



Key Developments and Trends in the US Power Industry

Tuesday, February 23, 2016

Presenters:

Bob Mudge, Principal, *The Brattle Group*

Marc Chupka, Principal, *The Brattle Group*

Susan Nickey, Managing Director, *Hannon Armstrong*

Elias B. Hinckley, Partner, *Sullivan & Worcester, LLP*

Moderator:

Erlyne J. Nazaire, Senior Legal Editor, *Practical Law Finance*

Agenda

- Introduction
- Background
 - US Carbon Overview in 2015
 - Focus on the Clean Power Plan (CPP)
- Sectoral Responses
 - Clean power imperative
 - Technology developments
 - Tax law developments
 - New business models
 - Financial innovation
- The Outlook for 2016

Introduction

- 2015 saw a number of dramatic and unprecedented events affecting the US power industry:
 - Finalization of EPA's Clean Power Plan (CPP)
 - Partly owing to CPP, a successful conclusion to the Paris Climate Agreement
 - Extended renewable tax credits addressing multiple technologies and phase-outs
- Early 2016 brought yet more drama in the form of two successive Supreme Court rulings:
 - 1/25/16: A ruling upholding FERC regulation of Demand Response
 - 2/9/16: A stay of CPP implementation activity, pending resolution of legal challenges
- Meanwhile, the past year has continued to be characterized by low fossil energy costs and declining average electricity demand.
- Against this background, this webinar is intended to address select topics emerging from 2015 and our outlook for 2016.

US Carbon Overview in 2015

EPA's Clean Power Plan

- Finalized in August 2015
- Target: electric CO2 emissions 32% below 2005 levels by 2030
- State targets:
 - Lower coal heat rates
 - Gas substitution for coal
 - More zero-emission generation
- Flexible approaches (i.e. trading) encouraged and enabled
- State plans due: 2016 – 2018
- Implementation: 2022
- Mutually reinforcing with Paris Climate Agreement

 **Now deferred by Supreme Court Stay, 2/9/16**

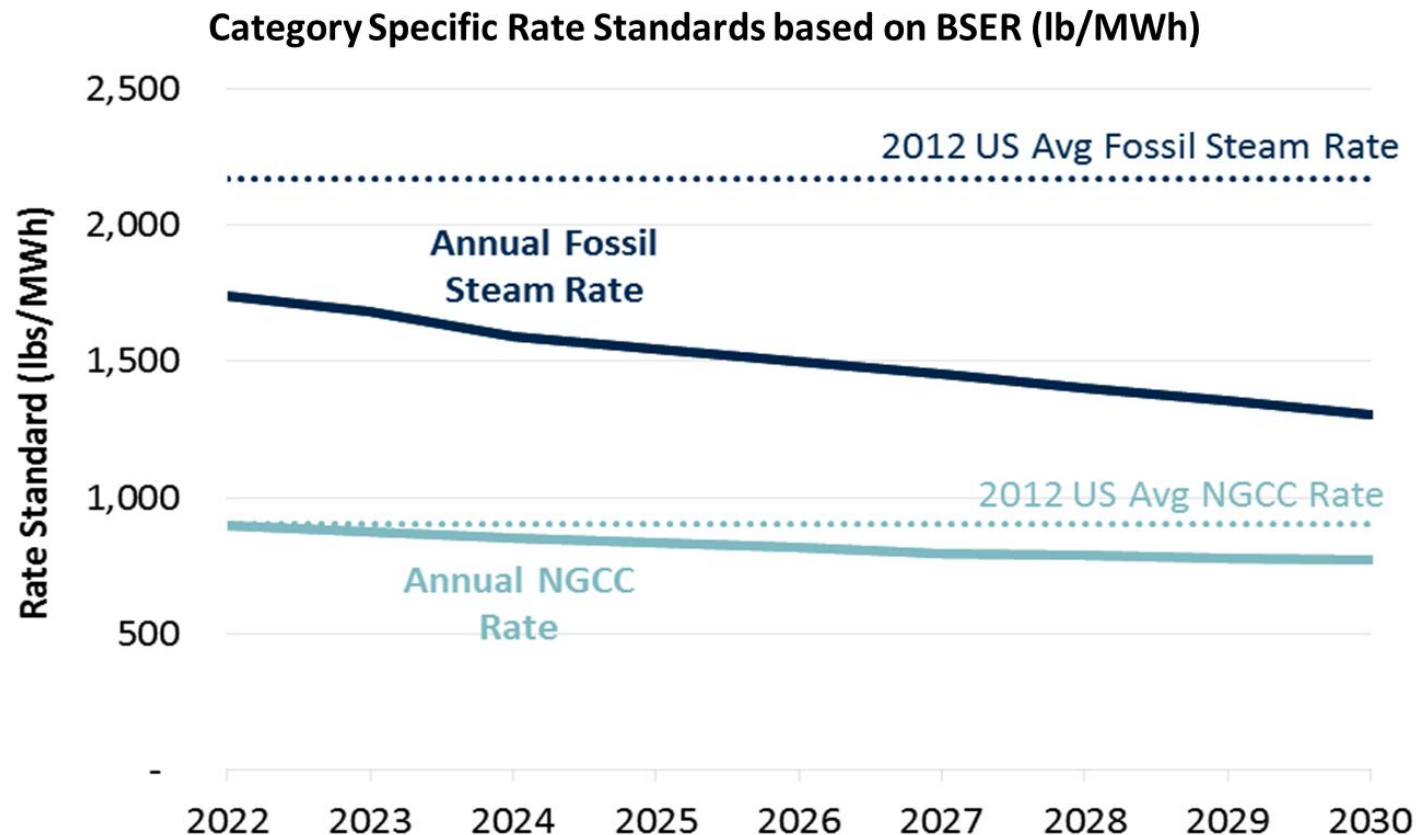
Regional CO2 Programs

- AB32 Cap and Trade Program (CA)
 - In 4th year of operation
 - Auction prices still low at \$13/ ton
 - Small emissions reductions to date
 - Expected to become more stringent post 2020
 - Will complement RPS, EE
- Regional Greenhouse Gas Initiative (RGGI)
 - In 7th year of operation
 - 12/15 auction clearing price at \$7.50/ ton

 **Regional CO2 markets form templates/ alternatives to CPP**

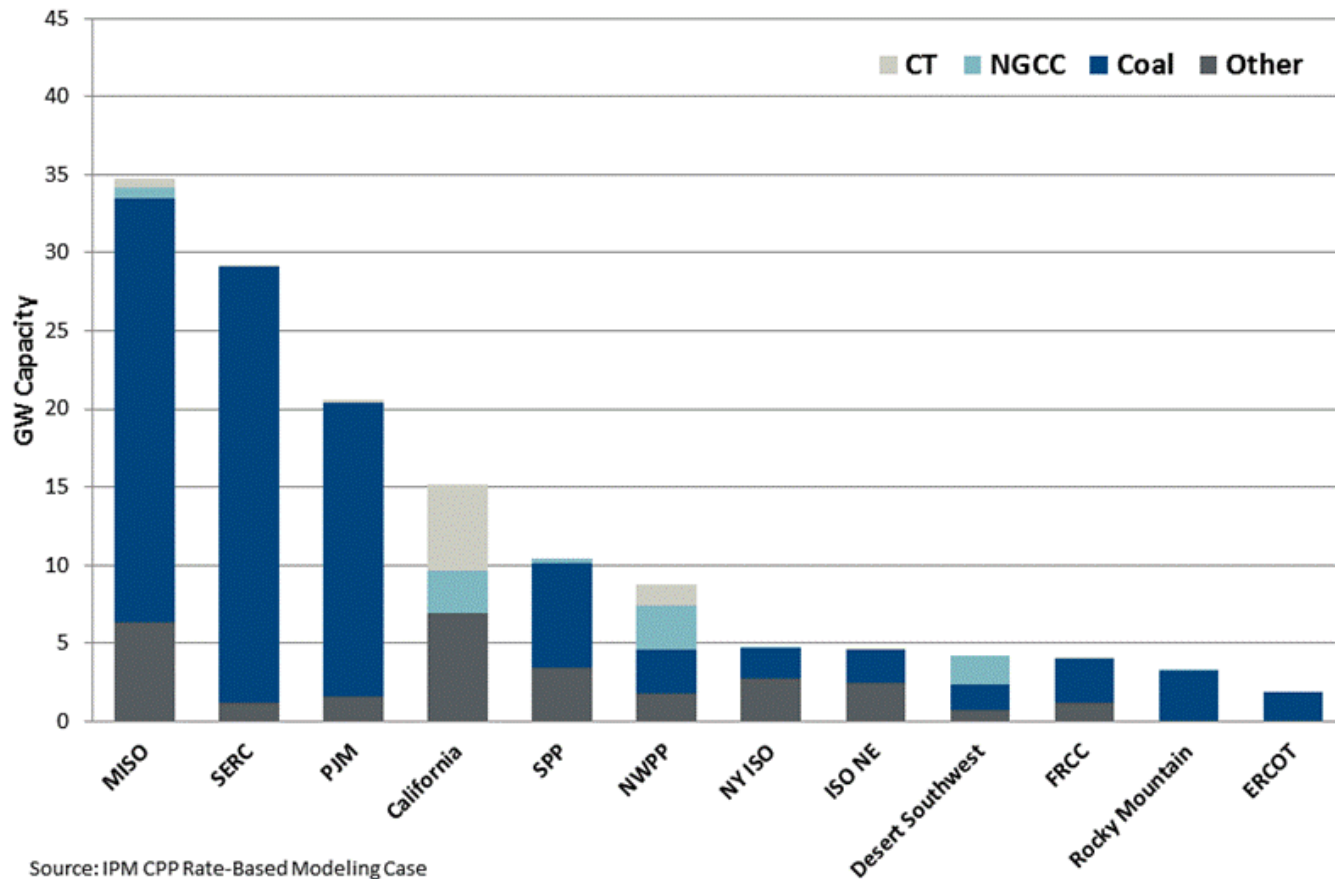
Focus on CPP: National Rate Targets, by Year

- The Final (8/15) CPP goals, which affect coal mostly in the near term (2022)
- Compliance assumes “beyond the plant fence” measures and credit trading



Focus on CPP: Expected Retirement Impact

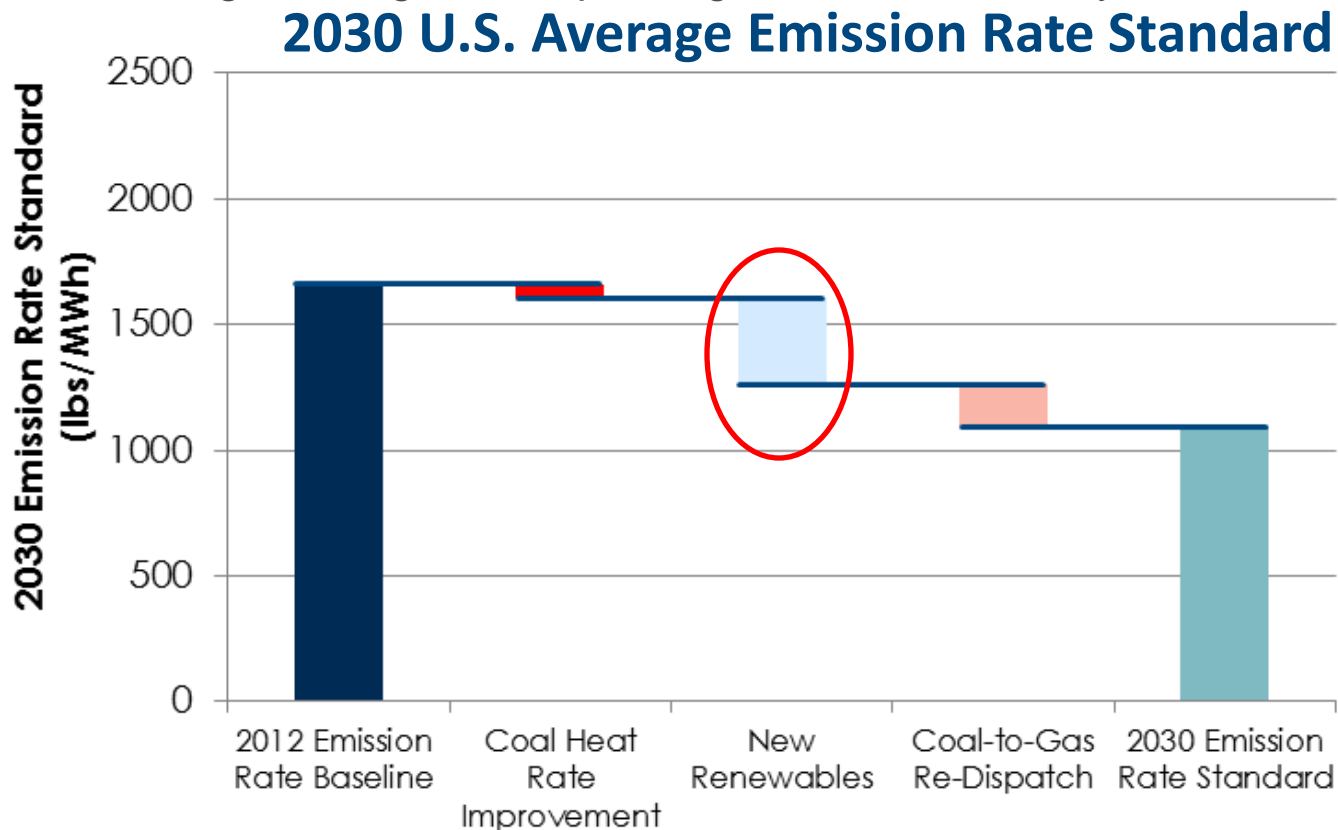
Cumulative Retirements through 2030 by EGU Type and Region



Source: IPM CPP Rate-Based Modeling Case

Focus on CPP: Expected Displacement

- New renewables expected to be single largest factor in reaching 2030 target
- Notwithstanding coal to gas re-dispatch, gas use also offset by renewables



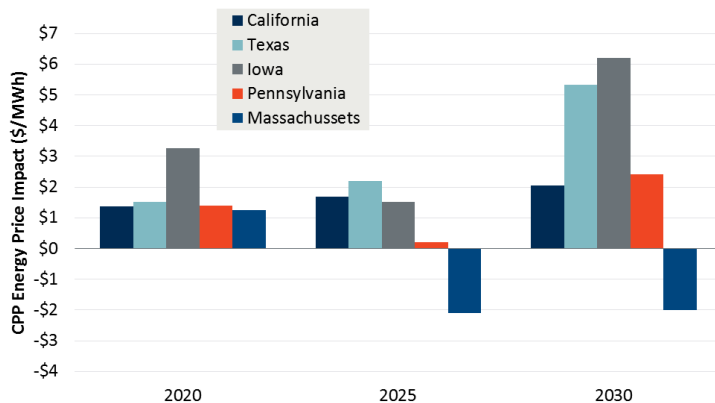
Focus on CPP: Potential Impact on Wholesale Electricity Prices

EPA estimated energy prices generally higher under mass-based compliance relative to rate-based by 2030, but impacts differ by state and by year

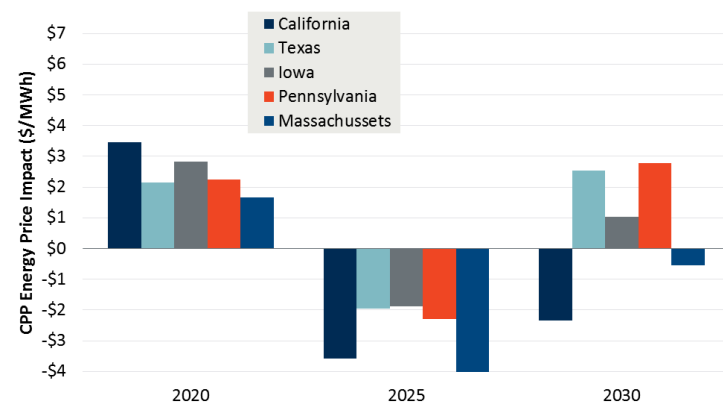
- Mass-based: +\$ 5/MWh by 2030 in TX/IA; +\$2-3/MWh in CA/PA, -\$2/MWh in MA
- Rate-based: price decreases in CA and MA by 2030; +\$1-3/MWh in TX, IA and PA

Energy Price Impact of CPP under EPA's IPM Analysis*

Mass-Based Standard



Rate-Based Standard



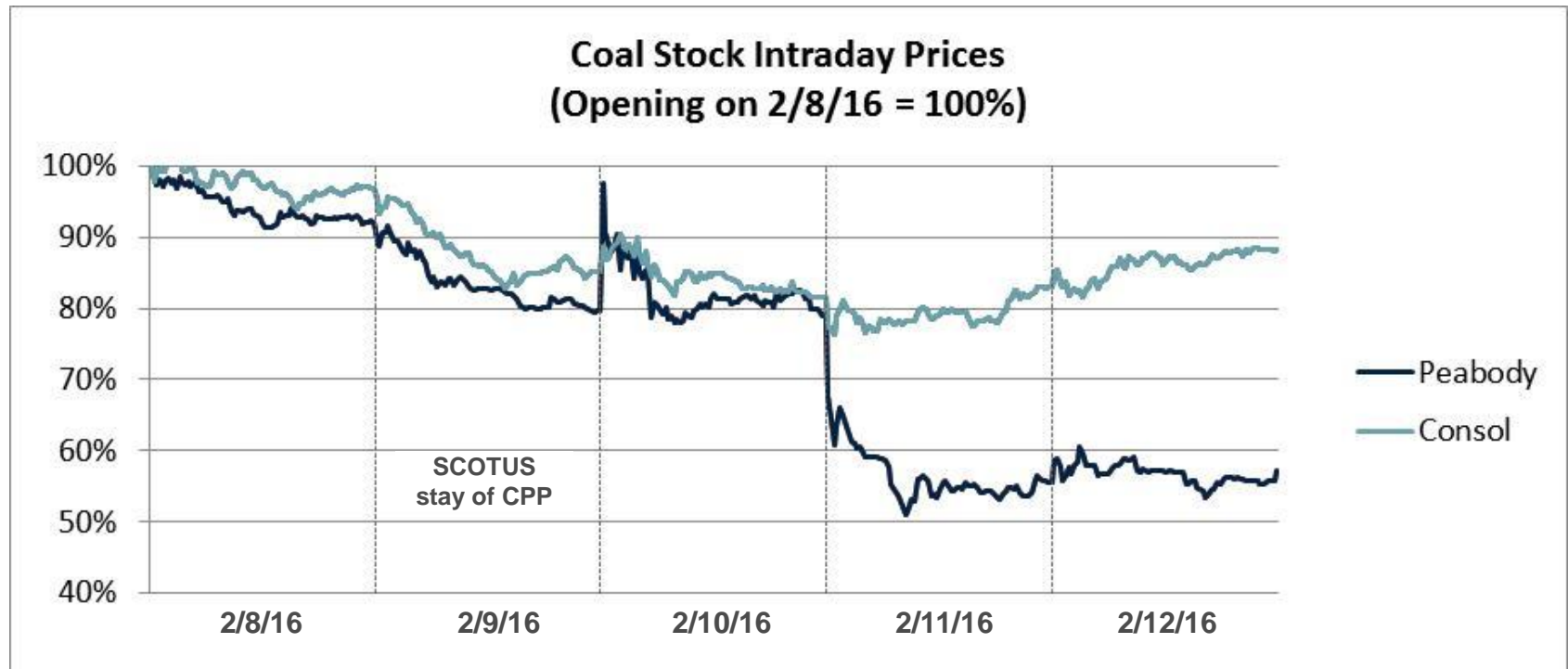
Note: Energy prices are the energy-weighted prices from the following IPM regions: CA - WECC_Southern California Edison; IA - MISO_Iowa-MidAmerican; PA - PJM_Western MAAC; MA - ISONE_MA, VT, NH, RI (Rest of ISO New England).

(*) The Brattle Group has not confirmed that the EPA IPM results are a valid reflection of the economic impacts of the Clean Power Plan Final Rule. These values are presented for illustrative purposes only

Source: Metin Celebi, "Clean Power Plan: Choices and Implications, October 13, 2015

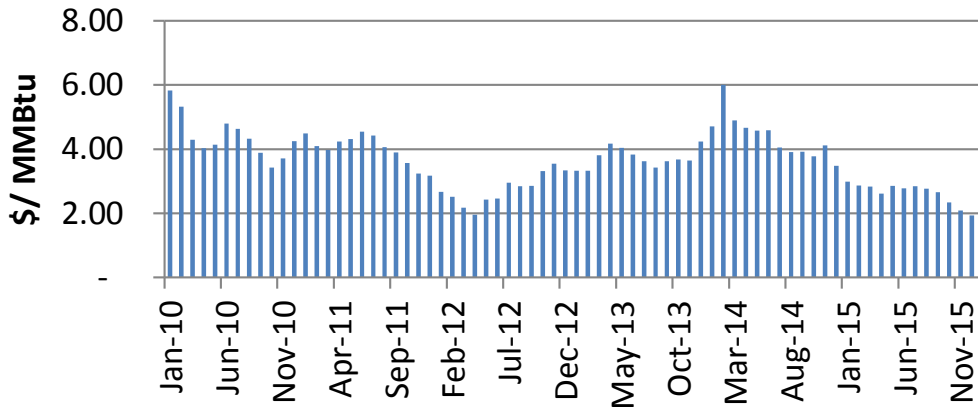
Focus on CPP: Impact of SCOTUS Stay

- Coal stocks jumped briefly after Supreme Court stay on 12/9/16...
- But market hope for coal stocks did not last long:



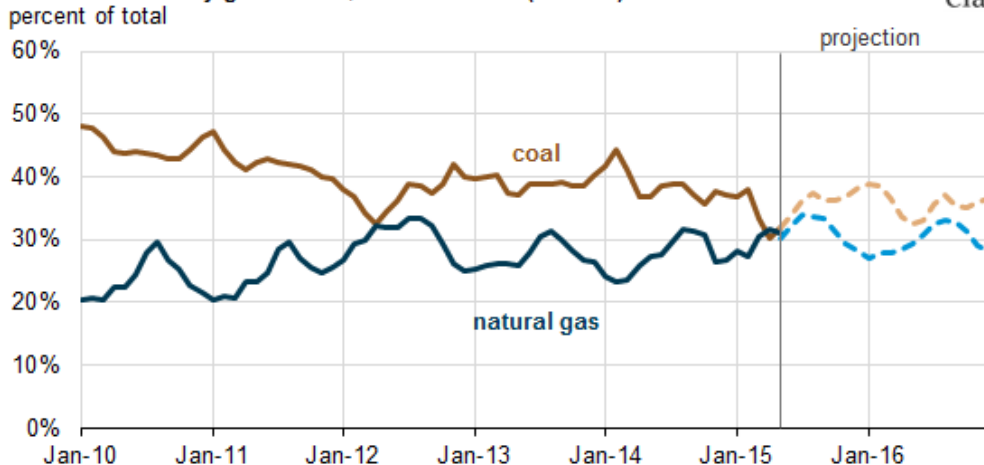
Focus on CPP: Impact of SCOTUS Stay (continued)

Henry Hub Natural Gas Spot Price



- Low gas prices have already eroded coal's position
- Coal and gas in rough economic parity in many regions, at least some of the time

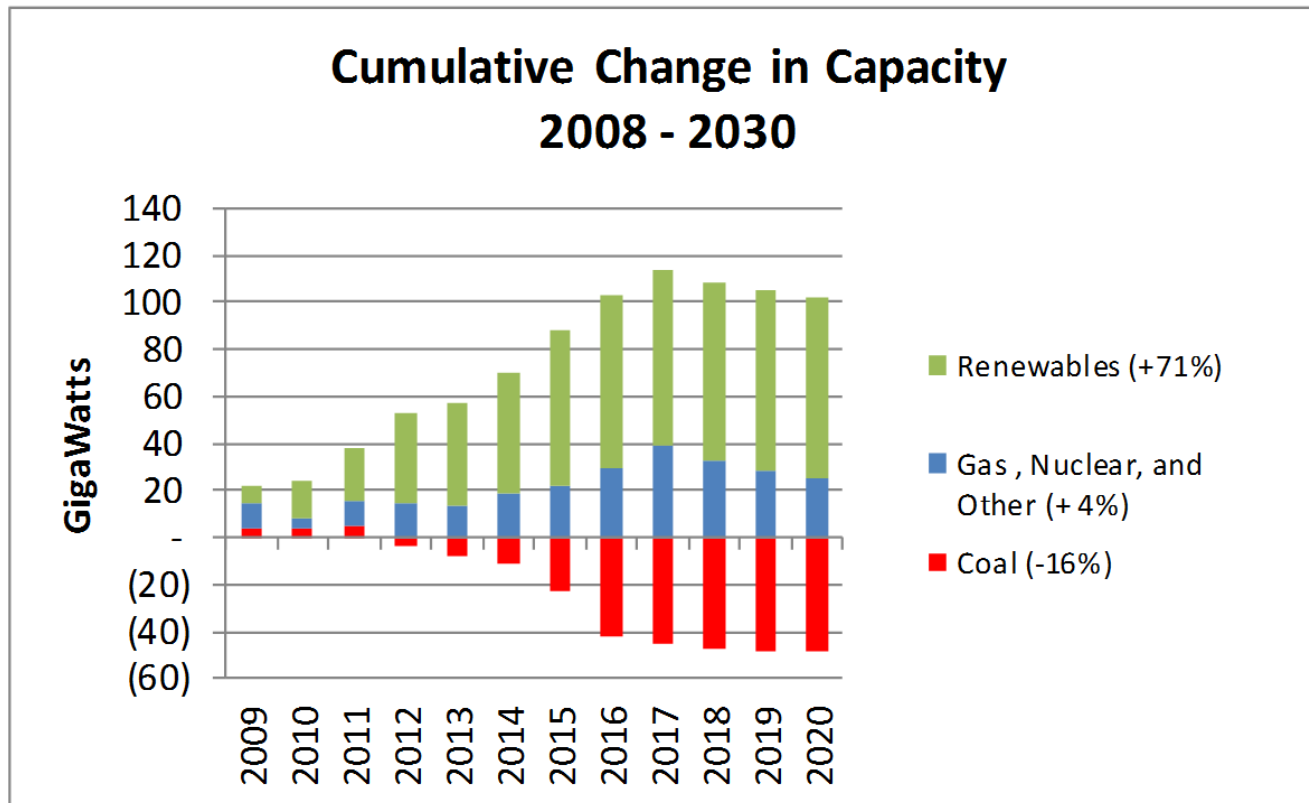
U.S. net electricity generation, selected fuels (2010-16)



Source: EIA

Focus on CPP: Impact of SCOTUS Stay (continued)

- EIA projections (w/o CPP but with MATS) that pre-dates tax credit extensions already show considerable displacement of coal capacity:



Source: EIA AEO data through April 2015

Focus on CPP: Impact of SCOTUS Stay (continued)

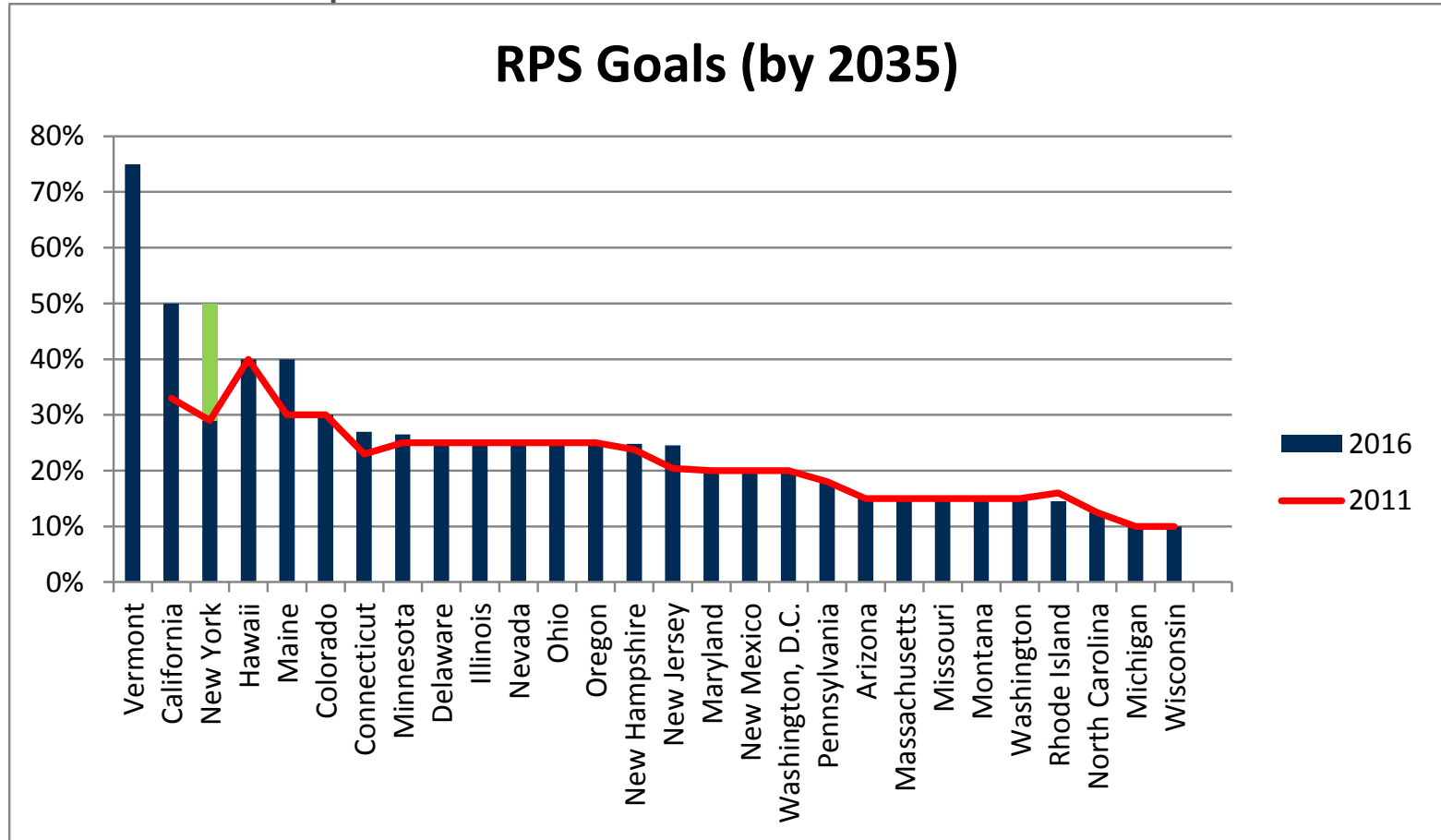
- Under the CPP, states had to submit implementation plans to EPA, for final approval by 9/2018. They clustered into three groups:
 - Support CPP and work on plans (e.g., West Coast, Northeast)
 - Oppose CPP and work on plans (about 20 states, including coal-based)
 - Oppose CPP and not work on plans “delay and pray” (handful, e.g. OK, KY)
- First and last group don’t change with the Stay; middle group split and reassessing
- Expect about 20 states to continue efforts (maybe slow down) and maybe a dozen to finish prior to existing deadline
- Current consensus is that policy and market developments will continue to move in the general direction of CPP compliance, with or without enforceable CPP deadlines

Sectoral Responses

1. Clean Power Imperative	2. Technology Developments	3. Tax Law Developments	4. New Business Models	5. Financial Innovation
<ul style="list-style-type: none">• RPS Roundup• Renewables Penetration	<ul style="list-style-type: none">• Renewables Cost• Scale Evolution• Storage	<ul style="list-style-type: none">• Tax Incentives Extended 12/15• More Visibility• Multiple Technologies• Coordinated Phase-outs	<ul style="list-style-type: none">• Declining Energy Demand• Distributed Energy Resources• Demand Response• Policy Development	<ul style="list-style-type: none">• Market Drivers• Public Markets• Private Markets• Public/Private Partnerships

Sectoral Responses: Clean Power and Energy Efficiency

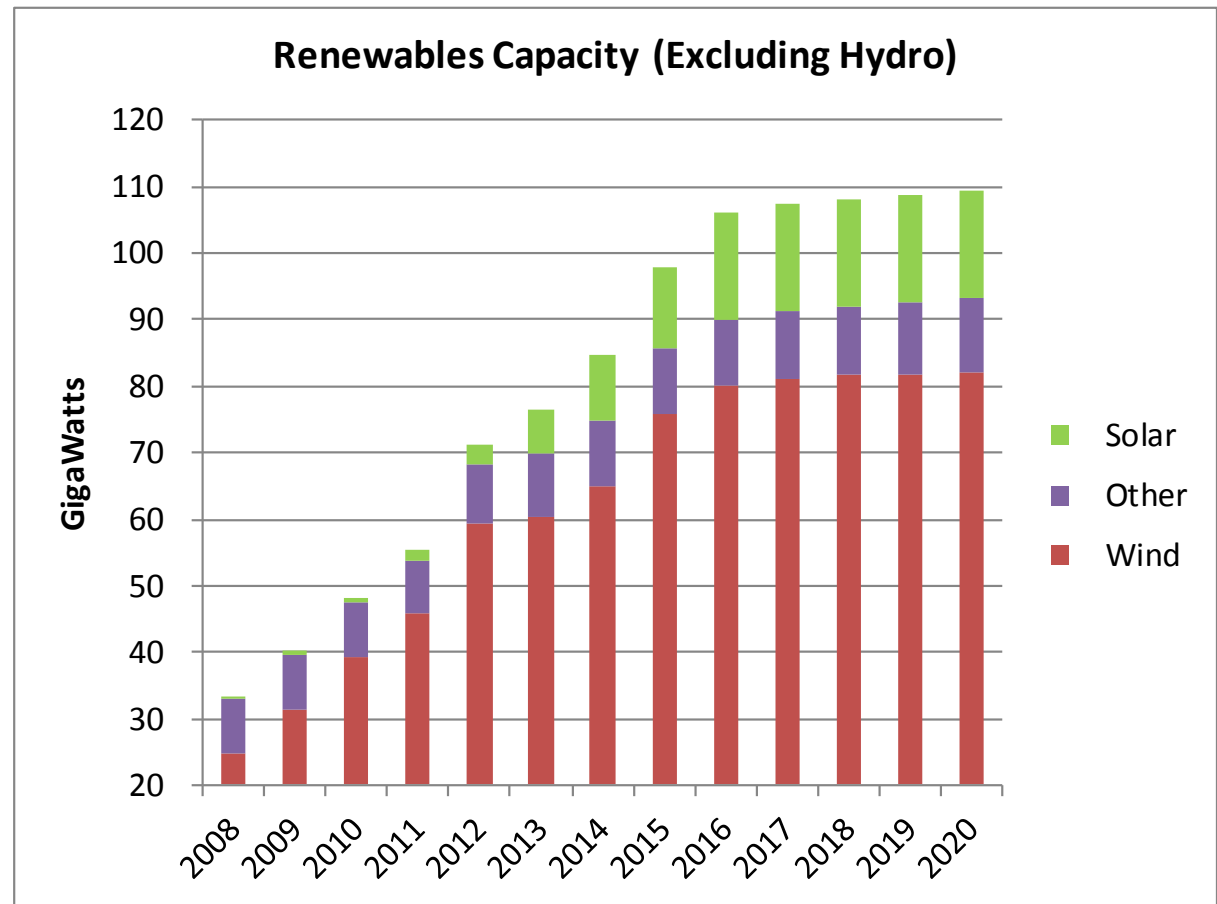
- RPS Roundup



Sectoral Responses: Clean Power and Energy Efficiency

- Renewables Penetration

- EIA forecasts conservative outlook for renewables, excluding distributed resources
- Still exceeding 10% of total US capacity by 2020 (excluding hydro)

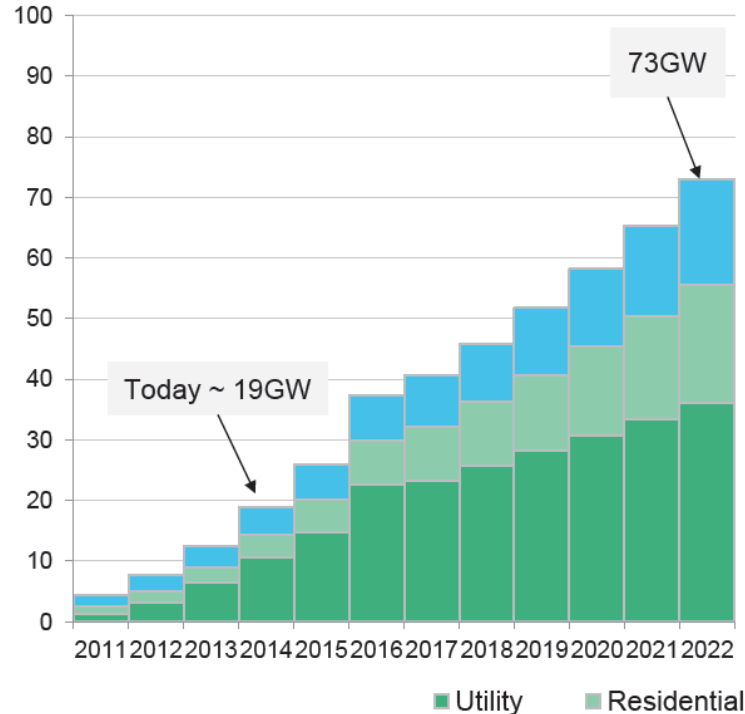


Source: EIA AEO data through April 2015

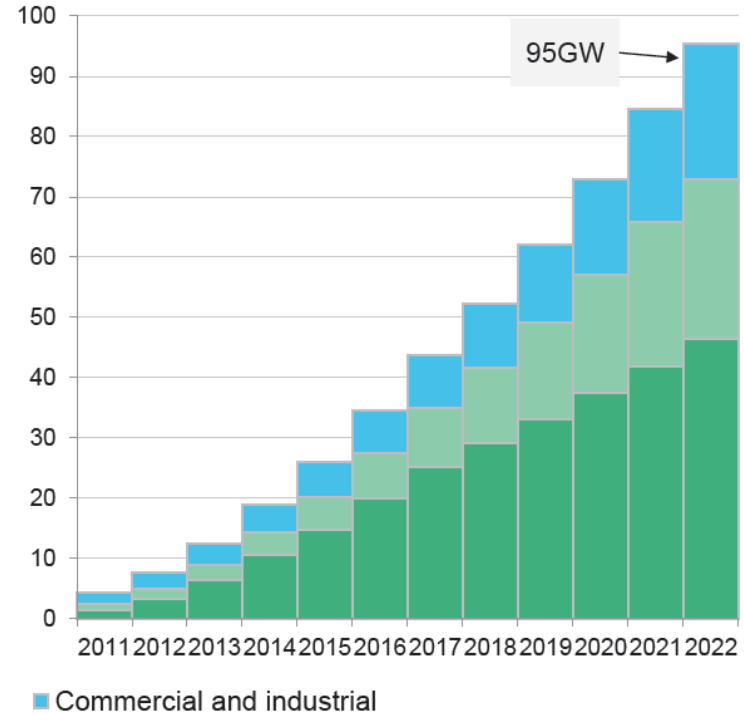
Sectoral Responses: Clean Power and Energy Efficiency

- Renewables Penetration: Forecasts Including Distributed PV are More Aggressive

POLICY AS USUAL – CUMULATIVE CAPACITY (GW)



ITC EXTENSION – CUMULATIVE CAPACITY (GW)



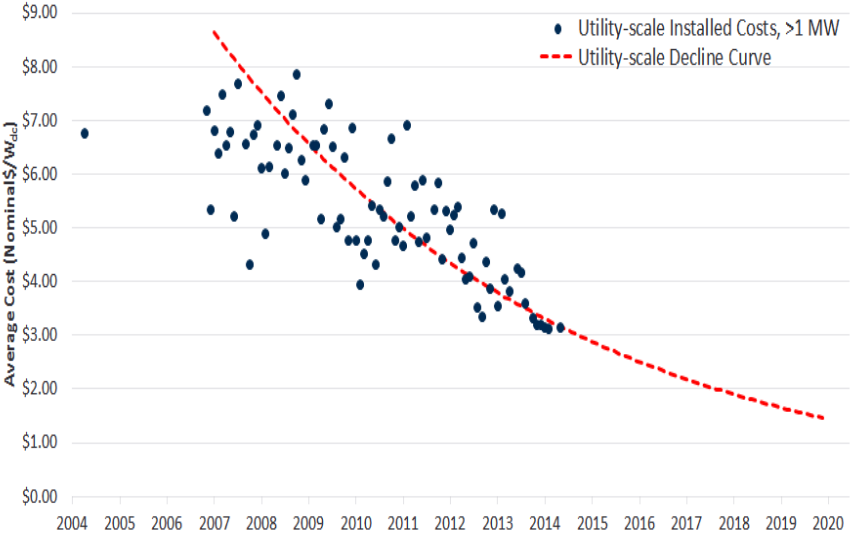
Notes: 'ITC extension' scenario considers a 5-yr extension to both the personal and business investment tax credits, and 'commence construction' language added to the business credit.

Source: Bloomberg New Energy Finance, EIA 826, 860 and 861

Sectoral Responses: Technology Developments

- Renewables Cost (example of PV): NREL OPEN PV data indicates dramatic reductions in installed costs at both utility and residential scale.

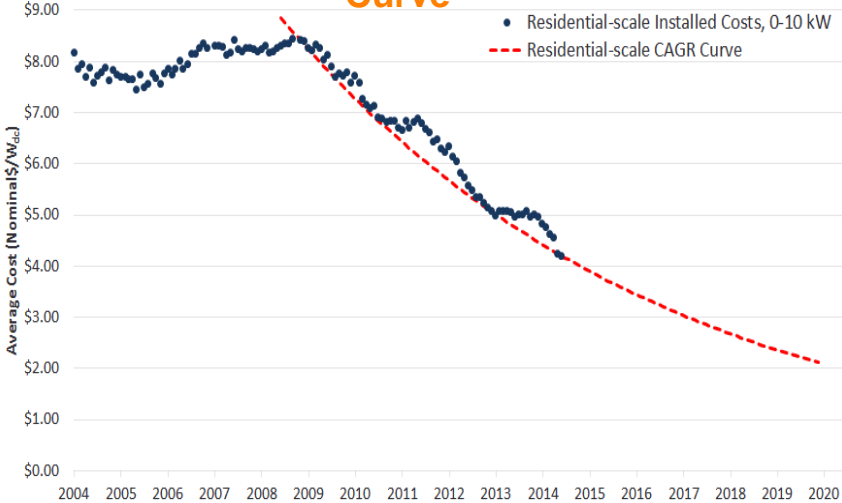
Utility-Scale Installed Costs with Decline Curve



Source: NREL Open PV Project; Analysis by The Brattle Group

Installed cost in 2014: \$2.88/W_{DC}
 Installed cost in 2019: \$1.43/W_{DC}

Residential-Scale Installed Costs with Decline Curve

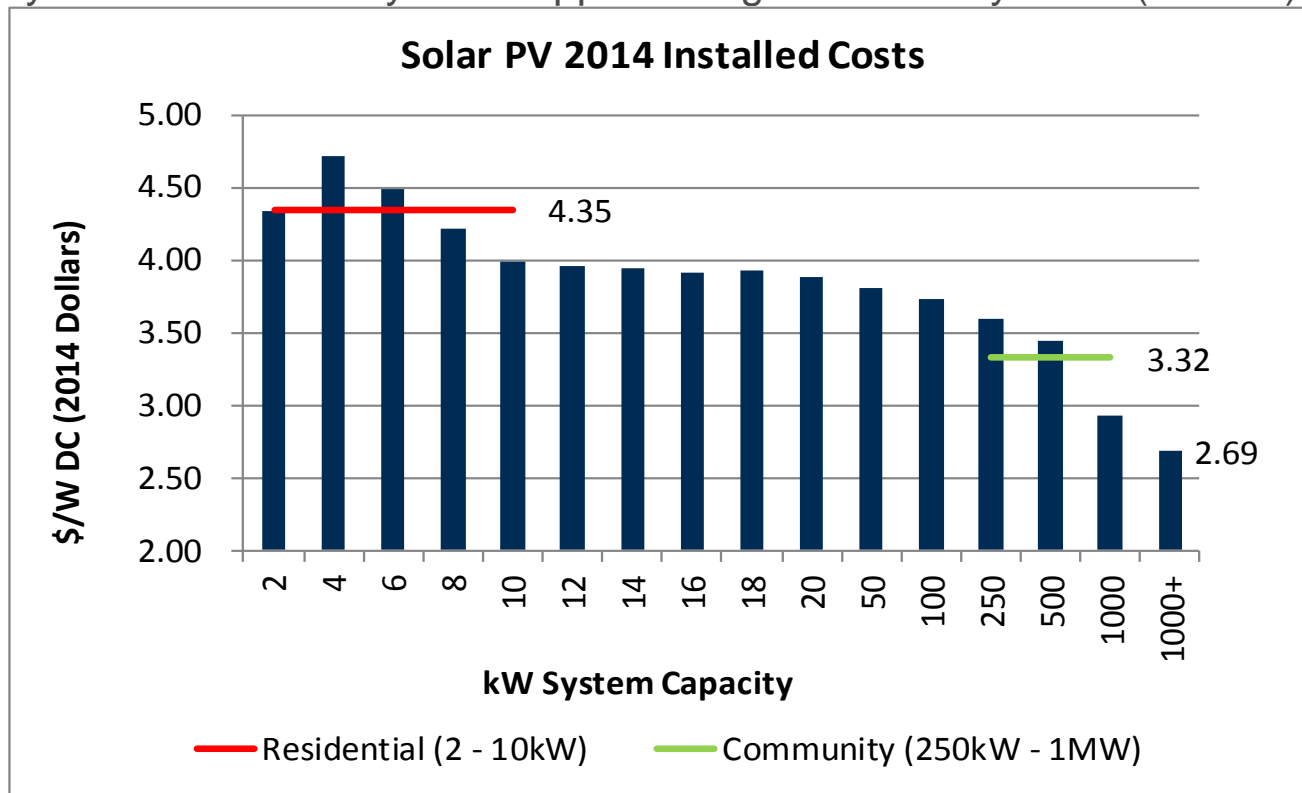


Source: NREL Open PV Project; Analysis by The Brattle Group

Installed cost in 2014: \$4.25/W_{DC}
 Installed cost in 2019: \$2.25/W_{DC}

Sectoral Responses: Technology Developments (continued)

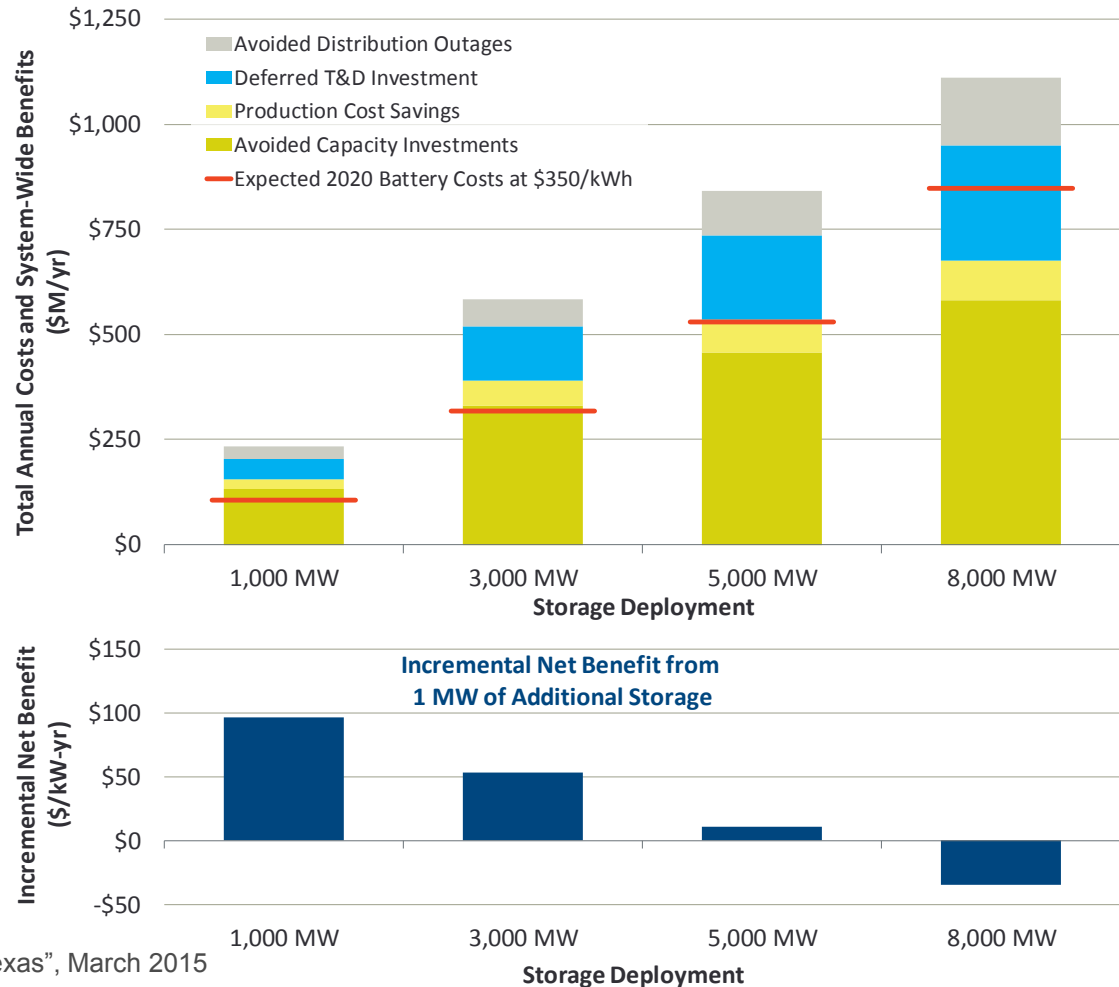
- Scale Evolution: If (conservatively) defined as 250kW – 1MW, recent DOE study shows Community Solar approaching cost of utility scale (1MW +):



Source: Photovoltaic System Pricing Trends, U.S. Department of Energy, September 2015

Sectoral Responses: Technology Developments (continued)

- Storage
 - At \$350/ kwh, Brattle study found that storage could pay for itself in ERCOT.
 - However, current market and regulatory mechanisms do not enable cost-effective deployment



Source: Hannes Pfeifenberger et. al., "The Value of Distributed Electricity Storage in Texas", March 2015

Sectoral Responses: Tax Law Developments

	Description	Eligibility	First Implemented	Changes and Extensions	Expiration and Phase Outs	Criteria
<u>1. Production Tax Credit</u>	Per kWh/ <i>10 years</i>	\$0.023 --> wind, geothermal, biomass [a]	1992	1999, 2002, 2004, 2005, 2006, 2009, 2013, 2014, 2015	2016, 2017 (80%), 2018 (60%), 2019 (40%)	Construction start [b]
		\$0.011 --> hydro, other				
<u>2. Investment Tax Credit</u>	% of capital, <i>upfront</i>	30% --> solar and PTC-eligible [c]	2005 [d]	2008 [e], 2015	2019, 2020 (26%), 2021 (22%)	Construction start (per 2015 change). In-service by 2023.
		10% --> CHP, microturbines and other				
<u>3. Accelerated Depreciation</u>	Tax <i>deductions</i>	5 year --> solar, wind, geothermal	1986	2005, 2008, 2015 [f]		In-service by tax year
		7 year --> biomass, other				

Notes:

[a] Geothermal, biomass, landfill gas, incremental hydroelectric and ocean energy projects expire in 2016 with no phase outs

[b] Changed from in-service in conjunction with extension in 2013 under the American Taxpayer Relief Act of 2012 .

[c] PTC-eligible facilities are able to use the 30% ITC (pro-rated with phase outs, as applicable).

[d] Start of 30% level; predecessor Energy Tax Act of 1978 provided a 15 % solar tax credit adjusted down to 10% by 1988.

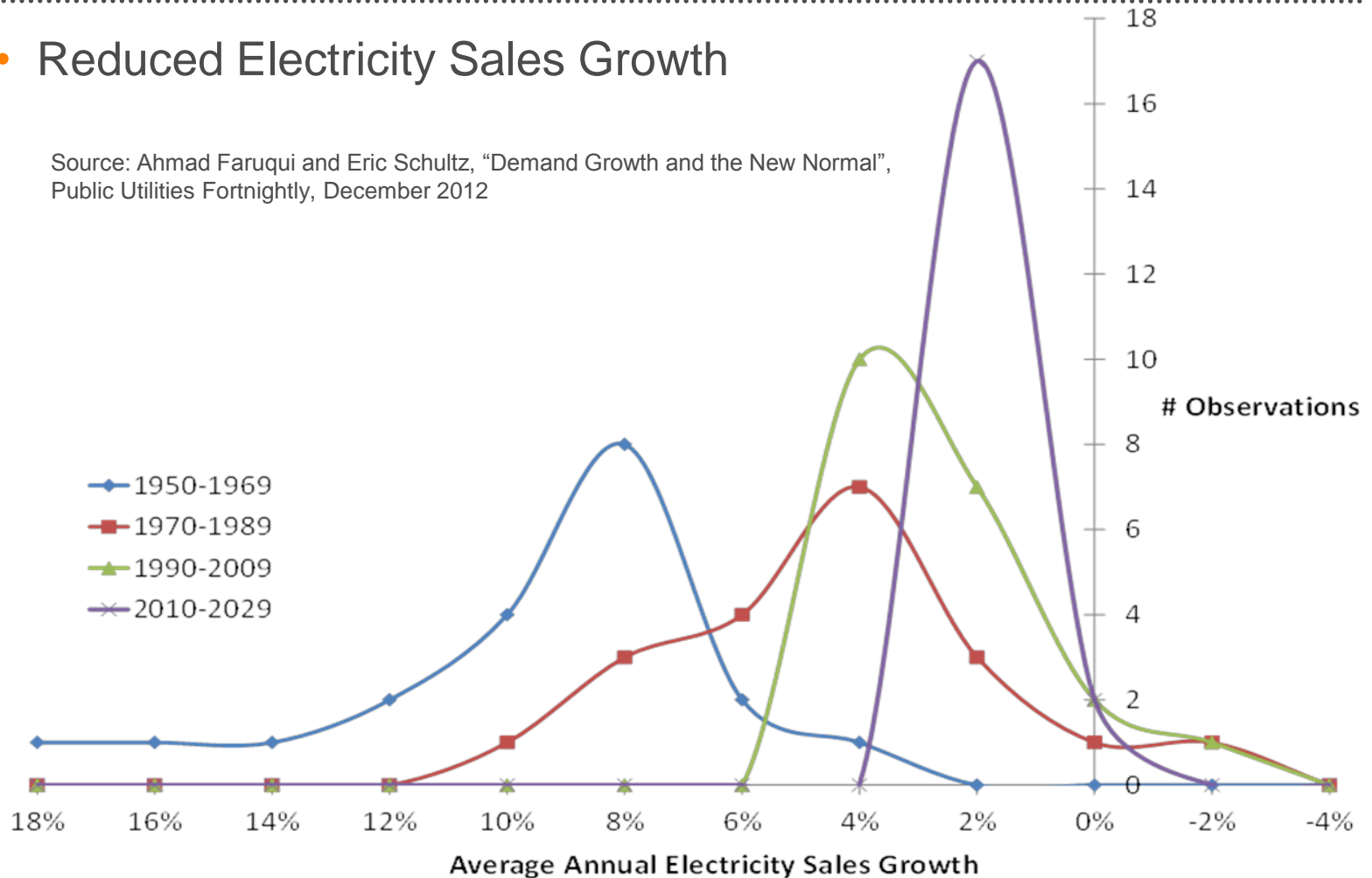
[e] Emergency Economic Stabilization Act of 2008; among other things, utilities became eligible for the ITC.

[f] Bonus depreciation extended

Sectoral Responses: New Business Models

- Reduced Electricity Sales Growth

Source: Ahmad Faruqi and Eric Schultz, "Demand Growth and the New Normal", Public Utilities Fortnightly, December 2012

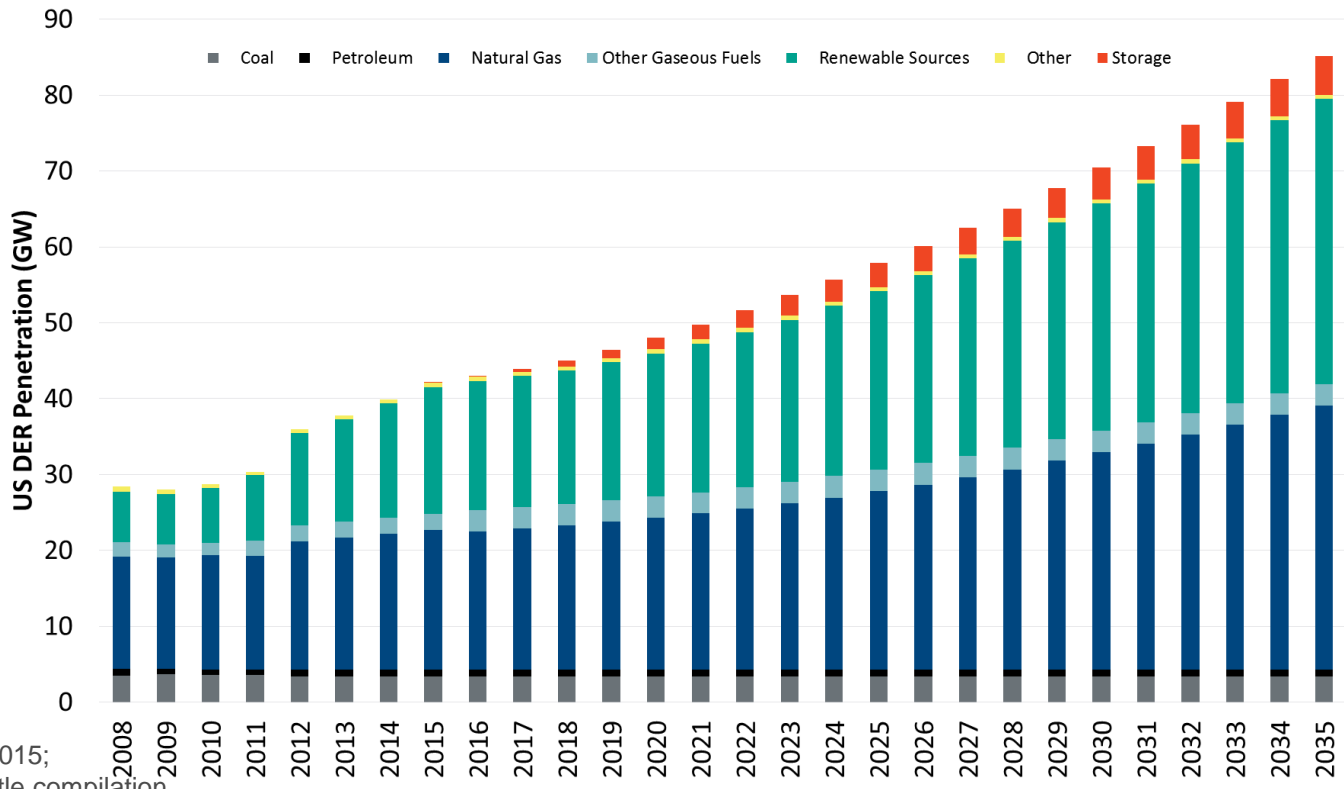


Sectoral Responses: New Business Models (continued)

- Distributed Energy Resources (“DER”)
- Defined as local or “behind-the-meter” generation resources and demand-side options
- Relied upon to meet all or a portion of customer’s electric load
- Includes a wide range of technologies:
 - solar photovoltaic (PV)
 - combined heat and power (CHP)
 - microgrids
 - wind turbines
 - back-up generators
 - energy storage
 - demand response
 - energy efficiency

Sectoral Responses: New Business Models (continued)

- Distributed Energy Resources
 - Not just renewables
 - Expected to grow



Source: AEO 2008-2015; GTM Research; Brattle compilation

Sectoral Responses: New Business Models (continued)

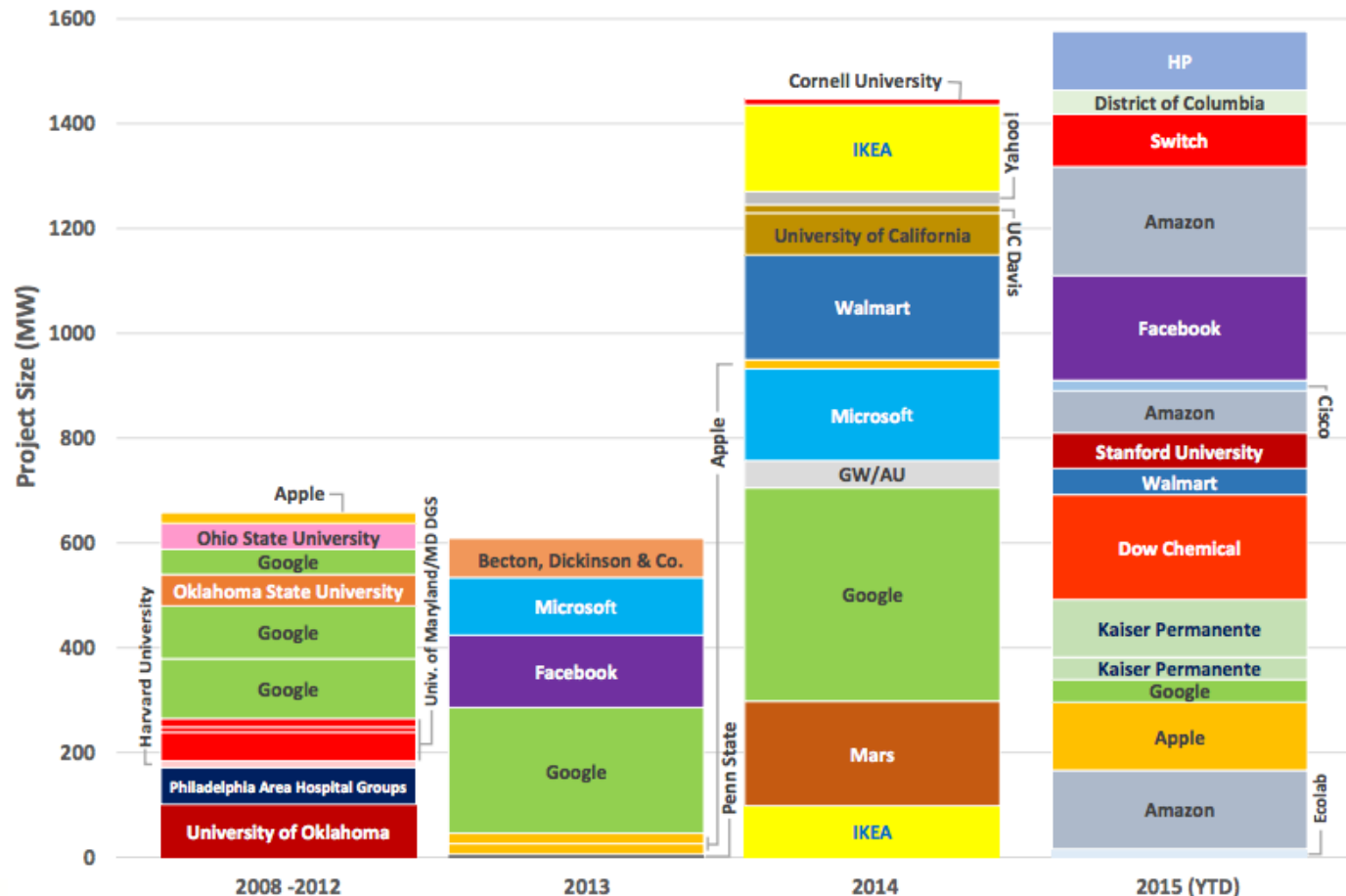
- Distributed Energy Resources
 - Wind is also increasingly distributed
 - Bloomberg New Energy Finance reported the following in their Sustainable Energy in America Factbook, 2016:

“Around 19% (1.7GW) of all projects commissioned in 2015 had a non-utility PPA contracted. Furthermore, over 1.2GW of additional non-utility wind PPAs were signed in 2015, typically for projects expected to begin operation in 2016.”

Sectoral Responses: New Business Models (continued)

- Distributed Energy Resources

The American Clean Skies Foundation elaborated on corporate PPAs in August 2015



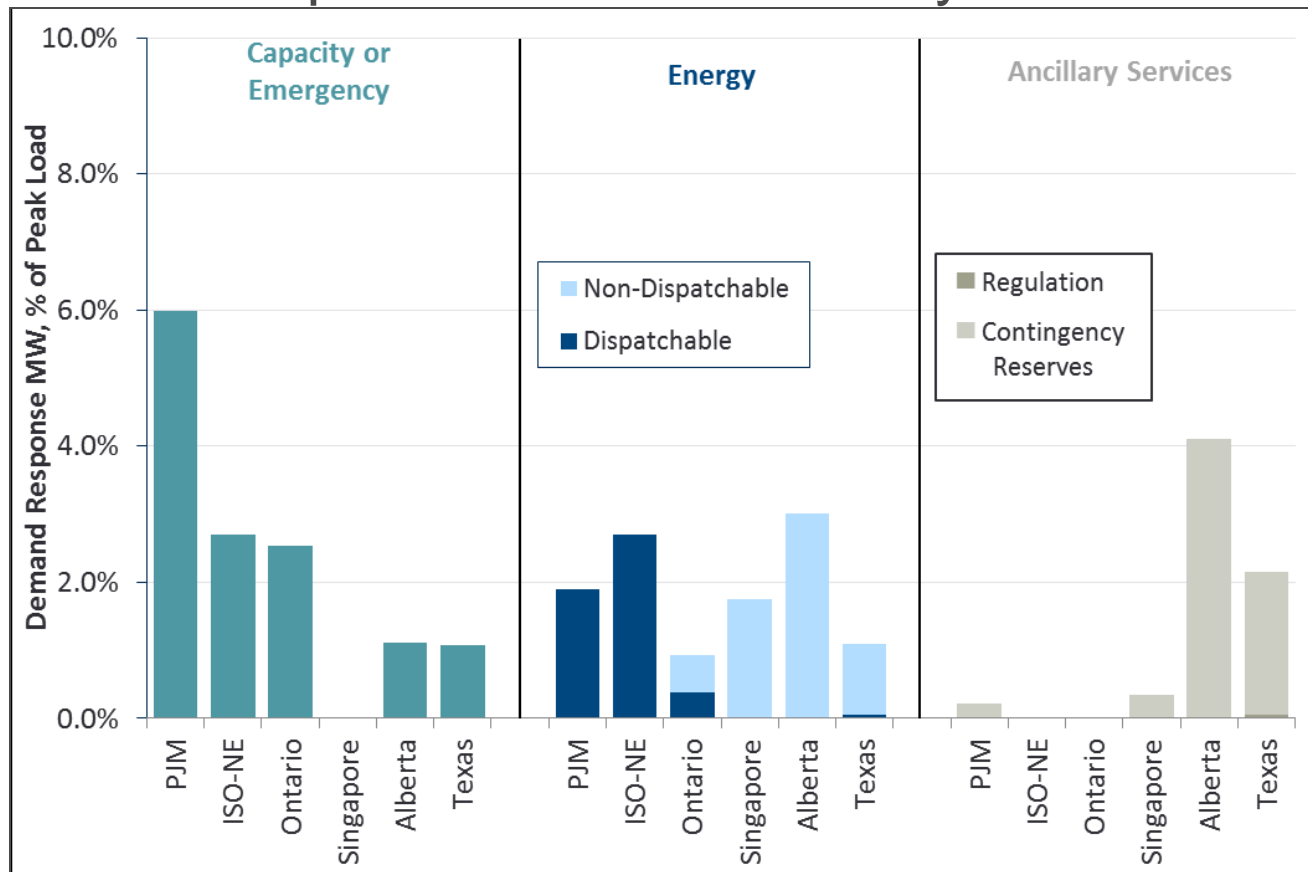
Sectoral Responses: New Business Models (Continued)

- Demand Response

- Refers to the ability of high-load electricity customers—such as industrials— to curtail consumption in peak demand hours.
- To date, principally a wholesale market phenomenon
- This trend reinforced by Supreme Court decision in January to uphold FERC Order 745
- Order 745 allows demand response resources to bid into wholesale markets as if they were generators

Sectoral Responses: New Business Models (Continued)

- Demand Response – Penetration by Market



Source: Sam Newell et al., "International Review of Demand Response Mechanisms", October, 2015

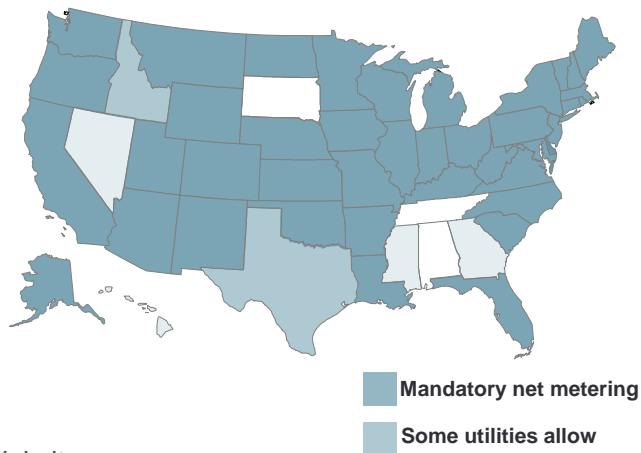
Sectoral Responses: New Business Models (Continued)

- Policy Development
- State and utility initiatives to address challenges and opportunities:
 - Net Metering/Net Generation Caps
 - Alternative business models
 - Detailed distribution system studies
 - Value of Solar Studies
 - Community Solar Growth
 - Utility Led DG Programs
- “*Utility of the Future*” efforts:
 - NY REV docket
 - HI “Commission’s Inclinations on the Future of Hawaii’s Electric Utilities” Whitepaper
 - CA AB 327- Section 769: Distributed Resource Plans

Sectoral Responses: New Business Models (Continued)

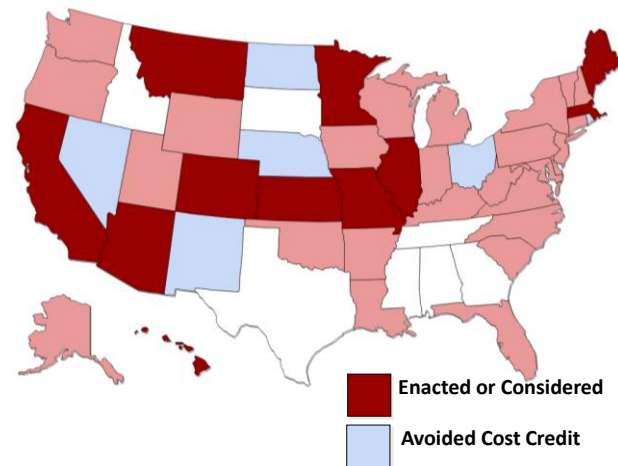
- Policy Development: Net Energy Metering
 - Net metering at retail rates can be a key driver of DER economics
 - However, with more DER, someone else has to cover utility fixed costs
 - True “avoided cost” remains highly contested

Net Energy Metering Regimes
41 states have mandatory net metering



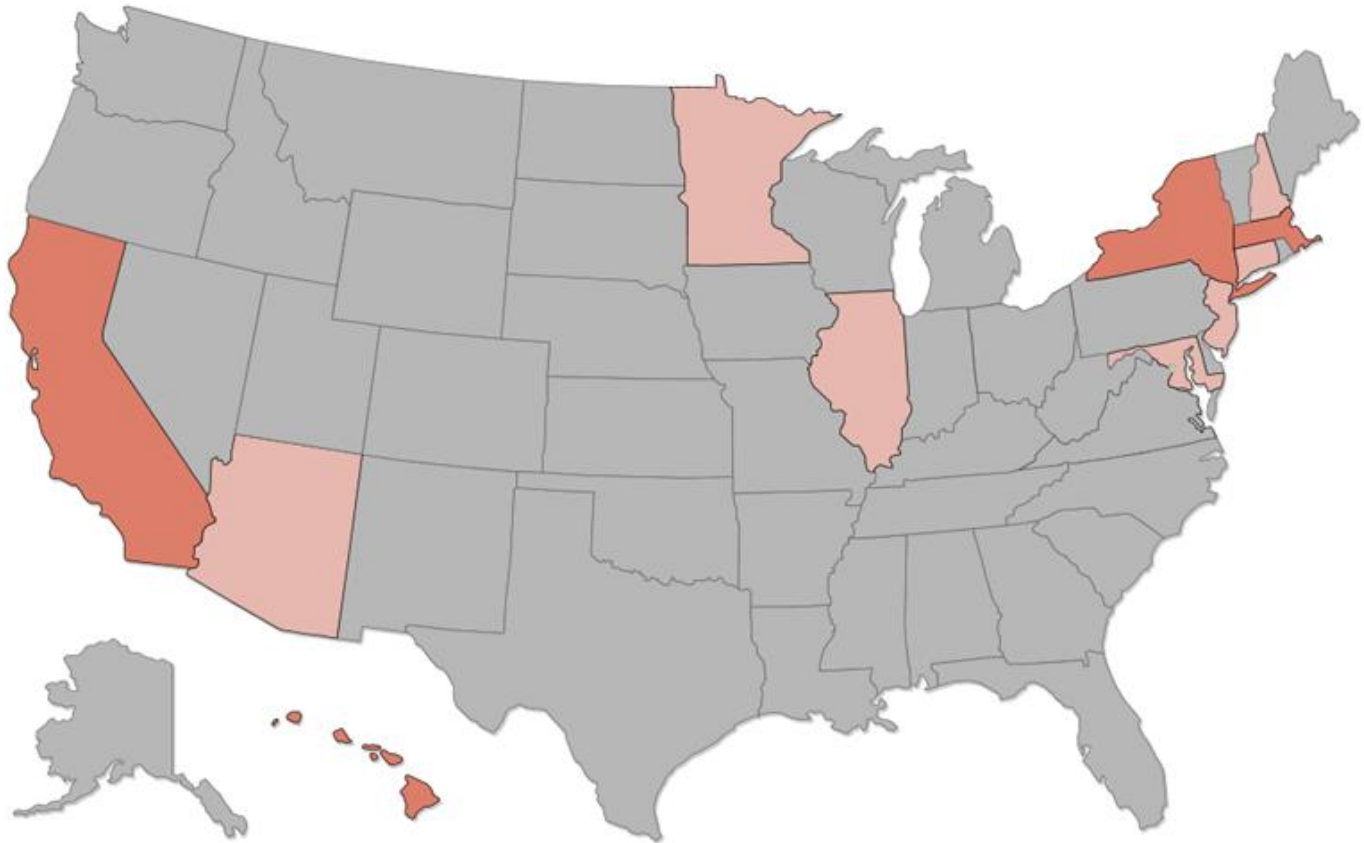
Source: DSIRE Website

Net Energy Metering Reforms
Push-back is occurring in CA, AZ and beyond



Sectoral Responses: New Business Models (Continued)

- Policy Development: State Level and Think Tank Efforts



Sectoral Responses: Financial Innovation

- Climate Change – Big Investment Required
- Right Side of Climate Change – Push/Pull
- SRI Investors
- Carbon Divestment
- Regulatory Requirements
- Risk Management
- Grassroots
- Improvement in Economics



Green Growth

A U.S. Program for Controlling Climate Change
and Expanding Job Opportunities

Robert Pollin, Heidi Garrett-Peltier, James Heintz, and Bracken Hendricks September 2014

WWW.AMERICANPROGRESS.ORG

The Center for American Progress estimates that the **U.S. needs at least \$200 billion** in renewable and efficiency investment **annually for 20 years** to reduce carbon emissions and **avert climate disaster**.

Sectoral Responses: Financial Innovation (continued)

- Public Market Trends - Innovation in Public “Green” Issuances
 - CarbonCount: Why?
 - Which investment would you rather make?

	Project Cost	NPV	Carbon Displaced	Green Bonds
Asset A	\$1mm	\$1mm	1000 MT CO2e	
Asset B	\$1mm	\$1mm	200 MT CO2e	
Asset C	\$1mm	\$1mm	--	

**If capital is scarce, SRI investors should favor investments with the largest impact per dollar invested, but...
the market lacks a metric to make such a comparison.**

Sectoral Responses: Financial Innovation (continued)

- **Public Market Trends – Innovation in Public “Green” Issuances**
CarbonCount™ scores the “green-ness” of investments by quantifying the annual displaced CO2 emissions per \$1,000 investment
- **What is the Goal?**
 - A single, concise, comparable and readily-available metric
 - Promote accountability and transparency
 - Encourage allocation of funds to those projects that are most impactful
 - Increase demand for the most impactful bonds, which will lower borrowing costs
- **Potential Participants?**
 - Issuers: Have the Alliance to Save Energy score their bond
 - Portfolio managers: Ask Issuers to provide a CarbonCount rating
 - All parties: Demand information on CO2 emissions impact per \$ unit of investment

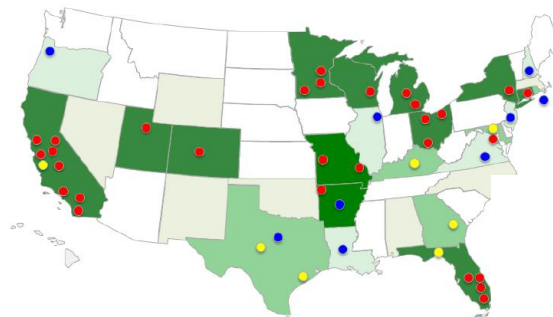
CarbonCount™ won Bloomberg New Energy Finance’s 2015 Finance for Resilience award.

First green bond with *CarbonCount*™ score; \$101m, A-Rated, 19 Year Term, 4.28% HASI Sustainable Yield Bond in September ‘15

Sectoral Responses: Financial Innovation (continued)

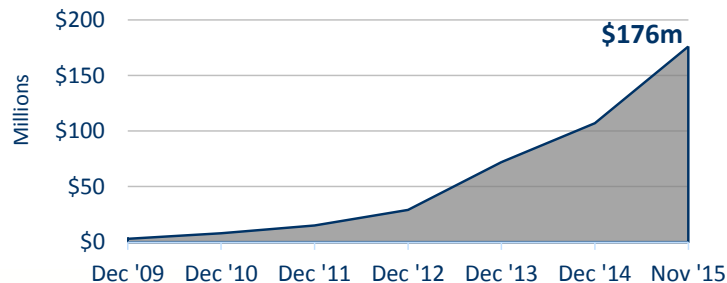
Private Market

PACE: Estimated investment: 2009 through mid-2015



- PACE enabled
- Early stage PACE program development
- Launched PACE programs
- PACE programs with funded projects

Cumulative Total C-PACE Funding (2009 – present)



- 480 projects funded
- \$176 million PACE funding
- 31 states with enabling legislation
- 2,059 municipalities

State	# Projects Funded	Total PACE Funding Estimate (\$, rounded)
California	179	65,000,000
Connecticut	89	54,000,000
Ohio	100	21,000,000
Florida	21	13,260,000
Minnesota	31	7,800,000
Wisconsin	3	4,845,000
Michigan	6	1,580,000
D.C.	4	1,510,000
Colorado	29	1,477,000
New York	3	305,000
Utah	1	100,000
Arkansas	1	30,000
Total	480	176,000,000

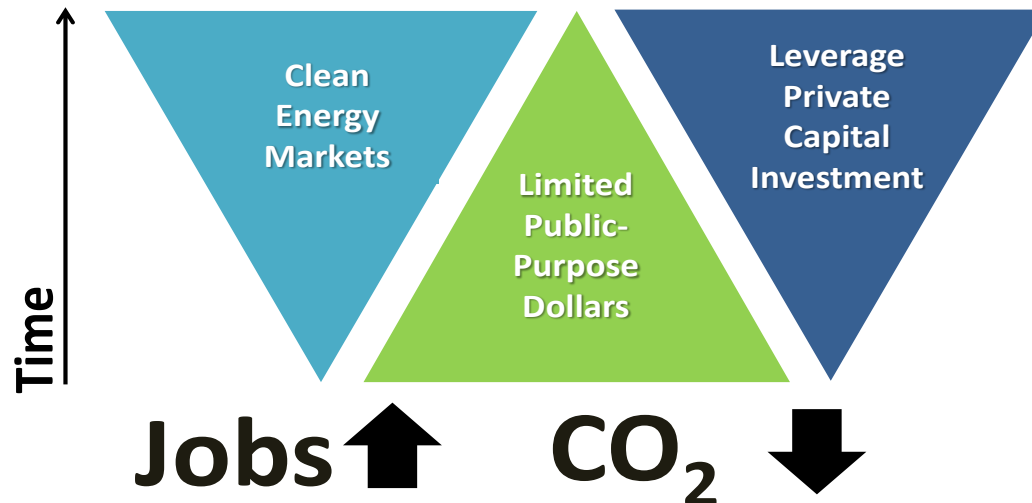
Sectoral Responses: Financial Innovation (continued)

Public/ Private Partnerships

Green Bank Model

Public-Private Partnerships for Climate Protection

A green bank is a **public financing authority** that **leverages private capital** with **limited public-purpose dollars** to **accelerate the growth** of clean energy markets



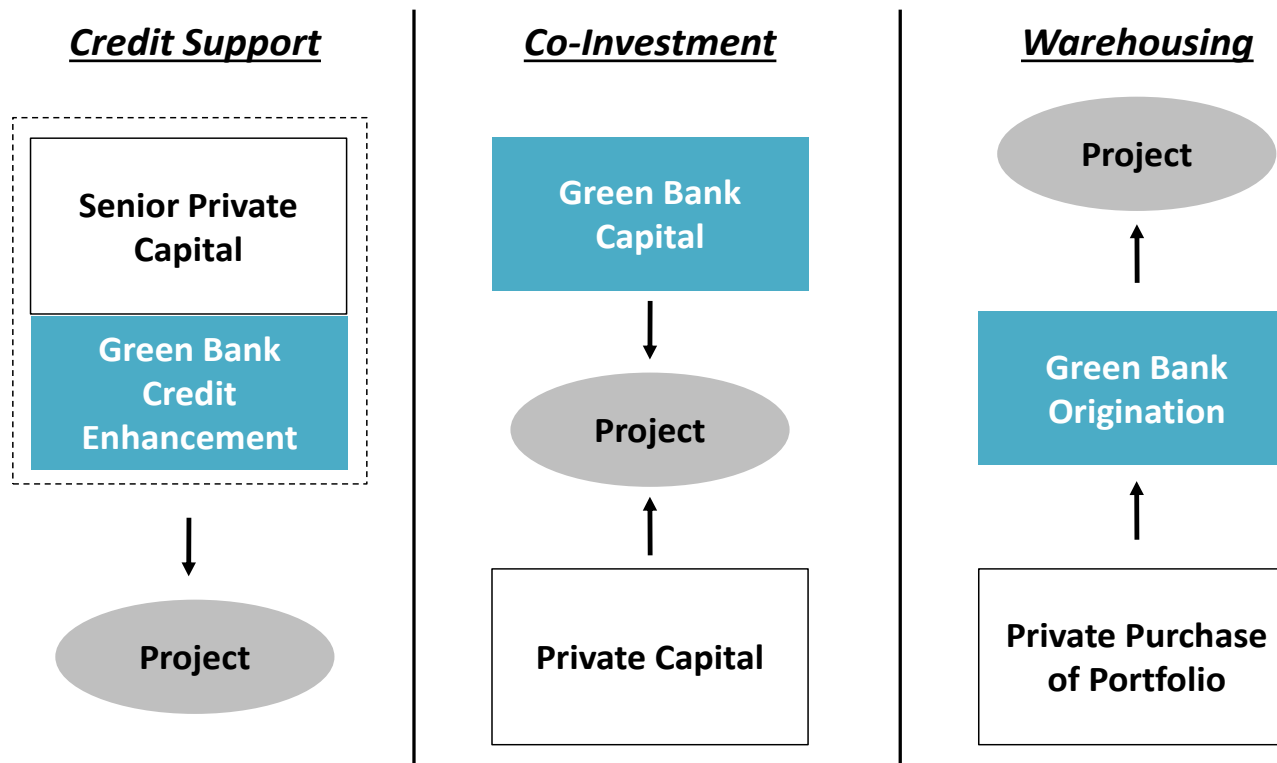
REFERENCE

Definition provided by the Coalition for Green Capital

Sectoral Responses: Financial Innovation (continued)

Public/ Private Partnerships

Green Bank Products and Programs



REFERENCE

Definition provided by the Coalition for Green Capital

The Outlook for 2016

- Stay of CPP will be offset by the extension of renewable tax credits and grassroots demand for renewables and energy efficiency
- Policy and market developments will continue to move in the general direction of CPP compliance, with or without enforceable CPP deadlines
- US renewables growth will be augmented by C&I demand:
 - In Q4 2015, 75% of utility-scale wind PPAs were corporate
 - Trend continuing in Q1 2016 with first-time buyers
- Solar will also experience more non-residential expansion at C&I and community scale
- New demand response models will emerge based on data analytic tools integrated with generation and project financing
- US Green Bond issuances will increase due to greater market acceptance and transparent reporting metrics

Relevant Practical Law Resources

- [Practice Note, Renewable Energy: Overview \(US\)](#)
- [Practice Note, Wind Energy Project Development Issues: Preliminary Considerations](#)
- [Practice Note, Solar Energy Project Development Issues: Preliminary Considerations](#)
- [Practice Note, Power Dynamics: Forces Shaping the Future of Coal in the United States](#)
- [Article, Update on the US's "All of the Above" Energy Strategy](#)

Questions

About the Speakers



Bob Mudge

Tel: 202-955-5050

Email: Robert.Mudge@brattle.com

Mr. Mudge is an expert in corporate and project finance matters in the energy industry. He has advised energy clients on issues relating to corporate restructuring, contract terminations or amendments, special capital needs, and acquisitions and divestitures. He also has experience in analyzing contractual, regulatory, financing, and tax matters, and projecting effects on cash flows, earnings, and customer rates.

Mr. Mudge currently serves as Chief Operating Officer of The Brattle Group. Prior to joining the firm, he was a principal at CRA International, where he focused on financial restructuring initiatives for electric utility clients and consulted on matters involving rate design, asset valuation, and project finance structuring and credit requirements. He has provided expert testimony in proceedings before federal and state courts, utility regulators in the U.S. and Canada, and state environmental regulators, as well as in connection with mediation and arbitration proceedings.

About the Speakers



Marc Chupka

Tel: 202-955-5050

Email: Marc.Chupka@brattle.com

Mr. Chupka is an economist with more than 25 years of public and private sector experience analyzing energy markets and regulation and assisting energy clients and counsel in a broad span of commercial analysis, regulatory proceedings, and litigation support. His recent work has focused on the litigation in Clean Air Act matters, utility integrated resource planning, electricity and fuel procurement policies, contract evaluation and litigation, and the analysis of clean energy policy design and impacts.

Mr. Chupka formerly served as the Acting Assistant Secretary for Policy and International Affairs at the U.S. Department of Energy, and was the Associate Director for Air, Energy and Transportation at the White House Office for Environmental Policy.

About the Speakers



Susan Nickey

Tel: 410-571-6188

Email: snickey@hannonarmstrong.com

Susan Nickey is a Managing Director at Hannon Armstrong (NYSE:HASI), a leading provider of debt and equity financing to the energy efficiency and renewable energy markets.

Ms. Nickey has over 25 years of executive leadership in the energy and finance sectors. She has focused her efforts on proving that creative solutions and innovation can make the production of clean energy more profitable, competitive, affordable and mainstream. Most recently, she founded and served as CEO of Threshold Power. Prior to working at Threshold, she served as CFO at ACCIONA Energy North America from 2007-2010 and before that as Managing Director of Investment Banking in the Project Finance Group of Mesirow Financial.

Ms. Nickey currently serves on the Advisory Board of the American Council of Renewable Energy. She has previously served on the Governor of Nevada's Renewable Energy Development Program Task Force and the Legislative and Finance Committees for the American Wind Energy Association (AWEA). She was named one of Women's eNews' 21 Leaders for the 21st Century for her leadership in sustainable development. Ms. Nickey holds a Bachelor in Business Administration from the University of Notre Dame and a Masters of Science in Foreign Service from Georgetown University.

About the Speakers



Elias Hinckley

Tel: 202-775-1210

Fax: 202- 293-2275

Email: ehinckley@sandw.com

Elias Hinckley is a strategic advisor on clean energy finance and energy policy to investors, energy companies and governments. He is the head of the energy practice for the law firm Sullivan and Worcester. Previously, he led the clean energy practice at two other large international law firms and was the head of the alternative energy practice for Deloitte USA for several years. He has been a senior advisor to several energy technology companies as well as an energy and resources focused venture capital firm.

Elias has a regular column, Banking Energy, which covers energy finance, policy and related topics. His work has been featured in a wide range of energy and finance publications, including The Economist and the World Economic Forum. He is on the Board of Directors for the Clean Energy Leadership Institute and the advisory boards of the Energy Collective and the Our Energy Policy Foundation.

Elias has taught courses on energy markets and energy policy in a wide range of settings and is an adjunct professor of international energy policy and markets at the Georgetown University Edmund A Walsh School of Foreign Policy.