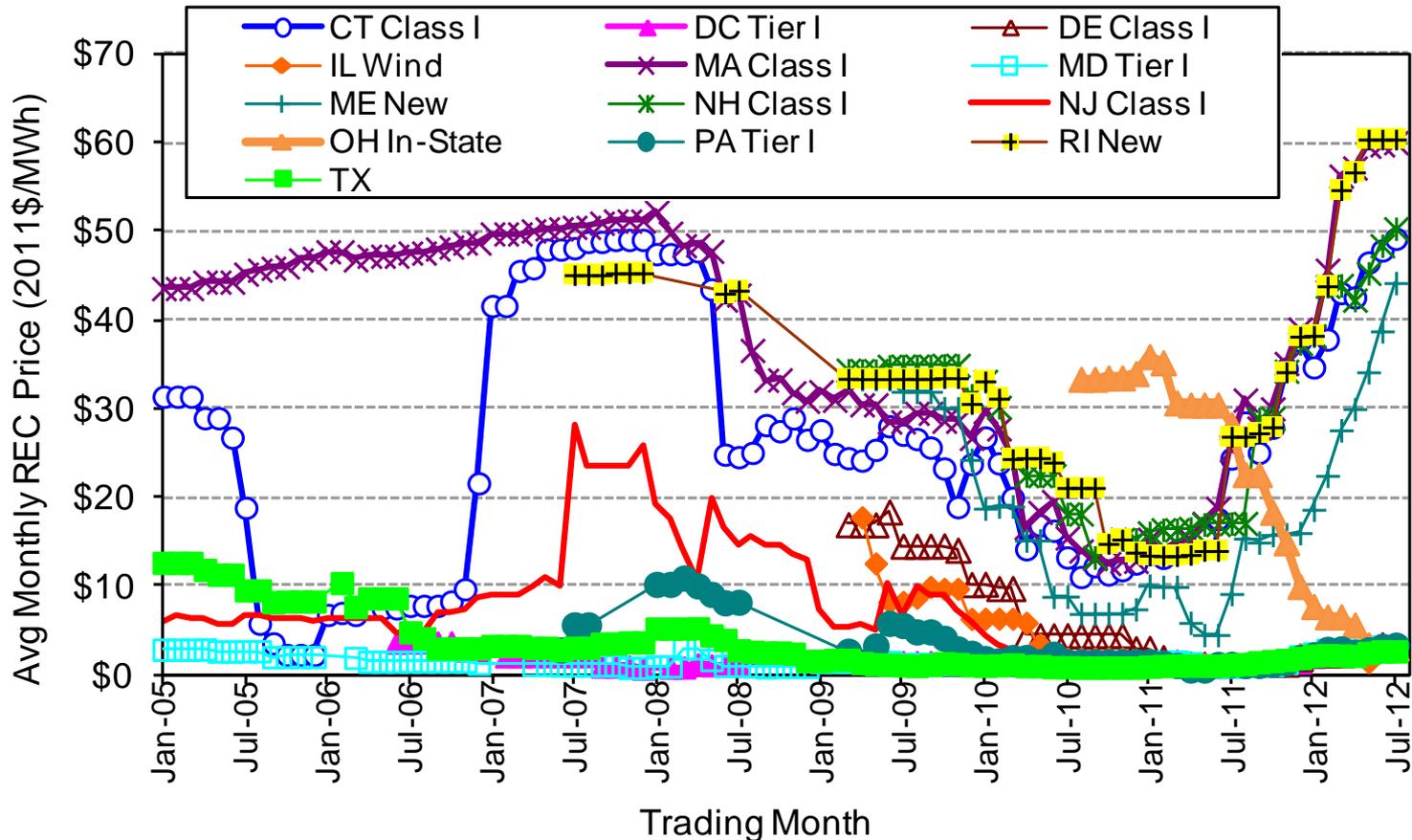
Note: "Percent of Solar/DG Target Met with Solar/DG Electricity or RECs" excludes ACPs but includes applicable credit multipliers. In cases where this figure is below 100%, suppliers may not have been technically out of compliance due to solar ACP compliance options, funding limits, and force majeure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

Retirement of solar electricity/RECs relative to set-aside requirements has often been mixed in initial compliance years

REC Prices Are Volatile, Creating Challenges for RE Project Financing

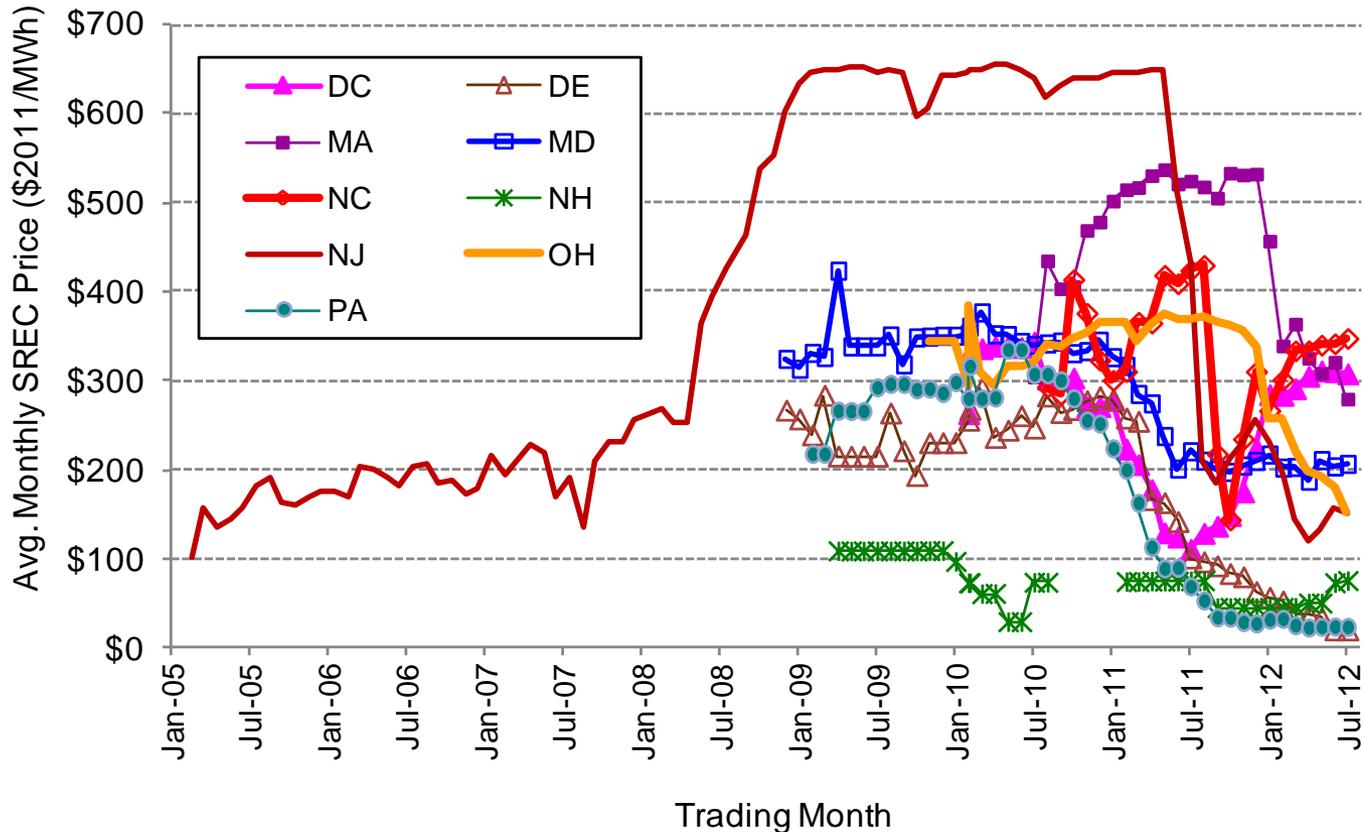
- **REC prices historically volatile, and dropped substantially in many regions recently (main tier and solar RECs)**
- **Depressed REC prices reflect “over-supply” for RPS needs in some markets**
 - Wholesale electricity prices have also declined substantially over the same period...
 - In concert with low REC prices, makes RE economics more challenging in near term, despite drop in RE costs
- **States have considered and implemented various measures to mitigate these effects**
 - Increasing or accelerating RPS targets
 - Long-term contracting programs/requirements
 - Price support mechanisms
 - Various other approaches

Main Tier and 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.

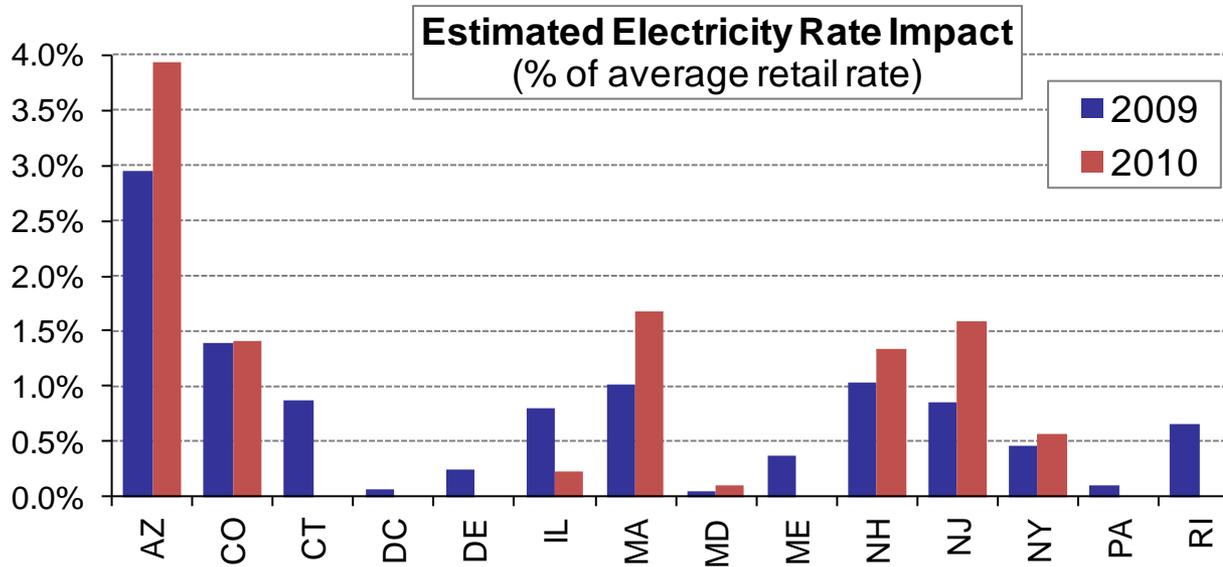
Solar RECs



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 Generally Been 'Modest' So Far (< 5%)

Translating REC prices or state-specific funding to rate impacts in 2009 and 2010 yields the results shown below



States not included if data on incremental RPS compliance costs are unavailable (CA, IA, HI, MN, MT, NC, NM, NV, OH, TX, WI) or if RPS did not apply in 2009-10 (KS, MI, MO, OR, WA).

- Rate impacts differ due to target levels, REC/ACP prices, and presence of set-asides
- Rate impacts in some states (AZ, CO, NY) include up-front incentives for solar/DG, which contribute to compliance in future years

- Rate impacts of RPS policies in states that are dominated by long-term contracts are generally unknown, but anecdotal evidence suggests limited impacts so far, and quite possibly even rate reductions in several states

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

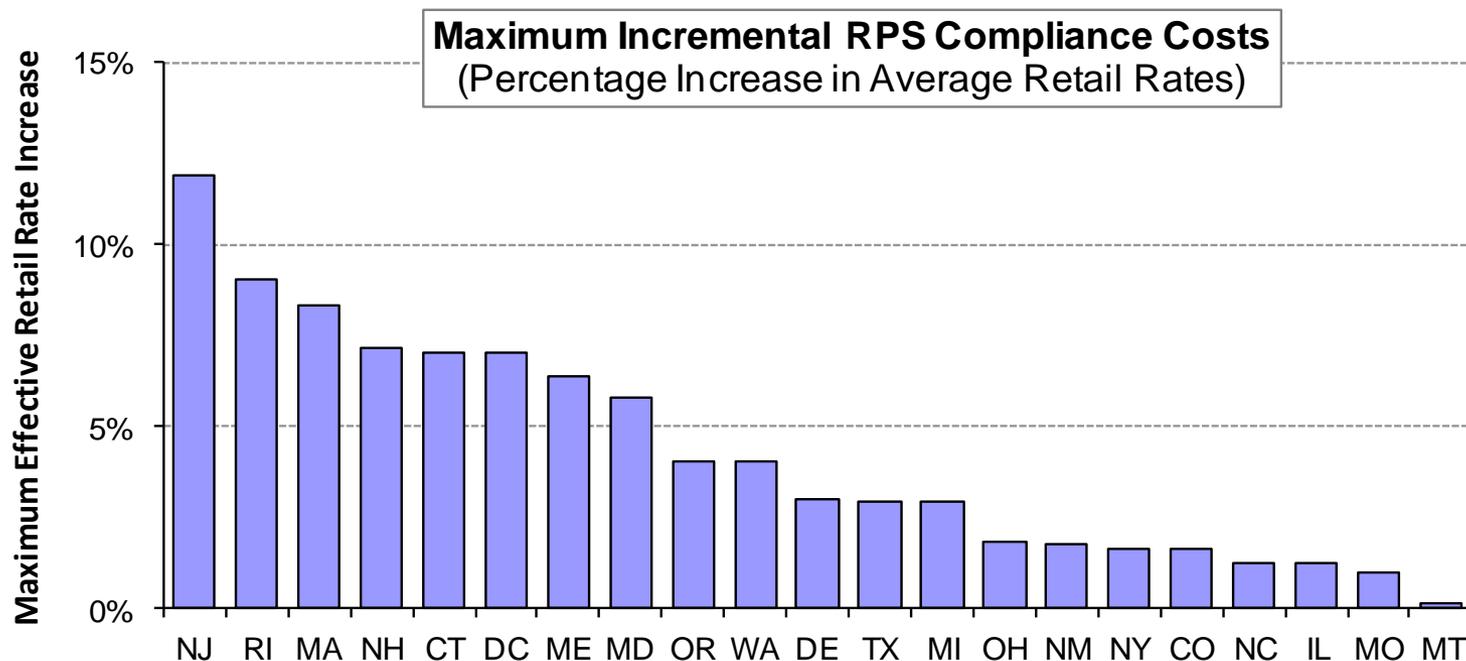
- 1) **ACP with automatic cost recovery:** MA, ME, NH, NJ, RI
- 2) **ACP with possible cost recovery:** DC, DE, MD, OR
- 3) **Retail rate / revenue requirement cap:** CO, KS, IL, MD, MO, NM, OH, OR, WA
- 4) **Renewable energy contract price cap:** MT, NM
- 5) **Per-customer cost cap:** MI, NC, NM
- 6)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

Emerging cost-containment issues:

- Challenges in calculating “incremental” RPS procurement costs in order to assess whether cap is reached (especially with bundled RE contracts)
- Costs for wind/solar have declined, but shale gas has reduced electricity market prices → net impact on incremental RPS costs, as well as on whether cost caps are limiting, TBD

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 8 states (AZ, CA, IA, KS, HI, NV, PA, WI), though KS caps gross RPS procurement costs and CA is currently developing its cost containment mechanism

RPS Compliance Experience-to-Date: In a Nutshell

- Growing experience with active compliance obligations, though many states still at relatively early stage in trajectory
- Generally high levels of compliance achieved thus far, and over-supply exists in a number of states (particularly for solar set-asides)
- REC price volatility and long-term contracting needs are perennial challenges, but states have made progress in addressing issues
- Significant RE growth required, but well in-line with pace of RE additions in recent years
- Compliance costs have thus far remained relatively modest, but concerns exist about increasing costs and potentially binding cost caps

Other Emerging and Continuing Issues Facing State RPS Programs

- Addressing the dual desires for liquid RE markets *and* in-state benefits in the face of the Commerce Clause
- Managing and anticipating interactions between state and possible future Federal policies (or changes to existing Federal policies)
- Addressing the other barriers to renewable energy deployment: transmission, integration, siting, etc.

Thank You!

For further information:

LBNL renewable energy publications:

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

Contact information:

Galen Barbose, *gbarbose@lbl.gov*, 510-495-2593

Ryan Wiser, *rhwiser@lbl.gov*, 510-486-5474

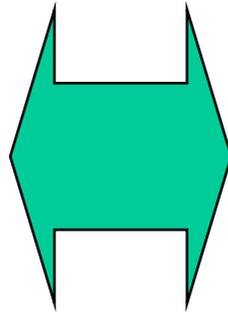
Extra Slides

Structure of RPS: RPS Compliance Models Vary Substantially

Regulated Markets

Dominated by long-term bundled contracts for electricity and RECs

Utility RFP solicitations or bilateral negotiations, with regulatory oversight



Restructured Markets

More often dominated by short-term trade in RECs, without PUC oversight

Developers often sell electricity and RECs separately

Two states require a government-directed agency to conduct procurements under the RPS: New York and Illinois

RPS Policies Are Increasingly Being Designed to Support Resource Diversity

Set Asides: Requirements that some portion of the RPS come from certain technologies, technology types, or applications

Credit Multipliers: Provides selected technologies or applications more credit than other forms of generation towards meeting the RPS

Resource-Specific Contracting Targets: Requirements that regulated utilities enter into long-term contracts for minimum quantities of specific resource types

Set-Asides			Credit Multipliers
General Technology	Specific Technology	Specific Application	
<u>Class I vs. II</u> : CT, DC, DE, MA, MD, ME, NH, NJ	<u>Solar Energy</u> : DC, DE, IL, MA, MD, MO, NC, NH, NJ, NM, NV, OH, OR, PA <u>Wind Energy</u> : IL, ME (goal), MN, NJ (offshore), NM <u>Existing Biomass/Methane</u> : NH <u>Existing Hydropower</u> : NH <u>Thermal</u> : NH <u>Geothermal or Biomass</u> : NM <u>Swine Waste</u> : NC <u>Poultry Waste</u> : NC <u>Non-Wind</u> : TX (goal)	<u>Distributed Generation</u> : AZ, CO, IL, NM, NY <u>Community Ownership</u> : MN (goal), MT (wind), OR (goal, community and small scale)	<u>Solar Energy</u> : DE (general RPS), MI, CO (POUs), NV (PV), OR <u>Wind Energy</u> : DC, MD, DE (offshore) <u>Methane</u> : DC, MD <u>Fuel Cells</u> : DE <u>Waste Tires</u> : NV <u>Non-Wind</u> : TX <u>Distributed Generation</u> : NV (PV), WA <u>Community Ownership</u> : CO, ME

No Differential Support: CA, HI, IA, KS, WI

Geographic Eligibility and Electricity Delivery Rules Vary Considerably

Variation reflects differing:

- wholesale market structure and geography
- state interests in supporting in-state or in-region RE
- interpretations of the requirements imposed by the Interstate Commerce Clause

Table provides examples: many states employ multiple requirements, and therefore would fit in multiple rows

Geographic Eligibility and Delivery Requirements (Main Tier)	Examples
In-state generation requirement	HI, IA
In-region generation requirement	DC, MI, MN, OR, PA
Electricity delivery required to state or to LSE	
Direct transmission inter-tie between generators and state	TX
Broader delivery requirements to state or to LSE	AZ, CA, KS, MT, NM, NV, NY, OH, WI
Electricity delivery required to broader region	
Generators <u>anywhere</u> outside region must deliver electricity to region	DE, ME, NJ, WA
Generators in <u>limited areas</u> outside region must deliver electricity to region	CT, DC, MA, MD, NH, RI
In-state generation encouragement	
In-state multipliers	CO, MO
Cost-effectiveness test	IL
Limit on RECs from out-of-state generators	NC

Enforcement Actions Have Thus Far Been Limited

- Enforcement mechanisms vary, and one should not assume that strictly failing to meet RPS targets leads to enforcement actions

Enforcement Mechanisms	States
ACP, Automatic Cost Recovery	MA, ME, NH, NJ, RI
ACP, Possible Cost Recovery	DC, DE, MD, OR
Explicit Financial Penalties, No Automatic Cost Recovery	CA, CT, KS, MI, MO, MT, PA, OH, TX, WA, WI
Discretionary Financial Penalties, No Cost Recovery	AZ, CO, HI, MN, NV
Enforcement at PUC Discretion	NC, NM
Not Applicable	IA, IL, NY

- Alternative compliance payments (ACPs) totaled \$66 million in 2010
- Penalties have been levied in CA, CT, MT, OH, PA, and TX
- Lack of compliance has sometimes been excused