



An Evaluation of Potential Demand for Renewable Generation

*H.R. 2454 (Waxman-Markey) Renewable Electricity Standard vs.
Existing State Renewable Portfolio Standards*



Prepared for Greenpeace

September 25, 2009



Passion. Expertise. Results.

Overview

➤ Task

- Conduct a comparative analysis of renewable generation requirements under the proposed H.R. 2454 (Waxman-Markey) Renewable Electricity Standard (RES) and renewable generation requirements under existing state Renewable Portfolio Standards (RPS)

➤ Assumptions were derived from EIA and EPA analyses of the Waxman-Markey bill

- EIA: *Energy Market and Economic Impacts of H.R. 2454, the American Clean Energy and Security Act of 2009*
 - Released July 2009; Modified August 5, 2009
 - Forecasts through 2030
- EPA: *Analysis of the American Clean Energy and Security Act of 2009 H.R. 2454 in the 111th Congress*
 - Released June 23, 2009
 - Forecasts through 2025

Renewable Generation Demand under Federal RES vs. State RPS - Evaluation Methodology

➤ Federal RES Analysis

- Relied upon EPA and EIA projections:
 - Average annual retail demand growth
 - New nuclear and coal + carbon capture and storage (CCS) generation
- Assumed that Federal RES applies to 78% of LSEs (those with 4 million MWh + of annual generation)

➤ State RPS demand analysis

- Relied upon EIA 2007 base energy sales data by load-serving entity (LSE)
 - Source: EIA, “Table 10. Class of Ownership, Number of Bundled Ultimate Consumers, Revenue, Sales, and Average Retail Price for All Sectors by State, Utility, 2007.”
- Evaluated how RPS regulations impact LSEs
 - Sources of RPS demand regulations: various, including state legislature and regulatory agency websites, Union of Concerned Scientists (UCS), LBNL, and DSIRE database.
 - Where RPS requirements are mandated as shares of final sales, the RPS is determined by projecting total energy sales from affected load-serving entities (LSE), multiplied by LSE-level RPS percentage requirement as per relevant state legislation.

HR 2454: American Clean Energy and Security Act of 2009 (Waxman-Markey Bill)

- Approved by the House on June 26, 2009.
- Combined Efficiency and Renewable Electricity Standard - CERES (Title I, Subtitle A, Sec. 101)
 - Requires retail electricity providers to meet a minimum share of sales with electricity savings and qualifying renewable generation by holding tradable credits.
 - Nominal targets begin at 6% in 2012 and rise to 20% by 2020.
 - Qualifying renewable resources include new and existing solar, wind, biomass, landfill gas, qualified waste-to-energy¹, geothermal, and qualified hydroelectric.²
 - Retailers selling less than 4 million MWh per year are exempted from CERES.
 - Up to 25 percent of the target may be met with electricity savings (Governors may petition to raise this amount to 40 percent).
 - Sales of generation from new nuclear, new coal with carbon-capture and sequestration (CCS), and existing hydropower capacity are deducted from each retail provider's total sales for assessing the CERES requirement

¹ Qualified waste-to-energy means energy from the combustion of municipal solid waste or construction, demolition, or disaster debris, or from the gasification or pyrolysis of such waste or debris and the combustion of the resulting gas at the same facility. For further information see HR 2454 subsection(a)(13).

² Qualified hydropower means energy produced from increased efficiency achieved, or additions of capacity made on or after Jan.1,1988 at a hydroelectric facility or dam placed in service before that date. For further information see HR 2454 subsection (a)(12).

State Renewable Portfolio Standards

- 29 states plus the District of Columbia have passed mandatory renewable generation requirements or goals and 5 more have passed voluntary standards or goals.
- The design of each RPS varies by target and timing, the types of renewable generation allowed, the geographic scope within which a generator might be eligible to meet the standard, and the types enforcement mechanisms and escape clauses included.

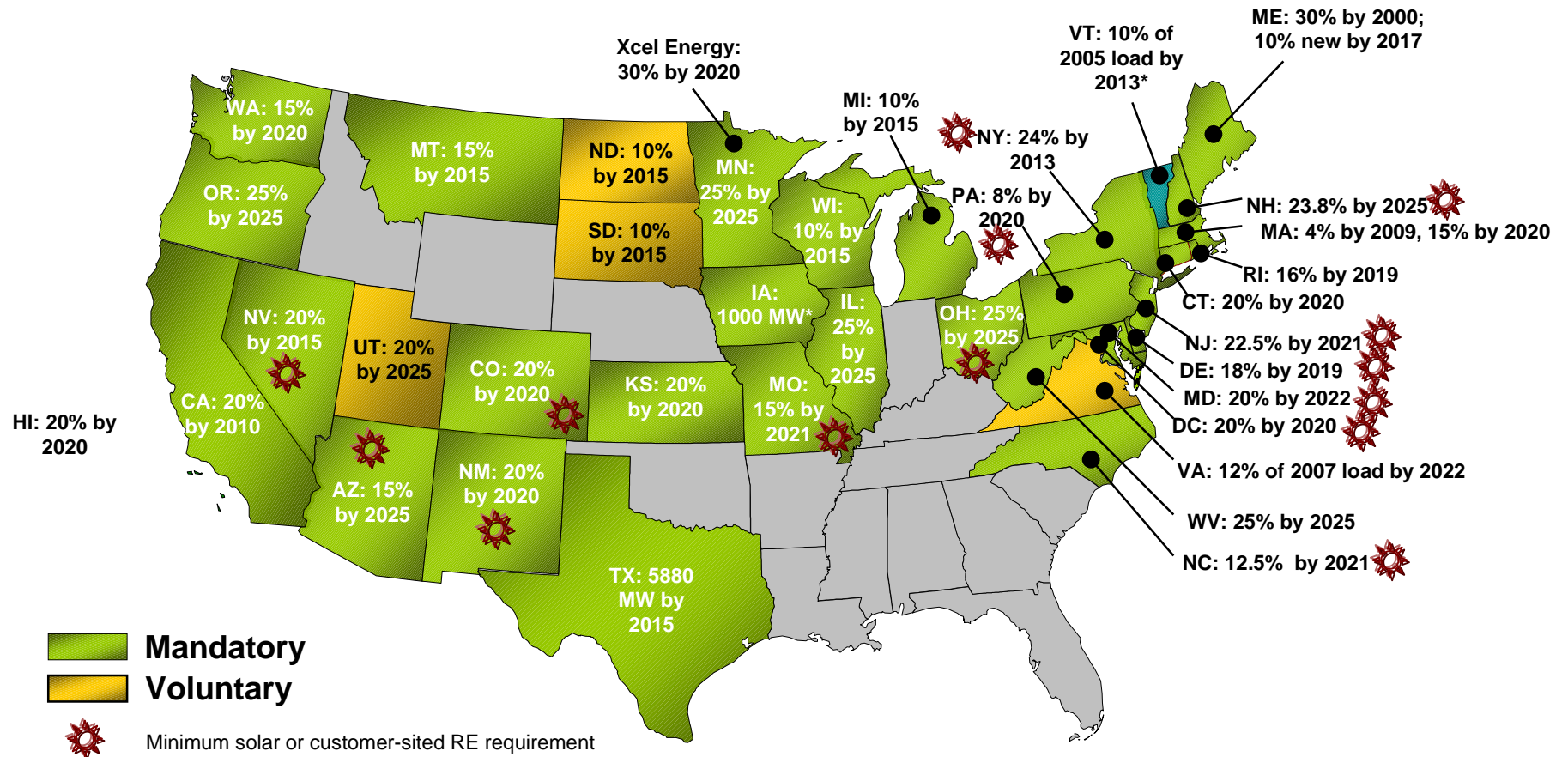
State Renewable Portfolio Standards

(Continued)

Mandatory standard/goal	Voluntary standard/goal
<ul style="list-style-type: none"> ■ Arizona ■ California ■ Colorado ■ Connecticut ■ Delaware ■ DC ■ Hawaii ■ Illinois ■ Kansas ■ Maine ■ Maryland ■ Massachusetts ■ Michigan ■ Minnesota ■ Missouri 	<ul style="list-style-type: none"> ■ Montana ■ Nevada ■ New Hampshire ■ New Jersey ■ New Mexico ■ New York ■ North Carolina ■ Ohio ■ Oregon ■ Pennsylvania ■ Rhode Island ■ Texas ■ Washington ■ West Virginia ■ Wisconsin ■ North Dakota ■ South Dakota ■ Utah ■ Vermont ■ Virginia

State Renewable Portfolio Standards

(Continued)



* WI – Mandate is for 6% above baseline (approx 8%) by 2015; goal is for 10% by 2015

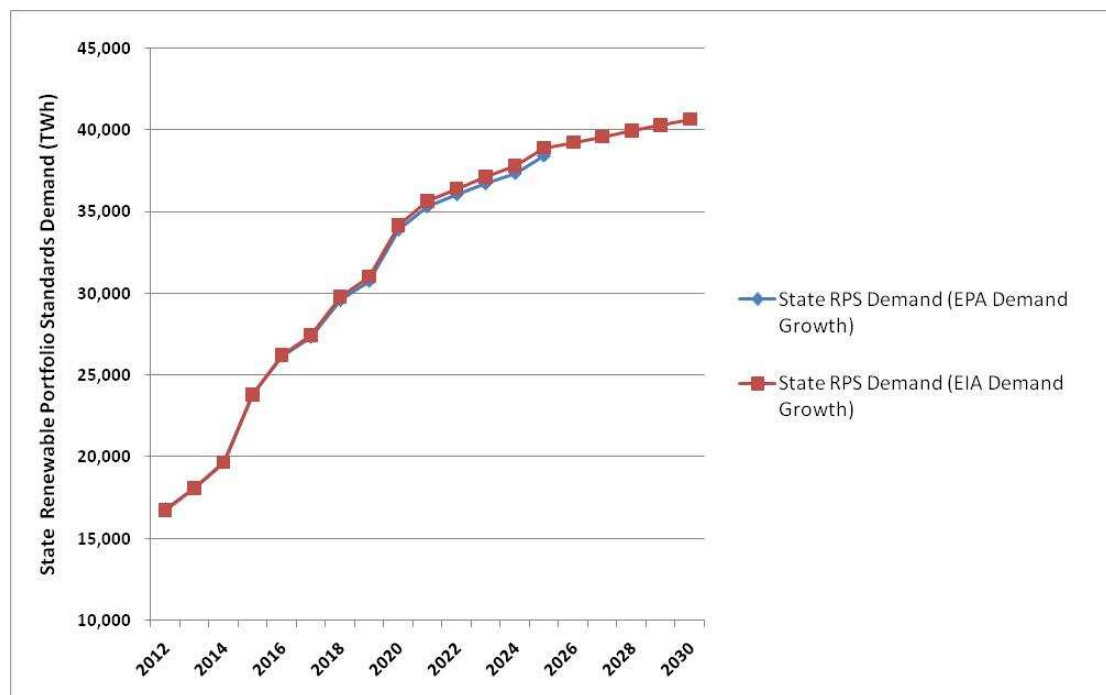
* IA – Goal is for 1000 MW new renewable generation by 2010

* VT – Goal to meet 2005-2012 incremental load growth; becomes mandate if a total of 10% of 2005 demand is not met by 2013. Additional goal for 25% by 2025.

* TX – Goal for 10,000 MW by 2025.

Demand for Renewable Generation under Existing State RPS

- Assuming EIA and EPA demand growth estimates, demand for renewable generation under state renewable portfolio standards around the U.S. ranges from approximately 16,000 TWh (roughly 5% of base retail demand) to over 40,000 TWh (roughly 10% of base retail demand) between 2012 and 2030.
- EPA and EIA annual average demand growth projections are slightly different (0.57% v. 0.64% respectively)



State RPS v. Waxman-Markey Federal RES

- When using EIA and EPA assumptions, the demand ultimately created for renewable generation through the proposed Waxman-Markey Federal RES is somewhat weaker than that created by existing state RPS programs.
- The following exhibit provides an overview of the provisions included in CERES that diminish the projected demand for renewables.

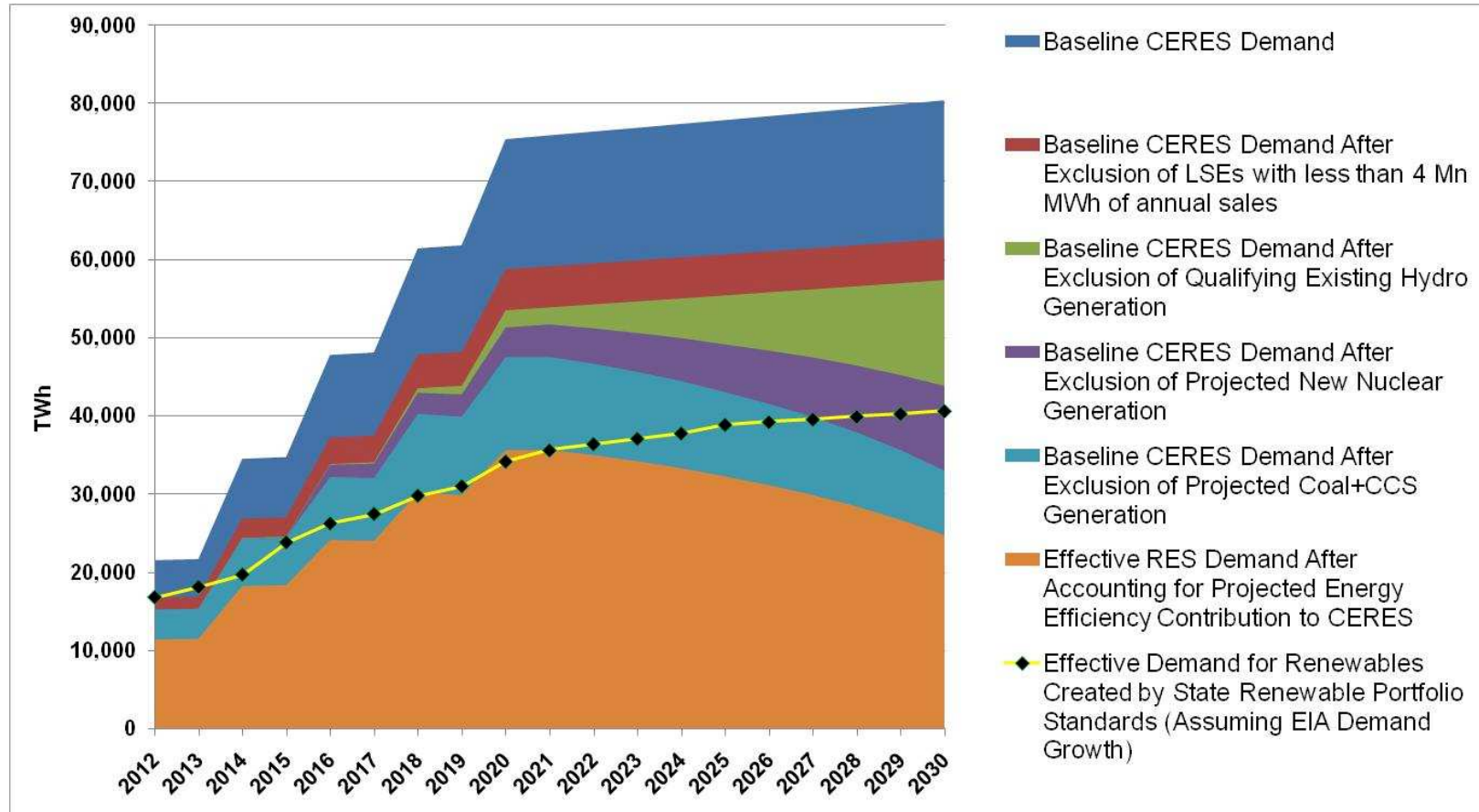


- The following comparative analysis provides a more in depth review of how these factors reduce the ultimate demand for renewables under the CERES provision of H.R. 2454 and how that effective demand relates to that projected to develop under existing state RPS programs.

Analysis of Effective RES using EIA Data

State RPS v. Waxman-Markey Federal RES Using EIA Data

Renewable Energy Demand Under CERES (TWh)



*Please note that the steps of the effective RES demand projection are a result of the incremental Federal RES

State RPS v. Waxman-Markey Federal RES

Using EIA Data (Continued)

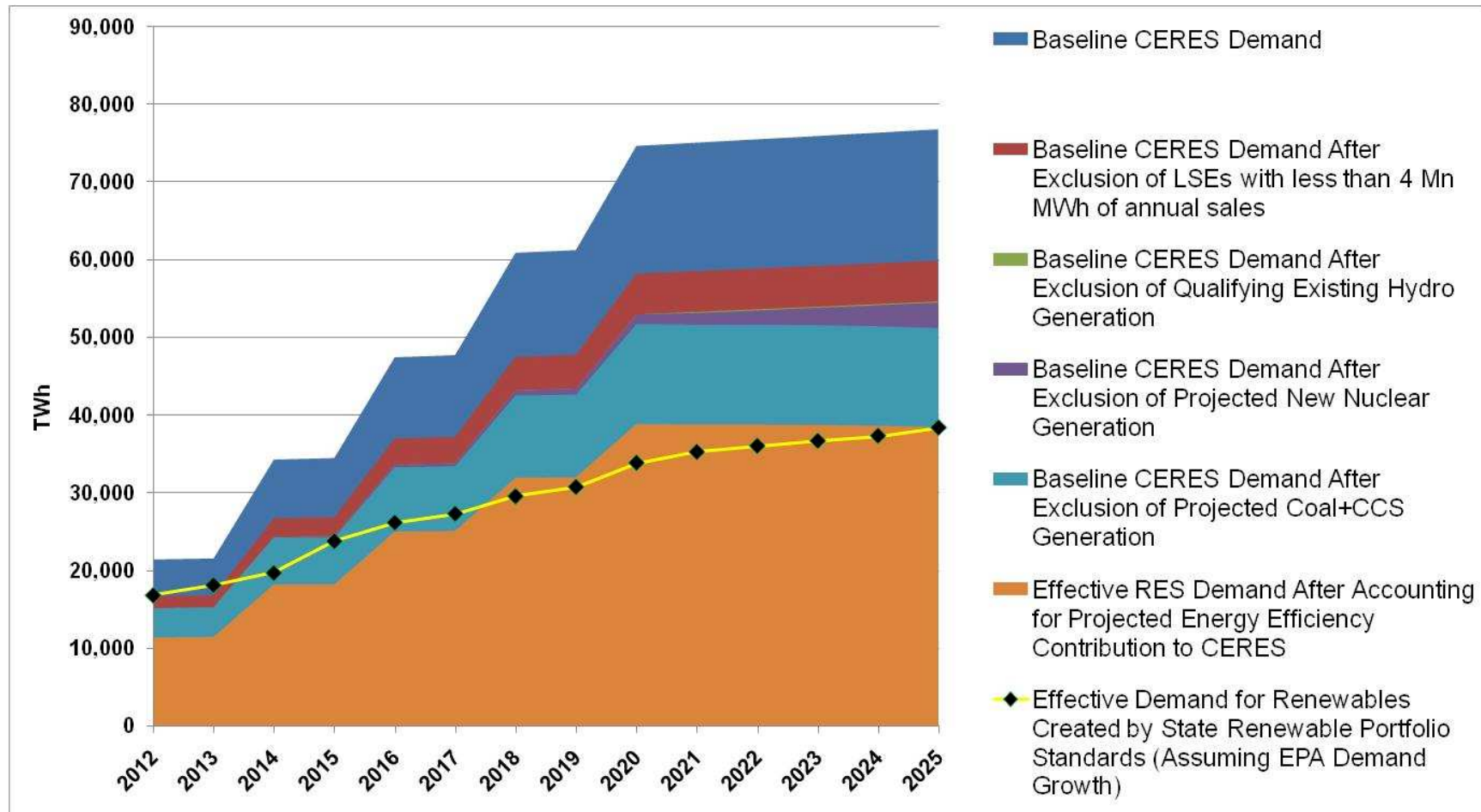
Effective RES Under CERES (%)

	Policy with Original Retail Base Demand	Baseline Demand Reduction Due to Exclusion of LSEs with less than 4 Mn MWh of Annual Sales	Baseline Demand Reduction from Existing Hydro Generation	Baseline Demand Reduction from Projected New Nuclear Generation	Baseline Demand Reduction from Projected New Coal+CCS Generation	Effective RES Demand for Renewables After Reduction of Energy Efficiency from CERES	Effective Demand for Renewables Created by State Renewable Portfolio Standards (Assuming EIA Demand Growth)
2012	6.00%	4.68%	4.24%	4.24%	4.24%	3.18%	4.80%
2013	6.00%	4.68%	4.25%	4.25%	4.25%	3.19%	5.15%
2014	9.50%	7.41%	6.73%	6.71%	6.71%	5.03%	5.56%
2015	9.50%	7.41%	6.73%	6.71%	6.71%	5.03%	6.69%
2016	13.00%	10.14%	9.22%	9.19%	8.76%	6.57%	7.33%
2017	13.00%	10.14%	9.22%	9.17%	8.68%	6.51%	7.62%
2018	16.50%	12.87%	11.72%	11.55%	10.83%	8.12%	8.22%
2019	16.50%	12.87%	11.72%	11.42%	10.66%	8.00%	8.50%
2020	20.00%	15.60%	14.22%	13.63%	12.62%	9.46%	9.31%
2021	20.00%	15.60%	14.23%	13.64%	12.54%	9.41%	9.64%
2022	20.00%	15.60%	14.24%	13.43%	12.24%	9.18%	9.79%
2023	20.00%	15.60%	14.25%	13.18%	11.89%	8.92%	9.91%
2024	20.00%	15.60%	14.25%	12.93%	11.51%	8.63%	10.03%
2025	20.00%	15.60%	14.26%	12.64%	11.07%	8.30%	10.26%
2026	20.00%	15.60%	14.27%	12.36%	10.62%	7.96%	10.28%
2027	20.00%	15.60%	14.28%	12.06%	10.12%	7.59%	10.31%
2028	20.00%	15.60%	14.29%	11.72%	9.56%	7.17%	10.33%
2029	20.00%	15.60%	14.30%	11.34%	8.93%	6.70%	10.36%
2030	20.00%	15.60%	14.30%	10.92%	8.22%	6.16%	10.39%

Analysis of Effective RES using EPA Data

State RPS v. Waxman-Markey Federal RES Using EPA Data

Renewable Energy Demand Under CERES (TWh)



State RPS v. Waxman-Markey Federal RES

Using EPA Data (Continued)

Effective RES Under CERES (%)

	Policy with Original Retail Base Demand	Baseline Demand Reduction Due to Exclusion of LSEs with less than 4 Mn MWh of Annual Sales	Baseline Demand Reduction from Existing Hydro Generation	Baseline Demand Reduction from Projected New Nuclear Generation	Baseline Demand Reduction from Projected New Coal+CCS Generation	Effective RES Demand for Renewables After Reduction of Energy Efficiency from CERES	Effective Standard with Existing State Renewable Portfolio Standards (Assuming EPA Demand Growth)
2012	6.00%	4.68%	4.24%	4.24%	4.24%	3.18%	4.82%
2013	6.00%	4.68%	4.24%	4.24%	4.24%	3.18%	5.17%
2014	9.50%	7.41%	6.72%	6.72%	6.72%	5.04%	5.58%
2015	9.50%	7.41%	6.73%	6.73%	6.68%	5.01%	6.71%
2016	13.00%	10.14%	9.21%	9.21%	9.13%	6.85%	7.34%
2017	13.00%	10.14%	9.22%	9.22%	9.11%	6.83%	7.62%
2018	16.50%	12.87%	11.71%	11.71%	11.53%	8.65%	8.20%
2019	16.50%	12.87%	11.71%	11.71%	11.49%	8.62%	8.48%
2020	20.00%	15.60%	14.21%	14.21%	13.86%	10.40%	9.29%
2021	20.00%	15.60%	14.21%	14.18%	13.76%	10.32%	9.62%
2022	20.00%	15.60%	14.22%	14.18%	13.69%	10.27%	9.77%
2023	20.00%	15.60%	14.23%	14.19%	13.60%	10.20%	9.89%
2024	20.00%	15.60%	14.24%	14.20%	13.48%	10.11%	10.01%
2025	20.00%	15.60%	14.24%	14.21%	13.34%	10.01%	10.24%

Conclusions

State RPS vs. Waxman-Markey Federal RES

Conclusions

- The effective demand for renewable generation under a federal standard falls short of that projected to develop under existing state programs in the EIA case. In the EPA case there is a shortfall in early years but in outer years this shortfall is eliminated. The extent of the shortfalls in the EPA case are less significant than that found in the EIA case.
- Given that EPA and EIA demand growth projections are very similar, the difference in the extent and timing of the projected shortfalls can be explained by the notable differences between EPA and EIA projections of new nuclear and coal + CCS generation. These differences and their impacts are shown in the next two exhibits.

State RPS vs. Waxman-Markey Federal RES Conclusions

(Continued)

EIA vs. EPA New Nuclear and Coal + CCS Generation

	New Nuclear Generation (TWh)		New Coal + CCS Generation (TWh)	
	EPA	EIA	EPA	EIA
2012	0	0	0	0
2013	0	0	0	0
2014	0	930	0	0
2015	0	930	2,100	0
2016	0	930	2,679	13,331
2017	0	1,719	3,418	15,644
2018	0	4,084	4,362	18,207
2019	0	7,592	5,565	19,174
2020	0	12,375	7,100	21,116
2021	788	12,375	8,590	23,095
2022	788	17,178	10,392	25,170
2023	788	22,701	12,572	27,617
2024	788	28,443	15,209	30,565
2025	788	35,045	18,400	33,954
2026	n/a	41,653	n/a	37,852
2027	n/a	48,678	n/a	42,335
2028	n/a	56,649	n/a	47,490
2029	n/a	65,607	n/a	53,418
2030	n/a	75,519	n/a	60,235

State RPS vs. Waxman-Markey Federal RES Conclusions

(Continued)

Differences in Effective Federal RES Estimated in EIA and EPA Scenarios (Delta, EIA-EPA)

	Policy with Original Retail Base Demand	Baseline Demand Reduction Due to Exclusion of LSEs with less than 4 Mn MWh of Annual Sales	Baseline Demand Reduction from Existing Hydro Generation	Baseline Demand Reduction from Projected New Nuclear Generation	Baseline Demand Reduction from Projected New Coal+CCS Generation	Effective RES Demand for Renewables After Reduction of Energy Efficiency from CERES	Effective Standard with Existing State Renewable Portfolio Standards (Assuming EPA Demand Growth)
2012	0	0.00%	0.00%	0.00%	0.00%	0.00%	-0.02%
2013	0	0.00%	0.00%	0.00%	0.00%	0.00%	-0.02%
2014	0	0.00%	0.00%	-0.02%	-0.02%	-0.01%	-0.02%
2015	0	0.00%	0.00%	-0.02%	0.03%	0.02%	-0.02%
2016	0	0.00%	0.01%	-0.02%	-0.36%	-0.27%	-0.02%
2017	0	0.00%	0.01%	-0.05%	-0.43%	-0.33%	0.00%
2018	0	0.00%	0.01%	-0.15%	-0.70%	-0.53%	0.02%
2019	0	0.00%	0.01%	-0.29%	-0.83%	-0.62%	0.02%
2020	0	0.00%	0.01%	-0.58%	-1.24%	-0.93%	0.02%
2021	0	0.00%	0.01%	-0.54%	-1.22%	-0.91%	0.02%
2022	0	0.00%	0.02%	-0.76%	-1.45%	-1.09%	0.02%
2023	0	0.00%	0.02%	-1.01%	-1.71%	-1.28%	0.02%
2024	0	0.00%	0.02%	-1.27%	-1.98%	-1.48%	0.02%
2025	0	0.00%	0.02%	-1.57%	-2.28%	-1.71%	0.02%

Appendix

State RPS v. Waxman-Markey Federal RES Using EIA Data

Renewable Energy Demand Under CERES (TWh)

	Baseline CERES Demand	Baseline CERES Demand After Exclusion of LSEs with less than 4 Mn MWh of annual sales	Baseline CERES Demand After Exclusion of Qualifying Existing Hydro Generation	Baseline CERES Demand After Exclusion of Projected New Nuclear Generation	Baseline CERES Demand After Exclusion of Projected Coal+CCS Generation	Effective RES Demand After Accounting for Projected Energy Efficiency Contribution to CERES	Effective Demand for Renewables Created by State Renewable Portfolio Standards (Assuming EIA Demand Growth)
2012	21,483	16,756	15,195	15,195	15,195	11,396	16,760
2013	21,620	16,864	15,302	15,302	15,302	11,477	18,089
2014	34,451	26,872	24,400	24,320	24,320	18,240	19,664
2015	34,671	27,044	24,572	24,492	24,492	18,369	23,806
2016	47,749	37,244	33,861	33,752	32,193	24,145	26,229
2017	48,054	37,482	34,100	33,899	32,068	24,051	27,462
2018	61,382	47,878	43,585	42,978	40,275	30,206	29,801
2019	61,775	48,185	43,891	42,764	39,916	29,937	31,031
2020	75,358	58,779	53,575	51,348	47,547	35,660	34,187
2021	75,840	59,155	53,951	51,724	47,567	35,675	35,632
2022	76,326	59,534	54,330	51,238	46,707	35,031	36,433
2023	76,814	59,915	54,711	50,625	45,654	34,240	37,110
2024	77,306	60,299	55,095	49,975	44,473	33,355	37,797
2025	77,801	60,684	55,480	49,172	43,061	32,295	38,902
2026	78,298	61,073	55,869	48,371	41,558	31,168	39,242
2027	78,800	61,464	56,260	47,498	39,877	29,908	39,587
2028	79,304	61,857	56,653	46,456	37,908	28,431	39,939
2029	79,811	62,253	57,049	45,240	35,625	26,718	40,297
2030	80,322	62,651	57,447	43,854	33,012	24,759	40,662

State RPS v. Waxman-Markey Federal RES Using EPA Data

Renewable Energy Demand Under CERES (TWh)

	Baseline CERES Demand	Baseline CERES Demand After Exclusion of LSEs with less than 4 Mn MWh of annual sales	Baseline CERES Demand After Exclusion of Qualifying Existing Hydro Generation	Baseline CERES Demand After Exclusion of Projected New Nuclear Generation	Baseline CERES Demand After Exclusion of Projected Coal+CCS Generation	Effective RES Demand After Accounting for Projected Energy Efficiency Contribution to CERES	Effective Demand for Renewables Created by State Renewable Portfolio Standards (Assuming EPA Demand Growth)
2012	21,404	16,695	15,134	15,134	15,134	11,351	16,822
2013	21,526	16,790	15,229	15,229	15,229	11,422	18,134
2014	34,275	26,735	24,263	24,263	24,263	18,197	19,690
2015	34,469	26,886	24,414	24,414	24,235	18,176	23,796
2016	47,436	37,000	33,617	33,617	33,304	24,978	26,188
2017	47,705	37,210	33,827	33,827	33,427	25,070	27,337
2018	60,891	47,495	43,202	43,202	42,554	31,916	29,582
2019	61,236	47,764	43,471	43,471	42,645	31,983	30,782
2020	74,646	58,224	53,020	53,020	51,742	38,807	33,888
2021	75,069	58,554	53,350	53,208	51,662	38,747	35,296
2022	75,495	58,886	53,682	53,540	51,669	38,752	36,065
2023	75,922	59,219	54,015	53,873	51,611	38,708	36,710
2024	76,352	59,555	54,351	54,209	51,471	38,604	37,365
2025	76,785	59,892	54,688	54,546	51,234	38,426	38,431