



Energy Technologies Area

Lawrence Berkeley National Laboratory

# U.S. Renewables Portfolio Standards

## 2017 Annual Status Report

**Ryan Wiser (subbing for Galen Barbose)**  
*Lawrence Berkeley National Laboratory*

**2017 National Summit on RPS**  
*Washington, D.C.*  
*November 7, 2017*

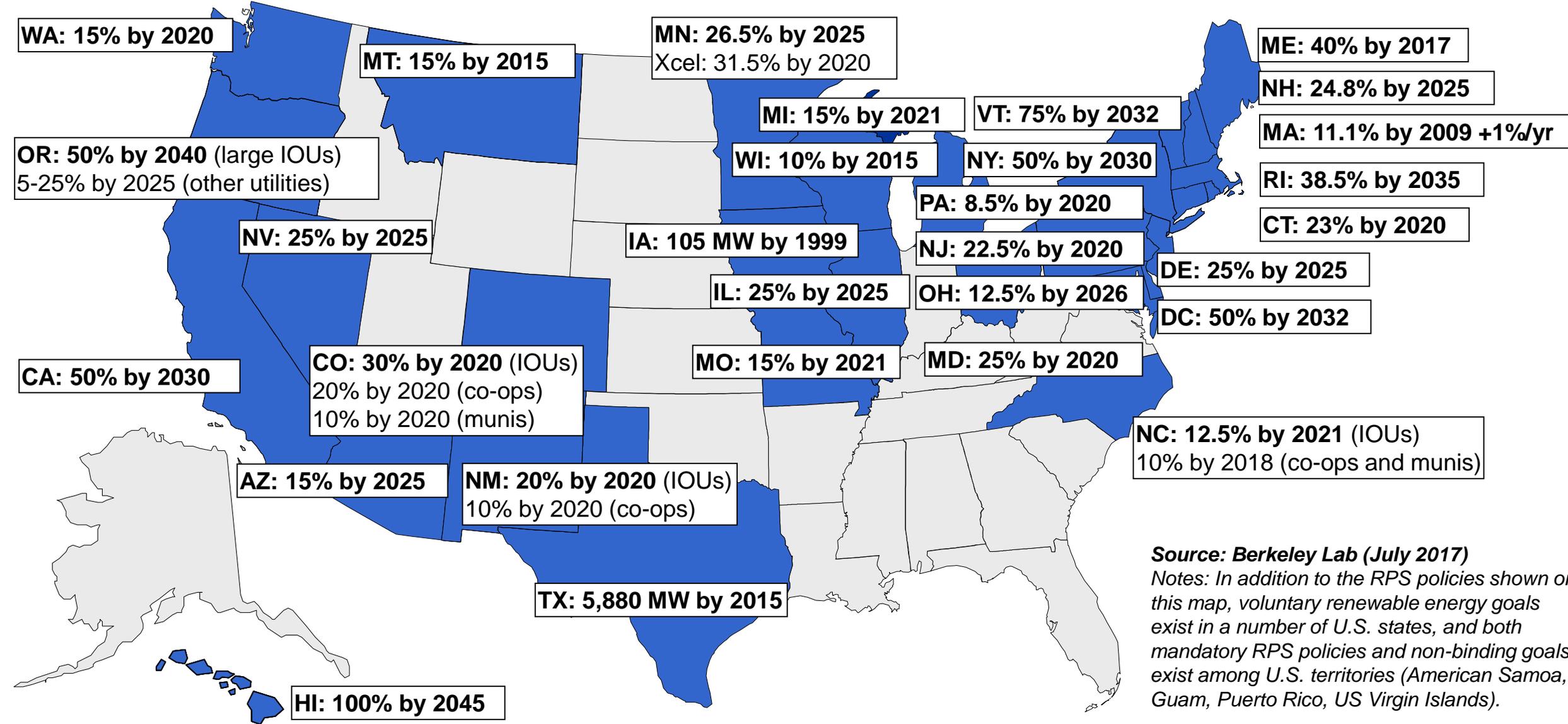
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- **Evolution of state RPS programs**
- Historical compliance, impacts on renewables development
- Future RPS demand and incremental needs
- REC pricing trends
- RPS compliance costs and cost caps
- Future Outlook

# RPS Policies Exist in 29 States and DC

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

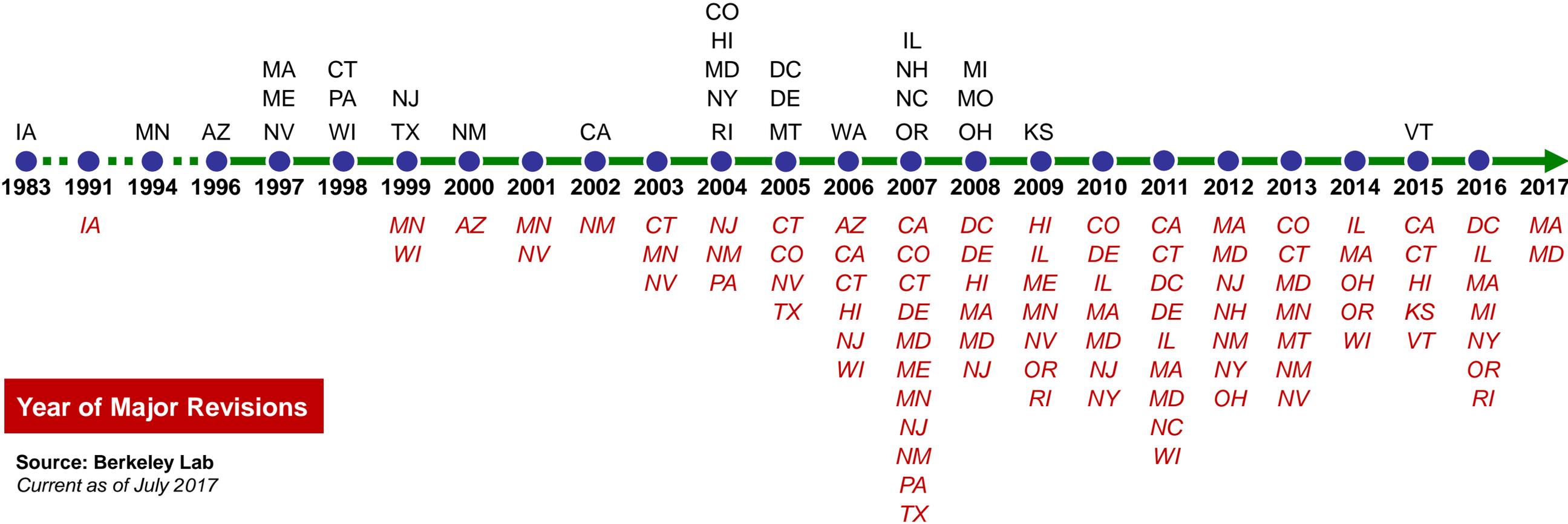


**Source: Berkeley Lab (July 2017)**  
 Notes: In addition to the RPS policies shown on this map, voluntary renewable energy goals exist in a number of U.S. states, and both mandatory RPS policies and non-binding goals exist among U.S. territories (American Samoa, Guam, Puerto Rico, US Virgin Islands).

# Most RPS Policies Have Been in Place for at Least 10 Years

States continue to make regular and significant revisions

## Year of RPS Enactment



## Year of Major Revisions

Source: Berkeley Lab  
Current as of July 2017

# General Trends in RPS Revisions

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**Increase and extension of RPS targets:** More than half of all RPS states have raised their overall RPS targets or carve-outs since initial RPS adoption; many in recent years

**Creation of resource-specific carve-outs:** Solar and DG carve-outs are most common (18 states + D.C.), often added onto an existing RPS

**Long-term contracting programs:** Often aimed at regulated distribution utilities in competitive retail markets; sometimes target solar/DG specifically

**Refining resource eligibility rules:** Particularly for hydro and biomass, e.g., related to project size, eligible feedstock, repowered facilities

**Loosening geographic preferences or restrictions:** Sometimes motivated by concerns about Commerce Clause challenges or to facilitate lower-cost compliance

In addition, although many states have introduced bills to repeal, reduce, or freeze their RPS programs, only two (OH, KS) have thus far been enacted

# RPS Legislation and Other Revisions in 2016 and 2017 (thru August)

Most proposals sought to strengthen or make small technical changes

## RPS-Related Bills Introduced and Enacted in 2016 & 2017

	Strengthen	Weaken	Neutral	Total
<b>Introduced</b>	96	51	81	228
<b>Enacted</b>	13	3	17	33

Contrasts to previous years with more prevalent efforts to repeal or weaken RPS requirements

**Data Source:** EQ Research (August 31, 2017)

Notes: Includes legislation from 2016 sessions and from 2015-2016 sessions active in 2016, as well as legislation active in 2017 sessions. Companion bills are counted as a single bill.

## Major RPS revisions (legislative and administrative) made in 2016 and 2017 include:

- **DC:** Increased and extended RPS to 50% by 2032
- **IL:** Created requirements for “new” solar and wind, with additional carve-outs; IPA takes over procurement for retail suppliers
- **MA:** Created requirements for off-shore wind (1,600 MW by 2027) and new solar procurement program (1,600 MW)
- **MD:** Increased and accelerated RPS to 25% by 2020
- **MI:** Increased and extended RPS to 15% by 2021
- **NY:** Increased and extended RPS to 50% by 2030, and expanded coverage statewide
- **OR:** Increased and extended RPS to 50% by 2040 for large IOUs
- **RI:** Increased and extended RPS to 38.5% by 2035

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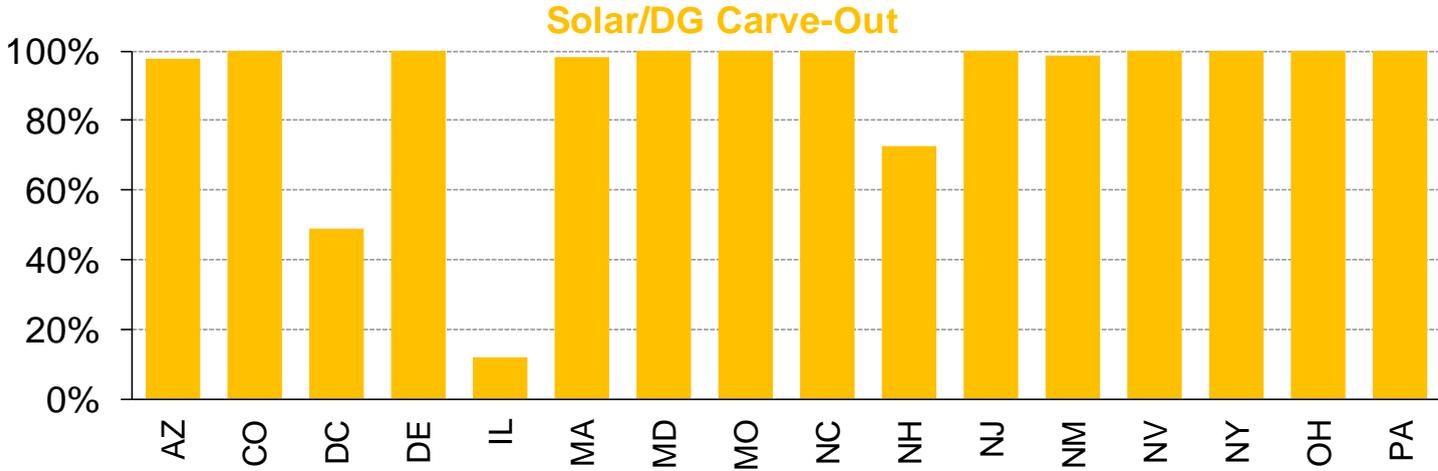
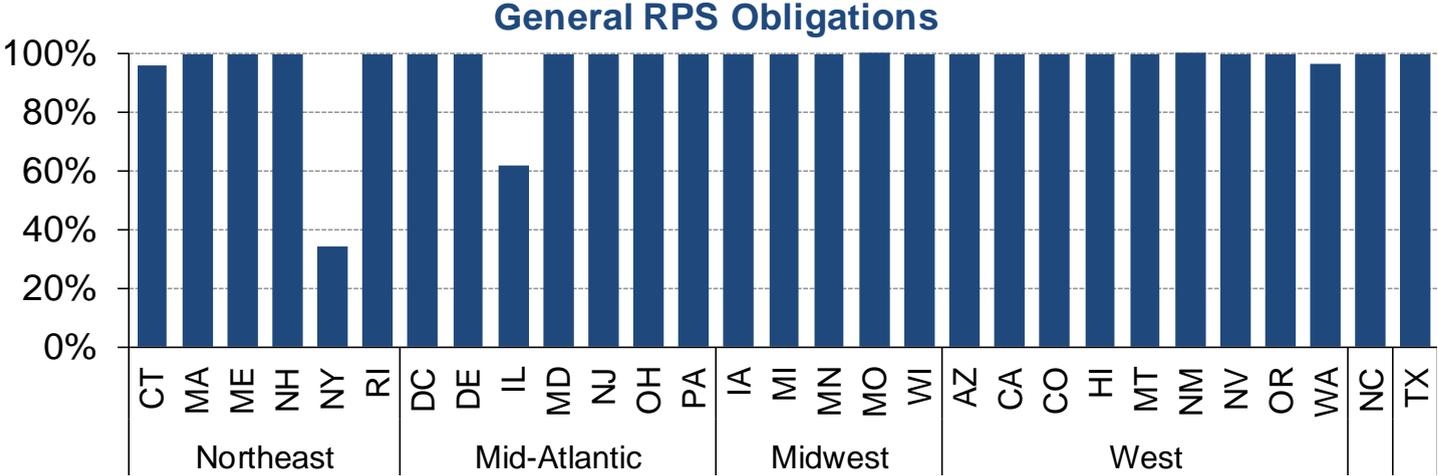
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- Evolution of state RPS programs
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# States Have Generally Met Their Interim RPS Targets

Exceptions typically reflect unique state-specific issues

**Percentage of RPS Obligations Met with RECs or RE**  
*For most-recent compliance year available in each state*



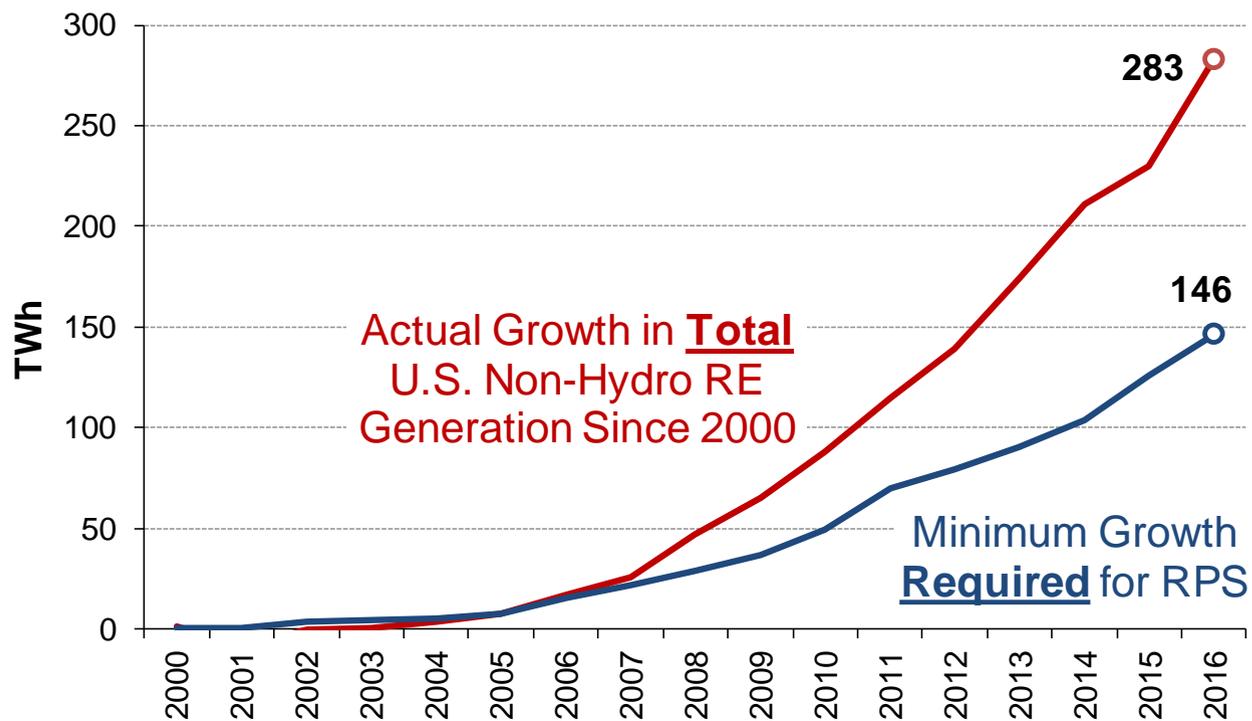
- Many states/utilities well ahead of schedule, easily meeting interim targets
- Others met interim targets only by relying on stockpile of banked RECs from prior years
- Relatively few instances where interim targets significantly missed
  - **DC (Solar):** In-district eligibility requirements limit pool of supply
  - **IL (General RPS & Solar):** Alternative retail suppliers required to meet 50% of RPS with ACPs
  - **NH (Solar):** Unusually low solar ACPs have led to SRECs flowing into neighboring Class I markets
  - **NY (General RPS):** Procurement has lagged targets, partly due to budget constraints

Notes: “General RPS Obligations” refers to the non-carve-out portion of RPS requirements in each state. For New England states, it refers to Class I obligations, and for PJM states it refers to Tier I obligations.

# RPS Policies Have Been One Key Driver for RE Generation Growth

RPS requirements constitute ~50% of total U.S. RE growth since 2000

## Growth in Non-Hydro Renewable Generation: 2000-2016



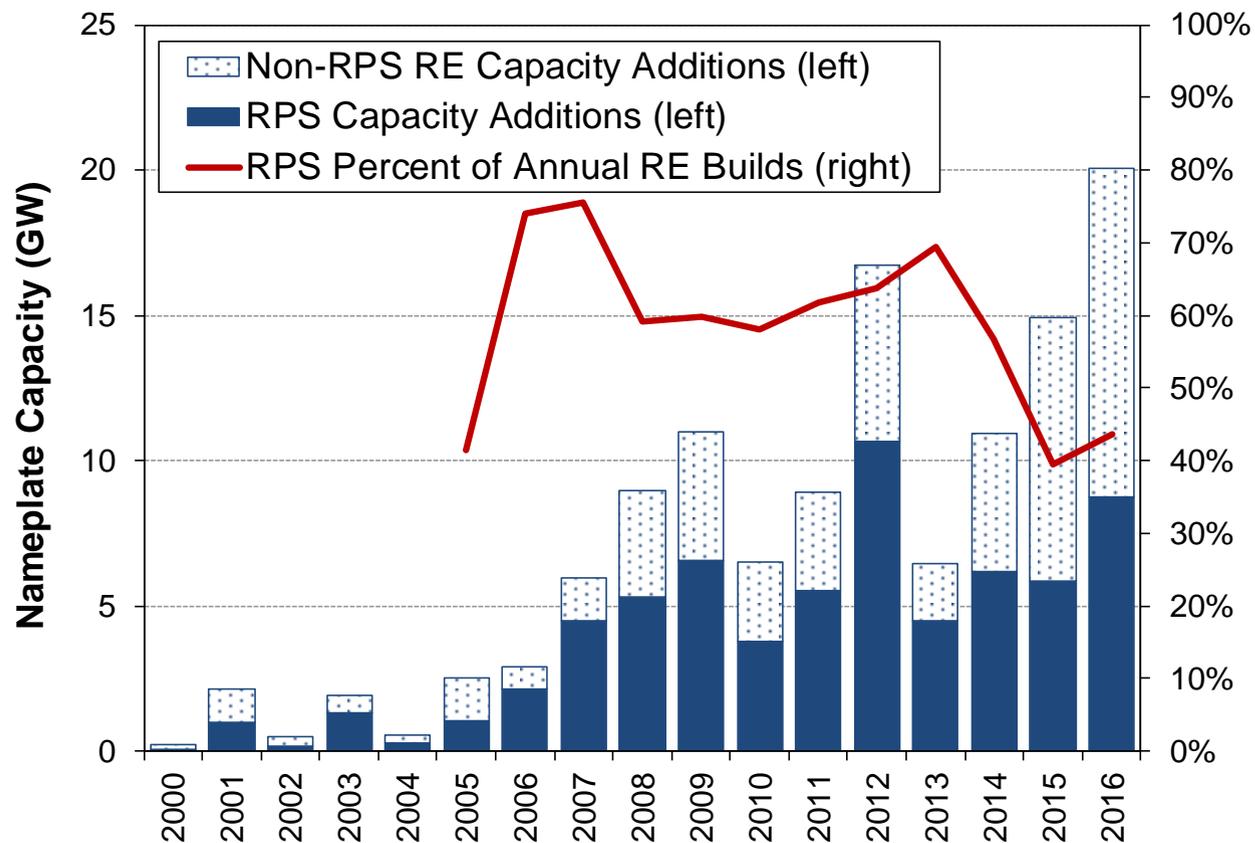
Notes: Minimum Growth Required for RPS excludes contributions to RPS compliance from pre-2000 vintage facilities, and from hydro, municipal solid waste, and non-RE technologies. This comparison focuses on non-hydro RE, because RPS rules typically allow only limited forms hydro for compliance.

- Total non-hydro RE generation in the U.S. grew by 283 TWh from 2000-2016
  - Many factors contributed to that growth (tax credits, other incentives, cost declines, etc.)
- RPS policies required 146 TWh increase over that period
  - Not strict attribution: some of that would have occurred without RPS
- Additional RE growth associated with:
  - Corporate procurement and other voluntary green power markets
  - Economic utility purchases
  - Accelerated RPS procurement

# RPS' Have Provided a Stable Source of RE Capacity Growth

Though RPS *portion* of total RE growth has declined over the past couple years

## Annual Renewable Capacity Additions



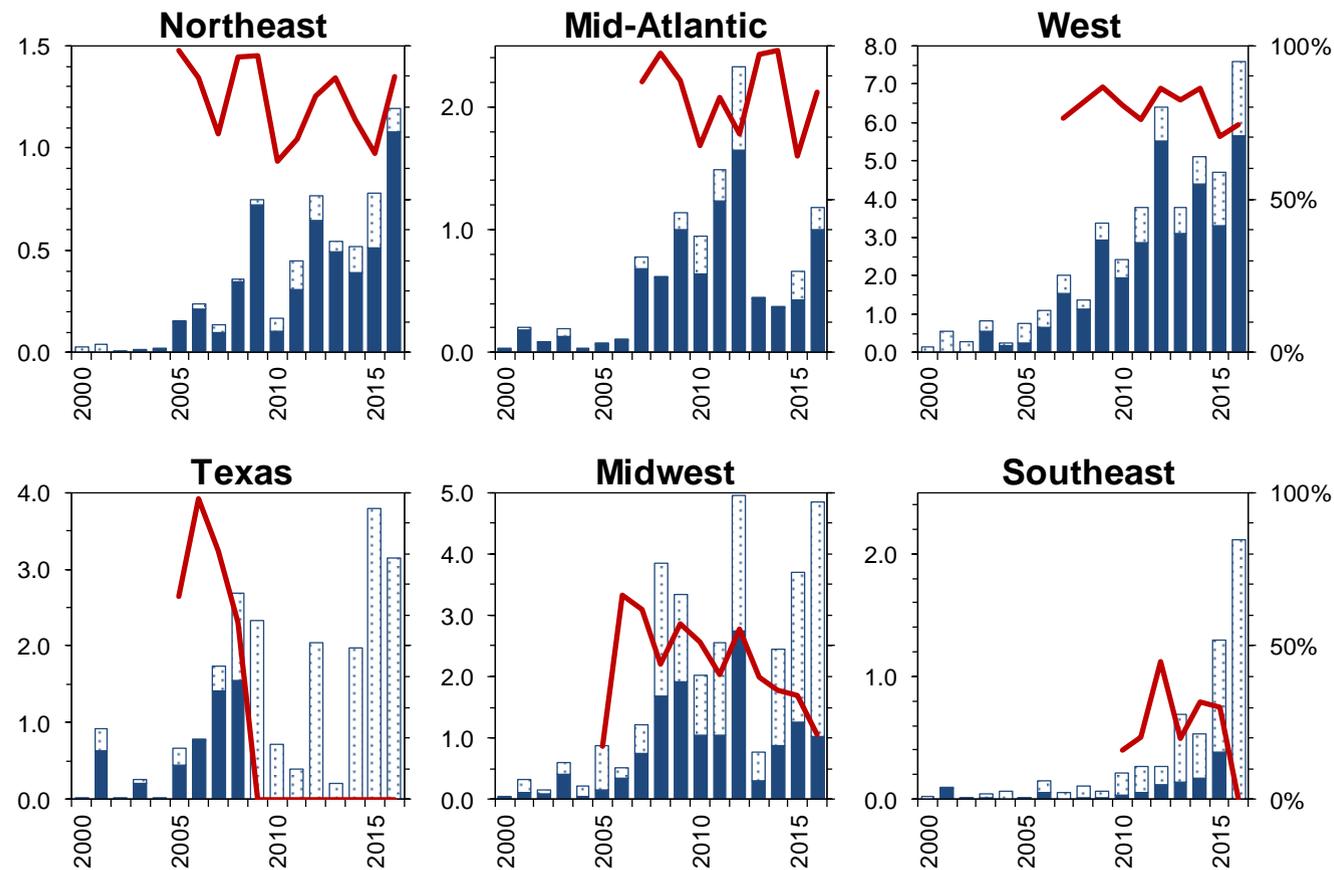
Notes: RPS Capacity Additions consists of RE capacity contracted to entities with active RPS obligations or sold on a merchant basis into regional RPS markets.

- Cumulatively, 120 GW of RE capacity added in the U.S. since 2000
  - Just over half of that capacity (56%) consist of projects (at least partially) driven by RPS obligations
- Over the past decade, an average of 6 GW/year of RE capacity added for RPS demand
  - Has provided a floor in down years (e.g., 2013)
- RPS-driven growth has increased in recent years in *absolute* terms, but declined as a *portion* of new RE builds (44% in 2016 vs. 60-70% in 2008-2014)
  - Partly due to rebounding wind growth in TX and Midwest, some serving growing demand from corporate procurement
  - Also the result of net-metered PV in California and some utility-scale PV in non-RPS markets

# RPS Policies Remain Central to RE Growth in Particular Regions

70-90% of 2016 RE additions in Northeast, Mid-Atlantic, West serve RPS demand

■ Non-RPS RE Capacity Additions (left, GW) 
 ■ RPS Capacity Additions (left, GW) 
 — RPS Percent of Annual RE Builds (right)



Notes: Northeast consists of New England states plus New York. Actual growth shown for that region is estimated based on new RE capacity that meets the vintage requirements for RPS eligibility. Mid-Atlantic consists of states that are primarily within PJM (in terms of load served).

## RPS policies have been a larger driver in...

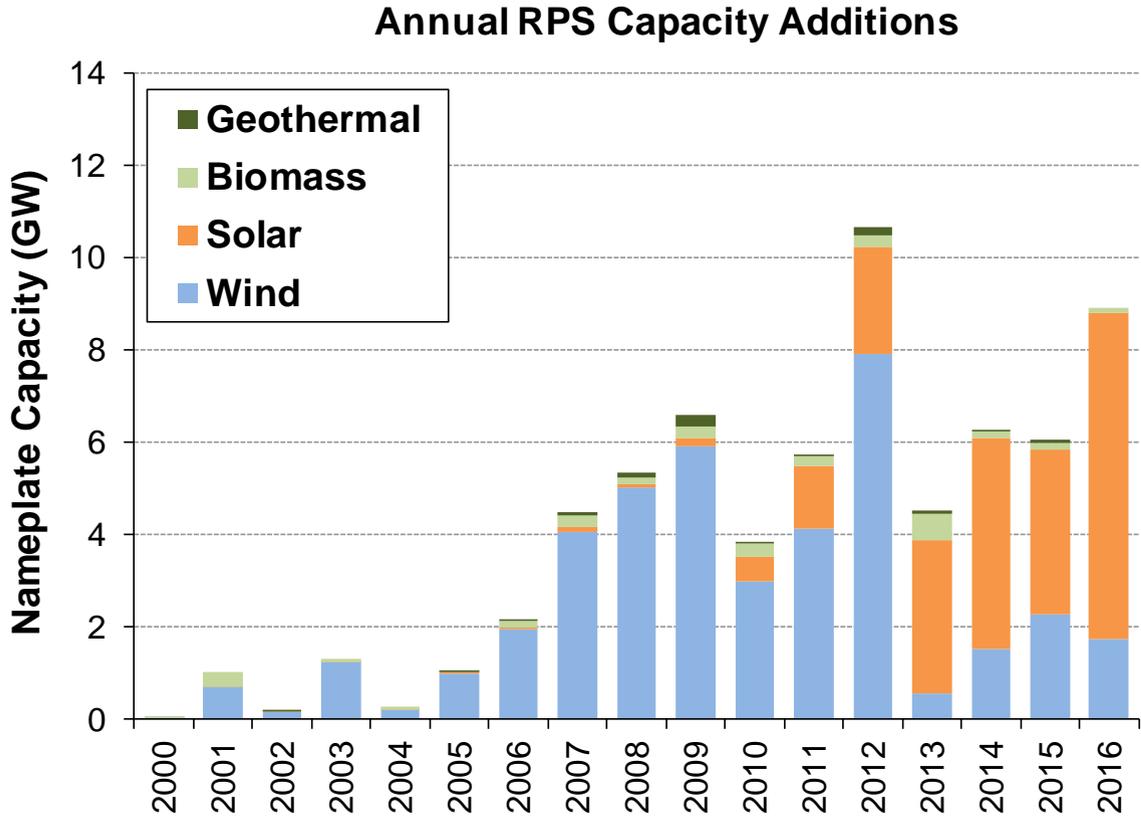
- **Northeast:** Relatively small market, but almost all capacity additions serving RPS demand
- **Mid-Atlantic:** Combo of solar carve-out capacity and wind projects (merchant or corporate procurement, but RPS-certified and likely selling RECs for RPS needs)
- **West:** The bulk of U.S. RPS capacity additions in recent years; split evenly between CA and other states

## But have been a smaller driver in...

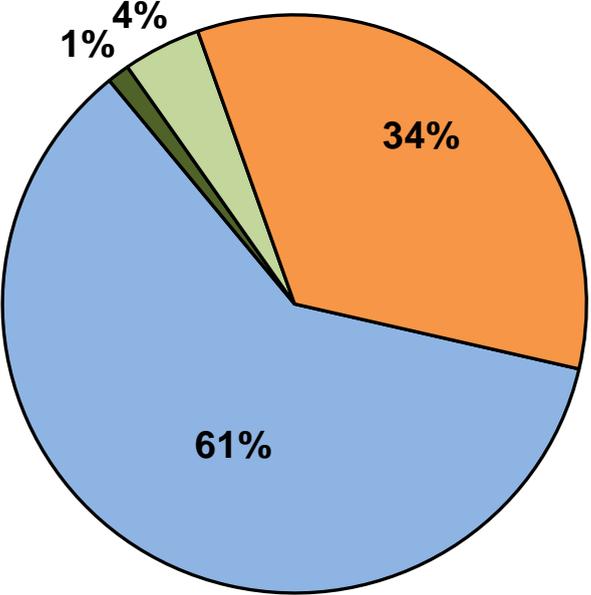
- **Texas:** Achieved its final RPS target in 2008 (7 years ahead of schedule); all growth since is Non-RPS
- **Midwest:** Lots of wind development throughout the region, some contracted to utilities with RPS needs
- **Southeast:** RE growth almost all utility-scale PV; primarily driven by PURPA and utility procurement, but some serving RPS demand in NC and PJM

# Wind as Historically the Dominant Source of New-Build for RPS, But Solar Has Recently Taken the Mantle

## RPS Capacity Additions by Technology Type



**Cumulative RPS Capacity Additions**



Wind is 61% of all RPS builds to-date, but solar was 79% of 2016 RPS builds

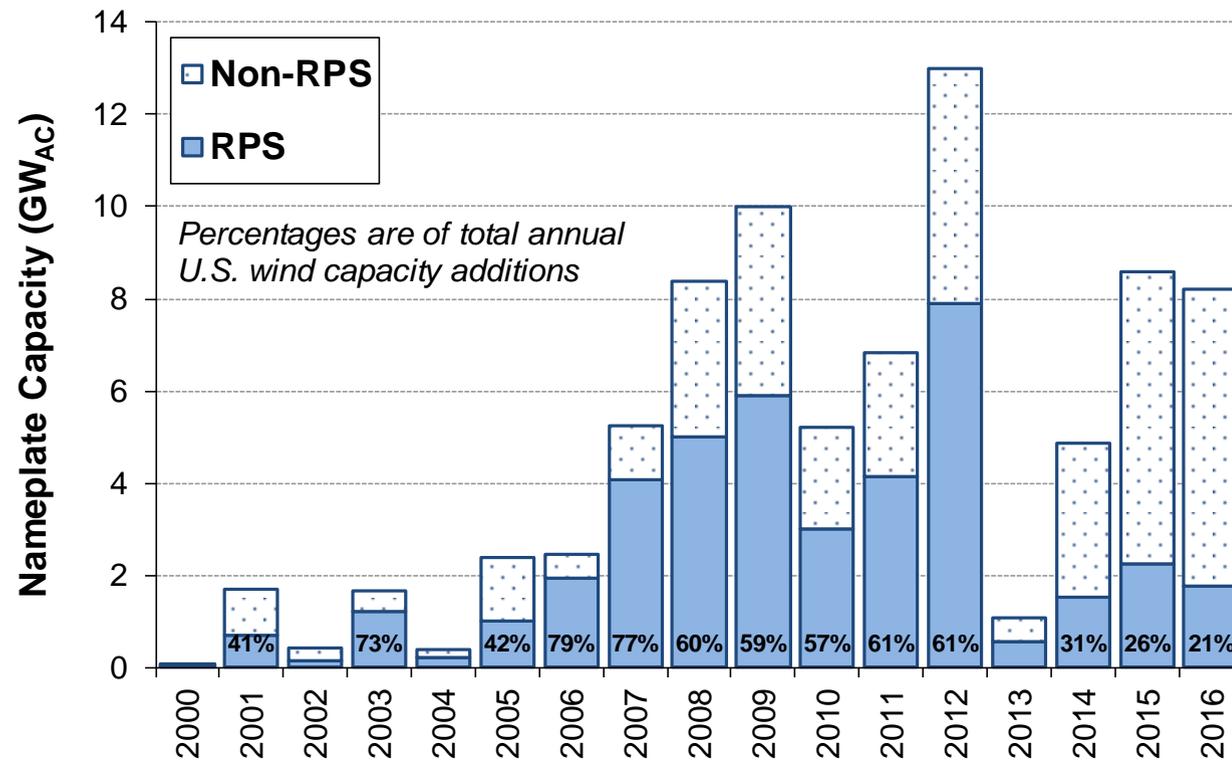
- Growing role of solar for RPS reflects:
  - Ramping up of solar carve-out requirements
  - Increasing cost-competitiveness of utility-scale solar vis-à-vis wind
- Wind capacity growth still strong, but recent additions primarily not for RPS

Notes: "RPS Capacity Additions" represent RE capacity contracted to entities subject to an RPS or sold on a merchant basis into regional RPS markets. On an energy (as opposed to capacity) basis, wind represents approximately 75%, solar 16%, biomass 5%, and geothermal 4% of RPS-related renewable energy growth.

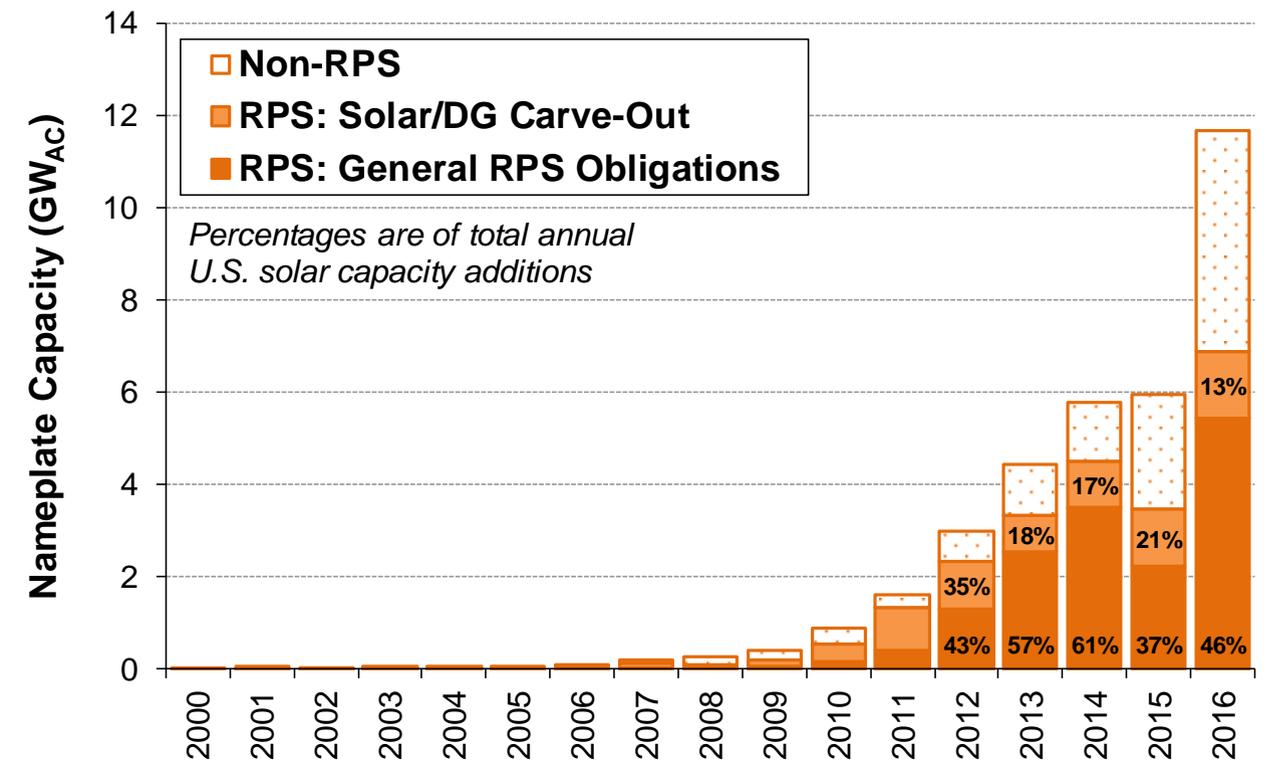
# Recent Wind Additions Built Primarily Outside of RPS Requirements, While Solar Is More-Concentrated in RPS States

In 2016, **21%** of all wind additions were dedicated to RPS demand, compared to **59%** for solar (46% for general RPS obligations + 13% for carve-outs)

## Wind Capacity Additions



## Solar Capacity Additions



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# States Are Starting to Approach Final Target Years

Half of all RPS states reach their final target year by 2021

## Year of Final RPS Target

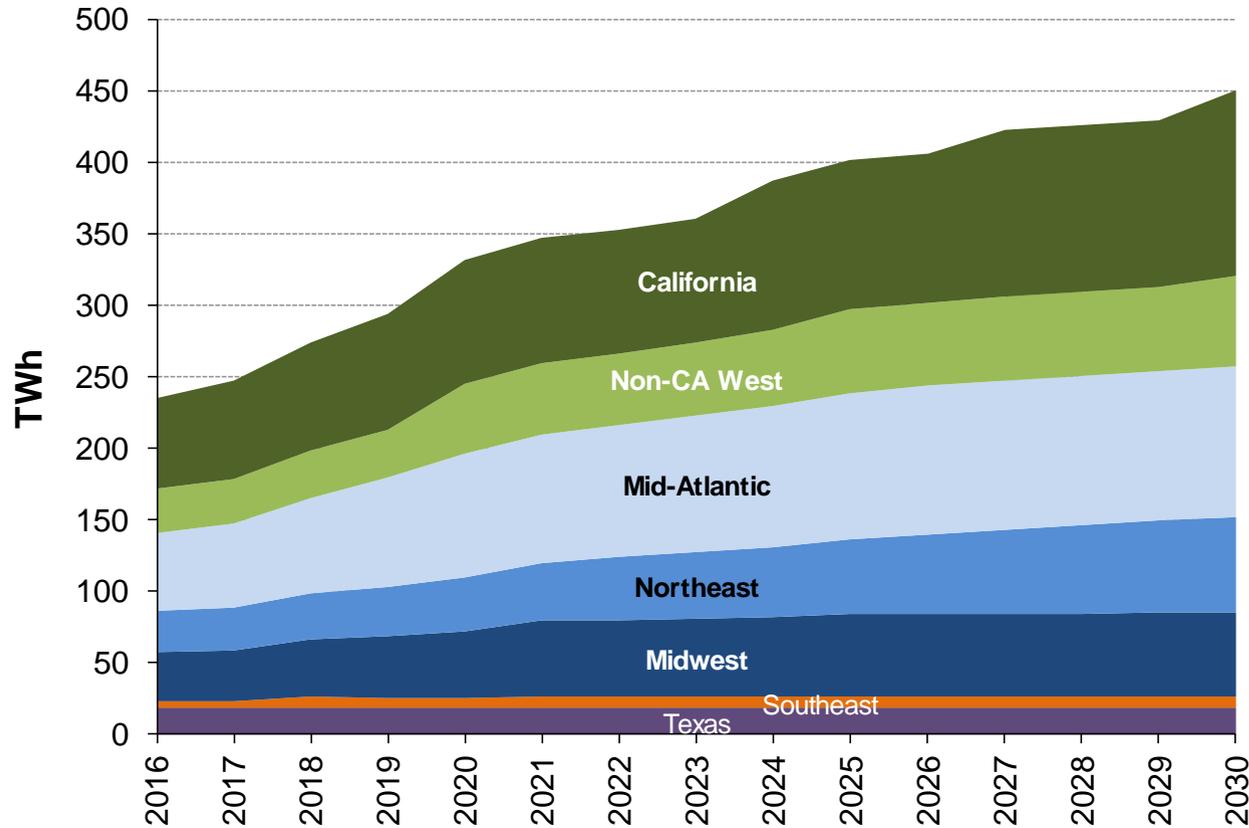


RPS needs will continue to slowly grow after final targets, due to load growth and RE retirements

# Projected RPS Demand

Total U.S. RPS demand roughly doubles by 2030

## Projected RPS Demand (TWh)



Notes: Projected RPS demand is estimated based on current targets, accounting for exempt load, likely use of credit multipliers, offsets, and other state-specific provisions. Underlying retail electricity sales forecasts are based on regional growth rates from the most-recent EIA Annual Energy Outlook reference case.

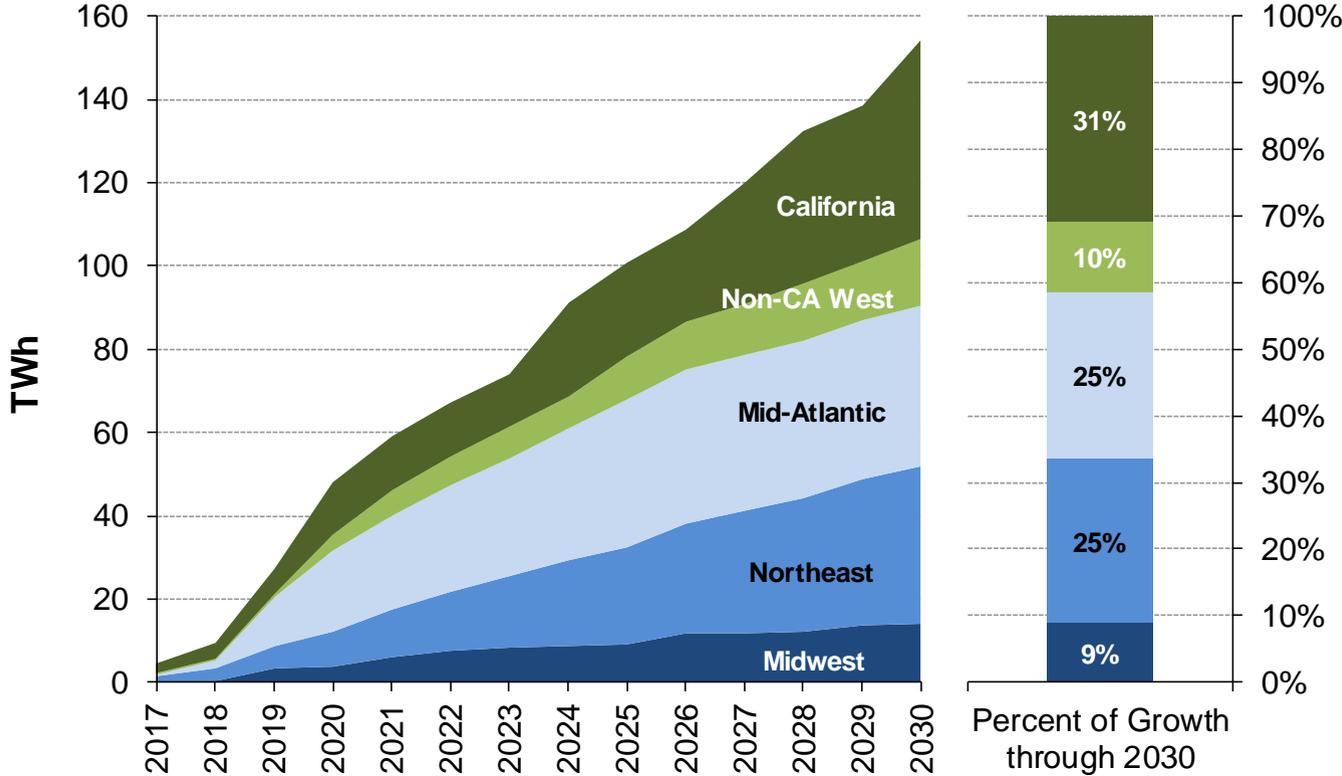
- Under current policies, total RPS demand grows from roughly 235 TWh in 2016 to 450 TWh in 2030
- To be sure, increased demand does not equate to required increase in supply
  - Some utilities/regions ahead of schedule, others are behind
  - Some growth in demand will likely be met with banked RECs

State-level RPS demand projections available for download at: [rps.lbl.gov](https://rps.lbl.gov)

# Required Increase in RPS Generation Supply

Equates to roughly 50% increase in U.S. non-hydro renewable generation

## Required Increase in RPS Generation (TWh)



Notes: For regulated states, incremental RPS needs are estimated on a utility-specific basis, based on each utility’s RPS procurement and REC bank as of year-end 2016. For restructured states, incremental RPS needs are estimated regionally, based on the pool of RPS-certified resources registered in the regional REC tracking system, allocated among states based on eligibility, demand, and other considerations.

**Required increase in RPS supply estimated:**

- Relative to *available* RPS resources as of year-end 2016 (see notes for further details)
- Accounting for REC banking over the forecast period, per each state’s rules

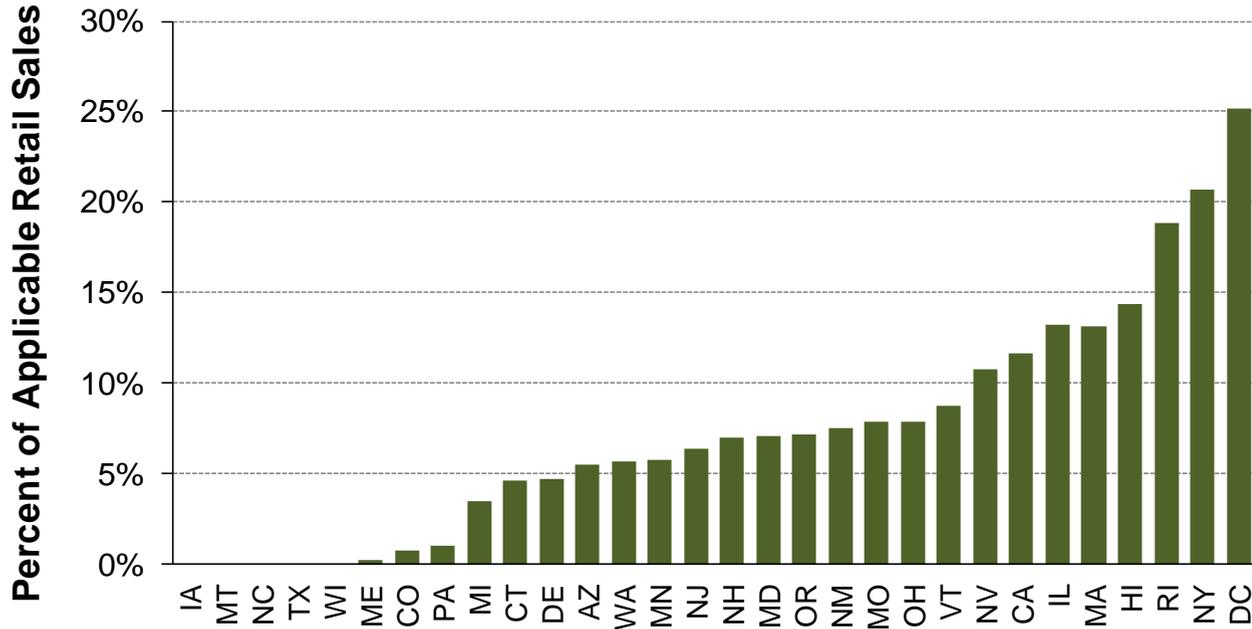
- 150 TWh increase in RPS resources needed to meet RPS demand growth through 2030
  - By comparison, current non-hydro RE = ~300 TWh
- Relatively steady rate of growth at aggregate national level; some regions are lumpy
- Greatest incremental needs in:
  - California (50% statewide RPS by 2030)
  - Mid-Atlantic (well distributed among states)
  - Northeast (mostly NY’s 50%-by-2030 CES)

# Residual RPS Procurement Needs by 2030

8 states with (effectively) no remaining need; 8 others with needs >10% retail sales

- Residual RPS procurement needs a function of target rise, current surplus, and REC banking rules
  - DC, NY, RI targets rise by 20-30% of retail sales by 2030
  - CA, HI, OR have similar target rise, but much smaller residual procurement needs due to current surplus and (in CA/OR) relatively permissive REC banking rules
- For regional REC markets (New England and PJM), residual needs may be more meaningfully expressed in aggregate regional terms
  - NEPOOL residual needs = 10% of retail sales by 2030
  - PJM residual needs = 7% of retail sales by 2030
- For some states, residual needs continue to rise beyond 2030 with increasing RPS targets and/or depletion of REC banks

**Residual RPS Procurement Needs by 2030**  
(Percent of Applicable Retail Sales)



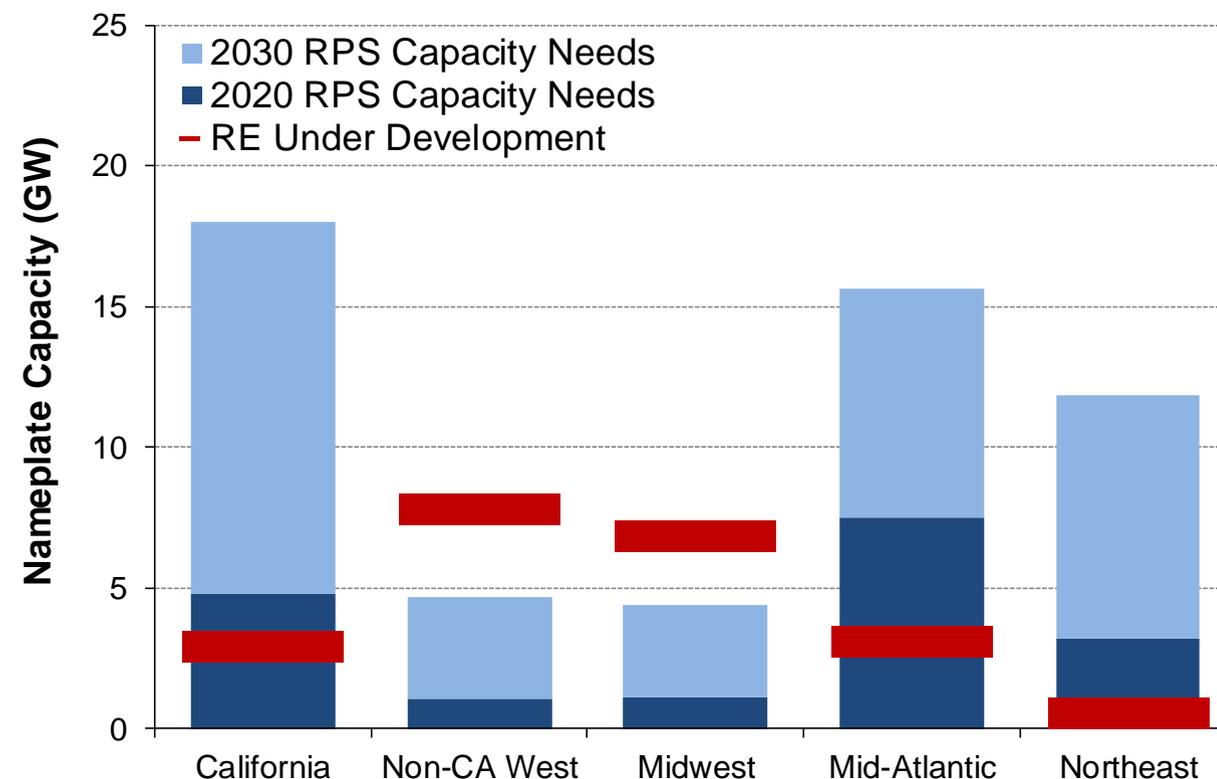
Notes: For regulated states, residual procurement needs are estimated on a utility-specific basis, based on each utility’s RPS procurement and REC bank as of year-end 2016, assuming no future sales of surplus RECs and accounting for the accumulation of banked RECs over time, per each state’s rules. For New England and PJM states, aggregate regional procurement needs are allocated among states in proportion to each state’s growth in RPS demand through 2030. For PJM, aggregate procurement needs are calculated separately for the “premium” states with more restrictive eligibility rules (DE, MD, NJ, PA) and for others (DC, IL, OH).

# Required RE Capacity Builds for RPS

Roughly 18 GW needed by 2020, 55 GW by 2030

- Equates to:
  - 40% increase in U.S. non-hydro RE capacity by 2030
  - Average build-rate of 4 GW per year (compared to ~6 GW/yr historically)
- RE already under development will likely meet some portion of remaining RPS needs
  - Could meet all RPS needs in Non-CA West and Midwest
  - May also serve RPS demand in neighboring regions
- Northeast residual needs to be met primarily through long-term contracts
  - NYSERDA procurements, MA (offshore wind, SMART, other clean energy), CT ZREC/LREC, etc.

## Required Increase in RPS Capacity (GW)



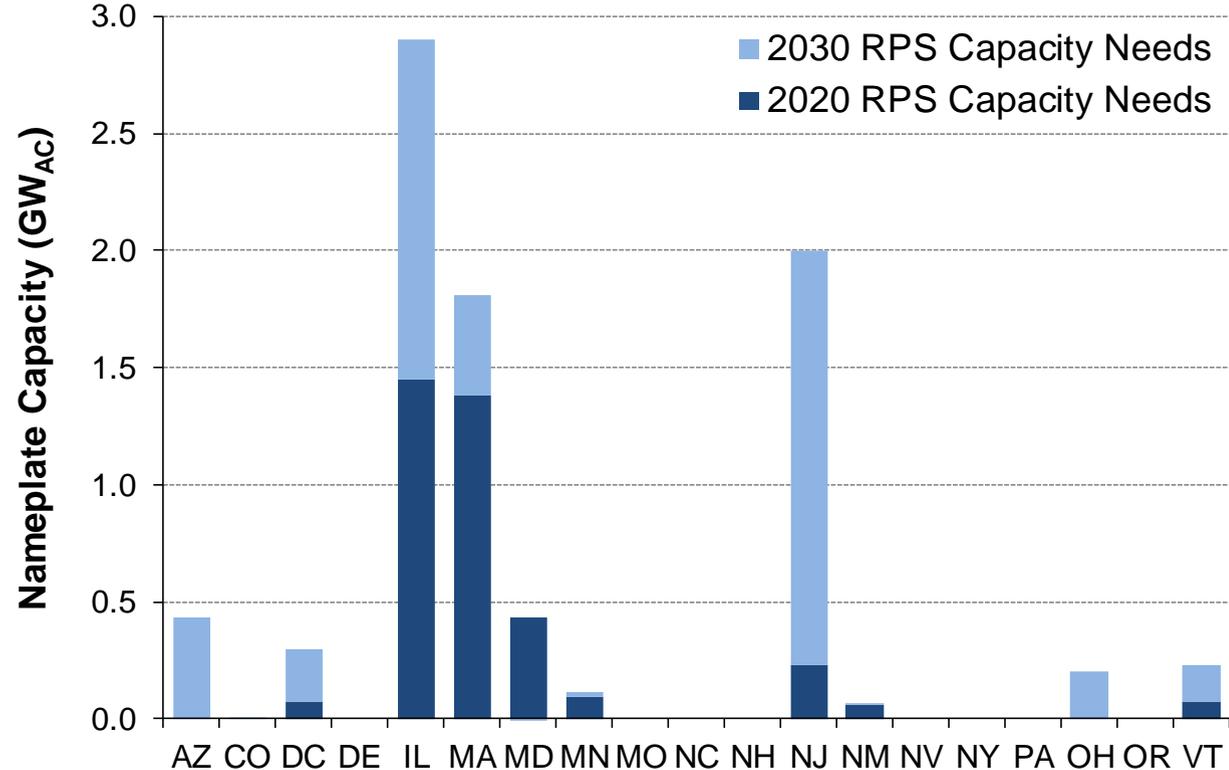
Notes: Calculated from estimated incremental generation needed to meet RPS demand, based on state-specific assumptions about the mix and capacity factor of new RPS supply. RE Under Development consists of units permitted or under construction, site preparation, or testing as of June 2017, plus units that entered commercial operation in 2017, based on data from ABB-Ventyx Velocity Suite.

# Required Capacity Builds for Solar/DG Carve-Outs

Concentrated primarily in IL, MA, NJ

- About half of all states have already met their final carve-out targets, so have no further needs
- Among those with some remaining need, an additional 4 GW required by 2020, 8 GW by 2030
  - **IL:** recently enacted requirement for long-term contracts with “new” solar (25% of which must be DG)
  - **MA:** recently developed SMART program; exact trajectory is undetermined
  - **NJ:** aggressive targets and 15-year limit on solar project eligibility; need for “replacement capacity” in later years
  - Various others (AZ, DC, MD, MN, NM, OH, VT) each with 100-400 MW remaining need

## Required Increase in Solar/DG Carve-Out Capacity (GW)

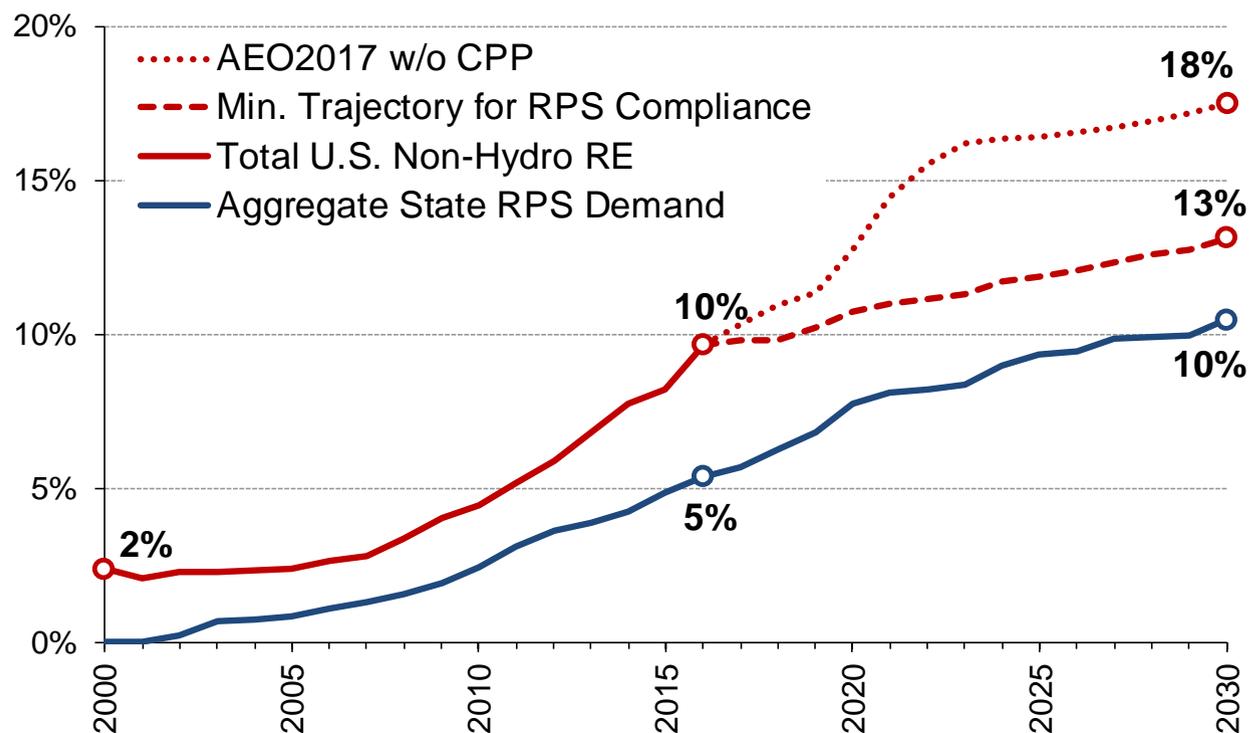


Notes: Calculated from estimated incremental generation needed to meet solar/DG carve-out demand, based on state-specific assumptions about the capacity factor of new solar/DG carve-out supply. For MA, we assume that the aggregate 1600 MW target under the SMART program is met by 2021, consistent with current build rates.

# Comparison of U.S. RPS Demand and RE Supply

EIA-forecasted RE growth projected to well-exceed minimum RPS needs

## U.S. RPS Demand vs. RE Supply (% of Retail Electricity Sales)



Notes: The figure focuses on non-hydro RE, given the limited eligibility of hydro for state RPS obligations. Accordingly, the Aggregate State RPS Demand excludes historical and projected contributions by hydro as well as by municipal solid waste, demand-side management, and other non-RE technologies.

- In aggregate, state RPS targets equate to 10% of U.S. retail electricity sales by 2030
- However, to meet those targets, total U.S. RE supply will need to reach 13% of retail sales
  - Accounts for the fact that not all existing RE supplies are available for future RPS demand
- EIA projects much greater RE growth, reaching 18% of retail sales by 2030
  - Rapid growth prior to expiration of ITC/PTC
- RPS policies clearly just one driver for continued RE growth
  - Other drivers: tax credits, RE cost declines, corporate procurement

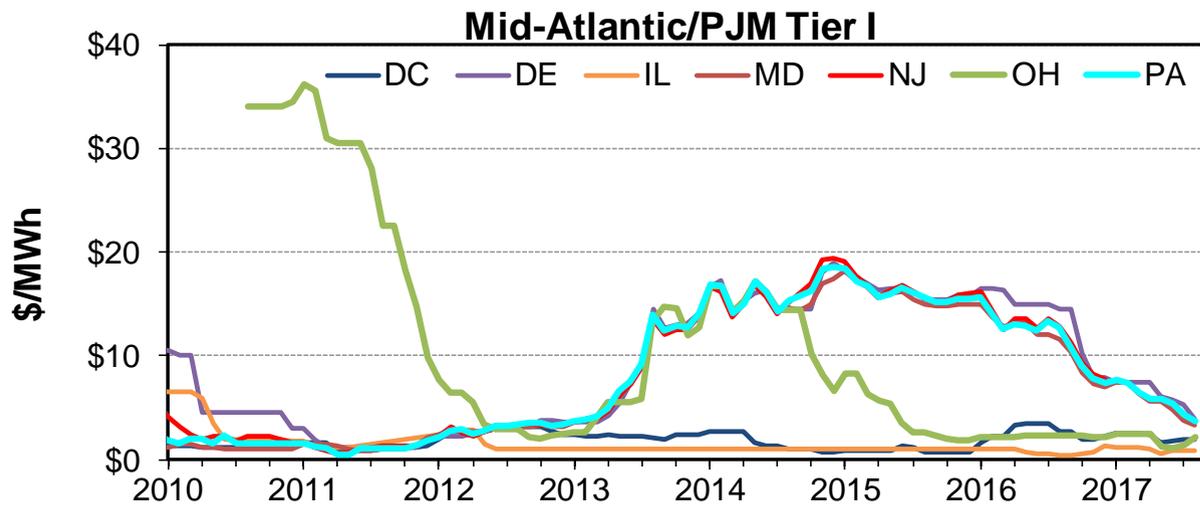
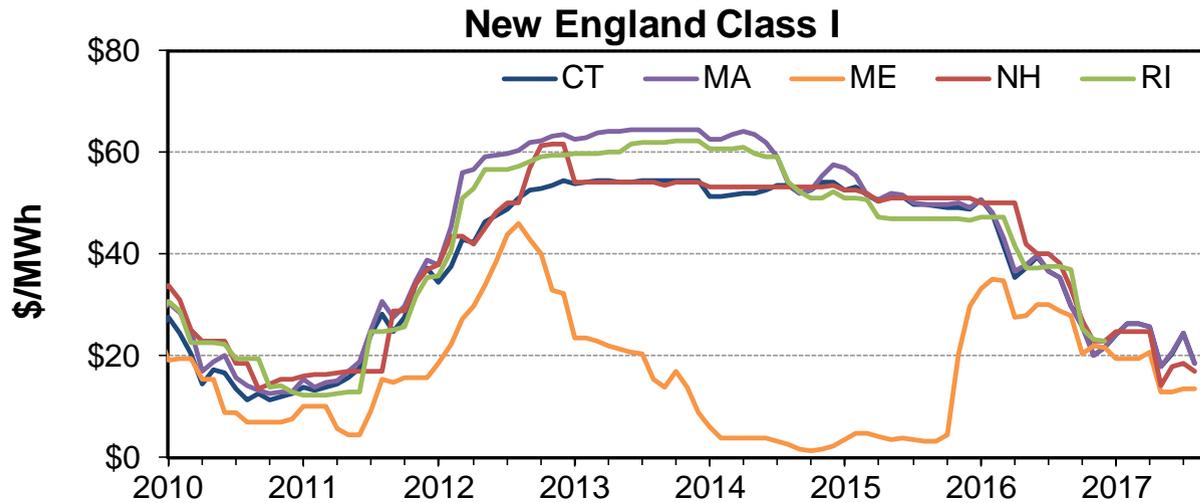
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# REC Pricing Trends for General RPS Obligations

Most markets have seen significant declines in 2016 and 2017



Source: Mares Spectron. Plotted values are the average monthly closing price for the current or nearest future compliance year traded in each month.

**REC prices are a function of ACP rates and current/expected supply-demand balance**

- As a result, REC prices can be volatile and are sensitive to sudden changes in eligibility rules
- Regional markets in New England and Mid-Atlantic emerge based on common pools of eligible supply

## New England:

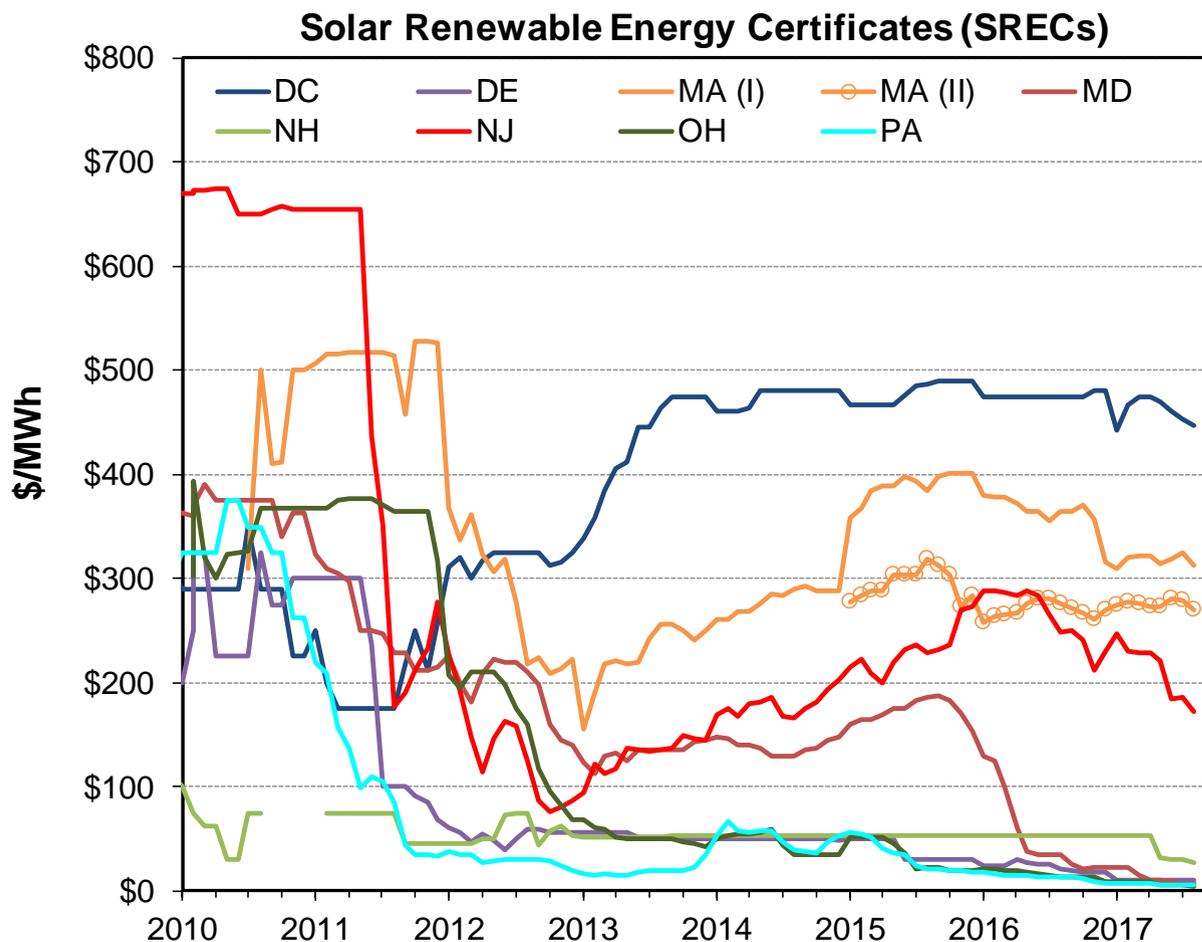
- Growing regional supplies have pushed prices to near a 5-year low (~\$20/MWh, compared to \$55-65 ACP levels)

## Mid-Atlantic/PJM:

- Bifurcated market based on geographic eligibility rules (more restrictive rules & higher prices in NJ/PA/MD/DE)
- Recent wind growth in PJM and adjacent states driving down prices

# SREC Pricing Trends for RPS Solar Carve-Outs

Varying trends by state; Maryland saw the most significant movement in 2016



Sources: Marex Spectron, SRECTrade, Flett Exchange. Depending on the source used, plotted values are either the mid-point of monthly average bid and offer prices or the average monthly closing price, and generally refer to prices for the current or nearest future compliance year traded in each month.

SREC pricing is highly state-specific due to *de facto* in-state requirements in most states and varying ACPs

- **MD:** Substantial over-supply emerged with completion of several 10-20 MW projects in 2015-2016
- **DC:** Acute undersupply due to in-district requirements and limited market footprint
- **MA:** Price movements bounded by clearinghouse floor and SACP
- **NJ:** Generally well-balanced market
- **DE, PA, OH** heavily oversupplied, in part due to eligibility of out-of-state projects
- **NH:** Low solar ACP (\$55/MWh)

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# RPS Compliance Costs

## Definition, data sources, and limitations

**RPS Compliance Costs:** Net cost to the load-serving entity (LSE), above and beyond what would have been incurred in the absence of RPS

### Restructured Markets

- We estimate RPS compliance costs based on REC plus ACP expenditures
- Rely wherever possible on PUC-published data on actual REC costs
- **Limitations:** Growing use of bundled PPAs; ignores merit order effect and some transmission/integration costs

### Regulated Markets

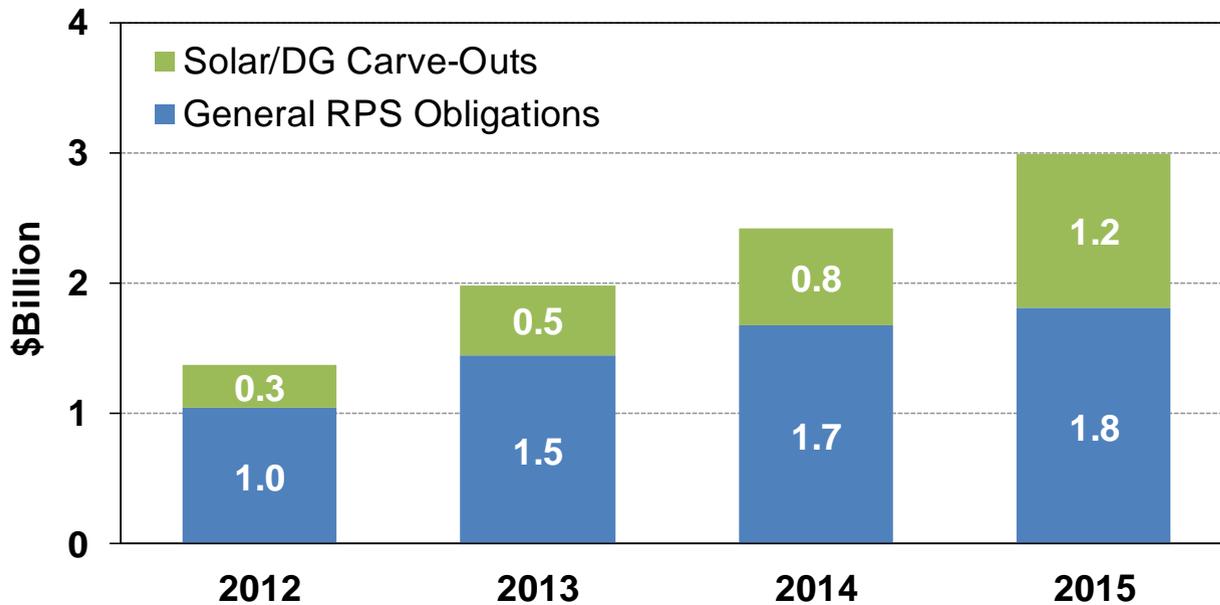
- Estimated by comparing gross RPS procurement costs to a counterfactual (e.g., market prices, long-term avoided costs)
- We synthesize available utility and PUC compliance cost estimates
- **Limitations:** Varying methods across states; incomplete or sporadic reporting (no data for several states)

**Compliance cost reporting is lagged → Data available for many states only through 2015**

# Aggregate U.S. RPS Compliance Costs

Totaled roughly \$3.0B in 2015, up from \$2.4B in 2014

## Total RPS Compliance Costs



Notes: General RPS obligations consist of all non-solar/DG carve-out requirements, including both primary and secondary tiers. Costs were extrapolated to several states/utilities without available data, based on other states/utilities in the region.

**These data should be considered a rough approximation given diverse methods used to estimate compliance costs across states**

- Cost growth year-over-year associated with increasing targets, dampened by falling REC prices in some markets
- Solar/DG carve-outs a growing share of aggregate RPS compliance costs
- Important note: Total U.S. RPS compliance costs highly sensitive to California
  - We use PUC estimates, which rely on the all-in cost of a combined-cycle gas turbine as the basis for avoided costs
  - Alternate IOU avoided cost estimates based on short-term market prices yield RPS compliance costs roughly \$2.8B higher in 2015 (increasing total U.S. costs to \$5.8B)\*

\* The CPUC has noted several concerns with the IOUs' approach: namely, that many of the IOUs' other generation resources, including nuclear and large hydroelectric generation, also would not be cost-effective compared to spot market prices, and that the utilities likely would not be able to procure such a large volume in the spot market. In addition, relying on actual realized spot market prices does not account for the merit order effect.

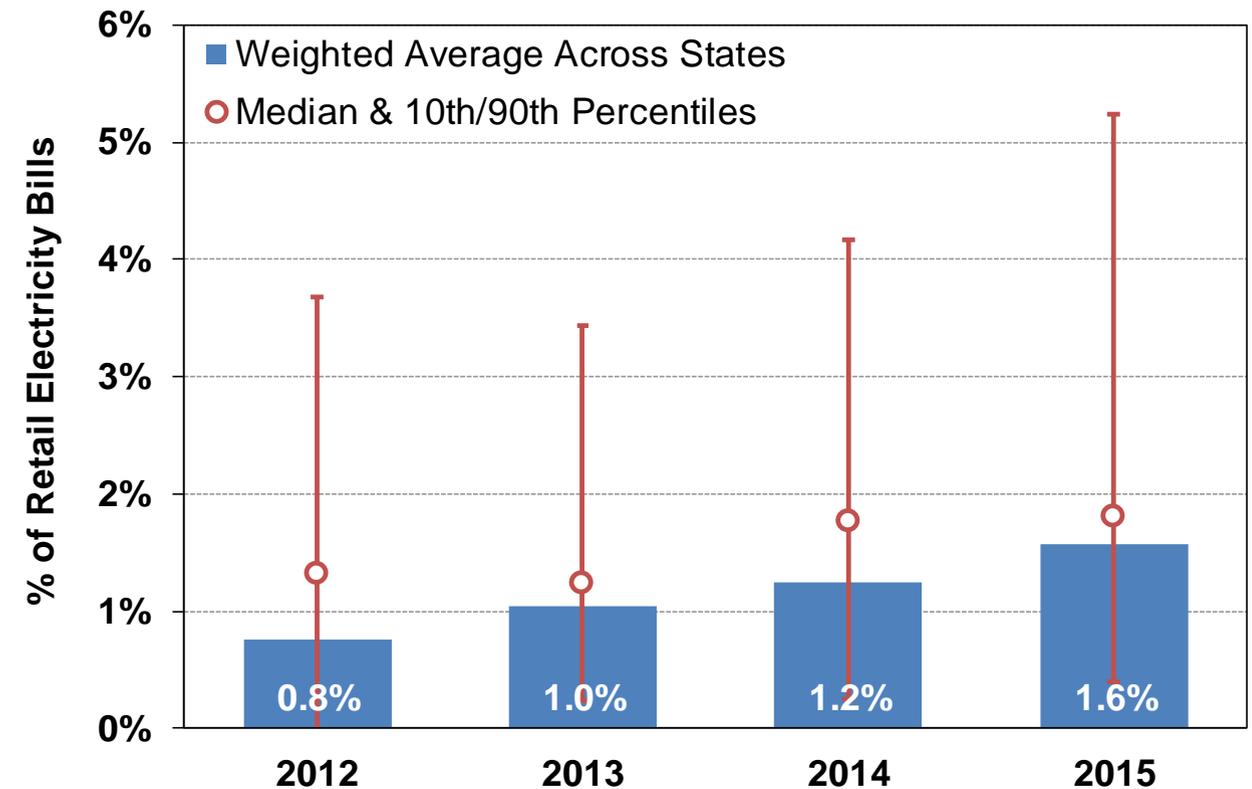
# RPS Compliance Costs as a Percentage of Customer Bills

Averaged 1.6% of retail electricity bills in 2015

## A proxy for “rate impact”, albeit a rough one:

- Some impacts (merit order effect, integration costs) not fully captured
  - Compliance costs borne by LSE not always fully or immediately passed through to ratepayers
  - ACPs may be credited to ratepayers or recycled through incentive programs
- Costs as a percent of retail bills have risen over time with rising targets, as discussed on previous slide
  - Wide variability across states, as evident by percentile bands, ranging from 0.4% to 5.2% in 2015 (10<sup>th</sup> to 90<sup>th</sup> percentile range) → more detail on next slide

## RPS Compliance Costs Percentage of Average Retail Electricity Bill

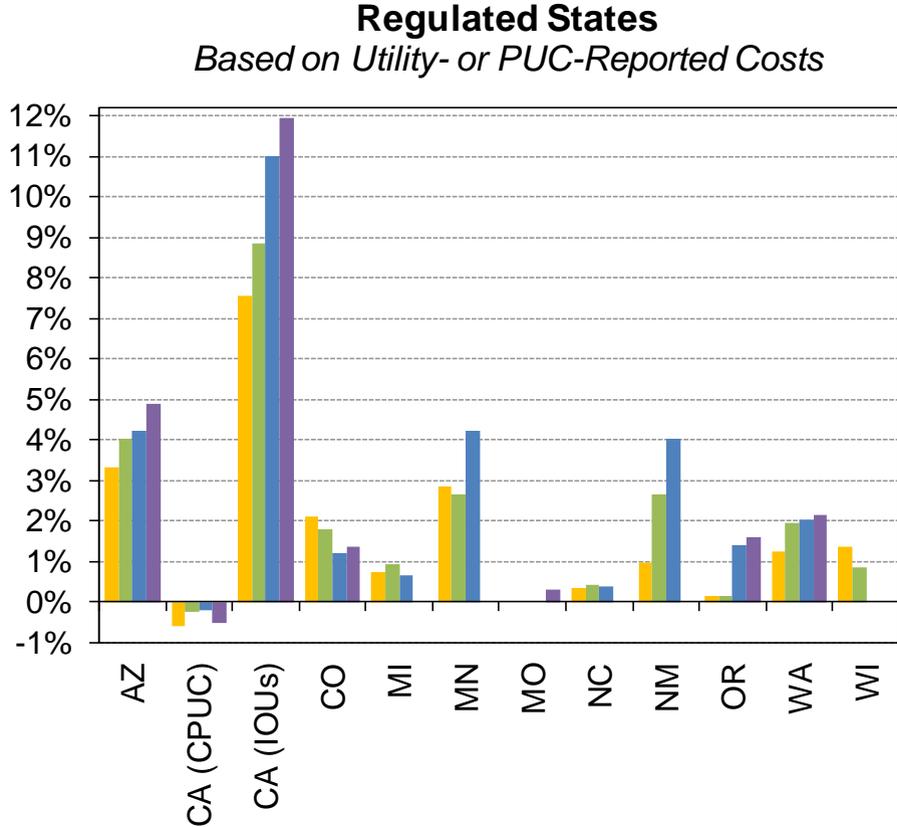
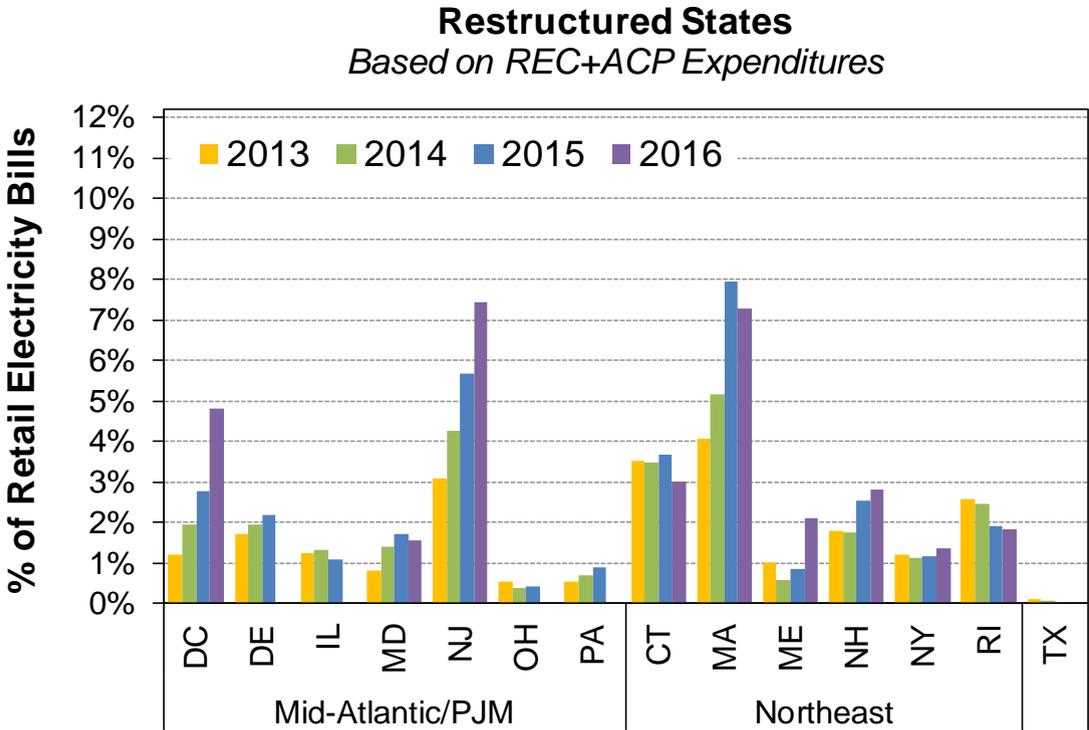


Notes: Annual averages are weighted based on each state's total revenues from retail electricity sales. Using IOU avoided cost estimates for CA, rather than the CPUC's estimates, would raise the U.S. weighted average costs substantially (e.g., to 3.1% of retail electricity bills in 2015).

# State-Specific RPS Compliance Costs, with 2016 data (where available)

Highly variable cost estimates across states; California data illustrate challenges

## RPS Compliance Costs (Percentage of Average Retail Electricity Bill)



### Cross-state cost variation reflects differences in:

- RPS target levels
- Resource tiers/mix
- REC prices
- Wholesale electricity prices
- Reliance on pre-existing resources
- State-specific cost calculation methods (see notes regarding CA)

### Falling REC prices in 2016 lead to declining RPS costs in some restructured states

Notes: RPS compliance cost estimates for restructured states are based, whenever possible, on the average cost of all RECs retired for compliance, including both spot market purchases and long-term contracts. For states with compliance years that begin in the middle of each calendar year (i.e., DE, IL, NJ, and PA), compliance years are mapped to the table based on the start date of each compliance year. Among regulated states, compliance cost data are wholly unavailable for IA, HI, MT, NV; these states are therefore omitted from the chart. The two sets of values for CA reflect alternate avoided-cost estimates (see earlier slide for explanation and discussion).

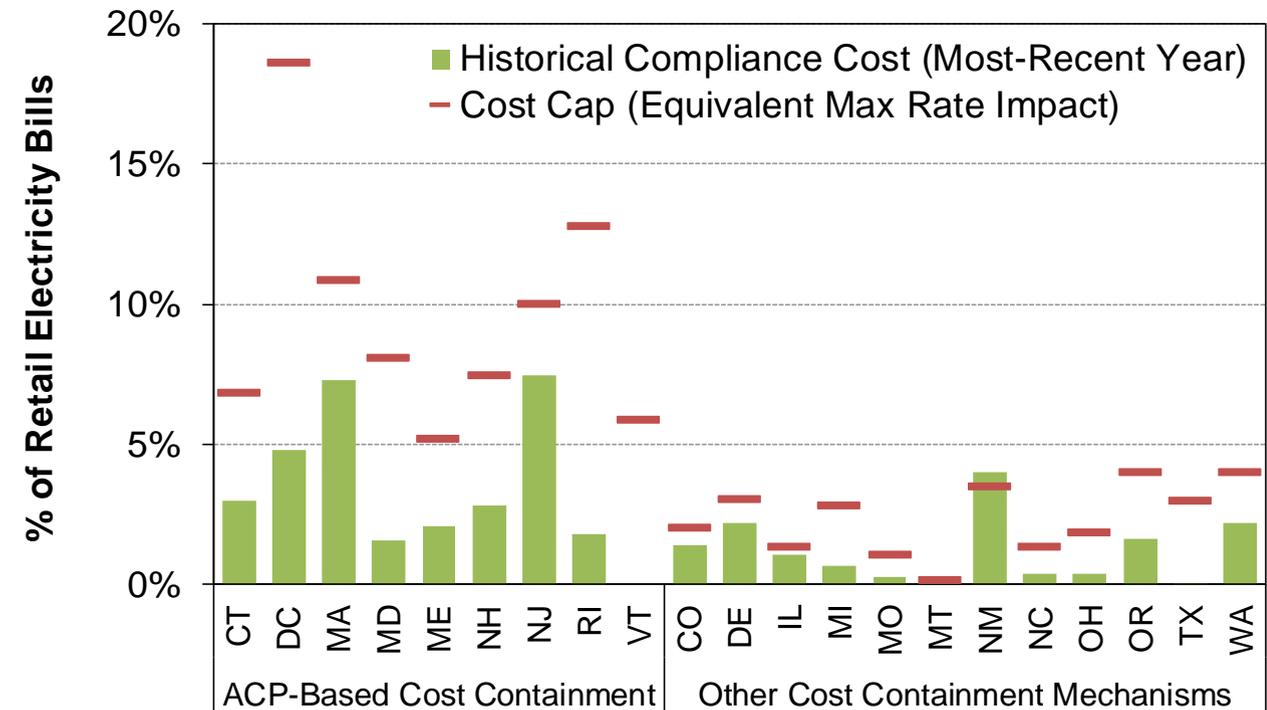
# RPS Cost Containment Mechanisms

Will cap growth in RPS compliance costs in most states

## RPS policies have various cost containment mechanisms

- ACPs (which cap REC prices)
  - Caps on rate impacts or revenue-requirements
  - Caps on surcharges for RPS cost recovery
  - RE contract price caps
  - Renewable energy fund caps
  - Financial penalties
  - Regulatory oversight of procurement
- Highest cost caps (10-20% of electricity bills) occur in states relying only on ACPs for cost containment and with relatively aggressive targets and/or high ACP rates
  - Cost caps in states with other cost containment mechanisms are generally more restrictive (1-4% of bills)
    - Have already led to curtailed procurement in NM, and are close to binding in several other states (DE, IL)

## Recent Costs Compared to Cost Caps



Notes: Each state's cost containment mechanism was translated into the equivalent maximum allowed rate impact for the final year in the RPS. For states with an ACP, this corresponds to the scenario in which the entire RPS obligation in the final RPS year is achieved with ACPs or RECs priced at the ACP rate. For MA, the year 2030 is used as the final target year, and the estimated cap does not yet account for the SMART program. Excluded from the chart are states currently without any explicit mechanism to cap incremental RPS costs (AZ, CA, IA, HI, MN, NV, NY, PA, WI), though many of those states have other kinds of mechanisms or regulatory processes to limit RPS costs.

# Compliance Cost Data Must be Interpreted with Caution

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**Restructured states:** Rate impacts are estimated based on REC and ACP expenditures, ignoring several other contributors (that work in opposing directions)

- Renewable integration and transmission costs: Some portion of incremental integration and transmission costs may be socialized by the network operator and therefore not reflected in REC prices
- Merit-order effect: At least within the short-run, low marginal-cost resources (like wind and solar) put downward pressure on wholesale prices, and in turn retail prices; can offset some portion of REC and ACP costs, though represents a transfer of wealth between generators and consumers and not a net welfare gain

**Regulated states:** Compliance costs must be estimated by comparing the gross cost of RPS procurement to the counterfactual cost of displaced non-RPS resources; utilities and states report compliance costs using widely varying methods, making comparison and aggregation challenging; the results from California on a previous slide illustrate this issue

**All states:** Compliance costs may not be fully or immediately passed through to ratepayers, for example, due to regulatory lag or to rules requiring that ACP revenues are refunded to ratepayers

# How Much Do We Really Know About the Cost of RPS Policies?

Maybe not as much as we would hope...

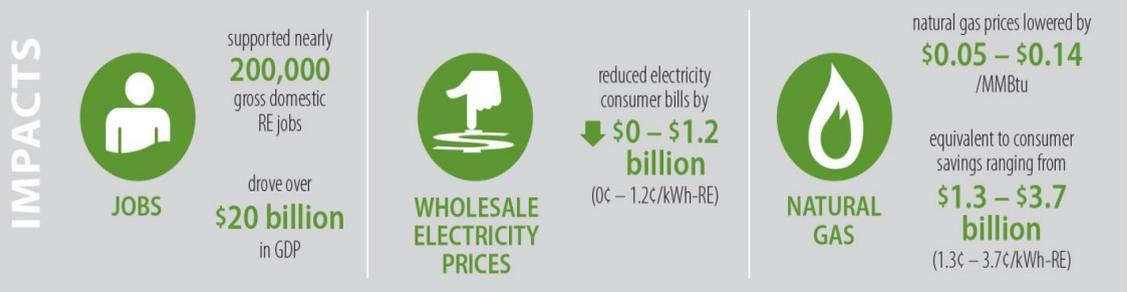
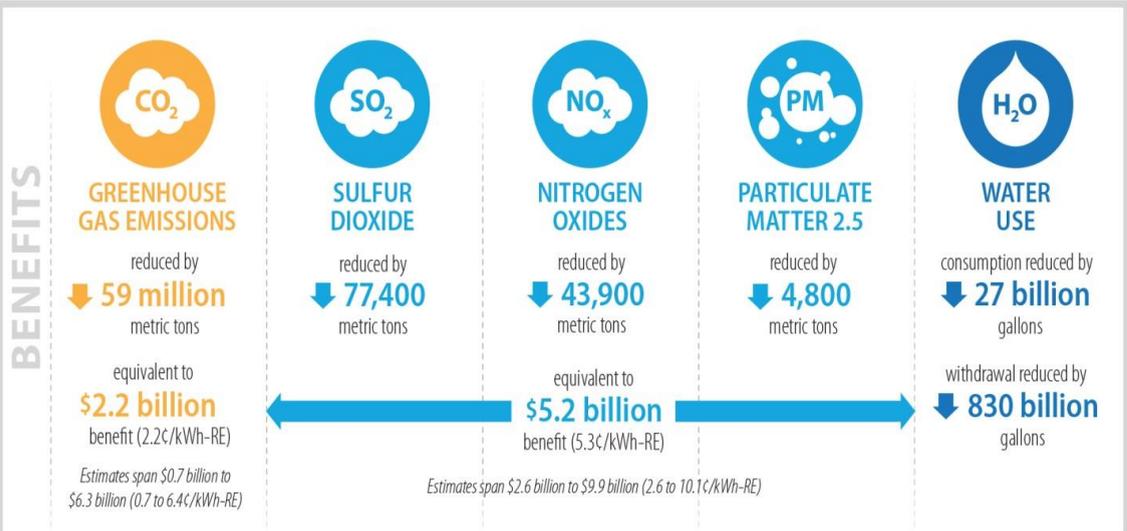
- Previously estimated costs apply varying methods, may not capture all impacts
- An alternative approach is statistical: three studies find 1-8% higher rates due to RPS; upper end of this range is higher than what bottom-up analyses have suggested on average, though not out of line with a number of individual higher-cost states

Study	Timeframe	Unit of Observation	Estimated Effect of RPS Policies on Retail Electricity Prices
Morey & Kirsch 2013	1990-2011	State-level annual average prices by customer class	Found a statistically significant effect for residential rates, with an increase of 0.45 cents/kWh (and an additional 0.27 cents/kWh in retail choice states). Results for commercial and industrial rates were smaller and less statistically significant. For commercial: 0.18 (+0.26 in retail choice). For industrial: 0.09 (+0.32 in retail choice). Based on US average retail prices in 2011, these correspond to the following percentage effects: residential (3.8%/6.2%), commercial (1.8%/4.3%), industrial (1.3%/6.0%).
Tra 2016	2001-2012	Utility-level annual average prices by customer class	Found roughly a 3% increase in both residential and commercial rates, but found no effects from increasing the stringency of the RPS. Based on US average retail prices in 2012, this corresponds to 0.3-0.4 cents/kWh.
Wang 2014	1990-2011	State-level annual average prices	Depending on model specification and variable definition, found statistically significant increases ranging from 5-7.5%. Based on US average retail prices in 2011, this corresponds to 0.5-0.75 cents/kWh.

# Costs Weighed Against Benefits: Also a Challenge!

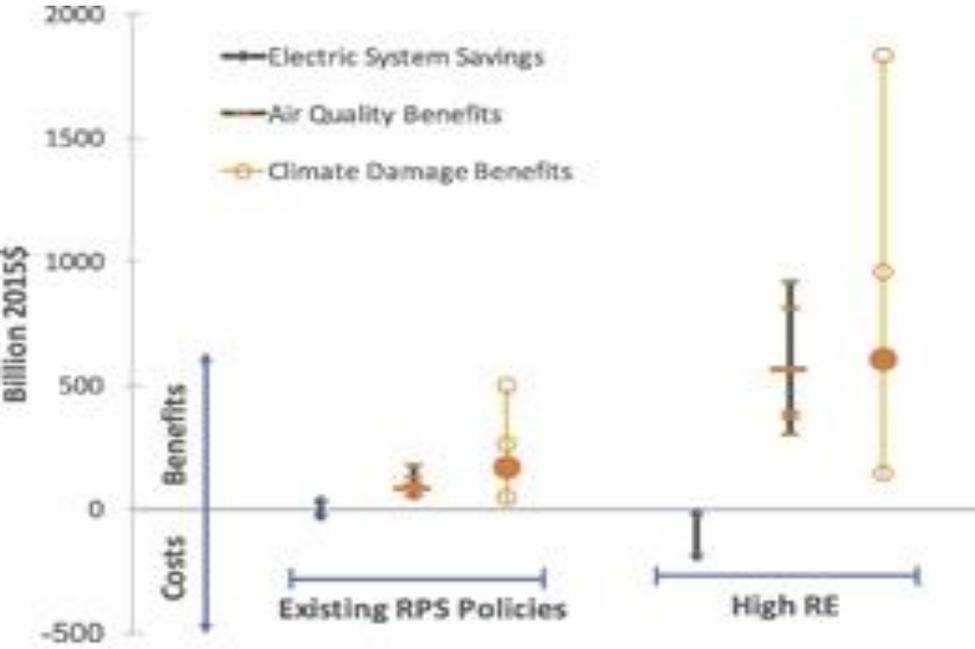
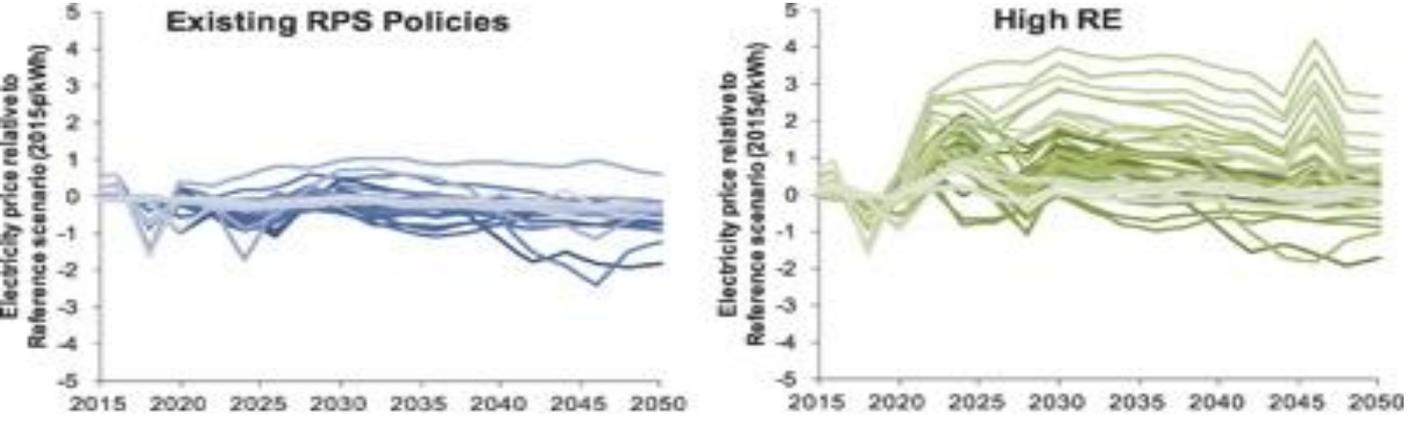
Past LBNL / NREL research provide some insight

## Historical benefits / impacts of RPS



Note: This study evaluated a subset of the potential benefits and impacts of state RPS policies. We distinguish impacts from benefits, because we do not estimate or claim any net social benefit from the impacts assessed here. We do not assess all potential benefits and impacts, for example land use and wildlife impacts, or job losses in the fossil industry. We also do not address the costs of state RPS programs, as that was the subject of an earlier study (Heeter et al. 2014).

## Prospective costs / benefits of RPS



# Table of Contents

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- Evolution of state RPS programs
- Historical compliance, impacts on renewables development
- Future RPS demand and incremental needs
- REC pricing trends
- RPS compliance costs and cost caps
- **Future Outlook**

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

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- ➔ RPS compliance costs and ACPs/cost caps
- ➔ Legislative and legal challenges to state RPS programs
- ➔ Whether additional states decide to increase and extend RPS targets as they approach their final target year
- ➔ Other ongoing refinements (e.g., REC banking rules, long-term contracting programs, eligibility rules, etc.)
- ➔ The many related issues affecting RE deployment and its costs (integration, transmission, siting, net metering, federal tax policy, etc.)

# For Further Information

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## RPS reports, presentations, data files, resources

*[rps.lbl.gov](https://rps.lbl.gov)*

## All renewable energy publications

*[emp.lbl.gov/reports/re](https://emp.lbl.gov/reports/re)*

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## Contact information:

Ryan Wisner, *[rhwisner@lbl.gov](mailto:rhwisner@lbl.gov)*, 510-486-5474

Galen Barbose, *[gbarbose@lbl.gov](mailto:gbarbose@lbl.gov)*, 510-495-2593

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