State-Federal RPS Collaborative

2011 National Summit on RPS

October 26-27, 2011

L'Enfant Plaza Hotel - Ballroom C

PRESENTATIONS

(Note: These presentations represent the personal views of the authors and do not necessarily reflect the views of their respective organizations)

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The State of the States:

Update on the Implementation of U.S. Renewables Portfolio Standards

Ryan Wiser & Galen Barbose

Lawrence Berkeley National Laboratory

2011 National Summit on RPS

Washington D.C.

October 26, 2011

Presentation Outline

1) Overview of State RPS Landscape

2) Policy Design Variations

3) Impacts: Past and Future

4) Ongoing Issues and Challenges

What Is a Renewables Portfolio Standard?

Renewables Portfolio Standard (RPS):

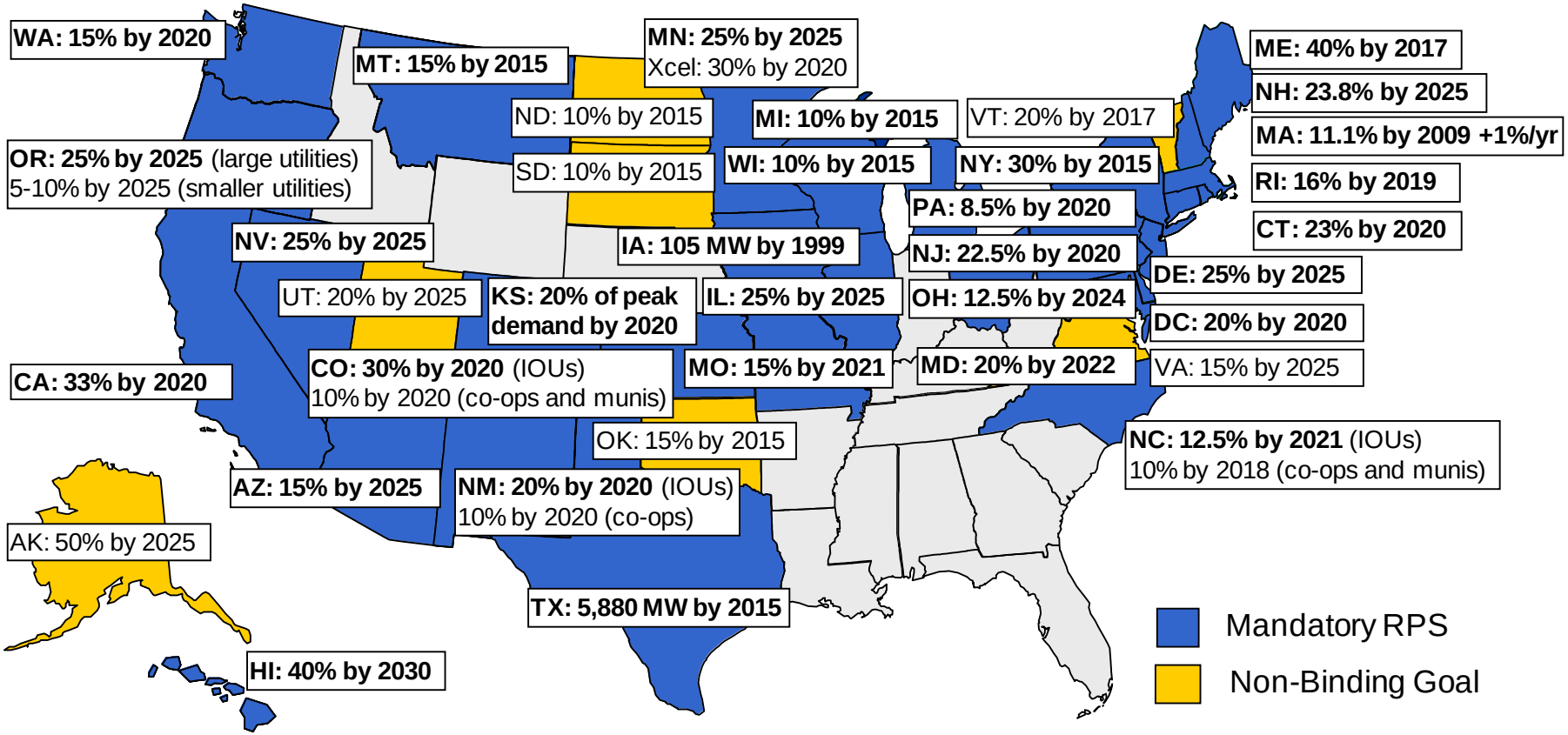
- A requirement on retail electric suppliers…
- to supply a minimum percentage or amount of their retail load…
- with eligible sources of renewable energy.

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

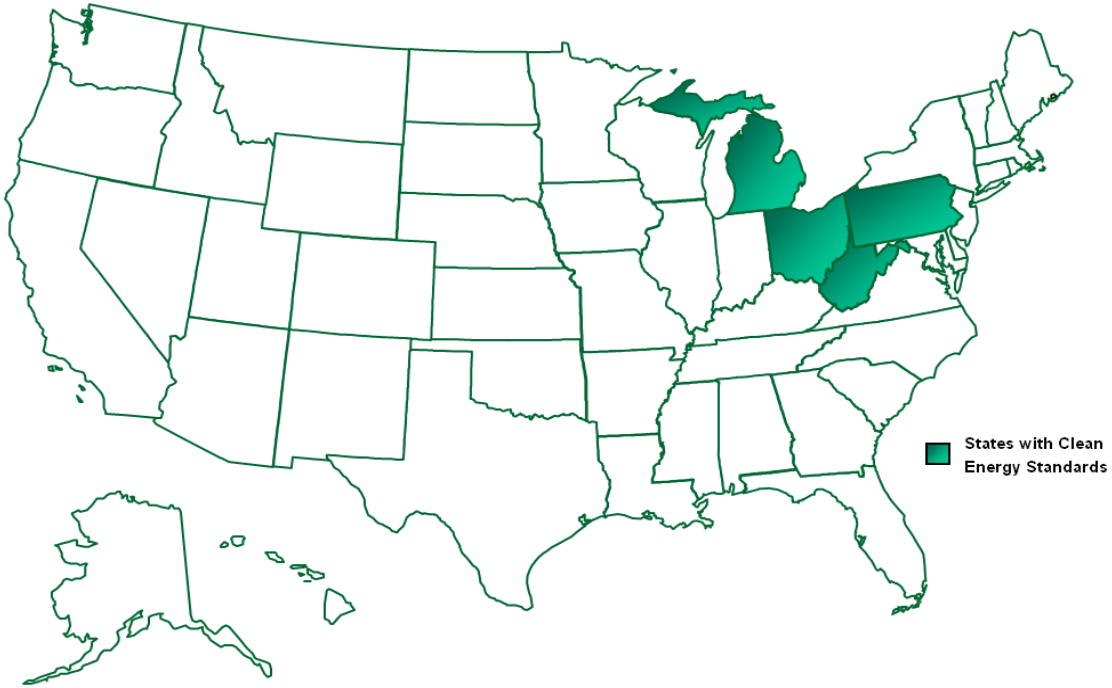


Source: Berkeley Lab

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

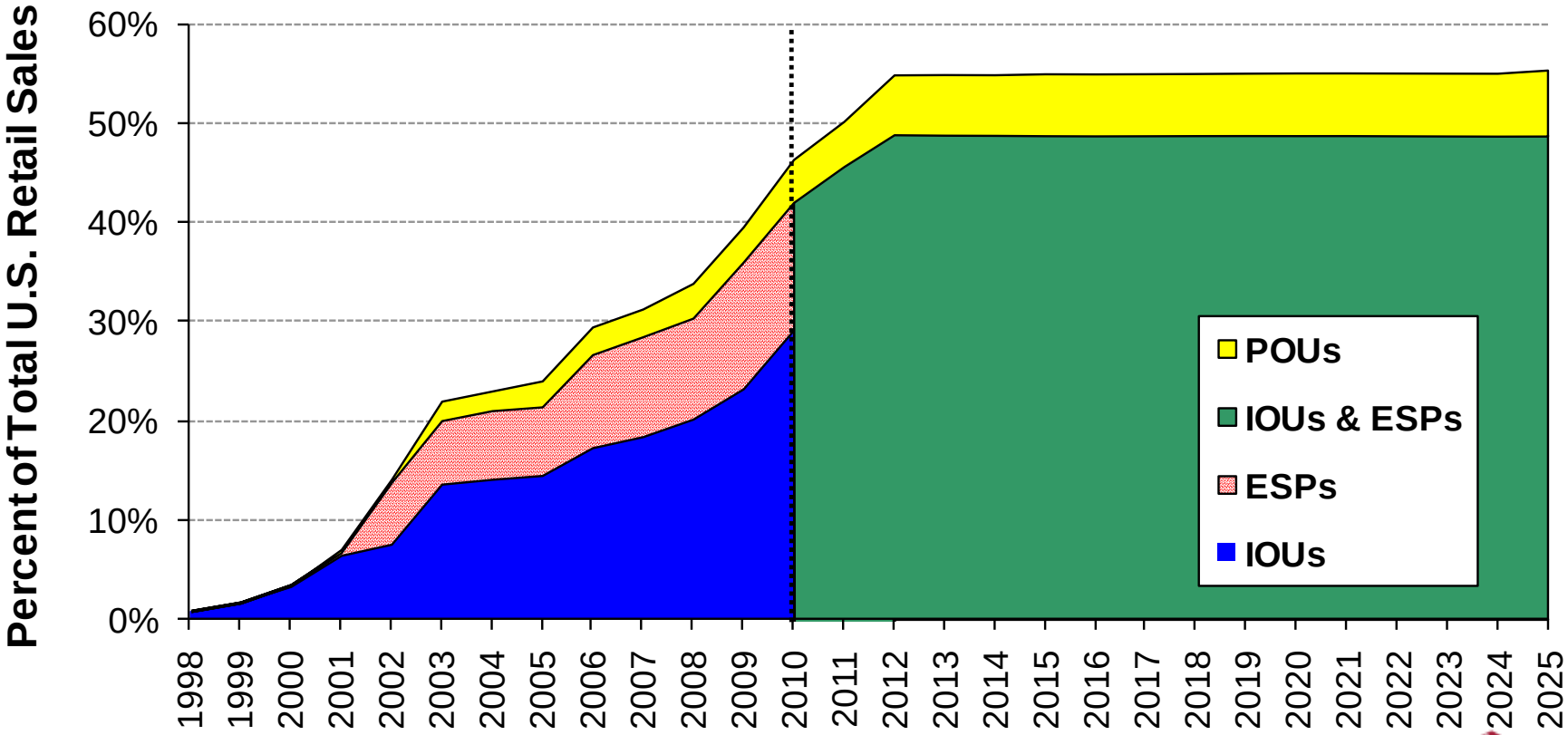
- Clean energy standards (CES') adopted in parallel to RPS (MI, OH, PA) or as a wholly separate policy (WV)
- IN has a voluntary clean energy goal
- Many states have adopted stand-alone energy efficiency (EE) resource standards or allow EE to qualify within an RPS or CES



Source: NREL (March 2011)

Existing RPS' Apply to 50% of U.S. Load in 2011 (Will Apply to 56% Once Fully Implemented)

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



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

Year	Enactment	Major Revisions
1983	IA	
1991		IA
1994	MN (2002)	
1996	AZ (1999)	
1997	MA (2003), ME (2000), NV (2001)	
1998	CT (2000), PA (2001), WI (2000)	
1999	NJ (2001), TX (2002)	MN, WI
2000	NM (2002)	AZ
2001		MN, NV
2002	CA (2003)	NM
2003		CT, MN, NV
2004	CO (2007), HI (2005), MD (2006), NY (2006), RI (2007)	NJ, NM, PA
2005	DC (2007), DE (2007), MT (2008)	CT, CO, NV, TX
2006	WA (2012)	AZ, CA, CT, HI, NJ, WI
2007	IL (2008), NH (2008), NC (2010), OR (2011)	CA, CO, CT, DE, MD, ME, MN, NJ, NM, PA, TX
2008	MI (2012), MO (2011), OH (2009)	DC, DE, HI, MA, MD, NJ
2009	KS (2011)	HI, IL, ME, MN, NV, OR, RI
2010		CO, DE, IL, MA, MD, NJ, NY
2011		CA, CT, DC, DE, MD, NC, WI

Enactment (above timeline)

Major Revisions (below timeline)

( ) Year of First Requirement

Notable Recent Developments

State-Specific RPS Developments (2011 to-date)

- 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; expanded solar set-aside eligibility to include certain fuel cell projects
- MA: Proposed long-term SACP schedule
- MD: Expanded solar set-aside eligibility to include solar water heating; reclassified waste-to-energy as Tier 1
- NC: Expanded eligibility to include direct load control/demand response
- WI: Expanded eligibility to include new large hydropower

General Trends in New and Proposed Revisions

- Increased stringency of RPS purchase targets (though momentum has slowed)
- Honing solar set-aside provisions (eligibility rules, SACP schedules, contracting mechanisms)
- Efforts to address REC oversupply/volatility (especially SRECs)
- Upsurge in legal/political efforts to weaken RPS policies

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

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

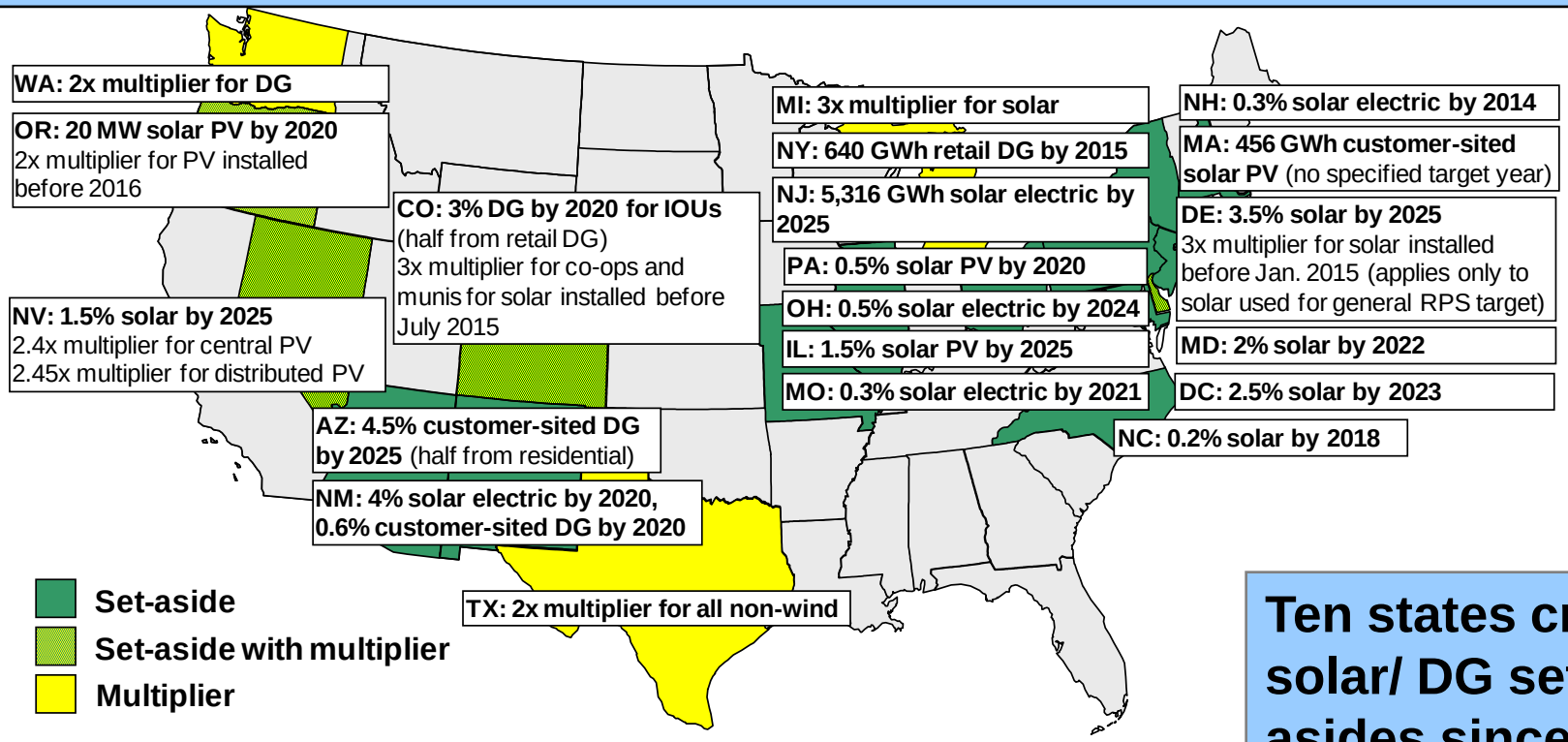
Credit Multipliers: Provides selected technologies or applications more credit than other forms of generation towards meeting the RPS

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**	
Class I vs. II: CT, DC, DE, MA, MD, ME, NH, NJ	Solar Energy: DC, DE, IL, MA, MD, MO, NC, NH, NJ, NM, NV, OH, OR, PA Wind Energy: IL, ME (goal), MN, NJ (offshore), NM Existing Biomass/Methane: NH Existing Hydropower: NH Geothermal or Biomass: NM Swine Waste: NC Poultry Waste: NC Non-Wind: TX (goal)	Distributed Generation: AZ, CO, NM, NY Community Ownership: MN (goal), MT (wind), OR (goal, community and small scale)	Solar Energy: DE (general RPS), MI, CO (POUs), NV (PV), OR Wind Energy: DC, MD, DE (offshore) Methane: DC, MD Fuel Cells: DE Waste Tires: NV Non-Wind: TX Distributed Generation: NV (PV), WA Community Ownership: CO, ME
No Differential Support: CA, HI, IA, KS, WI			

Solar/DG-Specific RPS Designs Are Common Nationwide

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 in CT and RI via long-term contracting programs with legislatively-established budgets or capacity targets

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

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 anywhere outside region must deliver electricity to region	DE, ME, NJ, WA
Generators in limited areas 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

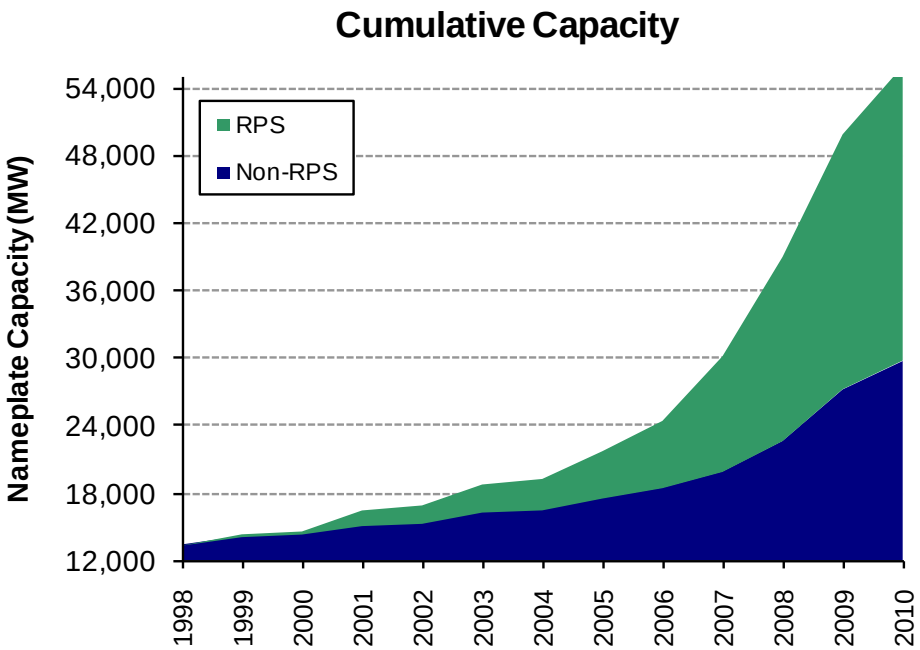
Operational Experience with State RPS Policies Remains Somewhat Limited

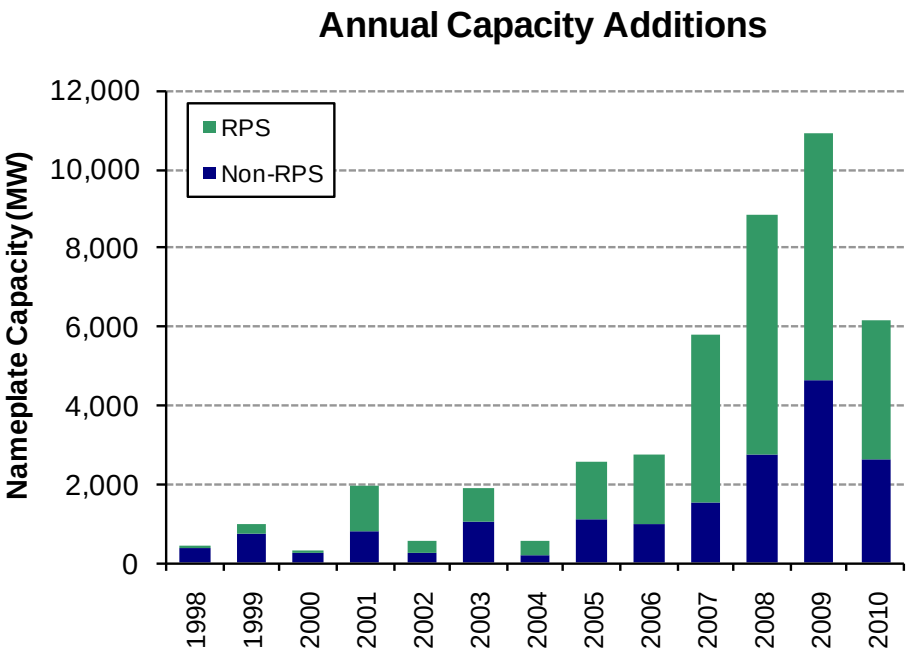
Operational Experience with State RPS Policies
(number of major compliance years completed-to-date)

< 1 year	1 – 2 years	3 – 4 years	5 – 6 years	7 – 8 years	> 8 years
Kansas	Hawaii	Colorado	Maryland	California	Arizona
Michigan	North Carolina	Delaware	New York	Connecticut	Iowa
Missouri	Ohio	Illinois	New Mexico	Massachusetts	Maine
Oregon		Montana	Wisconsin	Minnesota	New Jersey
Washington		New Hampshire		Nevada	Texas
		Pennsylvania			
		Rhode Island			
		Washington D.C.			

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

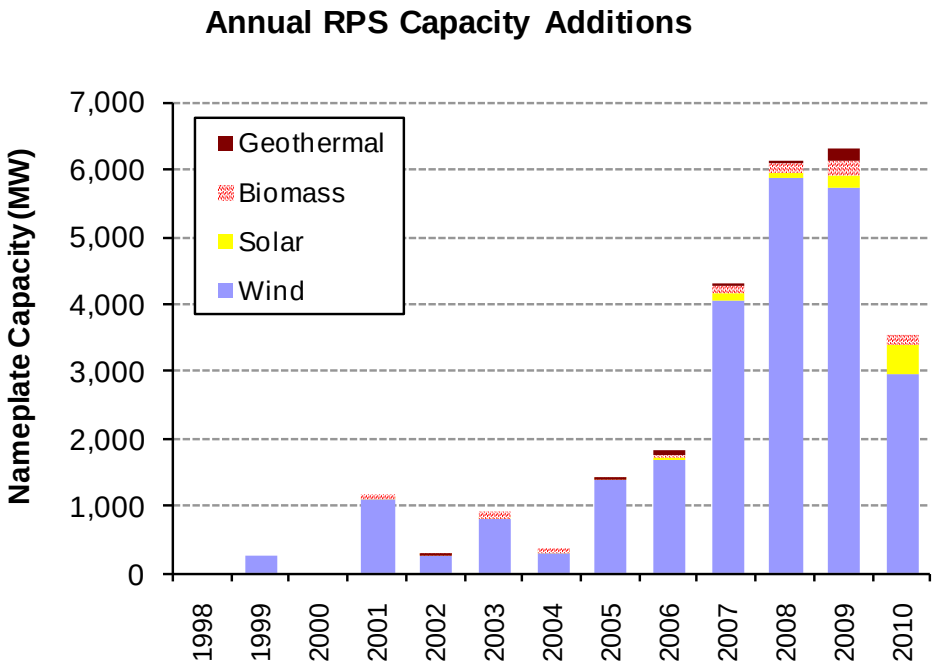


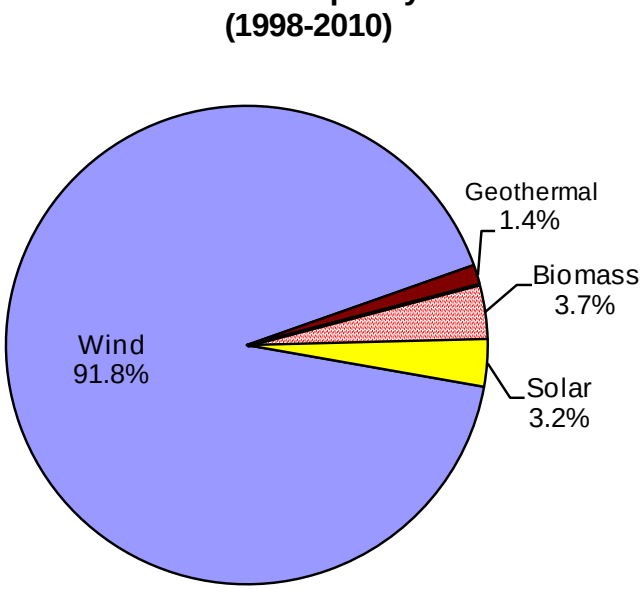


Though not an ideal metric for RPS-impact, 61% of the 44 GW of non-hydro renewable additions from 1998-2010 (**27 GW**) have occurred in states with active/impending RPS compliance obligations

State RPS' Have Largely Supported Wind: Resource Diversity Limited So Far

RPS-Motivated* Renewable Energy Capacity Additions from 1998-2010, by Technology Type

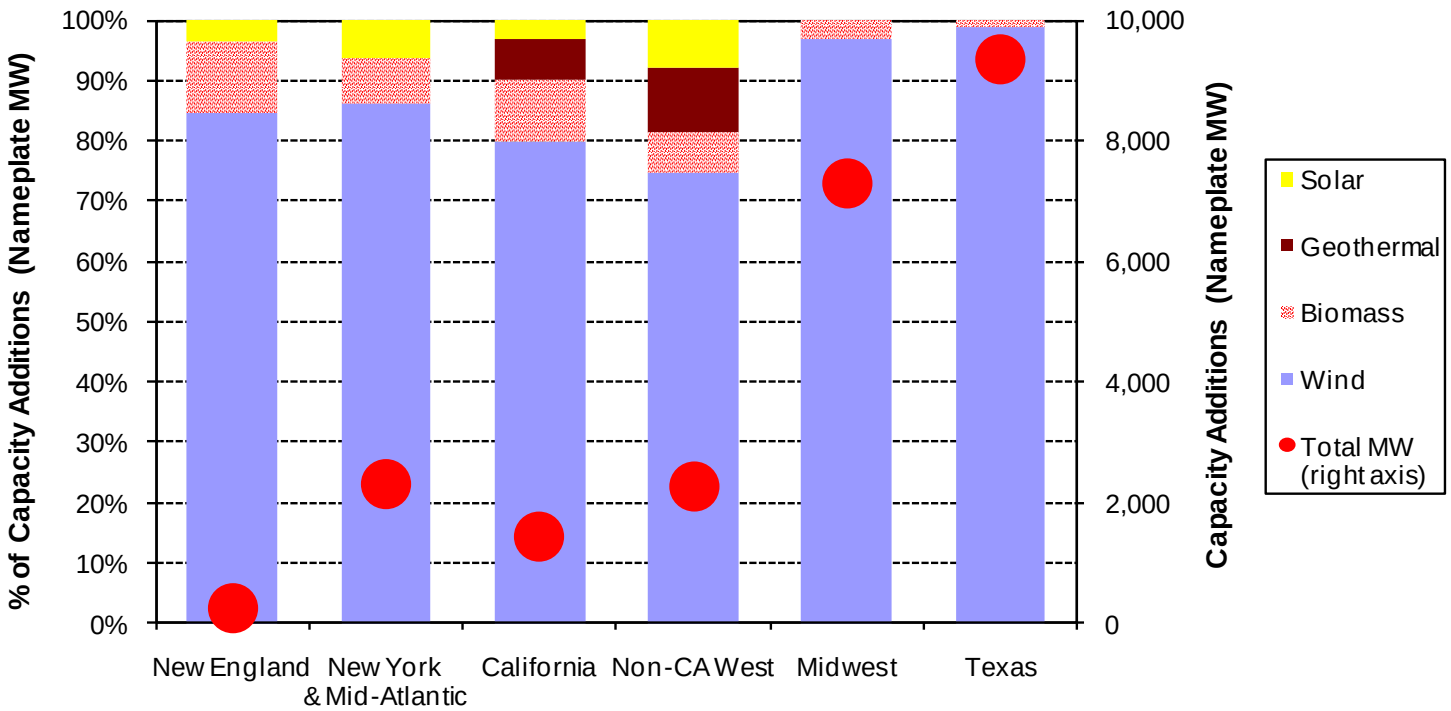




** Renewable additions are counted as "RPS-motivated" if and only if they are located in a state with an RPS policy and commercial operation began no more than one year before the first calendar year of RPS compliance obligations in the host state. On an energy (as opposed to capacity) basis, wind energy represents approximately 87%, biomass 9%, geothermal 3%, and solar 1% of cumulative RPS-motivated renewable energy additions from 1998-2010, 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 1998-2010, by Region and Technology Type



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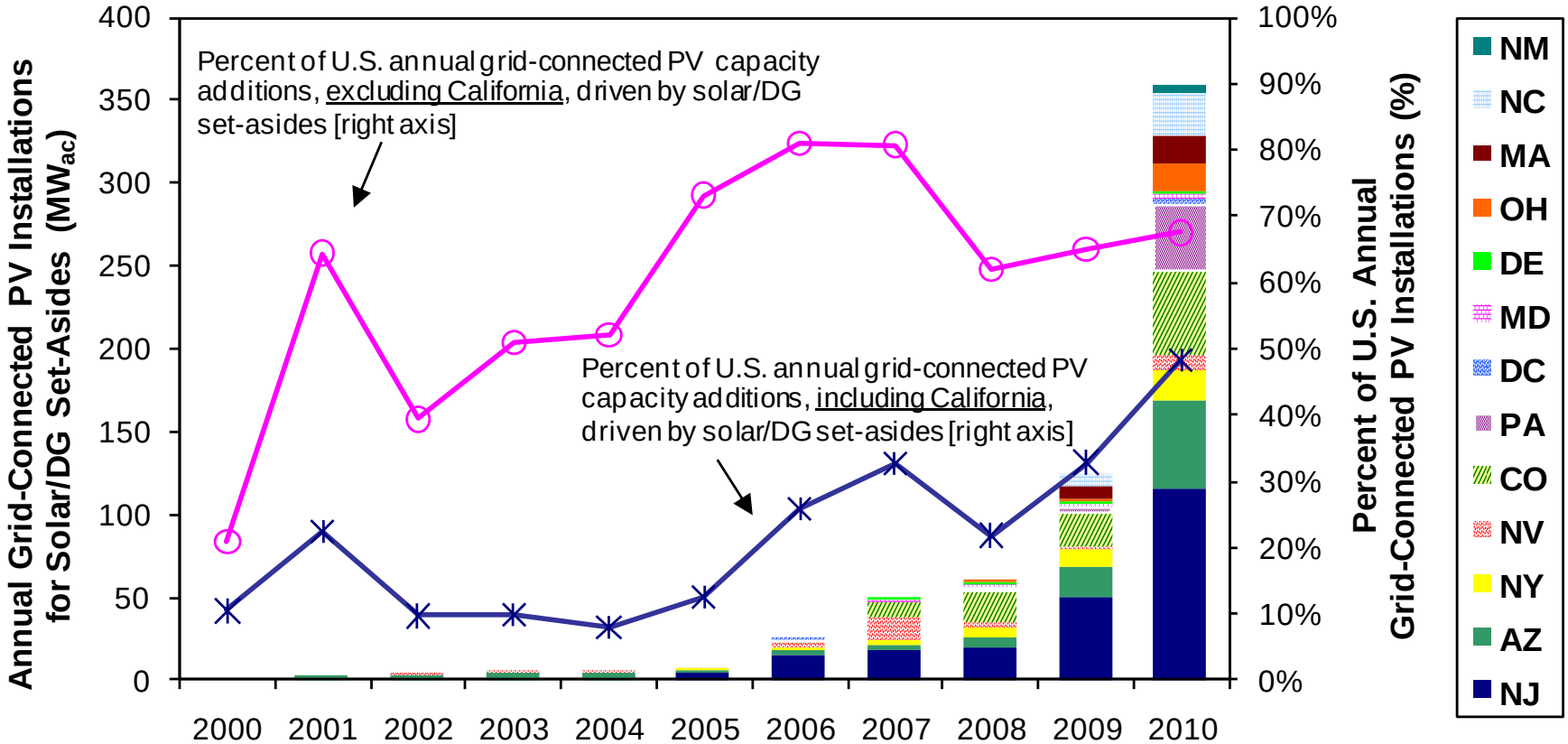
Impact of Solar/DG Set-Asides Is Growing: 646 MW_{ac} PV, 65 MW CSP from 2000-10



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

Declining Solar Costs Will Increase RPS Resource Diversity Even without Set-Asides

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

Increased competition largely driven by price reductions for utility-scale solar

More than 21,500 MW of contracts with new renewable generators signed in California since 2002*

Wind	53%
Solar	42%
Geothermal	3%
Biomass/MSW	3%
Small hydro	<1%

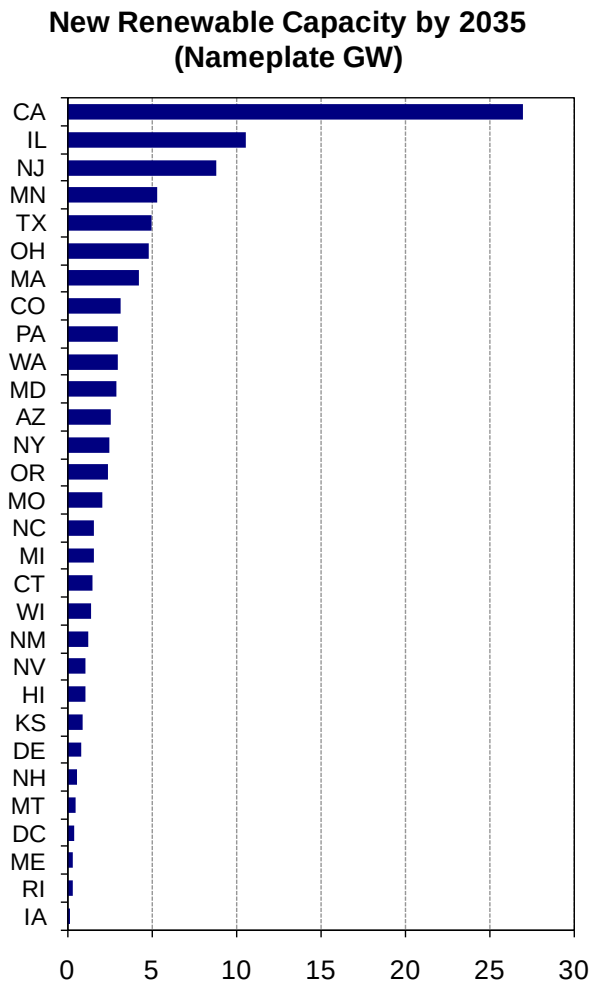
**Based on CPUC RPS contract database for IOUs and analysis of contract announcements by POUs*

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

~**100 GW** of new* RE by 2035, <u>if</u> full compliance is achieved

(**109 GW** including voluntary goals)

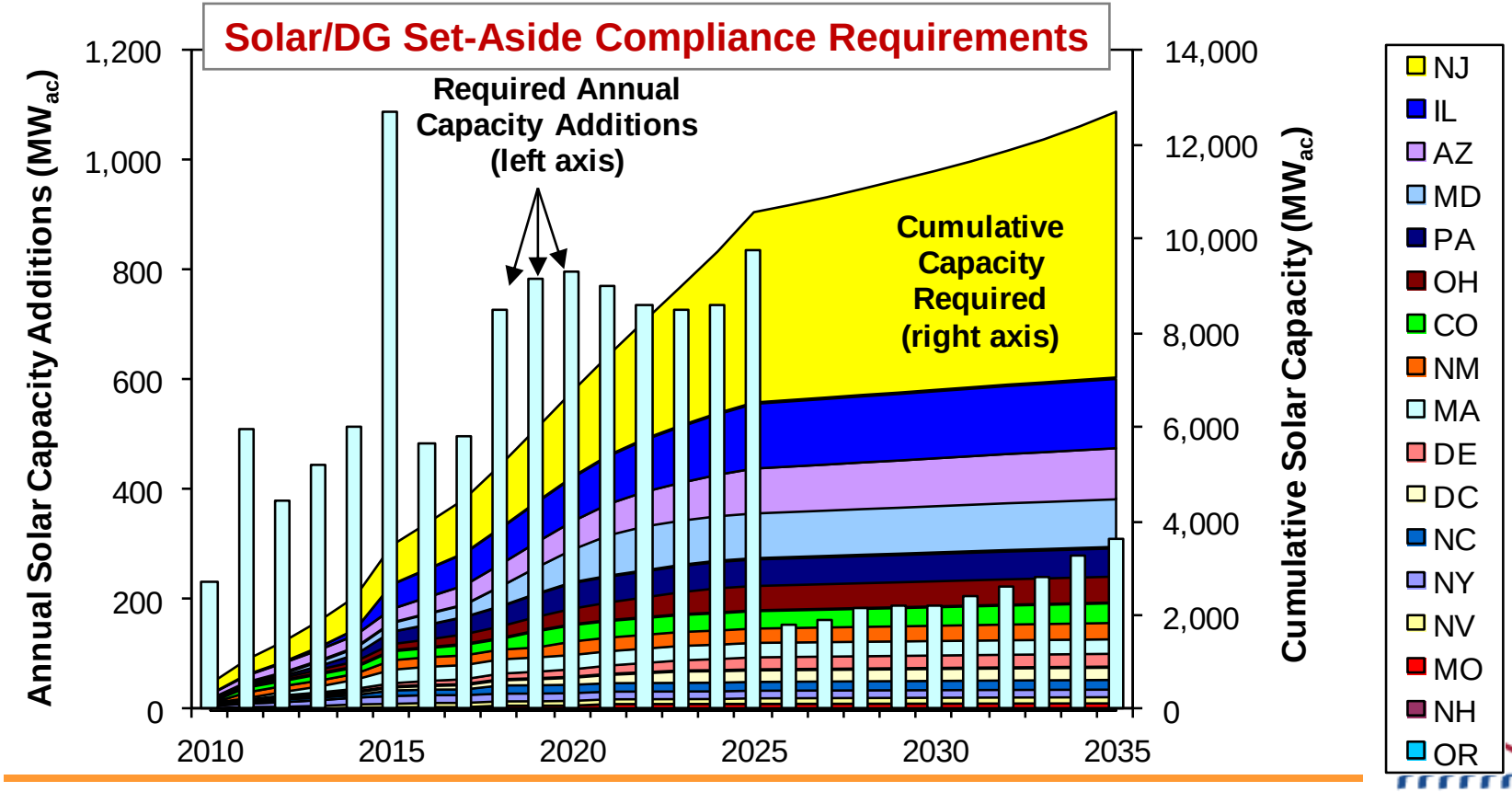
7% of projected generation in 2035; 32% of projected load growth from 2000-2035



* *New renewables* defined based on state-specific distinctions between new vs. existing or on the year in which the RPS was enacted

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

- Cumulative capacity requirement grows to **10,600 MW by 2025**
- Required average annual solar capacity additions of **~450 MW/yr** from 2011-14, **~700 MW/yr** from 2015-25



Ongoing Issues and Challenges

- Price trends and near-term over-supply of RE
- Required additional RE deployment is “limited”
- State RPS compliance challenges in some cases
- Rate impacts and cost concerns
- Other emerging state policy design issues

REC Prices Have Dropped Substantially in Many Regions Over the Last Two Years

- **REC prices historically volatile - dropped substantially in many regions recently (main tier and solar RECs)**
- **Recent price trends reflect "over-supply" to meet RPS (CA the obvious exception)**
  - Wholesale electricity prices have also declined substantially over the same period…
  - In concert with low REC prices, make 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

State RPS, and Proposed Federal RPS, Require Fewer RE Additions than Experienced in 2008-10

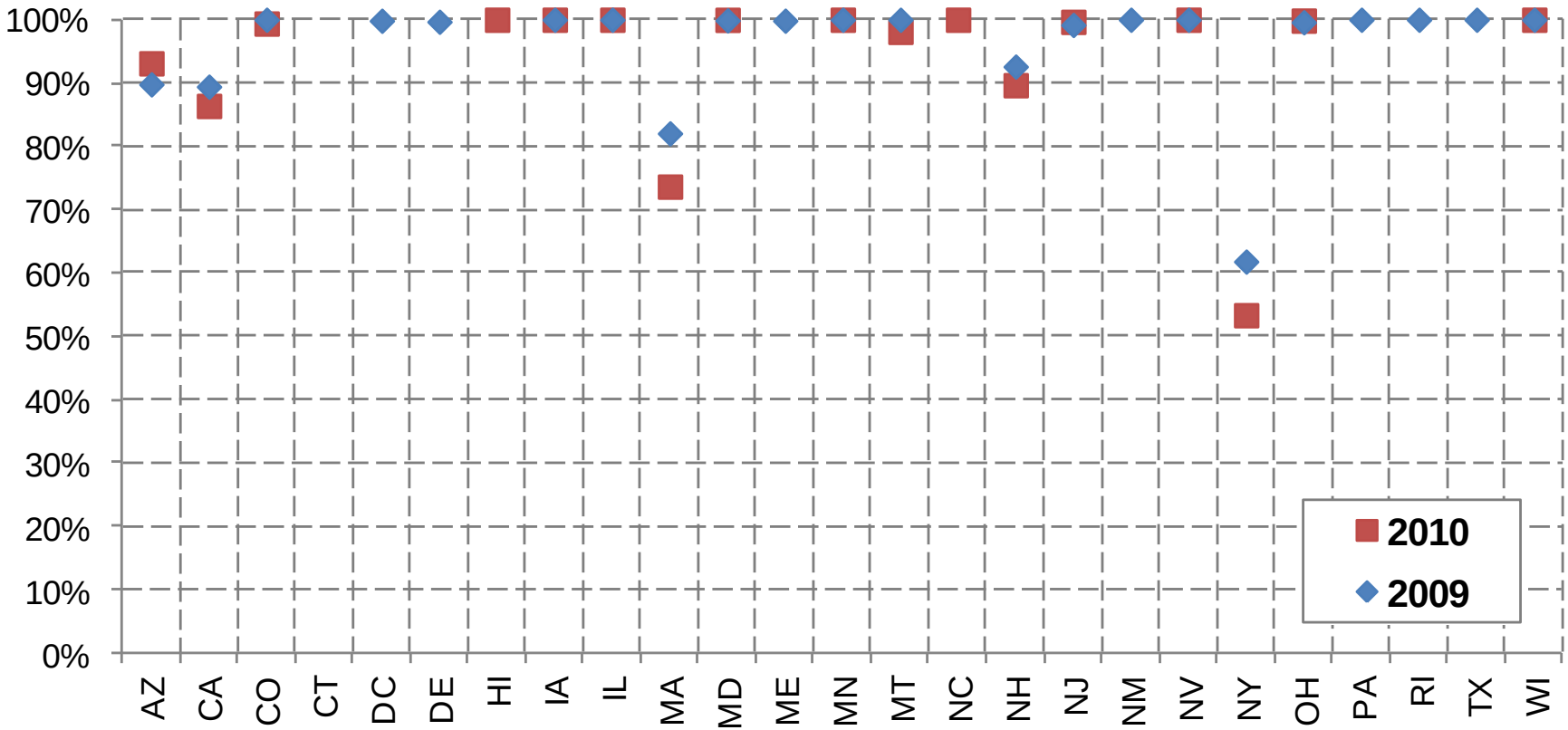
Recent RE capacity additions vs. RE additions required to meet current state RPS policies and proposed Federal RPS

Recent Renewable Capacity Additions (2008-2010)	6-11 GW/yr
Average Annual Renewable Capacity Additions (2011-2025)	
State RPS Requirements	4-5 GW/yr
Proposed Federal RPS (Bingaman 2010) + State RPS	3-9 GW/yr

- Continued growth at 2008-10 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 2008-10 installation rate

Targets Largely Met with Renewable Energy or RECs, But Some Struggles Are 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.

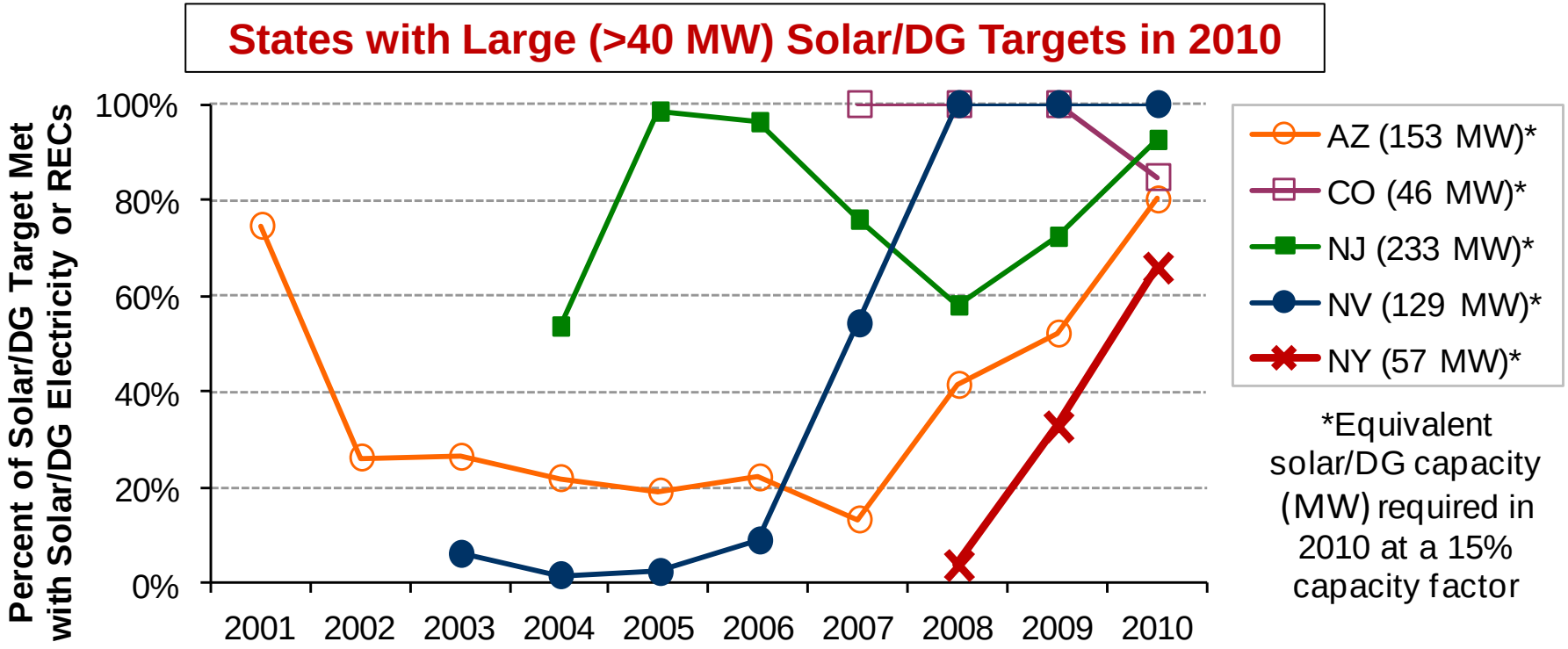
Targets Largely Met with Renewable Energy or RECs, But Some Struggles Are Apparent

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

State	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
AZ	-	-	85%	61%	30%	30%	25%	24%	30%	90%	90%	93%
CA	-	-	-	-	-	100%	100%	100%	100%	91%	89%	86%
CO	-	-	-	-	-	-	-	-	100%	100%	100%	99%
CT	-	no data	no data	no data	no data	100%	100%	96%	100%	100%	no data	no data
DC	-	-	-	-	-	-	-	-	99%	100%	100%	no data
DE	-	-	-	-	-	-	-	-	97%	96%	100%	no data
HI	-	-	-	-	-	-	100%	-	-	-	n/a	100%
IA	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
IL	-	-	-	-	-	-	-	-	-	100%	100%	100%
MA	-	-	-	-	100%	65%	64%	74%	99%	100%	82%	74%
MD	-	-	-	-	-	-	-	100%	100%	100%	100%	100%
ME	-	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	no data
MN	-	-	-	61%	72%	72%	81%	no data	99%	100%	100%	100%
MT	-	-	-	-	-	-	-	-	-	99%	100%	98%
NC	-	-	-	-	-	-	-	-	-	-	n/a	100%
NH	-	-	-	-	-	-	-	-	-	63%	93%	90%
NJ	-	-	100%	100%	100%	100%	100%	100%	100%	99%	99%	100%
NM	-	-	-	-	-	-	-	100%	100%	100%	100%	no data
NV	-	-	-	-	30%	30%	95%	39%	50%	100%	100%	100%
NY	-	-	-	-	-	-	-	52%	25%	24%	62%	53%
OH	-	-	-	-	-	-	-	-	-	-	100%	100%
PA	-	-	no data	no data	-	-	-	100%	100%	100%	100%	no data
RI	-	-	-	-	-	-	-	-	98%	100%	100%	no data
TX	-	-	-	99%	96%	99%	99%	100%	99%	100%	100%	no data
WI	-	40%	100%	100%	100%	100%	100%	100%	88%	99%	100%	100%
Weighted Average	**100%**	**98%**	**100%**	**91%**	**86%**	**94%**	**96%**	**95%**	**93%**	**92%**	**92%**	**88%**

Solar Set-Asides Not Universally Achieved with RE or RECs, But Signs of Improvement

Early-year retirement of solar electricity/RECs, relative to set-aside requirements, mixed: average level in 2010 **= 86%**



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.

Solar Set-Asides Not Universally Achieved with RE or RECs, But Signs of Improvement

State	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
AZ	75%	26%	26%	22%	19%	22%	13%	41%	52%	80%
CO	-	-	-	-	-	-	100%	100%	100%	85%
DC	-	-	-	-	-	-	0%	0%	62%	no data
DE	-	-	-	-	-	-	-	84%	94%	no data
MA	-	-	-	-	-	-	-	-	-	8%
MD	-	-	-	-	-	-	-	7%	53%	97%
NC	-	-	-	-	-	-	-	-	-	100%
NH	-	-	-	-	-	-	-	-	-	92%
NJ	-	-	-	54%	98%	96%	76%	58%	72%	93%
NV	-	-	6%	2%	2%	9%	54%	100%	100%	100%
NY	-	-	-	-	-	-	-	4%	33%	66%
OH	-	-	-	-	-	-	-	-	82%	94%
PA	-	-	-	-	-	100%	99%	100%	100%	no data
Average (weighted by obligation)	**75%**	**26%**	**19%**	**17%**	**17%**	**25%**	**41%**	**64%**	**72%**	**86%**

Enforcement Actions Have Thus Far Been Limited

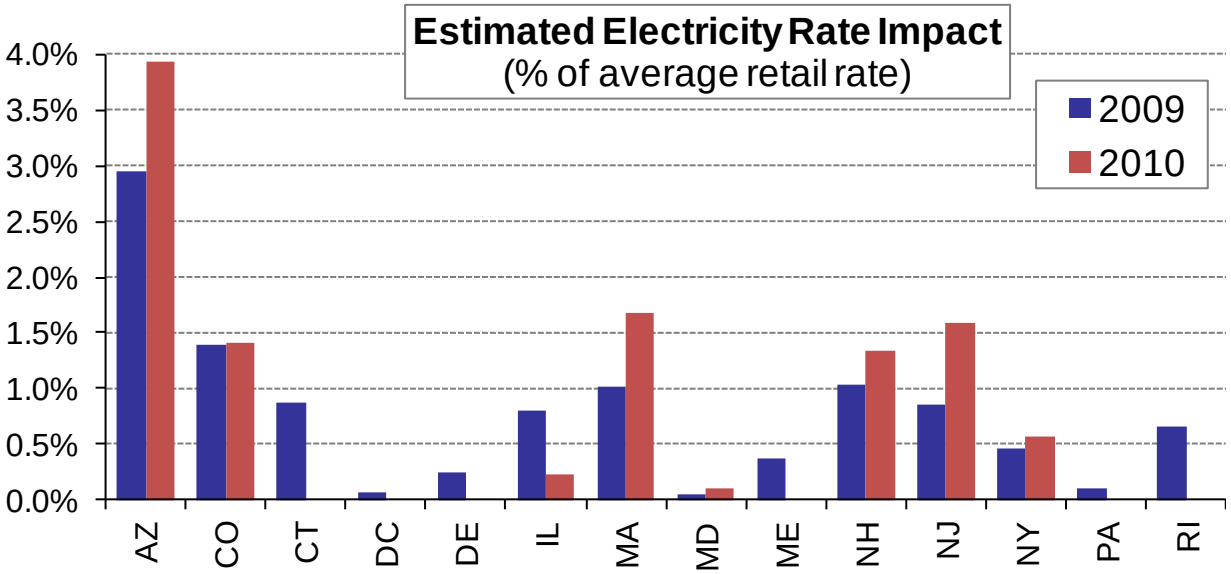
- Enforcement mechanisms vary, and one should not assume that strictly failing to meet RPS targets leads to enforcement actions

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 $50 million in 2009; partial data for 2010 shows roughly $40 million in ACPs
- Penalties have been levied in CA, CT, MT, OH, PA, and TX
- Lack of compliance has sometimes been excused

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

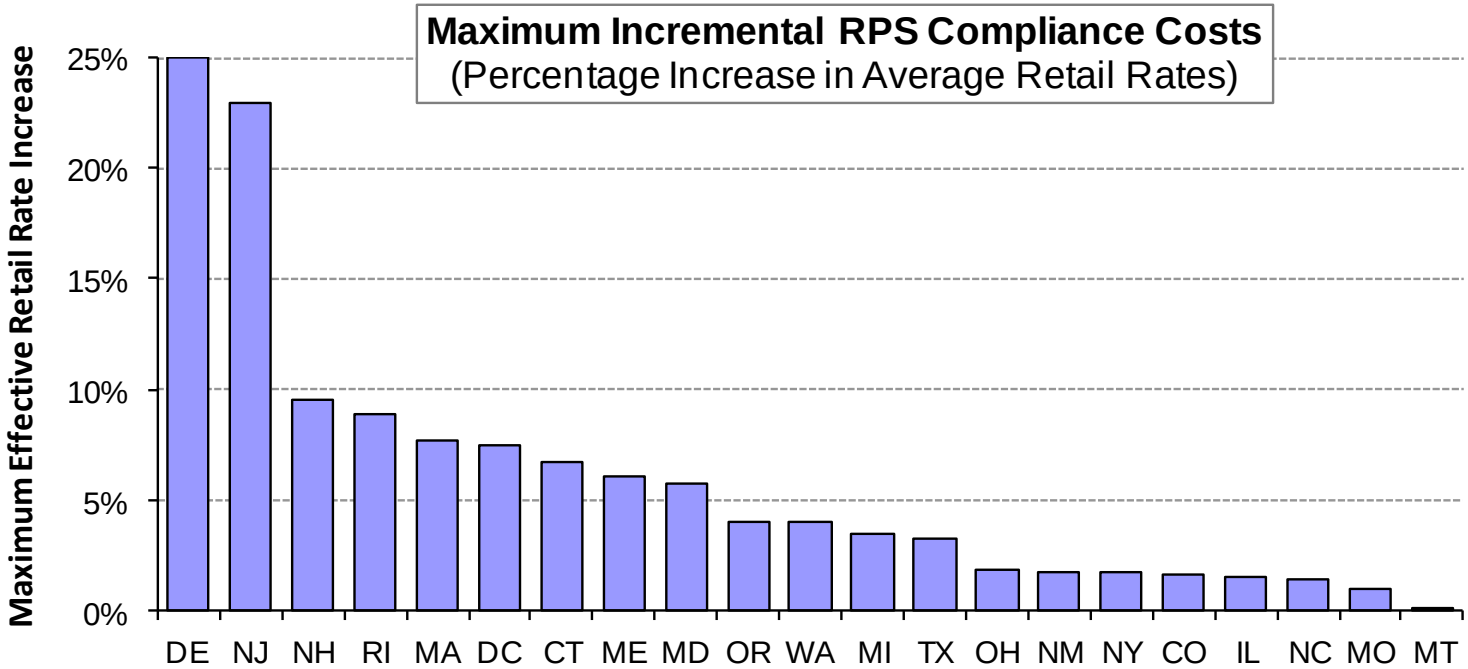
1) **ACP with automatic cost recovery:** MA, ME, NH, NJ, RI
2) **ACP with possible cost recovery:** DC, DE, MD, OR
3) **Retail rate / revenue requirement cap:** CO, KS, IL, MD, MO, NM, OH, OR, WA
4) **Renewable energy contract price cap:** MT, NM
5) **Per-customer cost cap:** MI, NC, NM
6) **Renewable 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% (12 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, NM, NV, PA, WI), though KS caps gross RPS procurement costs and CA is currently developing its cost containment mechanism.

Other Emerging and Continuing Issues Facing State RPS Programs

- Long-term contracting needs in “restructured” markets otherwise dominated by short-term REC transactions
- Addressing the dual desires for liquid RE markets *and* in-state benefits in the face of the Commerce Clause
- Managing compliance enforcement procedures, force majeure events, and cost caps as targets become binding
- Maintaining some stability and predictability in the face of numerous ongoing policy design changes
- Interactions between state and *possible* future Federal policies
- Addressing the other barriers to renewable energy: transmission, integration, siting, etc.

THE CORRECT PRICE

FOR THE 2011 NATIONAL RPS SUMMIT

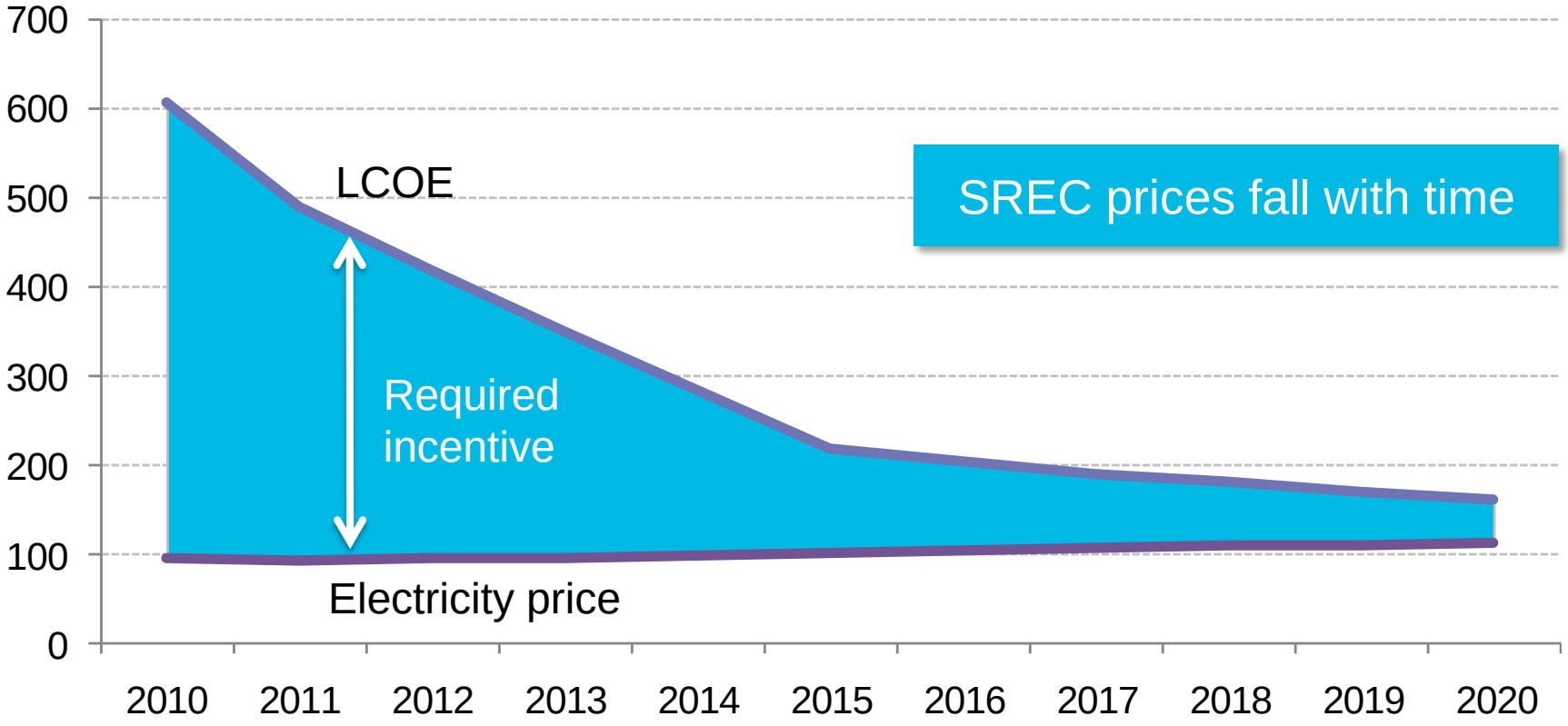
WILLIAM NELSON

26 OCTOBER 2011

Bloomberg
NEW ENERGY FINANCE

FUNDAMENTAL SREC PRICE, $/MWh

= levelised cost of electricity (LCOE) – power price



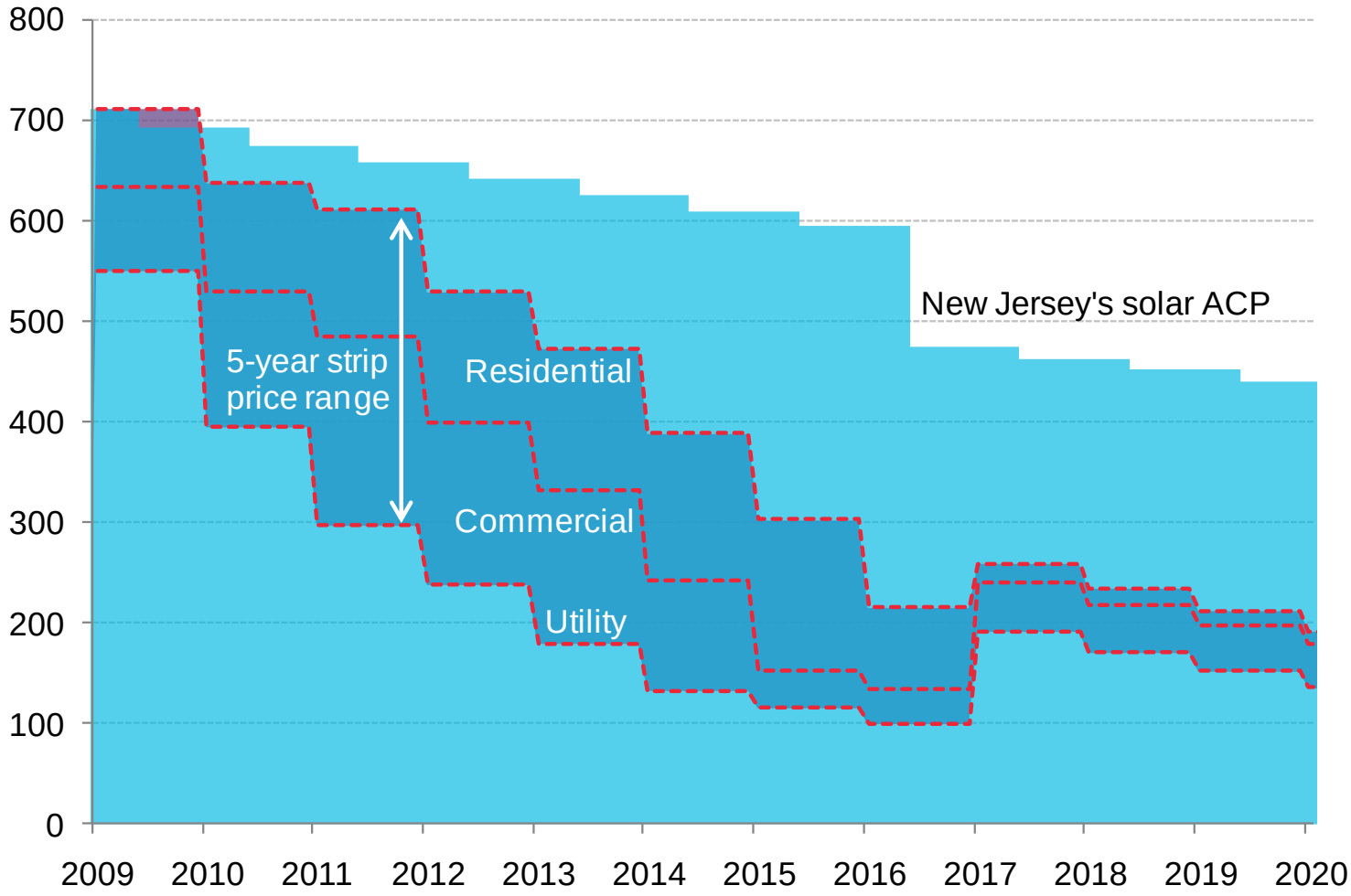
SREC prices fall with time

SREC PRICING METHODOLOGIES (1 OF 2)

SYSTEM ECONOMICS (STRIPS)

- 5-year strip prices necessary to induce new build
- Unlevered target equity IRR = 10%
- Assume ‘conservative’ tail: SREC price after 5-year strip (ie, years 6-15) = 50% of initial strip price
- Price declines over time as LCOE declines

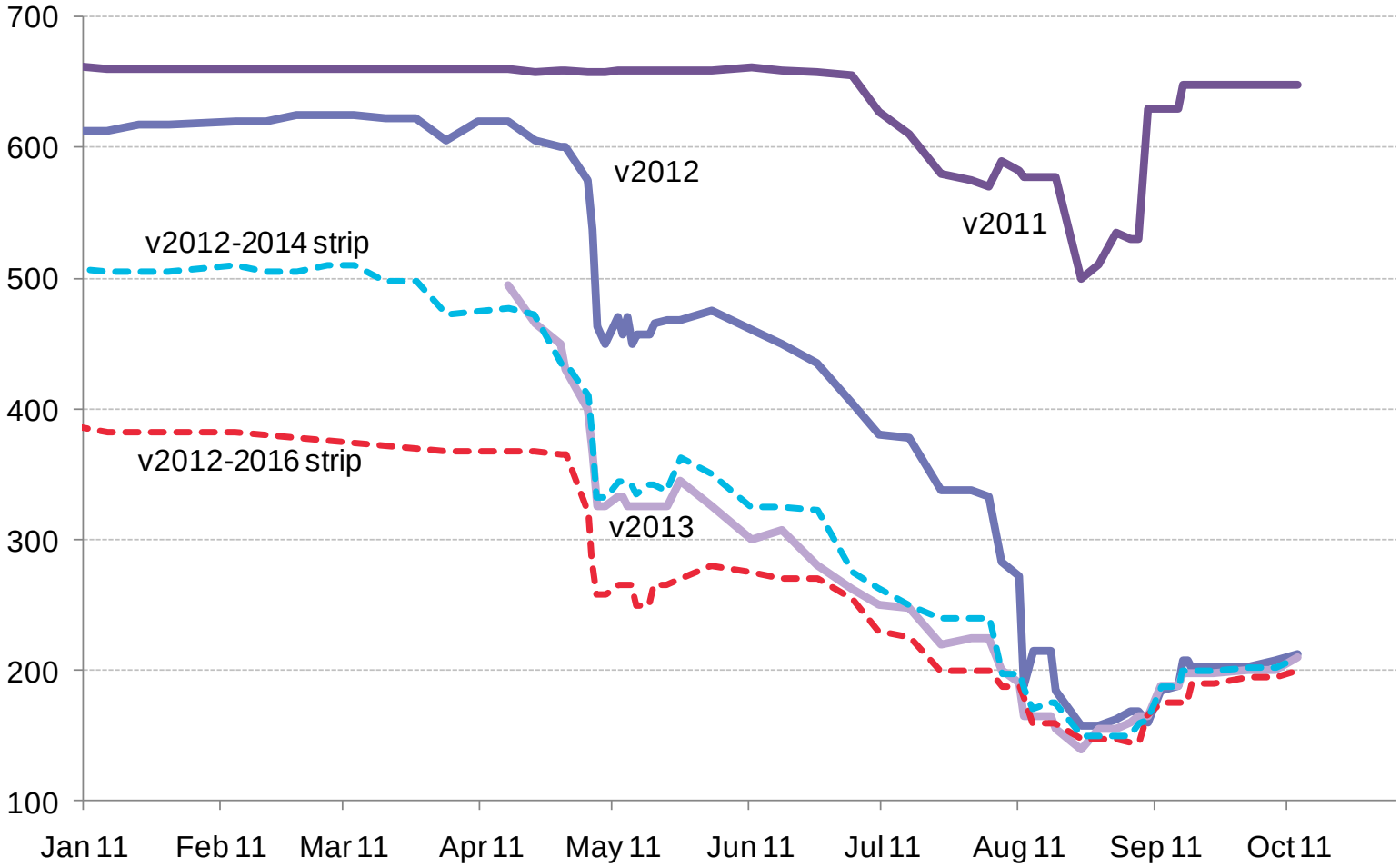
SYSTEM ECONOMICS METHODOLOGY: 5-YEAR STRIP PRICES TO INDUCE NEW BUILD IN NEW JERSEY ($/MWH)



Notes: Lines correspond to SREC price projections that correspond to the 5-year strip price that would deliver 10% target IRR. Assumes that the SREC price in years 6-15 of project equal 50% of initial strip price. For example, in 2012, 5-year strip prices of $300/MWh would be required for utility-scale projects to achieve 10% IRR, assuming prices in years 6-15 are $150/MWh. Assumes no leverage, $90/MWh PPA, 13.4% capacity factor, tax-efficient structure.

Source: Bloomberg New Energy Finance

NEW JERSEY SREC PRICES ($/MWH)



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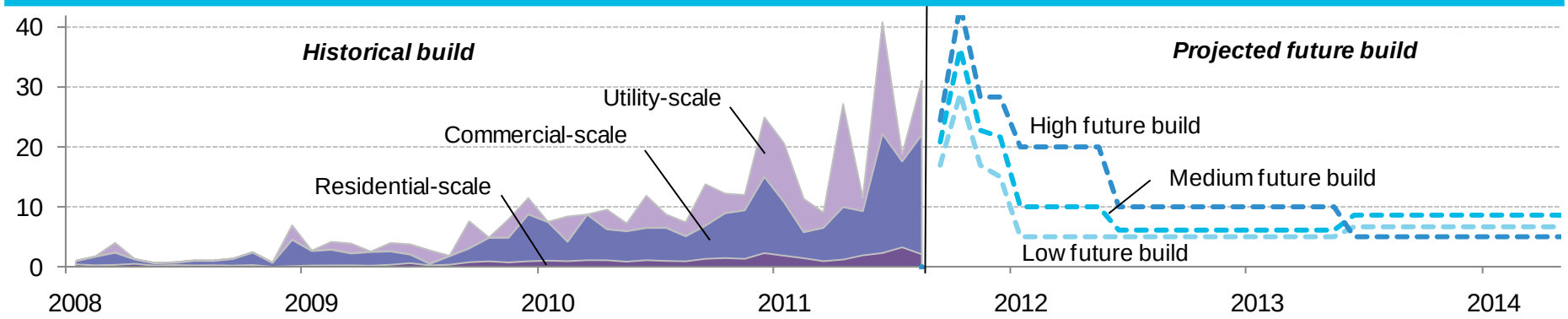
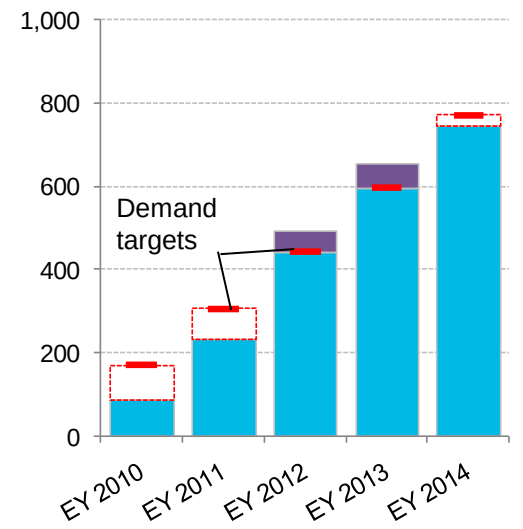
Source: Bloomberg New Energy Finance, ICAP

NEW JERSEY SREC SUPPLY AND DEMAND

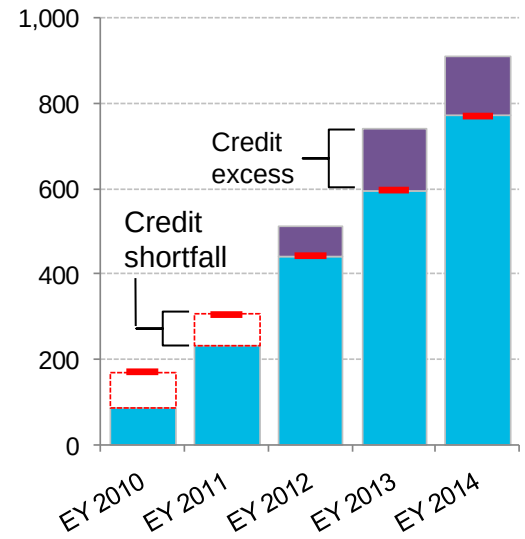
Historical installations and monthly future build scenarios (MW/month)



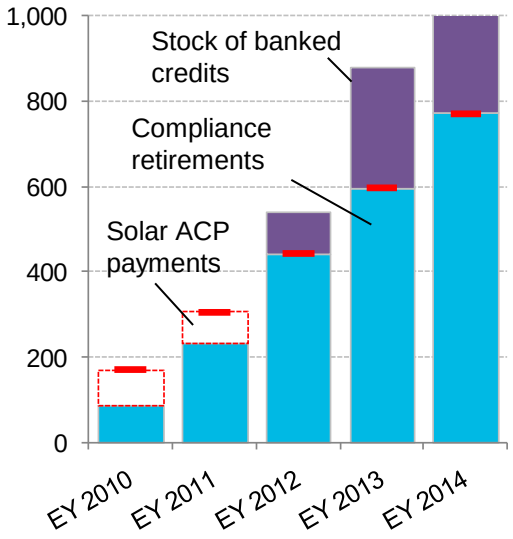
LOW (GWh)



MEDIUM (GWh)



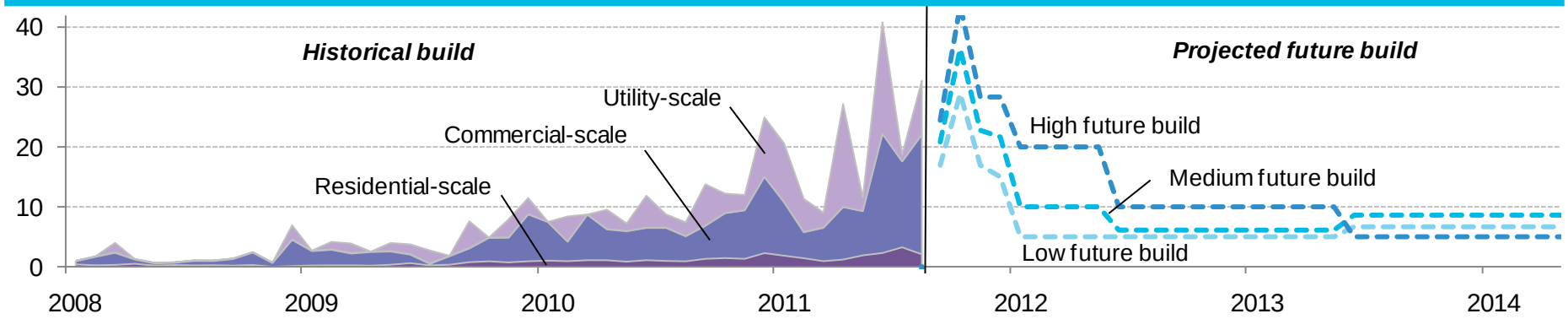
HIGH (GWh)



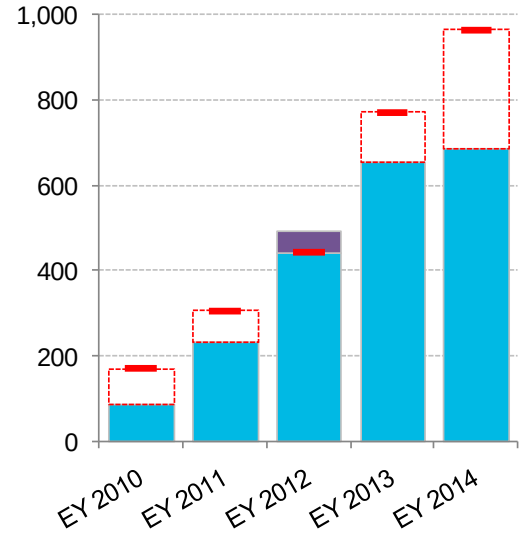
Source: Bloomberg New Energy Finance

NEW JERSEY SREC SUPPLY AND DEMAND – WITH LEGISLATIVE CHANGE (SB2371)

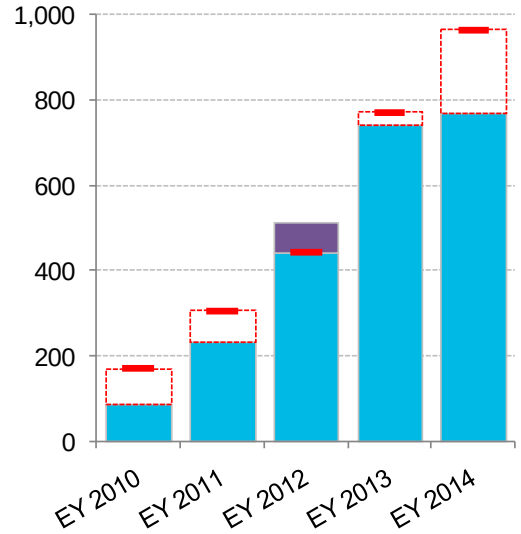
Historical installations and monthly future build scenarios (MW/month)



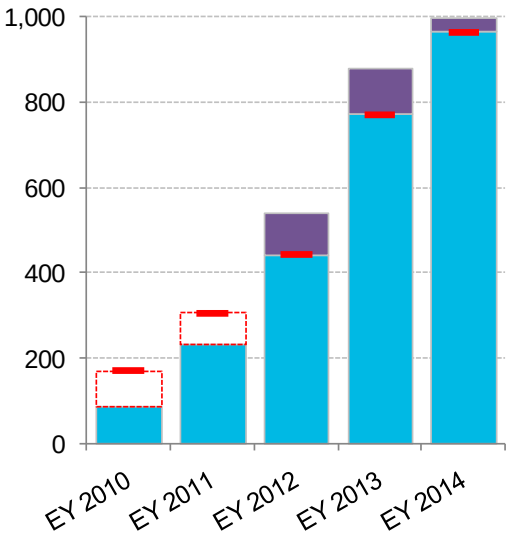
LOW (GWh)



MEDIUM (GWh)



HIGH (GWh)



Source: Bloomberg New Energy Finance

SREC PRICING METHODOLOGIES (2 OF 2)

SYSTEM ECONOMICS (STRIPS)

- 5-year strip prices necessary to induce new build
- Unlevered equity IRR = 10%
- Assume 'conservative' tail: SREC price after 5-year strip (ie, years 6-10) = 50% of initial strip price
- Price declines over time as LCOE declines

RETIREMENT OPTIONALITY (SPOT)

- SRECs derive all of their value from the possibility of being retired in an undersupplied market
- SREC price = the maximum expected value of all retirement options
- Price fluctuates over time based on expectations of upcoming supply-demand

RETIREMENT OPTIONALITY METHODOLOGY – EXPLANATION

v2012 NJ SREC price = *MAXIMUM of*

Future build scenario	EY2012 under-supplied?
Low	*No*
Medium	*No*
High	*No*
SB2371, Low	*No*
SB2371, Medium	*No*
SB2371, High	*No*

17% probability for each

0%

Expected retirement values

EY2012	EY2013	EY2014
$P(U_{2012})*SACP_{2012}$	$\frac{P(U_{2013})*SACP_{2013}}{(1+d)}$	$\frac{P(U_{2014})*SACP_{2014}}{(1+d)^2}$

(Probability of undersupply * SACP)

(ie, if oversupply, retirement value = 0)

$0/MWh

RETIREMENT OPTIONALITY METHODOLOGY – EXPLANATION

v2012 NJ SREC price = *MAXIMUM of*

Future build scenario	EY2012 under-supplied?
Low	*No*
Medium	*No*
High	*No*
SB2371, Low	*Yes*
SB2371, Medium	*Yes*
SB2371, High	*No*

17% probability for each

33%

Expected retirement values

EY2012	EY2013	EY2014
	$\frac{P(U_{2013})*SACP_{2013}}{(1+d)}$	$\frac{P(U_{2014})*SACP_{2014}}{(1+d)^2}$

(Probability of undersupply * SACP)

(ie, if oversupply, retirement value = 0)

$0/MWh	**$165/MWh**

RETIREMENT OPTIONALITY METHODOLOGY – EXPLANATION

v2012 NJ SREC price = *MAXIMUM of*

Expected retirement values

EY2012	EY2013	EY2014
$0/MWh	$165/MWh	$220/MWh

$$\frac{P(U_{2014})*SACP_{2014}}{(1+d)^2}$$

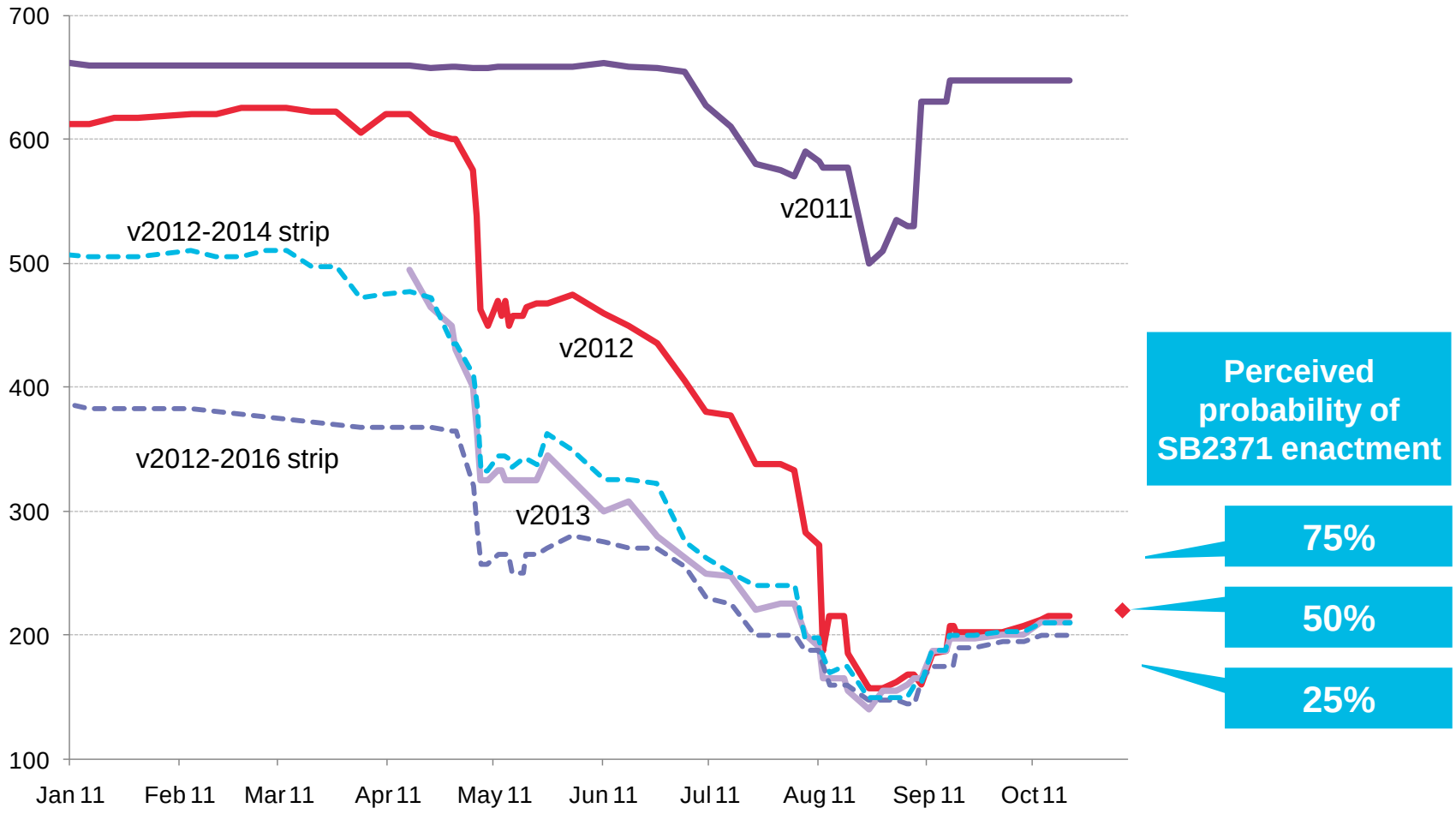
(Probability of undersupply * SACP)
(ie, if oversupply, retirement value = 0)

Future build scenario	EY2012 under-supplied?
Low	*Yes*
Medium	*No*
High	*No*
SB2371, Low	*Yes*
SB2371, Medium	*Yes*
SB2371, High	*No*

17% probability for each

50%

RESULTS: RETIREMENT OPTIONALITY METHODOLOGY – NJ SREC EXISTING AND 'FUNDAMENTAL' PRICES ($/MWH)



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Source: Bloomberg New Energy Finance, ICAP

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THE CORRECT PRICE

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MARKETS

Renewable Energy
Carbon Markets
Energy Smart Technologies
Renewable Energy Certificates
Carbon Capture & Storage
Power
Water
Nuclear

SERVICES

Insight: research, analysis & forecasting
Industry Intelligence: data & analytics
News & Briefing: daily, weekly & monthly
Applied Research: custom research & data mining
Knowledge Services: Summit, Leadership Forums, Executive Briefings & workshops

Subscription-based news, data and analysis to support your decisions in clean energy, power and water and the carbon markets

info@bnef.com

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RPS Rate Caps and the Determination of Reasonable Costs: The Colorado Experience

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26 October 2011
State-Federal RPS Collaborative
2011 National Summit on RPS
Washington, DC USA

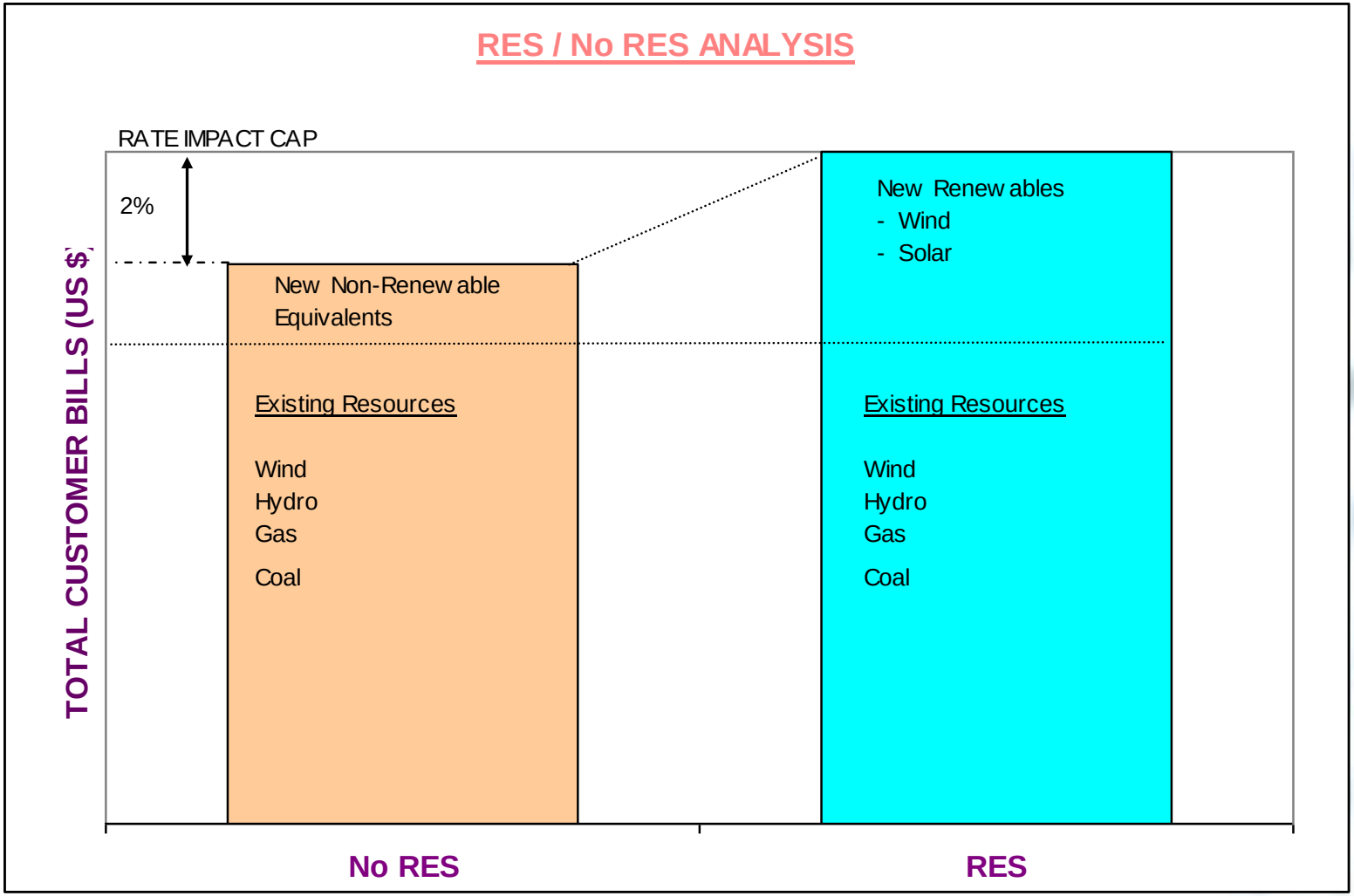
Retail Rate Impact Rule

§40-2-124(1)(g)(I),C.R.S., rev.

"For each qualifying utility, the commission shall establish a maximum retail rate impact for this section of two percent of the total electric bill annually for each customer. The retail rate impact shall be determined net of new alternative sources of electricity supply from noneligible energy resources that are reasonably available at the time of the determination."

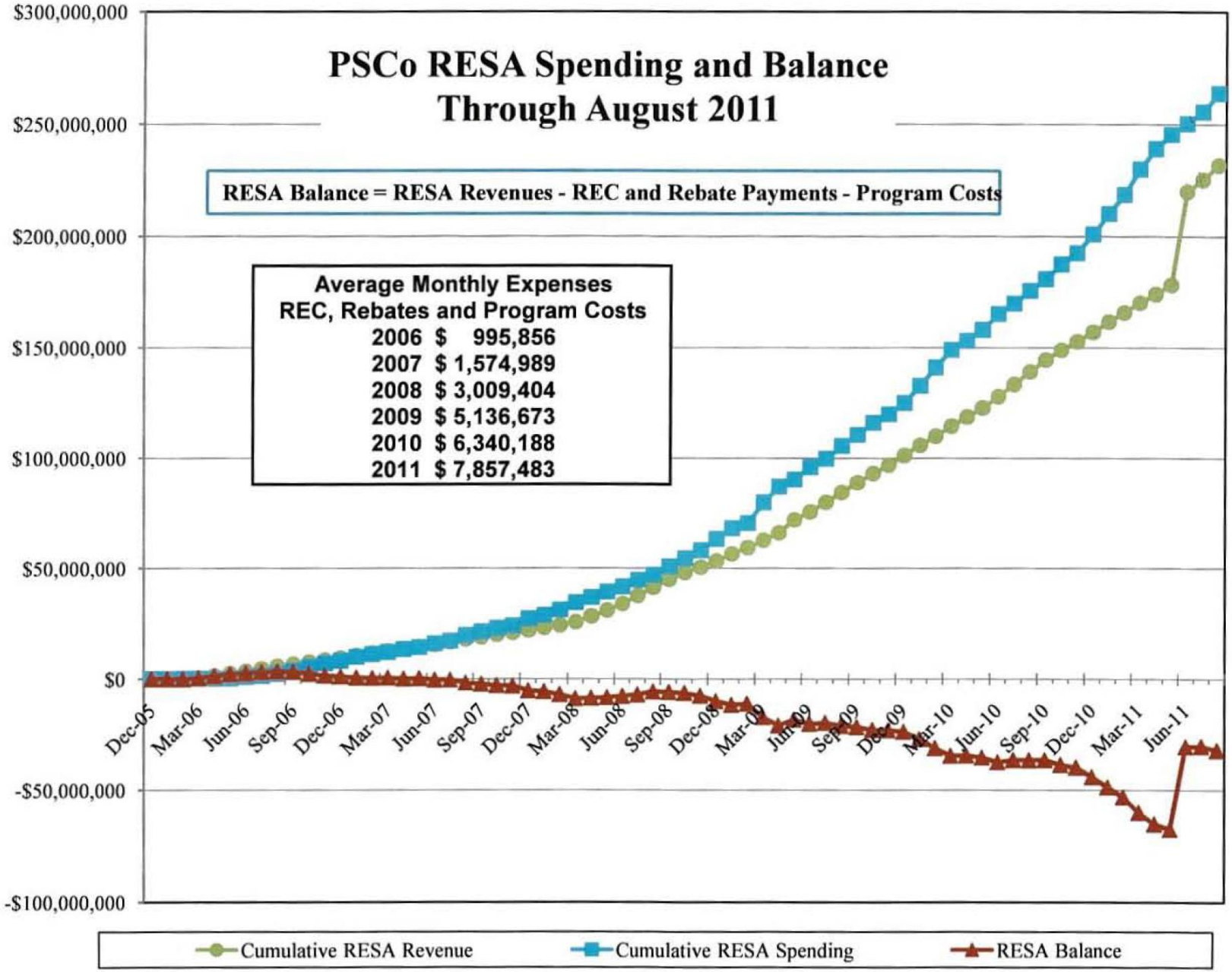
REA & Muni impact limited to one percent.

Rate Impact Limitation



2% ≠ 2% ≠ 2%

- Mechanisms to circumvent a rate cap:
  - ⇨Provide a waiver for a given resource from inclusion in the rate impact calculation
  - ⇨Move the time fence
  - ⇨Reclassify new resources as *existing*
    - Resets the base
  - ⇨Fail to consider the Electric Commodity Adjustment (ECA)
  - ⇨Create a new category excluded from the calculation
    - Section 123 (§ 40-2-123, C.R.S.)
  - ⇨Redefine the rate cap as a monthly charge and create a deferred account



Source: Docket 06S-016E Monthly Reports

PSCo RESA Deferred Account

Table 7.3 - 2012 RES Compliance Plan

	U	V	W	X	Y
	Totals				
	Total RESA Costs (J+K+L+M+N+O)	Annual Excess/ (Deficiency) (S+T-U)	Interest	Annual Excess/ (Deficiency) w/ Interest (V+W)	Rolling Balance (Deferred)
2010					(46,574,129)
2011	102,101,191	11,688,364	(2,654,458)	9,033,906	(37,540,224)
2012	92,071,426	(25,725,407)	(4,813,882)	(30,539,289)	(68,079,512)
2013	67,953,124	(4,455,892)	(5,519,219)	(9,975,111)	(78,054,623)
2014	53,557,016	9,861,277	(5,188,832)	4,672,446	(73,382,178)
2015	31,339,587	31,884,831	(3,157,533)	28,727,298	(44,654,880)
2016	31,759,498	32,577,218	(918,989)	31,658,229	(12,996,651)
2017	31,373,097	34,364,180	1,625,855	35,990,035	22,993,385
2018	5,145,581	60,051,098	6,318,855	66,369,953	89,363,338
2019	(6,026,170)	71,873,901	12,268,542	84,142,443	173,505,781
2020	(22,163,390)	88,417,429	19,929,737	108,347,167	281,852,947
2021	(31,705,085)	98,942,419	28,974,719	127,917,139	409,770,086

Current RE policy questions to ponder…

- Under the most likely portfolios, PSCo's renewable generation could exceed 25% by 2015 (utility projects that it already has sufficient RECs for the 30% RES to 2028)
  - ⇨This is far in excess of the RES
  - ⇨But the cost will be far beyond the 2% rate cap
  - ⇨Should ratepayers bear this cost?
  - ⇨Should the utility profit from the additional RECs created?
- In a regulated monopoly utility, how should the PUC balance the interests of the IOU, ratepayers, and other stakeholders?

Thank you

Contact:

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NREL
NATIONAL RENEWABLE ENERGY LABORATORY

RE Financing: Key Considerations, Innovations, Data and Tools

RPS Collaborative Summit

Session 5: Renewable Energy Project Finance Trends

Karlynn Cory
Strategic Energy Analysis Center

October 26, 2011

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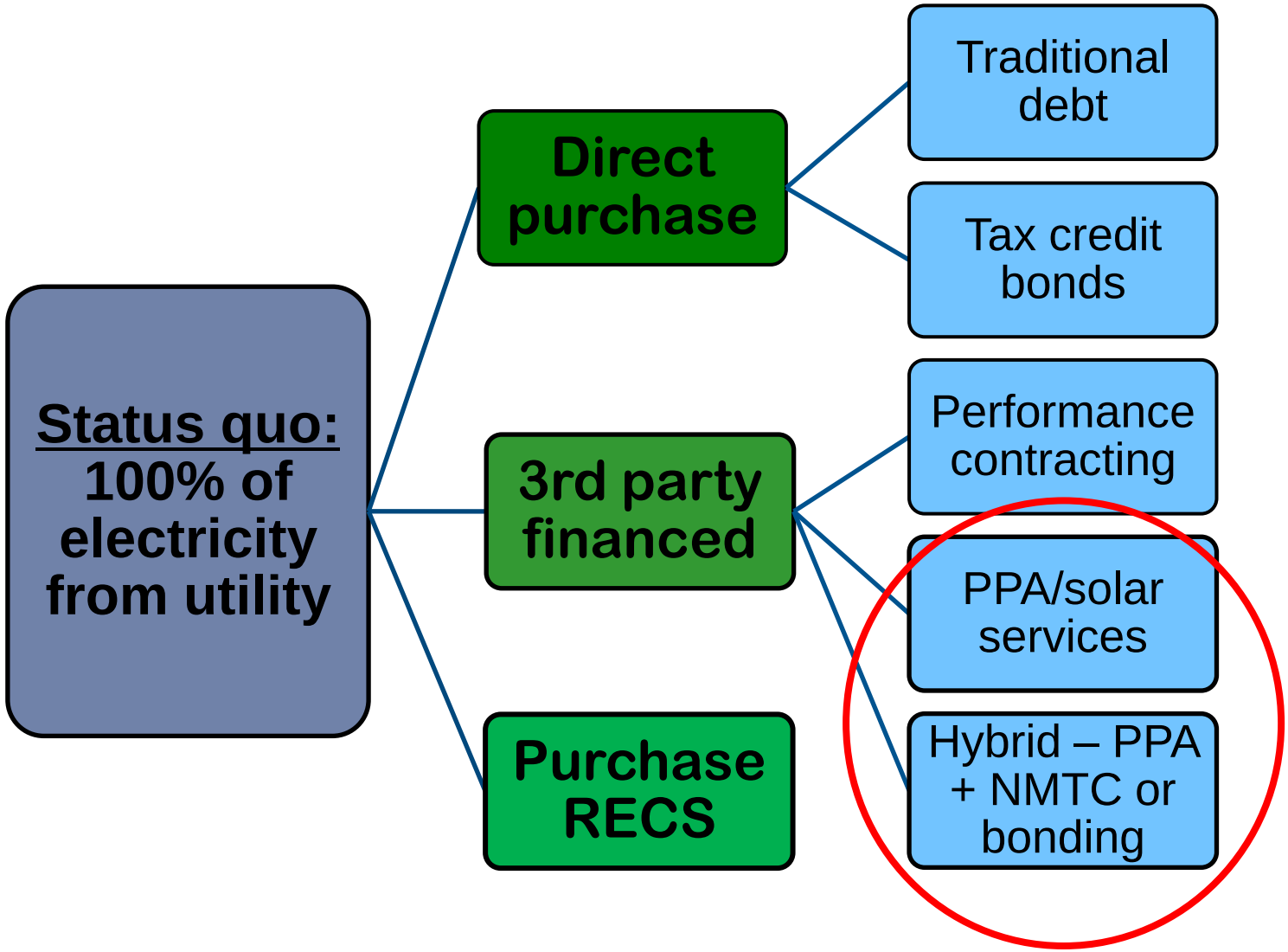
This work was supported by the U.S. Department of Energy under Contract No. DE-AC36-08-GO28308 with the National Renewable Energy Laboratory.

Overview

- Reminder: Tax credits drive much of the market today
  - Not only for commercial and industrial systems
  - But also for residential and municipal deployment

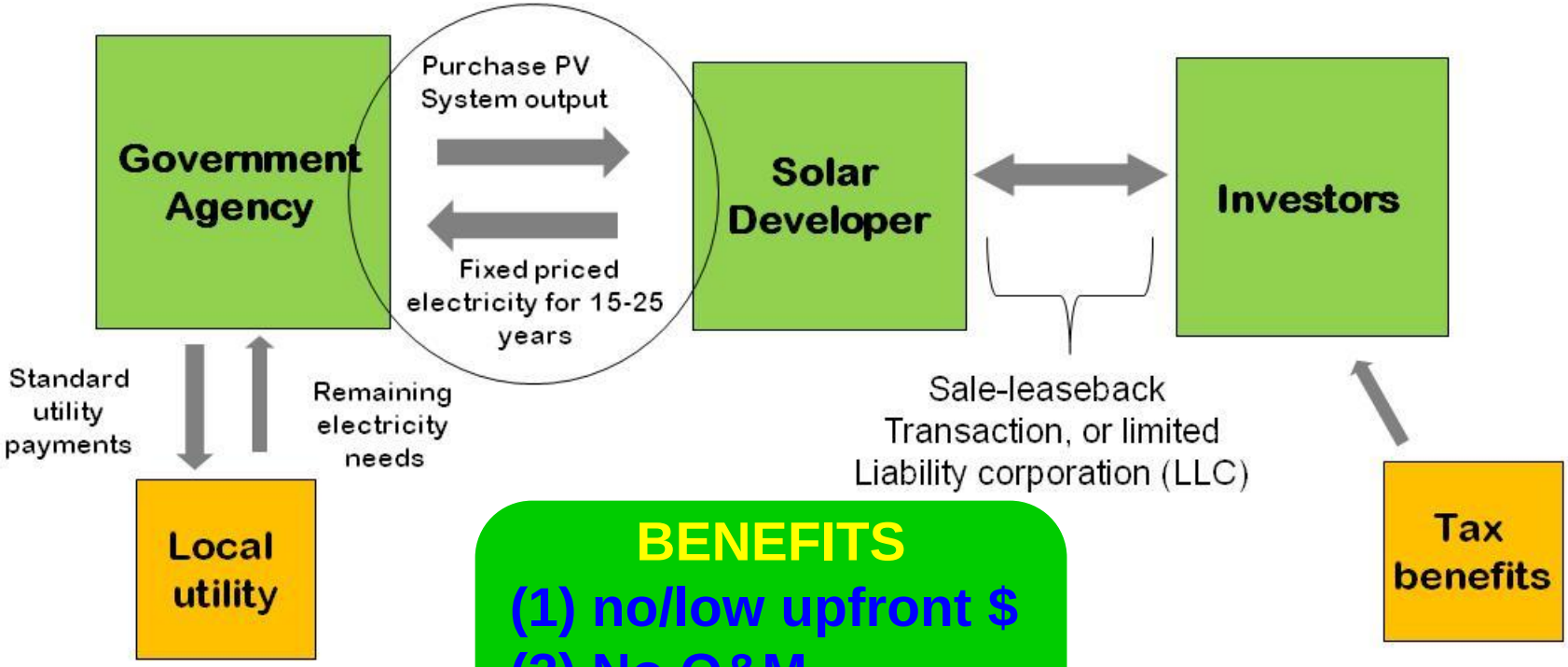
1. RE project financing options for municipalities
   - Q: Does your state support innovative financing for state and local government?
2. Financing resources available
   - NREL Data, Tools and Analysis
3. Technical assistance resources

How Can Municipalities Finance RE?



Option 1. 3rd-Party Owned PPA

Instead of purchasing a PV system, an end-user customer agrees to **host** the system and **purchase** the electricity using a power purchase agreement (PPA)



BENEFITS

(1) no/low upfront $
(2) No O&M
(3) Expected to beat utility elec. rates

Source: DOE solar program

2. New Market Tax Credits (NMTC) + PPA

- **NMTC**: Tax credit encourages low income community investment
  - Covers 39% of cost, over a 7-year period
  - "Equity that ends up as low cost debt to solar developer"
- **NMTC Awards**
  - Through 2010: 594 awards made totaling $29.5 billion
  - 2011 Round: 314 applications requesting $26.7 billion ($3.5 B avail)

Denver Example

- Developer for Denver (Main Street Power), combined the NMTC with traditional tax benefits and incentives.
- NMTC allowed a 10-15% reduction in PPA price
- **Results**
  - 1 MW on 13 city facilities
  - City expects to save $400k over life of transaction

Sources: http://www.cdfifund.gov/what_we_do/programs_id.asp?programid=5 ; and http://www.nrel.gov/docs/fy10osti/49056.pdf

3. Hybrid: Bond financing + PPA

<u>Innovation for Municipalities</u>: Hybrid combination of municipal bonding, plus a 3rd party PPA

- County Improvement Authority (CIA) issues debt with guarantee from the County itself (credit rating is key).
  - County pays for the system
- Capital lease structure: developer owns and builds the PV system.
  - Developer must own the system to get the **tax benefits.**
  - Lease passes ownership to developer for tax purposes
- Developer signs PPA with the County
  - Lease payments to CIA covers bond payments
- Low cost debt (along with SRECS) allows for an attractive PPA price in NJ

http://service.govdelivery.com/docs/NJSOMER/NJSOMER_137/NJSOMER_137_20100222_131700_en.pdf

3. Hybrid: Bond financing + PPA – cont.

Morris County, NJ Project Example

- Solar developer was Tioga Energy/SunDurance Energy
- 3.2 MW from 19 facilities for 7 local governments
- Bond Pricing with AAA County Guaranty: 4.46%
- Transaction closed in February 2010

Terms

- 15 Year PPA
- 1st year price in PPA: $0.106/kWh; Year 15 price: $0.16/kWh
- 3% annual escalator
- SREC sharing agreement between Tioga and Morris County

Year 15 price is equivalent to today's retail price ($0.16/kWh)

Expected savings to the County: $2 million

Sources:
Somerset County, New Jersey
http://service.govdelivery.com/docs/NJSOMER/NJSOMER_137/NJSOMER_137_20100222_131700_en.pdf
Tioga Energy
http://www.tiogaenergy.com/new-jersey-renewable-energy-pilot-program.php

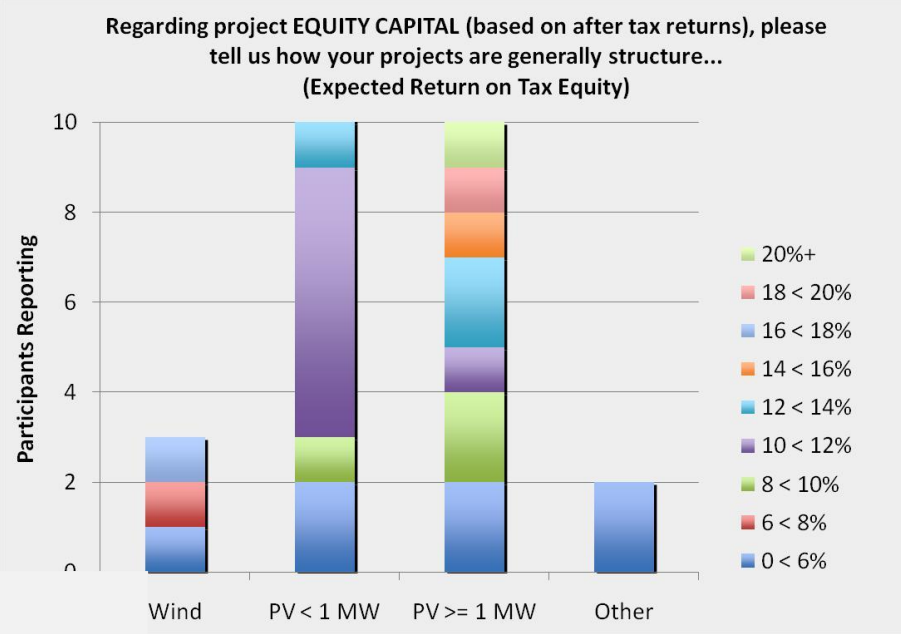
NREL has many RE financing resources

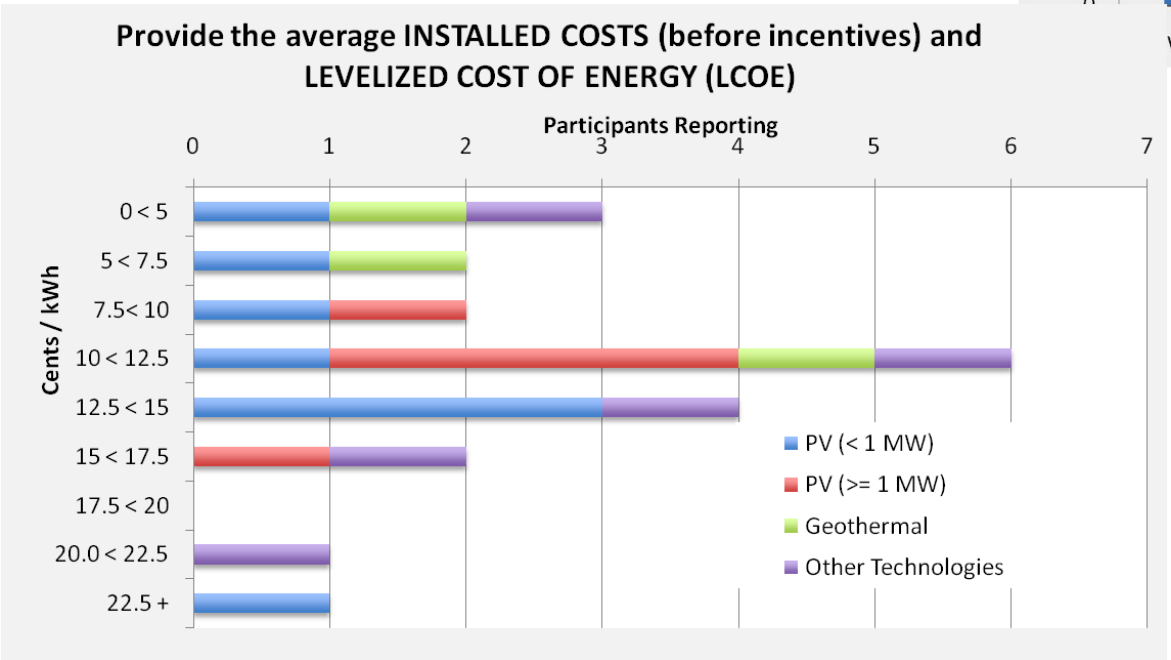
- NREL Data: REFTI
- NREL Tools: CREST and SAM
- NREL Analysis: RE Finance Information Application

RE Finance Tracking Initiative (REFTI)

REFTI collects and disseminates a wide array of RE project and financial info.

http://financeRE.nrel.gov/finance/REFTI





Information includes:

- Cost of equity & debt
- LCOE
- PPA terms
- Financial structure
- Application of state and federal incentives
- Other timely info

Simple LCOE Tools: Geo, Wind, PV

Goal: Develop simple, yet analytically robust Excel-based discounted cash flow models (wind, PV, geo)

http://financere.nrel.gov/finance/content/CREST-model

Cost of Renewable Energy Spreadsheet Tool (CREST):

- Gives PUCs & others a tool to quickly evaluate LCOE
- Can handle simple or complex level of inputs (user's choice)
- Simple to operate – no macros
- Solar, geothermal and wind

Whitepaper on Methodology:
"Renewable Energy Cost Modeling: A Toolkit for Establishing Cost-Based Incentives in the United States"
http://www.nrel.gov/docs/fy11osti/51093.pdf

Check				Notes
	Selected Technology		Photovoltaic	?
	Project Size and Performance			
	Generator Nameplate Capacity	*kW dc*	2,200	?
	DC-to-AC Conversion Efficiency	%	77.0%	?
				?
	Net Capacity Factor, Yr 1	*%, ac*	18.5%	?
	Production, Yr 1	*AC kWh*	2,745,296	?
	Annual Production Degradation	%	0.5%	?
	Project Useful Life	*years*	25	?
	Feed-in Tariff Payment Duration	*years*	25	?
	Feed-In Tariff Escalation Rate	%	2.0%	?
	% of Year-One Tariff Rate Escalated	%	30.0%	?
	Capital Costs			
	Select Cost Level of Detail		Intermediate	?
				?
	Generation Equipment	$	$10,500,000	?
	Balance of Plant	$	$0	?
	Interconnection	$	$0	?
	Development Costs & Fee	$	$0	?
	Reserves & Financing Costs	$	$488,815	?
				?
	Total Installed Cost	$	$10,988,815	?
	Total Installed Cost		$4,99	?

Advanced Tool: Financing Structures Included in System Advisor Model (SAM)

Partnership Type / Characteristics	All Equity Partnership Flip	Leveraged Partnership Flip	Sale Leaseback	Single Owner
Equity Owners	Tax Investor / Developer	Tax Investor / Developer	Tax Investor (Lessor)	Developer (Third party if sold)
Project Debt	None	Yes	None	Potential (Owner Choice)
Return Target	Tax Investor After-Tax IRR (Flip Target)	Tax Investor After-Tax IRR (Flip Target)	Lessor After-Tax IRR	Owner After-Tax IRR
Cash Sharing	Pre-Flip: Bifurcated Post-Flip: Primarily Developer	Pre-Flip: Pro Rata Post-Flip: Primarily Developer	Lessor: Lease Payment Lessee: Project Margin	Owner: 100% of project cash
Tax Benefit Sharing	Pre-Flip: Primarily Tax Investor Post-Flip: Primarily Developer	Pre-Flip: Primarily Tax Investor Post-Flip: Primarily Developer	Lessor and Lessee have different taxable incomes ITC and Depreciation goes to Lessor	Owner: 100% of project tax benefits

https://www.nrel.gov/analysis/sam/

Developed with help from Deacon Harbor Financial, Birch Tree Capital and Stoel Rives

NREL's RE Finance Information Application
http://financeRE.nrel.gov

Search: by keyword, or by filters

User Login: to comment

Market Insights: Weekly policy and market observations from NREL analysts

Featured Analysis: In-depth NREL policy, market and financing analysis

Useful Tools and Data: Buttons for financing data and LCOE analysis tools

NREL RE Finance – Original Content

http://financeRE.nrel.gov

Weekly Market Analysis Insight Articles

- *Wind Energy Rejoins the Leveraged Lease Club*
- *Treasury Grant Termination on the Horizon*
- *Delivering Solar: Group Purchasing Drives Down Costs*
- *Can RECs Help Your Project Cross the Finish Line?*

Regular Feature Analysis

- *Power Purchase Agreement Checklist for State & Local Governments*
- *First Known Use of QECBs will Save Yolo County at least $8.7 Million over the Next 25 Years*

Technical Assistance and Resources

U.S. DOE's Technical Assistance Program (limited funding available)

http://www.nrel.gov/applying_technologies/state_local_activities/

TAP Webinars:
http://www.nrel.gov/applying_technologies/state_local_activities/webinars.

or you can e-mail Liz Doris for guidance: Elizabeth.Doris@nrel.gov

U.S. DOE's Solar-Specific Support

For additional help with solar policies and projects, contact STAT@nrel.gov for more information

NREL's RE Project financing website: http://financeRE.nrel.gov

Sign up for our newsletter: http://financere.nrel.gov/finance/contact

Database for State Incentives for Renewables and Efficiency

www.dsireusa.org

NATIONAL RENEWABLE ENERGY LABORATORY

Leading the Way to a Clean Energy Future

Karlynn Cory

RE Project Finance Analysis Team Lead

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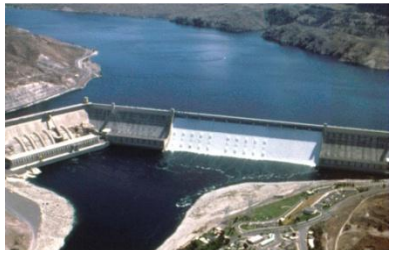


RPS Summit: Renewable Energy Opportunities & Challenges

October 26, 2011

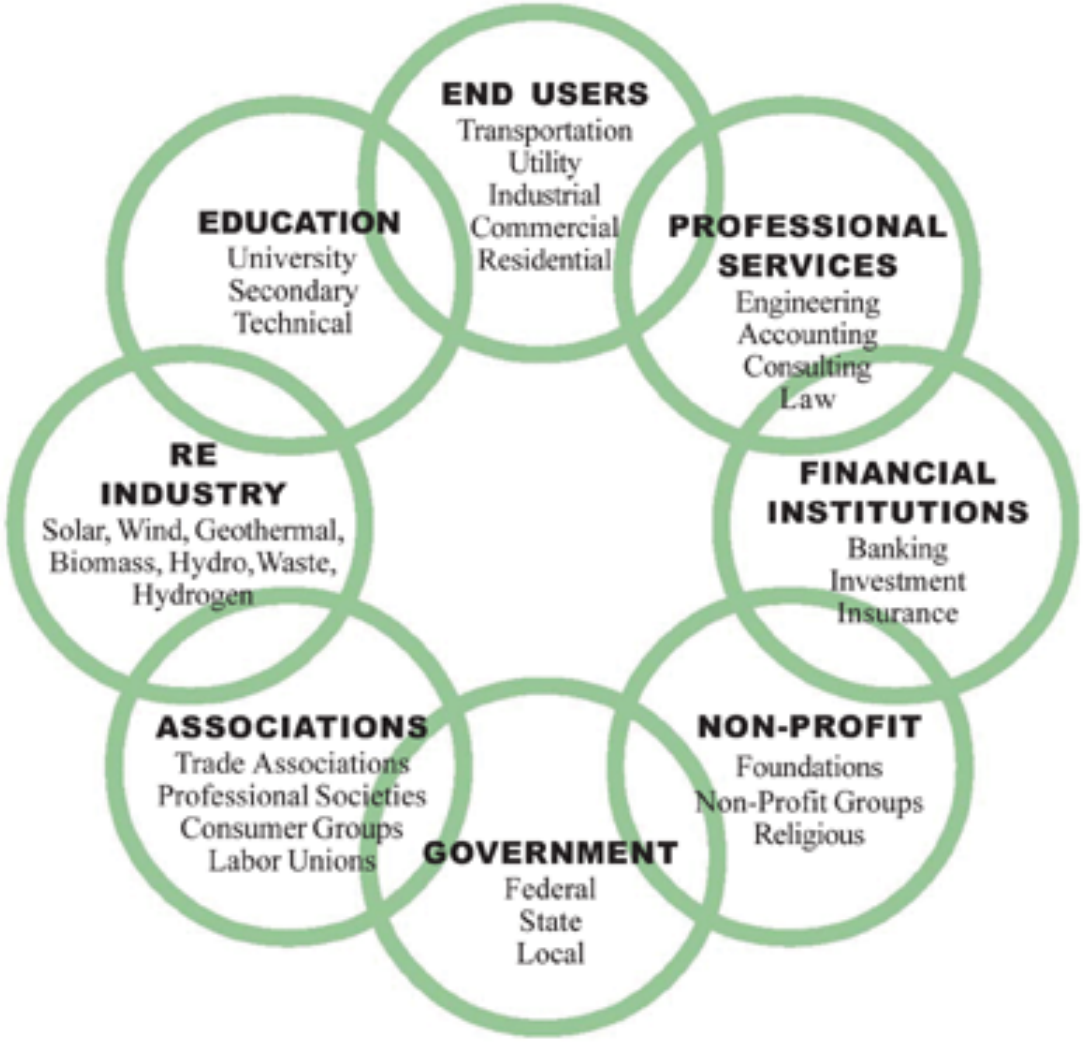
Todd Foley
Senior Vice President, Policy
American Council On Renewable Energy (ACORE)
www.acore.org

Agenda

- ACORE Background
- Renewable Energy Market/Technology Drivers
  - Market Growth
  - Cost Reduction
- Renewable Energy Policy Drivers: State & Federal
  - RPS/RES/CES
  - EPA MACT Rules
  - FERC
  - DOE Budget
- Renewable Energy Finance: "1603 Grant At Risk"
  - Investment
  - Finance incentives

ACORE's 600+ Organizational Members

Strategy to Assemble All the Players Necessary to Make Renewable Energy Successful in the U.S.



ACORE's Mission & Strategy

501(c)(3) tax-exempt research & education nonprofit organization:

"…bring renewable energy into the mainstream of our economy and lifestyle"

"…be *for* renewable energy & *against* nothing"

ACORE encompasses all renewable & inexhaustible energy options:

- **Solar energy**
- **Wind power**
- **Hydropower & ocean**
- **Biomass energy & fuels**
- **Geothermal energy**
- **Waste-to-energy**

…in all forms of energy:

- **Electricity**
- **Fuels**
- **End-use thermal energy**
- **Hydrogen**

…while focusing on three strategic themes & three major activities:

- **Markets**
- **Finance**
- **Policy**
- **Research & publishing**
- **Convening & education**
- **Communications**

A Strategic Plan to Make Renewable Energy Successful in the U.S.

Three Goals to Be Achieved

National Security

Climate & Environment

Growth & Jobs

Three Means by Which to Achieve Them

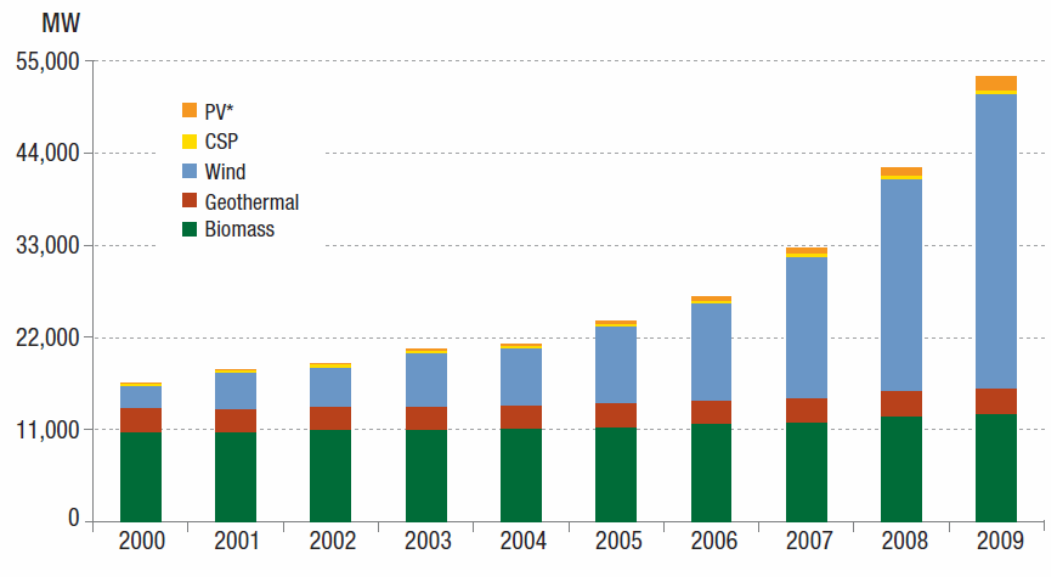
Policy

Finance

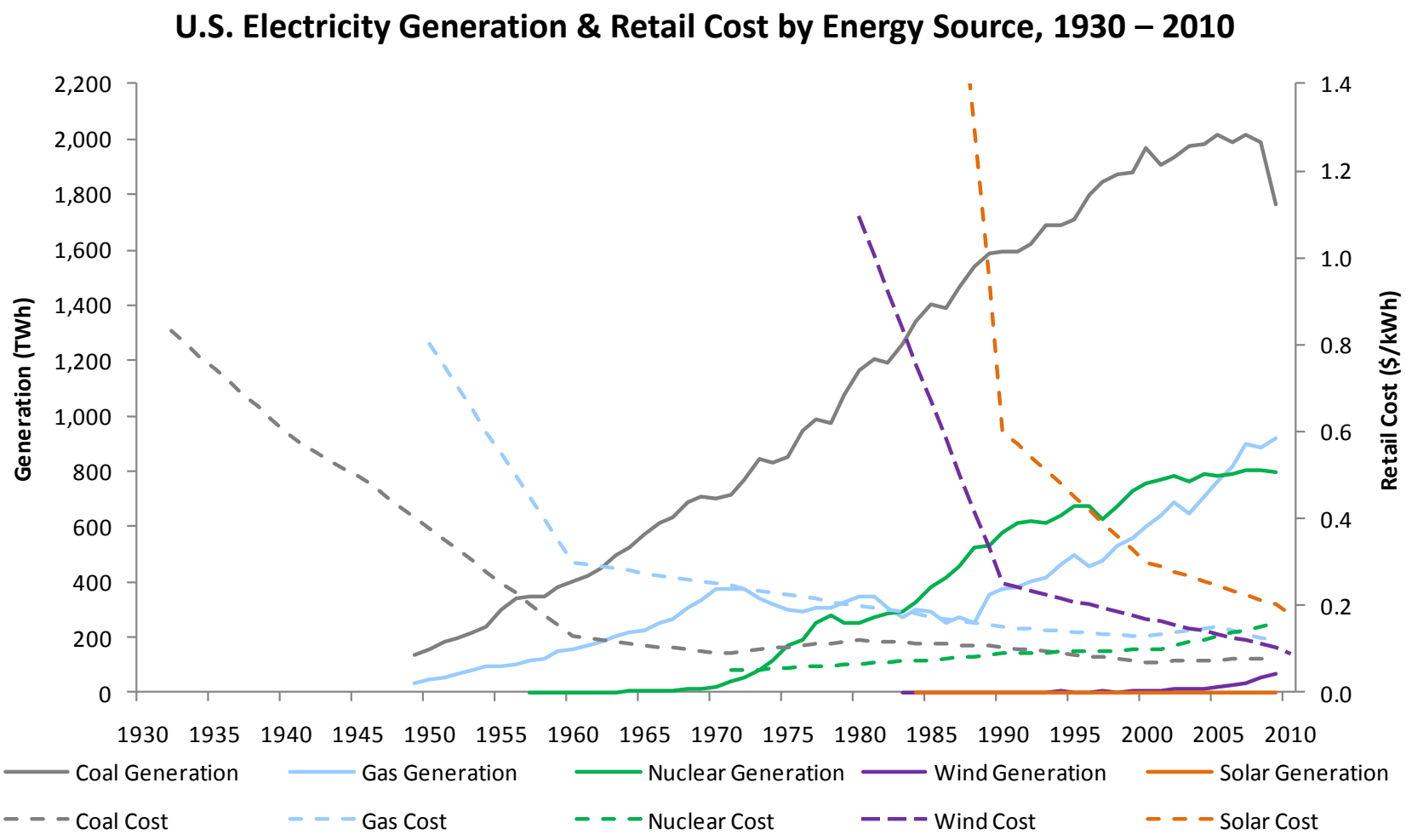
Education

2010 Market Growth

- **U.S. RE Market:**
  - **25% Growth**
- **Wind:**
  - **20% growth in (~6 GWs)**
  - **33% of all new generation**
- **Solar:**
  - **96% growth in 2010 (~850 MWs)**



Market Driver: Impressive Cost Reduction



Renewable Energy Increasingly Competitive!

US Market Overall

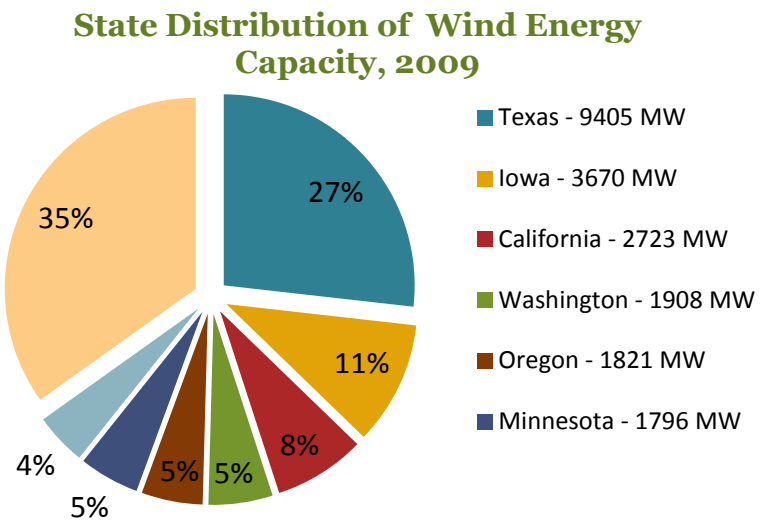
- Investment - $30.7 billion in 2010
- Jobs - 850,000 to 950,000 total (all renewable energy)

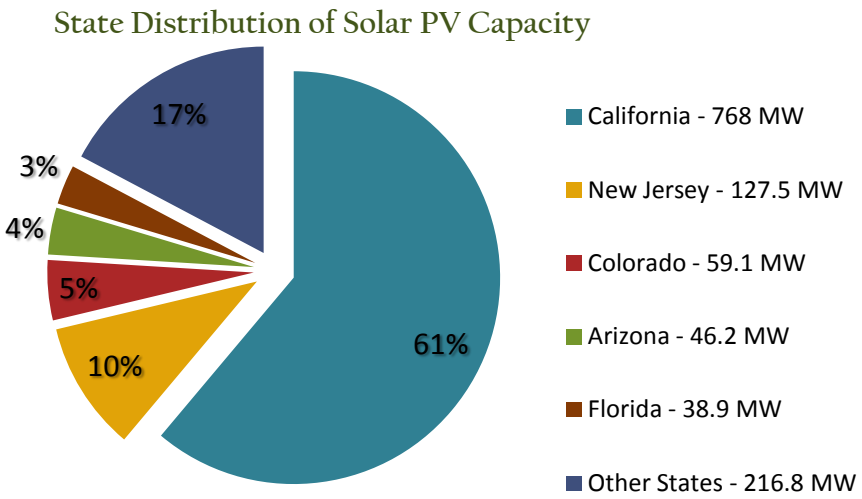
Wind

- Costs down 20% since 2008 (technology improvements + scale)
- 75,000 direct jobs

Solar

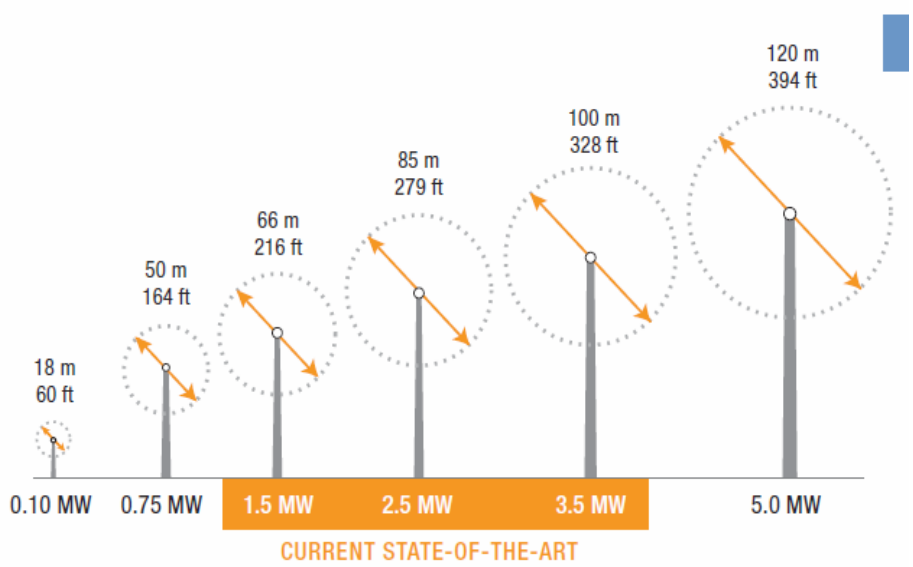
- Costs down ~60% since 2008 - $3.20 to $3.80/watt installed!
- 93,500 direct jobs
- $6 billion industry in 2010 – fastest growth in US energy sector of 67%, up from $3.6 billion in 2009



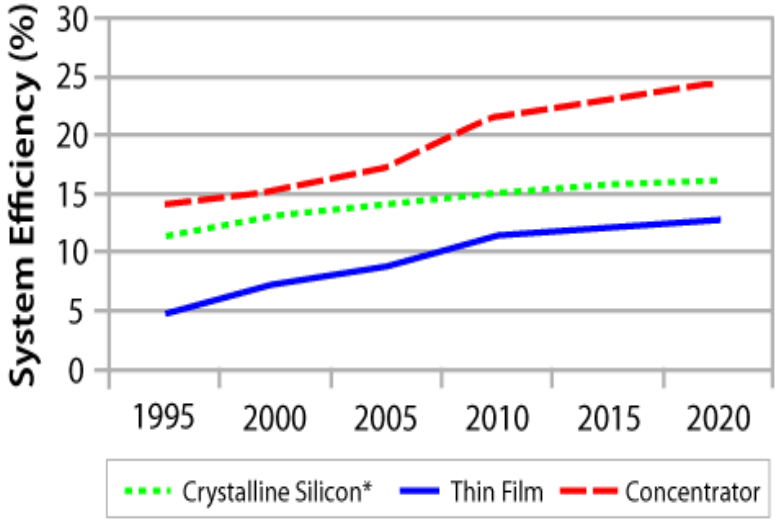


Technology Improvements

Wind Turbine Size Range

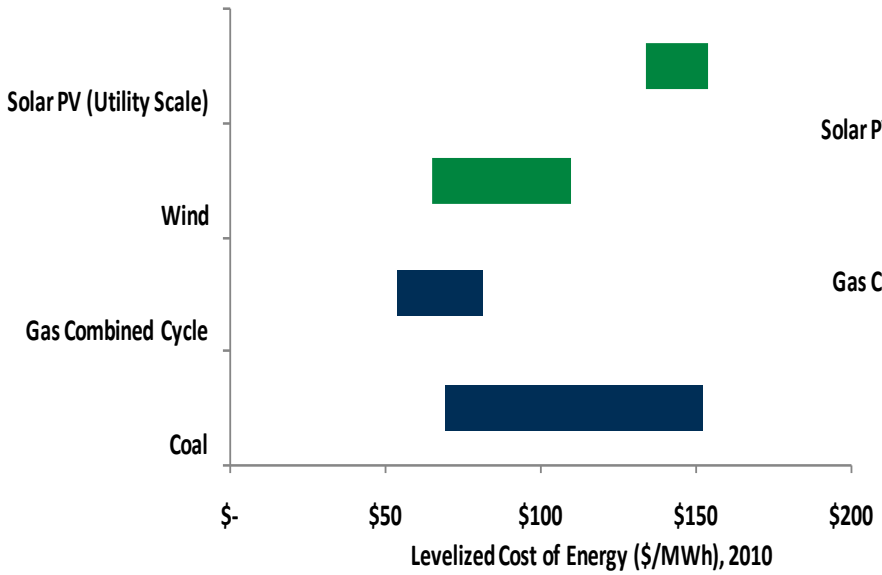


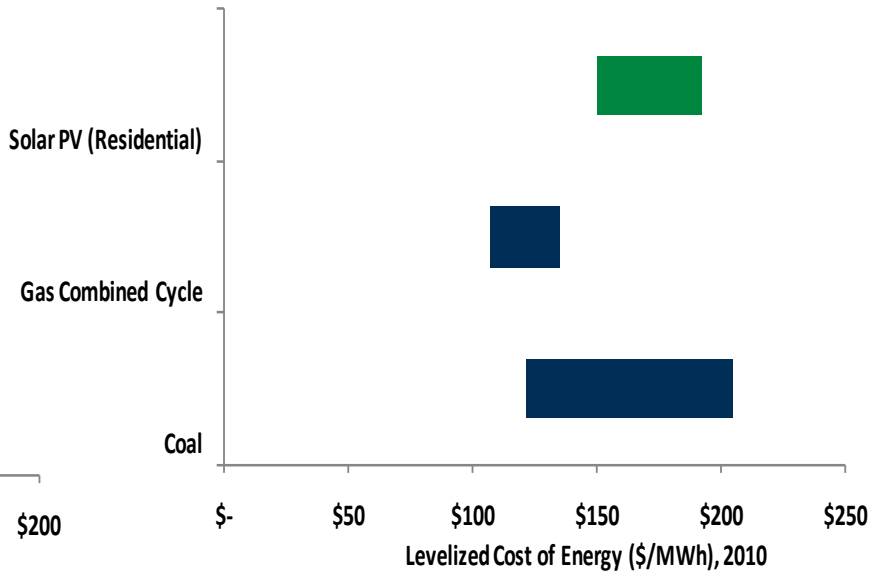
Solar Efficiency Trends



Market Driver: Increasingly Cost Competitive

U.S. Levelized Cost of Wholesale & Retail Energy, 2010





Sources: "Levelized Cost of Energy Analysis – Version 4.0", Lazard, June 2010; Hudson Clean Energy Partners estimates
Notes: Solar PV assumes conventional silicon modules; gas assumes $4/MMBtu; retail energy for gas and coal incorporate a $53/MWh cost of transmission and distribution

Policy Context

www.dsireusa.org / November 2010
www.dsireusa.org / November 2010

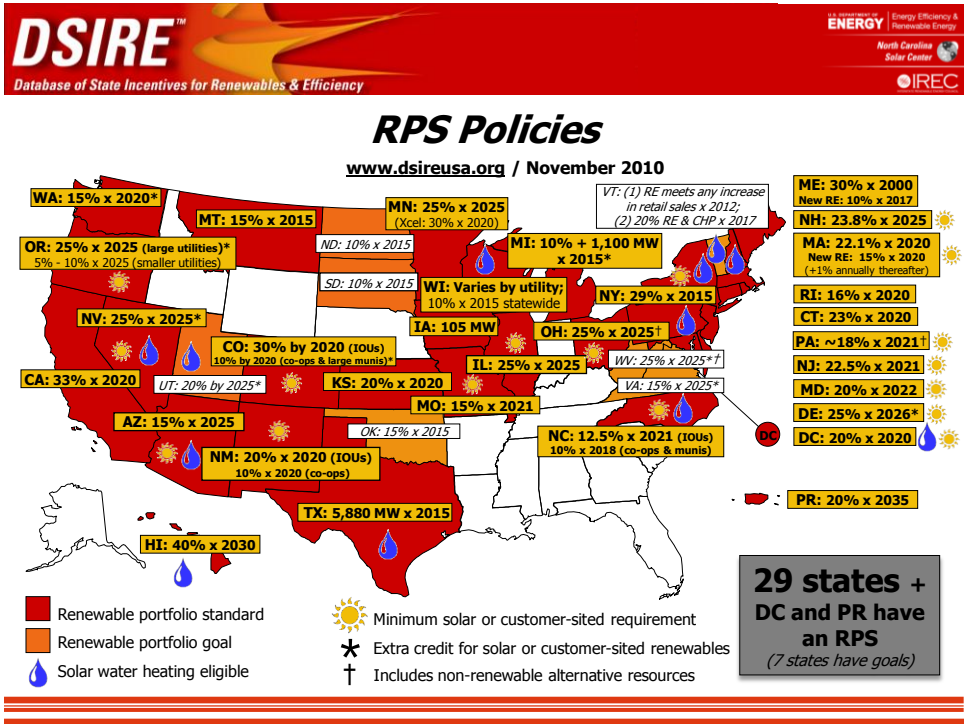
- Energy sector– one of most heavily regulated & subsidized markets

- Issue is not free market vs. regulated market
  BUT…
- What is minimum amount & proper mix of carrots & sticks, policies & market rules, that will unlock free market forces:
  - Market demand
  - Private sector financing

  ….within the regulated market?

State Policy Driver: RPS

- Federalism – state policy complements federal policies
- Important market demand driver
- States RPSs responsible for 80% of non-hydro renewable generation
- Will drive 90 GW of renewable energy by 2025 (according to UCS)



Federal Policy Drivers

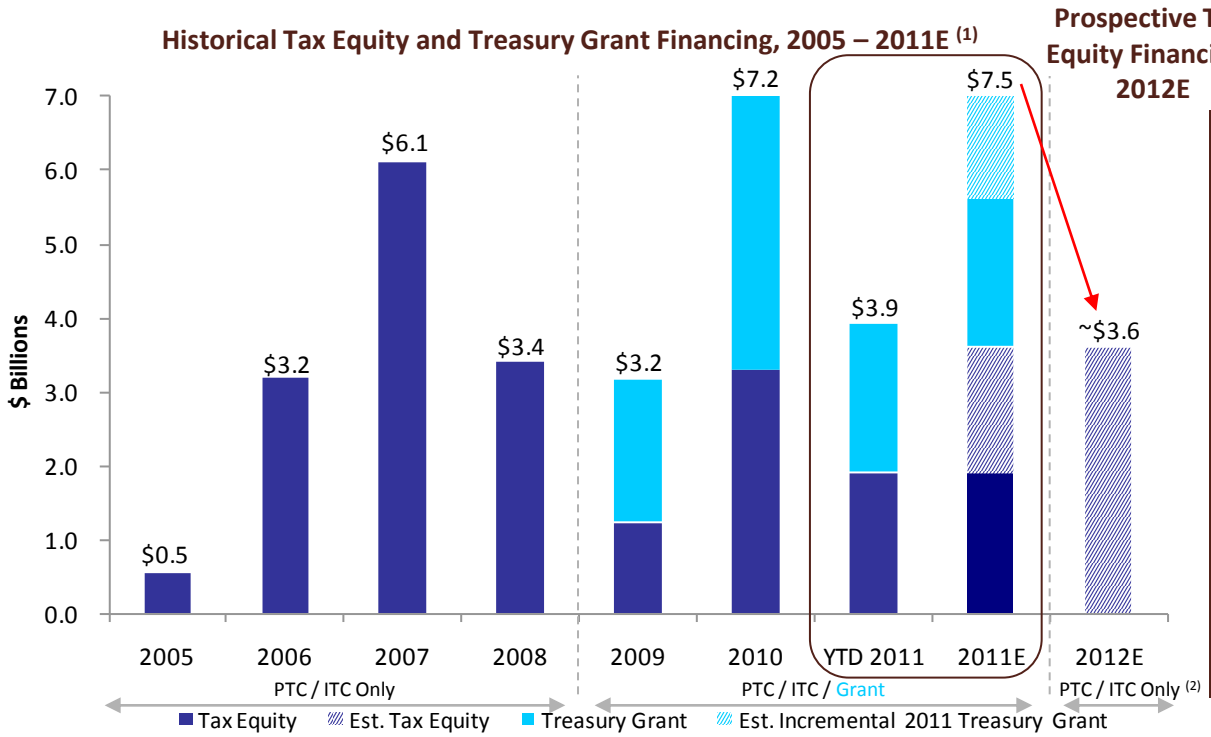
- **National RES/CES?**:
  - 80% CES by 2035 (President Obama)
- **EPA MACT Rules – coal plant retirements**
  - Offset by new renewables, efficiency & gas
  - As much as 40% of existing fleet by 2020
- **FERC renewables Integration**
  - Order 1000 – Transmission planning & cost allocation
  - Diversify generation, increase market competition, support consumer interests - feed-in tariff/Renewable Energy Standard Offer Rates & Contracts (RESO)
- **DOE EERE R&D Budget**:
  - FY 2012 Request = $3.2 billion (+$984 million)
  - FY 2012 Senate Approps (9/7) = $1.8 billion (equal to FY 2011)
  - FY 2012 House Approps = $1.3 billion

Federal Finance Policy – "At Risk"

- **Current Policy**
  - **PTC** (Expires 12/31/12)
  - **ITC** (Expires 12/31/16)
  - **1603 Grant in Lieu of ITC** (Expires 12/31/11) - **$7.8 billion leveraged ~$25 billion in total investment**
    - Extension possible
  - **1703, 1705 Loan Guarantees** - **$2.5 billion leveraged $20 billion in total investment**
    - 1705 - CR rescind all unobligated balances that remain from stimulus package as of 2/11/11
    - 1703 – Authority reduced by $25 billion to $3.5 billion
  - **48C Manufacturing Tax Credit** ($2.3 allocated and spent)
- **Proposed Policy**
  - **CEDA/Green Bank**
  - **Master Limited Partnerships (MLP)** – applicability to renewables

Success of the 1603 Treasury Grant

- In 2009, the Section 1603 Cash Grant program was introduced and stabilized the renewable energy market by providing $1.9 billion of cash grants in lieu of tax credits, more than doubling the depth of the $1.2 billion broken tax equity market and keeping the level of renewable energy project finance nearly constant with levels achieved in 2008. **This was a successful Federal program**
- In 2010, the Section 1603 Cash Grant program accelerated the penetration of the renewable energy market by providing $3.9 billion of cash grants in lieu of tax credits – the Cash Grant continued to fill a void for renewable energy project finance in a market place with an overall shortage of tax equity; **promoting job growth, installation of renewable MWs, and broader economic development**
- The tax equity market has recovered since the depths of the financial crisis in 2009, but the cash grant continues to play a crucial role in meeting the demand for renewable energy project finance by **promoting job growth, installation of renewable MWs, and broader economic development**



Last year's US PREF tax equity study estimated there would be ~$3.0 billion of tax equity available in the market place through the end of 2010 – by the end of 2010 ~$3.3 billion of tax equity was deployed.

Last year's study estimated there would be ~$3.0 billion in a normal market of tax equity available in 2011 – year-to-date $1.9 billion in tax equity has been deployed, this study estimates by year end 2011 there may be ~$3.6 billion of total tax equity

Sources: U.S. Department of The Treasury, US PREF Estimates, Leading Tax Equity Market Participants

(1) Includes all 1603 Treasury Grants for renewable projects

(2) Projects with 5% equity spend or in continuous construction prior to 12/31/2011 and that achieve COD by 12/31/2012 are eligible for the Section 1603 cash grant

ACORE
American Council On Renewable Energy

Thank you!

www.acore.org

Warren Leon
Clean Energy States Alliance

Evaluating a Renewable Portfolio Standard

October 26, 2011

States' Interest in RPS Evaluation

- States want to know what they are accomplishing with their RPS
- They want to know how the costs and the benefits compare
  - Especially the economic costs and benefits
  - Most states are currently focused on the state of the economy and economic development
  - They want the evaluation to be easy and inexpensive

The Central Dilemma

- It's hard to evaluate an RPS
  - Data is generally incomplete or difficult-to-obtain
  - NY did a thorough evaluation based on solid data but it is not applicable to other states

Complexities

- Data issues
  - Incomplete data about REC prices
  - The facilities that supply RECs for the RPS can vary year-to-year, especially if there are other states in the region with an RPS
  - Many generators and incomplete data about particular facilities
- A regional electricity system
  - Facilities that supply RECs may be out of state
    - Some of the economic benefits flow out of state
    - To the extent that an RPS is part of a regional regime, with many states doing their part, a state benefits from the RPSs of its neighbors even as those neighbors benefit from its RPS

A Work in Progress

- Your suggestions and input requested

Three Possible Approaches

1. Description of costs and benefits
2. Building blocks
3. Economic modeling

Approach 1: Description of Costs and Benefits

- The easiest, least expensive approach
- Helps people understand the various ways in which an RPS benefits the state and costs the state
  - Useful for getting policymakers and the public to see all sides and the complexity of cost-benefit calculations
- Can include some numbers, but it does not lead to a bottom-line total and does not try to quantify everything
  - Explain the difficulty of quantifying the costs and benefits precisely. It's not that information is being hidden or suppressed.

Describing Benefits

- Renewable energy
  - Translate into terms that people can understand
    - X number of wind turbines of an average size of y megawatts; z solar panels, etc.
      - Use the best data available, but acknowledge that you only be presenting a representative illustration
    - The electricity is enough to supply the homes of X thousand people in the state
- Environmental benefits
  - Can either describe or quantify these benefits
    - Can be difficult to know exactly what generation is displaced
    - Approximations or ranges can be OK if acknowledged
    - Resource: US EPA, *Assessing the Multiple Benefits of Clean Energy: A Resource for States* (February 2010)

Describing Economic Benefits

- In-state spending and jobs
  - Constructing, operating, and maintaining facilities
  - Manufacturing technology, the supply chain, and elsewhere in the clean energy industry, including financial, legal, research, and consulting services
  - Indirect economic impacts of the spending and jobs
- Price suppression
  - In competitive and some regulated markets, keeps high-priced peaking units offline that set prices
  - Reduces natural gas prices
- DG can reduce transmission and distribution costs
- Less vulnerability to swings in fossil fuel prices
  - Equivalent to insurance; may not look good in a cost-benefit analysis but economically valuable

Describing Costs

- Higher electricity prices
  - But note that price suppression could diminish this
- Job losses
  - Higher electricity prices
  - Reduced use of fossil fuel generation
- System costs of increased renewable energy use
  - Transmission upgrades
  - More complicated system management

A Variation: Comparisons between States

- Can compare:
  - Size of targets
  - Amount of generation brought online
  - REC prices

Approaches 2 and 3: Quantifying Costs and Benefits

- Economic modeling is theoretically preferable
  - Can cost as little as $20,000 or well more than $100,000
  - May not be justified if the data is problematic
- The building block approach can be less expensive but won't capture the complexities of the economy
  - Use different data sources for different pieces of the calculation
  - Acknowledge that it yields approximate results
  - Show results as a range, not an exact number

Past vs. Future

- The choice
  1. Costs and benefits up to the present day
  2. Costs and benefits over the life of the facilities the RPS caused to be built
- Including the future provides a more complete picture
  - But increases the complexity of the analysis
  - Adds uncertainty to the results
    - Predictions about the future notoriously uncertain (e.g., electricity prices, output and maintenance costs for new technologies)

Building Blocks Approach: Benefits

- Jobs and indirect economic benefits
  - Determine how much RPS generation built in state
    - Discount generation built before the RPS period unless there is evidence that those facilities would not have survived without the RPS
    - Use JEDI to estimate the jobs and indirect impacts the generation produces in state
      - Free from NREL—models for wind, concentrating solar, PV, biofuels
      - Can modify model assumptions to fit state's conditions
- Price suppression
  - May have been calculated for energy efficiency programs or there may be other studies that will make it inexpensive to calculate by an expert
  - Can modify calculations from a nearby state

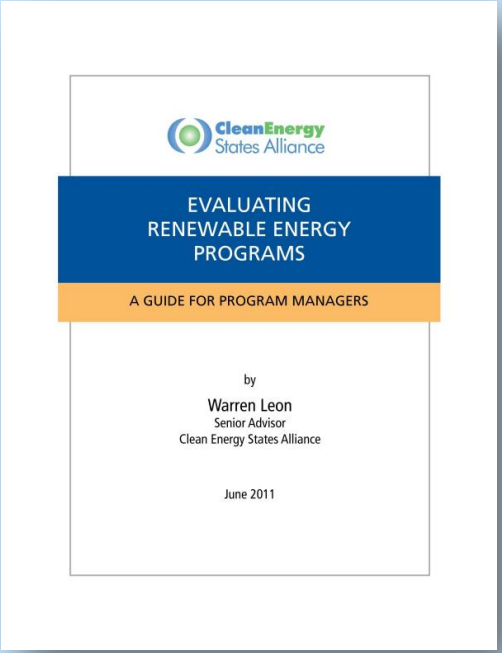
Building Blocks Approach: Costs

- Higher electricity prices
  - Need to estimate REC prices
    - Can get some data from a REC broker or research firm
- The indirect effects of REC spending (minus price suppression) on incomes and jobs
  - Get an expert to use the best available method to make an approximation
    - See if a study done for another purpose
    - Can modify the results from a nearby state
- Assume that other smaller costs and benefits balance out
  - E.g., system benefits of DG vs system costs of renewables

Approach 3: Economic Modeling

- Input-output model, such as IMPLAN
  - Static; doesn't include changes over time in a dynamic economy
  - JEDI uses this approach
- Multi-faceted model, such as REMI
- Captures indirect costs and benefits

- Resource on evaluation
  - Appendix on the models
  - Section on cost-benefit evaluation
  - On CESA website



Using Economic Modeling

- Still need to collect some of the data used in the building block approach
  - REC prices, location and type of generation, the share of generation attributable to the RPS
- Need not be expensive
  - If there is an existing state economic model available to the evaluator
  - If there has been a prior study of the electricity system in the state
- Choose experienced evaluators & understand their methodology
  - Make sure you understand the research methods
  - Have the evaluator justify key assumptions
- Show results as a range or approximation, not a precise result
- Make sure the presentation of results reveals the assumptions and uncertainties (especially about the future)

Questions and comments?

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Creating A Greener Energy Future For the Commonwealth

Massachusetts Department of Energy Resources

Design & Incorporation of CHP into an RPS Framework & Tracking System

Howard Bernstein

Program Manager

Renewable & Alternative Energy Portfolio Standards (RPS & APS)

October 27, 2011

(slides revised 11/3/11)

State-Federal RPS Collaborative

2011 National Summit on RPS

L'Enfant Plaza Hotel
Washington, DC
October 26-27, 2011

DOER Mission

Creating a greener energy future – economically and environmentally:

- all available cost-effective energy efficiencies
- greener energy resources
- reliable supplies and improved relative cost
- Clean tech companies and clean energy jobs

MA Renewable & Alternative Energy Portfolio Standards (RPS & APS)

Standard	Sub-Class	Technologies	Minimum Standard	ACP Rate, 2010 & thereafter, $/MWh
RPS Class I	**[Renewable Energy]** (post-1997)	Wind, LFG, Biomass, Solar, Small Hydro, etc.	5% in 2010 (minus Solar Carve-Out), increases 1% per year	$60.93; increases annually with CPI
	Solar Carve-Out (post-2007)	Solar PV; 6 MW or less per site; grid-connected; in MA	0.0679% in 2010 (never lower); set by formula to grow MA installed capacity to 400 MW	$600; can be reduced by DOER
RPS Class II (pre-1998)	**Renewable Energy**	same as Class I	3.6%, stays constant	$25; increases annually with CPI
	Waste Energy	MA Municipal Solid Waste Combustors,	3.5%, stays constant	$10; increases annually with CPI
APS (post-2007)		CHP (also fly-wheel storage, paper-derived fuel, fuel gasification w/ CCS)	1% in 2010; rises to 4% in 2016; then increases 0.25% per year	$20; increases annually with CPI

Alternative Energy Portfolio Standard

- Established under Green Communities Act 2008. Provides for RPS-modeled program for selected "alternative energy" technologies, mainly with non-renewable fuels.
- Program compliance obligation began in 2009.
- Eligible technologies include **CHP**, flywheel storage, fuel gasification with carbon capture/sequestration, fossil fuel displacement by paper derived fuel.
- **Key technology of interest in APS is CHP. Provides credit for net source fuel energy saved by cogeneration of electrical energy & useful thermal energy.**
- Qualified units earn Alternative Energy Certificates (AECs).
- Alternative Compliance Payment (ACP) Rate is $20/MWh (2010) and increases annually with Consumer Price Index.
  - Provides AEC ceiling price.

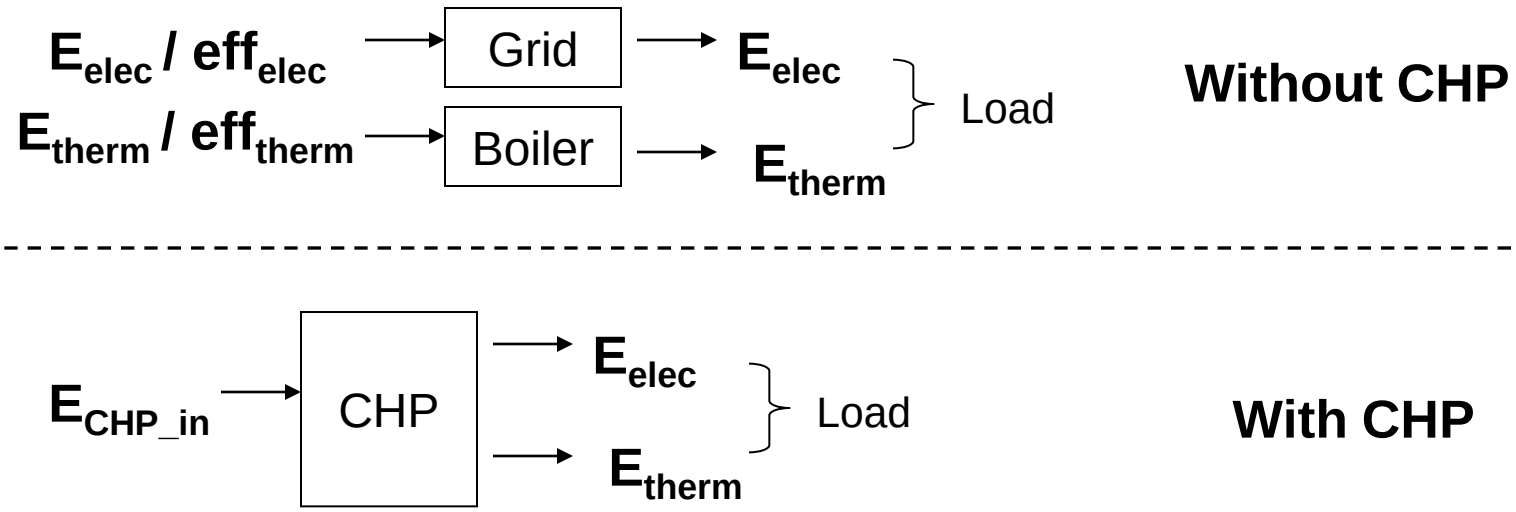
Guidelines for APS Eligible CHP Systems

- Metering Requirements:
  - Must meet DOER metering specifications to document *useful* thermal & power output *and* fuel input.
  - Metering requirements relaxed for small systems.
  - Meter data acquisition, AEC calculation, AEC reporting to NEPOOL GIS by independent third-party meter reader.
- Program supports incremental CHP:
  - Provides incentive for existing electric-only power plants to add useful thermal load, for existing thermal-only plants to add electrical generation, and for existing CHP units to increase electrical &/or thermal output/usage.
- CHP Projects must serve thermal load in MA.

CHP and NEPOOL GIS

- Metrics: energy values of electricity output, thermal output, & fuel input – each expressed as MWh.
  - *Not* electricity output, *not* thermal output, *not* total of both.
  - *Rather:* calculation of *source fuel* ***energy saved*** by CHP use vs non-CHP sources of both electricity & heat, per formula.
- Meter reading/AEC calculation/reporting by DOER-approved independent 3rd party meter reader for all metered inputs & outputs – not by owner, not by ISO New England.
- New *type* of Generation Asset at NEPOOL GIS (New England grid's attribute tracking system).
- Not counted in generation/emission *totals* at NEPOOL GIS.
- CHP Unit can *also* qualify for RPS if uses RPS-qualified fuel – → separate Generation Asset at NEPOOL GIS for *separate* minting & recording of RECs (≠ AECs).

AECs for CHP – Account for Efficiency Gains



Alternative Energy Credits (AECs) calculated as energy savings of CHP compared with grid power and separate thermal unit, to meet the same load.

$$\text{AECs} = E_{elec}/0.33 + E_{therm}/0.80 - E_{CHP_in}$$

All energy expressed in MWh.

MA APS Minimum Standard & Projected Cumulative CHP Capacity Demand

Year	APS Minimum Standard	Est. MW of Installed CHP
2009	1.00%	
2010	1.50%	64
2011	2.00%	92
2012	2.50%	121
2013	3.00%	148
2014	3.50%	177
2015	3.75%	205
2016	4.00%	215
2017	4.25%	226
2018	4.50%	237
2019	4.75%	249
2020	5.00%	261

Estimate based upon APS being met only by CHP

Approximately 27 MW of new CHP installations required each year through 2014, and half this amount in years following.

Questions/Comments

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http://www.mass.gov/doer

http://www.mass.gov/energy/rps or

http://www.mass.gov/energy/aps [=same page]