

**Appendix E1 to California's Compliance Plan for  
the Federal Clean Power Plan:  
Detailed Annual Energy and Emissions Results for  
Reference Case and Stress Case**

**U.S. EPA Clean Power Plan (existing power plants)  
Summary of Emissions, Fuel Use, and  
Generation from California Power Plants  
Energy Assessment Division  
04-25-16**

**Summary:** The following data sheets contain a summary of CO<sub>2</sub> emissions, generation (MWhs) and fuel use (1000 MMBTUs) for power plants in California covered by EPA's Clean Power Plan. The case summary sheets also contain generation (MWhs) from renewable resources, hydroelectric facilities, energy efficiency and other power plants not covered under the clean power plan rule 111D.

The intended audience is the EPA and stakeholders.

**Source of Data:** The historical data (prior to 2020) is from the QFER CEC-1304 power plant report filings for next generation (MWhs) and fuel use (MMBTUs). The data for the forecast years (2020 -2026) come from the PLEXOS production cost model IEPR 2015 simulations for the Mid Demand and a modified IEPR 2015 High Demand Case with Diablo Canyon retired and low hydro sensitivity (aka Stress Case).

These CPP final IEPR15 simulations for the Mid Demand Case include 6,267 MW (800 MW CTs, 2,837 MW CCs) and 2,830 MW new CHP (1,339 MW BTM CHP and 1,491 MW grid connected CHP) thermal resources. The Stress Case includes 6,270 MW (2,800 MW CT, 3,470 MW CCs and no new CHP) of new thermal resources and no replacement capacity is included when Diablo is retired 12/31/2024.

The renewables for both the Mid and Stress Case meet a 33% RPS by 2020 and remain at 33% through the forecast period.

Non OTC retirements are aligned with the 2014 LTPP, which used a generic retirement date assumption for thermal, non-OTC plants in California of 40 years from COD. This produced about 2,000 MW of retirements by 2026 (mostly CHP). This will impact the 111d results because some of the retired plants are affected units that are assumed to retire during the forecast period.

**Key Caveats:**

1. The PLEXOS production cost model simulations are through 2026; the 2027-2031 forecast are estimated by applying the average growth rate from 2025-2026 to the 2026 values unless otherwise noted.
2. For the CO<sub>2</sub> calculations, staff assumes natural gas emits 117.1 pounds CO<sub>2</sub> per MMBTU, and coal emits 225.3 pounds of CO<sub>2</sub> per MMBTU. These numbers are converted to short tons.

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Year	2014	2020-Mid	2021-Mid	2022-Mid	2023-Mid	2024-Mid	2025-Mid	2026-Mid	2027-Mid (extrapolated)	2028-Mid (extrapolated)	2029-Mid (extrapolated)	2030-Mid (extrapolated)	2031-Mid (extrapolated)
<b>In-State: Electricity Emissions (Short Tons CO2e)</b>	45,488,109	37,959,050	36,130,594	34,879,034	33,621,320	32,253,757	33,396,549	33,046,821	32,726,329	32,408,945	32,094,639	31,783,381	31,475,142
<b>In-State: UTO and Onsite Cogen (Short Tons CO2e)</b>	-	2,171,943	2,171,943	2,171,943	2,171,943	2,171,943	1,820,808	1,820,808	1,820,808	1,820,808	1,820,808	1,820,808	1,820,808
<b>Total In-State Emissions (Short Tons CO2e)</b>	45,488,109	40,130,993	38,302,537	37,050,977	35,793,262	34,425,700	35,217,356	34,867,629	34,547,137	34,229,753	33,915,447	33,604,189	33,295,950
<b>In-State: NGCC Non-Cogeneration (MWh)</b>	82,315,087	80,211,231	80,747,075	77,859,606	75,549,714	72,802,613	75,592,233	74,863,992	74,137,952	73,418,953	72,706,926	72,001,806	71,303,523
<b>In-State: NGCC Cogeneration (MWh)</b>	9,022,643	8,086,736	7,927,489	7,903,895	7,864,154	7,809,341	7,488,036	7,384,052	7,314,082	7,244,789	7,176,169	7,108,215	7,040,919
<b>In-State: OGST Non-Cogeneration (MWh)</b>	6,450,261	3,163,579	1,099,027	1,108,597	827,009	606,621	835,904	855,940	847,639	839,418	831,277	823,216	815,232
<b>In-State: OGST Cogeneration (MWh)</b>	-	-	-	-	-	-	-	-	-	-	-	-	-
<b>In-State: COALST - Cogen (MWh)</b>	521,974	-	-	-	-	-	-	-	-	-	-	-	-
<b>In-State Generation (MWh) for Emissions Determination</b>	98,309,965	91,461,546	89,773,591	86,872,098	84,240,877	81,218,576	83,916,173	83,103,984	82,299,672	81,503,160	80,714,373	79,933,236	79,159,674
<b>PLEXOS Results and EPA targets</b>													
<b>Total GRID EF (lb CO2e/MWh)-PLEXOS</b>	925	878	853	853	850	848	839	839	840	840	840	841	841
<b>Total GRID EF (Short Ton CO2e)-PLEXOS</b>	45,488,109	40,130,993	38,302,537	37,050,977	35,793,262	34,425,700	35,217,356	34,867,629	34,547,137	34,229,753	33,915,447	33,604,189	33,295,950
<b>EPA Rule 111 Target EF (lb CO2e/MWh)</b>	-	-	-	985	961	932	910	888	866	853	839	826	-
<b>EPA Rule 111 Mass Based Target (Short Ton CO2e)</b>	-	-	-	55,102,677	54,501,575	53,900,473	53,299,371	52,698,269	52,097,167	51,496,065	50,894,963	50,293,861	50,293,861
<b>EXCLUDED Generation</b>													
<b>In-State: RPS Eligible Renewables Excl. Small Hydro (MWh)</b>	43,771,524	61,311,310	61,136,915	62,035,963	62,188,627	62,436,402	62,281,875	62,330,498	62,053,769	62,268,186	62,478,351	62,784,579	62,984,510
<b>In-State: Energy Efficiency (MWh)</b>	-	12,554,838	14,483,493	16,356,149	18,226,575	20,013,761	21,758,599	23,505,782	24,155,591	24,880,258	25,626,666	26,395,466	27,249,644
<b>In-State: Existing Fossil (MWh)</b>	-	14,294,153	13,800,371	13,265,567	13,124,530	12,500,277	12,219,009	11,521,911	-	-	-	-	-
<b>In-State: New Fossil With COD &gt;=1/1/2014 (MWh)</b>	-	14,940,857	17,807,620	22,823,910	24,963,948	26,989,232	29,634,635	30,118,375	-	-	-	-	-
<b>In-State: Nuclear (MWh)</b>	-	17,819,256	17,788,536	16,643,928	17,847,024	19,099,008	16,616,688	17,847,024	-	-	-	-	-
<b>In-State: Hydro Large and Small (MWh)</b>	-	30,889,008	30,887,961	30,887,961	30,887,961	30,889,008	30,887,961	30,887,961	-	-	-	-	-
<b>Out-of-State: RPS Eligible Renewables (MWh)</b>	15,422,668	14,613,198	14,152,618	13,015,592	12,480,231	11,780,786	11,518,991	11,122,236	11,122,236	11,122,236	11,122,236	11,122,236	11,122,236
<b>Net Imports: Less Out-of-State RPS Eligible Renewables (MWh)</b>	-	38,246,742	37,654,857	37,745,488	37,327,071	37,699,342	35,074,000	34,475,771	-	-	-	-	-

Year	2014	2020-Stress	2021-Stress	2022-Stress	2023-Stress	2024-Stress	2025-Stress	2026-Stress	2027-Stress (extrapolated)	2028-Stress (extrapolated)	2029-Stress (extrapolated)	2030-Stress (extrapolated)	2031-Stress (extrapolated)
<i>In-State: Electricity Emissions (Short Tons CO2e)</i>	45,488,109	45,348,644	43,548,363	43,522,637	42,042,472	41,253,301	46,628,076	46,572,952	46,530,933	46,488,951	46,447,007	46,405,101	46,363,233
<i>In-State: UTO and Onsite Cogen (Short Tons CO2e)</i>	-	2,171,943	2,171,943	2,171,943	2,171,943	2,171,943	1,820,808	1,820,808	1,820,808	1,820,808	1,820,808	1,820,808	1,820,808
<b>Total In-State Emissions (Short Tons CO2e)</b>	<b>45,488,109</b>	<b>47,520,587</b>	<b>45,720,305</b>	<b>45,694,580</b>	<b>44,214,415</b>	<b>43,425,244</b>	<b>48,448,884</b>	<b>48,393,760</b>	<b>48,351,740</b>	<b>48,309,759</b>	<b>48,267,815</b>	<b>48,225,909</b>	<b>48,184,041</b>
<i>In-State: NGCC Non-Cogeneration (MWh)</i>	82,315,087	94,592,815	96,364,682	96,233,428	93,652,137	92,283,068	104,509,950	104,415,402	104,321,196	104,227,074	104,133,037	104,039,085	103,945,218
<i>In-State: NGCC Cogeneration (MWh)</i>	9,022,643	8,534,207	8,375,652	8,355,061	8,255,889	8,211,156	8,162,245	8,021,277	8,014,193	8,007,115	8,000,043	7,992,978	7,985,919
<i>In-State: OGST Non-Cogeneration (MWh)</i>	6,450,261	4,821,471	1,174,212	1,261,460	829,900	608,354	913,273	1,046,461	1,045,517	1,044,574	1,043,631	1,042,690	1,041,749
<i>In-State: OGST Cogeneration (MWh)</i>	-	-	-	-	-	-	-	-	-	-	-	-	-
<i>In-State: COALST - Cogen (MWh)</i>	521,974	-	-	-	-	-	-	-	-	-	-	-	-
<b>In-State Generation (MWh) for Emissions Determination</b>	<b>98,309,965</b>	<b>107,948,494</b>	<b>105,914,545</b>	<b>105,849,949</b>	<b>102,737,926</b>	<b>101,102,579</b>	<b>113,585,468</b>	<b>113,483,140</b>	<b>113,380,905</b>	<b>113,278,762</b>	<b>113,176,711</b>	<b>113,074,753</b>	<b>112,972,886</b>
<b>PLEXOS Results and EPA targets</b>													
Total GRID EF (lb CO2e/MWh)-PLEXOS	925	880	863	863	861	859	853	853	853	853	853	853	853
Total GRID EF (Short Tons CO2e)-PLEXOS	45,488,109	47,520,587	45,720,305	45,694,580	44,214,415	43,425,244	48,448,884	48,393,760	48,351,740	48,309,759	48,267,815	48,225,909	48,184,041
EPA Rule 111 Target EF (lb CO2e/MWh)	-	-	-	985	961	932	910	888	866	853	839	826	826
EPA Rule 111 Mass Based Target (Short Tons CO2e)	-	-	-	55,102,677	54,501,575	53,900,473	53,299,371	52,698,269	52,097,167	51,496,065	50,894,963	50,293,861	50,293,861
<b>EXCLUDED Generation</b>													
<i>In-State: RPS Eligible Renewables Excl. Small Hydro (MWh)</i>	43,771,524	62,506,546	62,900,457	63,849,564	65,157,508	67,242,892	67,536,096	68,301,397	67,313,413	68,161,582	69,015,496	69,934,069	70,798,989
<i>In-State: Energy Efficiency (MWh)</i>	-	9,974,110	11,336,440	12,686,500	14,045,650	15,354,960	16,682,310	18,059,200	18,208,194	18,754,440	19,317,073	19,896,585	20,493,483
<i>In-State: Existing Fossil (MWh)</i>	-	16,077,069	15,867,287	15,796,046	15,120,783	14,397,916	16,575,135	15,803,406	-	-	-	-	-
<i>In-State: New Fossil With COD &gt;=1/8/2014 (MWh)</i>	-	9,102,065	11,472,308	14,525,554	14,655,774	13,917,312	15,639,716	15,867,072	-	-	-	-	-
<i>In-State: Nuclear (MWh)</i>	-	17,819,256	17,788,536	16,643,928	17,847,024	19,045,056	-	-	-	-	-	-	-
<i>In-State: Hydro Large and Small (MWh)</i>	-	20,980,149	22,482,014	22,506,913	22,457,874	22,458,653	22,278,491	22,325,569	-	-	-	-	-
<i>Out-of-State: RPS Eligible Renewables (MWh)</i>	15,422,668	19,255,136	19,764,240	19,306,879	18,727,623	16,901,106	17,348,636	17,241,391	17,241,391	17,241,391	17,241,391	17,241,391	17,241,391
<i>Net Imports: Less Out-of-State RPS Eligible Renewables (MWh)</i>	-	40,961,097	41,684,221	42,377,229	46,475,087	50,455,575	54,907,907	52,550,795	-	-	-	-	-