New Source Complements to Mass Goals Technical Support Document for CPP Final Rule

U.S Environmental Protection Agency

Office of Air and Radiation

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New Source Complements to Mass Goals under 111(d)

This Technical Support Document (TSD) provides information that supports the EPA's quantification of new source complements in Section VIII.J of the preamble. These new source complements represent the EPA's estimated new source emissions associated with satisfying incremental demand from 2012. States may add these new source complements to the final rule's mass goals in pursuing a mass-based compliance pathway inclusive of both affected EGUs and new fossil fuel-fired sources. The methodology for quantifying these new source complements is presented in five steps:

1. Calculate incremental generation needed for each interconnection to satisfy projected load growth from 2012 levels[1]
2. Subtract generation from under construction facilities included in the final rule
3. Subtract generation growth from affected EGUs and incremental renewable energy (RE) accounted for in the calculation of mass goals
4. Apportion remaining incremental generation to states on the basis of each state's 2012 share of the interconnection's affected EGU generation total[2]
5. Convert state-level incremental generation to state-level incremental emissions by assuming the New Source Performance Standard emission rate for NGCC of 1,030 lbs/MWh

The spreadsheet 'New Source Complements' is available in the docket and provides the complete set of calculations for each state.

1. Calculate incremental generation needed for each interconnection to satisfy projected load growth from 2012 levels

For this step, the EPA relies on the projected net energy for load values from the Energy Information Administration's (EIA's) 2015 Annual Energy Outlook (AEO2015).[3] Those values are presented in Table 1 for the baseline year of 2012 and all years, 2022 through 2030.

Table 1. Net Energy for Load by Interconnection (TWh)

Year	Eastern Interconnection	Western Interconnection	Texas Interconnection
2012	2,881	730	333
2022	3,094	775	361
2023	3,114	782	365
2024	3,137	789	369
2025	3,158	797	372
2026	3,178	803	376
2027	3,196	810	380
2028	3,213	816	383

[1] In this document, unless otherwise indicated, "incremental" means beyond the level observed in 2012.

[2] Affected EGU generation total is equal to the 2012 adjusted baseline used to calculate goal rates

[3] Net energy for load is defined by the EIA as the net generation of main generating units that are system-owned or system-operated, plus energy receipts minus energy deliveries

2029	3,231	823	387
2030	3,245	829	391

The AEO projections are then converted into a percent increase in net energy for load, relative to 2012, for each interconnection and each year. Conversion to a percent increase enables the EPA to apply the projected demand growth to 2012 historical data.

Table 2. Increase in Net Energy for Load From 2012 (%)

Year	Eastern Interconnection	Western Interconnection	Texas Interconnection
2022	7.4%	6.2%	8.6%
2023	8.1%	7.1%	9.6%
2024	8.9%	8.2%	10.8%
2025	9.6%	9.2%	11.9%
2026	10.3%	10.1%	13.0%
2027	10.9%	11.0%	14.0%
2028	11.5%	11.9%	15.1%
2029	12.2%	12.8%	16.3%
2030	12.7%	13.6%	17.4%

The historical generation associated with each interconnection is calculated as 2012 historical sales adjusted to account for an average transmission loss factor of 7.51%:[4]

- 2012 Generation = 2012 Sales × (1+ Transmission Losses)
- 2012 Eastern Interconnection Generation = 2,626,988 GWh × 1.0751 = 2,824,274 GWh
- 2012 Western Interconnection Generation = 671,260 GWh × 1.0751 = 721,672 GWh
- 2012 Texas Interconnection Generation = 365,467 GWh × 1.0751 = 392,914 GWh

For each year, 2022 through 2030, the incremental generation required to support demand growth is 2012 sales multiplied by the percent increase in net energy for load for that year.[5] For example:

- 2030 Incremental Generation to Support Demand Growth in the Eastern Interconnection = 2,824,274 GWh × 12.7% = 357,353 GWh

Table 3 contains the incremental generation to support demand growth for each interconnection in each year:

Table 3. Incremental Generation to Support Demand Growth (GWh)

Year	Eastern Interconnection	Western Interconnection	Texas Interconnection

[4] The 7.51% scalar represents an average historical difference between total net generation of electricity and retail sales of electricity. http://www.eia.gov/electricity/state/pdf/sep2010.pdf a

[5] This relationship assumes that the international export/import balance remains constant at 2012 levels and all incremental demand is met with generation from the U.S.

2022	209,623	44,887	33,605
2023	228,901	51,476	37,525
2024	251,878	59,148	42,332
2025	272,214	66,281	46,616
2026	291,203	72,570	51,229
2027	308,827	79,060	55,042
2028	325,981	85,759	59,323
2029	343,525	92,729	64,065
2030	357,353	98,181	68,244

2. Subtract generation from under construction facilities included in the final rule

The incremental generation to support demand growth calculated in step 1 would be served in part by the under construction facilities that are part of the final rule but not reflected in the 2012 historical data. Table 4 displays the under construction capacity that did not commence operations in 2012 for each facility type – affected coal-fired EGUs, affected natural gas-fired EGUs, and nuclear units that are eligible for compliance.[6]

Table 4. Under Construction Facilities by Interconnection (MW)

Facility Type	Eastern Interconnection	Western Interconnection	Texas Interconnection
NGCC	10,633	2,636	2,489
Coal	655	0	0
Nuclear	5,522	0	0

Each facility type is assigned an annual net capacity factor associated with the amount of generation expected to meet future demand. This capacity factor does not represent expected total annual output, but instead represents the portion of total annual output that will deduct from the incremental generation needed to support demand growth.[7] For example, and consistent with the application of building block 2, under construction NGCC is assigned a capacity factor associated with future demand of 55%; coal-fired EGUs are assigned a capacity factor of 60%; and nuclear facilities are assigned a capacity factor of 66%.[8]

[6] Under construction facilities that commenced operation in 2012 are excluded from this adjustment due to the unknown impact their full-year operations would have on the 2012 data. Instead, the assumed output of full-year operations from these facilities is reflected in each state's adjusted 2012 baseline generation total, which is the basis for apportioning interconnection-level new source complement generation to state-level new source complement generation.

[7] The amount of generation from under construction facilities that is expected to replace existing source generation is irrelevant to the calculation of new source emissions associated with satisfying incremental demand from 2012.

[8] The 66% capacity factor assigned to nuclear is set at the same ratio of future demand to total output (66% dedicated to future demand; total output of 90%) as under construction NGCCs in building block 2 (55% dedicated to future demand; total output of 75%)

The generation totals associated with applying these capacity factors to under construction facilities are shown in Table 5:

Table 5. Incremental Generation Assumed to Meet Future Demand from Under Construction Facilities by Interconnection (GWh)			
Facility Type	**Eastern Interconnection**	**Western Interconnection**	**Texas Interconnection**
NGCC	51,231	12,702	11,991
Coal	3,443	0	0
Nuclear	31,926	0	0

3. Subtract generation growth from affected EGUs and incremental RE accounted for in the calculation of mass goals

The calculation of mass goals incorporates an amount of generation growth from both affected EGUs and RE that would serve to meet future demand requirements.[9] Consequently, because the estimated emissions from this particular incremental generation are already included in the mass goals, it is necessary to deduct this amount of generation, listed in Table 6, from the incremental generation needed to support demand growth that will inform the estimation of the new source complements.

Table 6. Affected EGU and RE Generation Growth Incorporated in Mass Goal Calculation (GWh)			
Year	**Eastern Interconnection**	**Western Interconnection**	**Texas Interconnection**
2022	138,054	29,209	22,689
2023	131,858	27,898	21,670
2024	135,132	28,591	22,208
2025	149,186	31,565	24,518
2026	161,395	34,148	26,525
2027	164,934	34,897	27,106
2028	191,779	40,576	31,518
2029	218,279	46,183	35,873
2030	241,664	51,131	39,716

The amount of generation remaining after deducting the generation growth incorporated in mass goals is referred to as the new source complement generation, and it is defined as:

- Interconnection-level new source complement generation = Incremental generation to support demand growth – Generation from under construction facilities dedicated to serving future

[9] For more information, please see section VII of the preamble and the CO2 Emission Performance Rate and Goal Computation TSD

demand (step 2) – Generation growth from affected EGUs and RE assumed in the mass goal calculation (step 3)[10]

- Eastern Interconnection new source complement generation in 2030 = 357,353 GWh – 86,600 GWh – 241,664 GWh = 29,090 GWh

The new source complement generation for each interconnection in each year is provided below in Table 7:

Table 7. Interconnection-Level New Source Complement Generation (GWh)			
Year	**Eastern Interconnection**	**Western Interconnection**	**Texas Interconnection**
2022	-	2,976	-
2023	10,443	10,876	3,864
2024	30,146	17,855	8,133
2025	36,428	22,015	10,107
2026	43,208	25,720	12,714
2027	57,294	31,462	15,945
2028	47,602	32,480	15,814
2029	38,647	33,844	16,200
2030	29,090	34,349	16,537

4. Apportion remaining incremental generation to states on the basis of each state's 2012 share of the interconnection's affected EGU generation total

The apportionment of interconnection-level new source complement generation to states is performed on the basis of each state's 2012 adjusted share of the interconnection's 2012 adjusted affected EGU generation.[11] For the purposes of this calculation, states that are in multiple interconnections are assigned the interconnection that contains the majority of that state's territory. Each state's new source complement generation share is provided in Table 8 below:[12]

Table 8. Generation Shares for State-Level Apportionment		
State	**Interconnection**	**Share of Interconnection 2012 Affected EGU Generation**[13]
Alabama	Eastern	5.0%

[10] For the year 2022, this procedure yields negative incremental generation results in the Eastern and Texas Interconnections, because under-construction capacity and the amount of generation growth already represented in the mass goals would suffice to meet projected load growth in that year. As a result, the new source complement generation in these instances is assigned a value of zero.

[11] The goal rates are calculated based on adjusted 2012 generation data to reflect the impact of significant unit outages, estimated impact of normalizing hydropower output, and all under construction facilities

[12] For full generation data, refer to 'New Source Complements' spreadsheet

[13] Values rounded to tenth of a percent; for unrounded values refer to 'New Source Complements' spreadsheet

Arkansas	Eastern	2.4%
Arizona	Western	12.5%
California	Western	24.9%
Colorado	Western	10.9%
Connecticut	Eastern	0.8%
Delaware	Eastern	0.5%
Florida	Eastern	10.3%
Lands of the Fort Mojave Tribe	Western	0.3%
Georgia	Eastern	4.0%
Iowa	Eastern	1.8%
Idaho	Western	0.8%
Illinois	Eastern	4.8%
Indiana	Eastern	5.5%
Kansas	Eastern	1.5%
Kentucky	Eastern	4.4%
Louisiana	Eastern	2.9%
Massachusetts	Eastern	1.3%
Maryland	Eastern	1.0%
Maine	Eastern	0.2%
Michigan	Eastern	3.7%
Minnesota	Eastern	1.7%
Missouri	Eastern	3.9%
Mississippi	Eastern	2.4%
Montana	Western	3.7%
Lands of the Navajo Nation	Western	7.1%
North Carolina	Eastern	4.1%
North Dakota	Eastern	1.4%
Nebraska	Eastern	1.3%
New Hampshire	Eastern	0.4%
New Jersey	Eastern	1.8%
New Mexico	Western	4.6%
Nevada	Western	6.8%
New York	Eastern	3.1%
Ohio	Eastern	5.6%
Oklahoma	Eastern	3.4%
Oregon	Western	4.0%
Pennsylvania	Eastern	7.4%
Rhode Island	Eastern	0.4%

South Carolina	Eastern	2.0%
South Dakota	Eastern	0.3%
Tennessee	Eastern	2.1%
Texas	Texas	100.0%
Lands of the Uintah and Ouray Reservation	Western	0.7%
Utah	Western	8.6%
Virginia	Eastern	2.7%
Washington	Western	4.7%
Wisconsin	Eastern	2.1%
West Virginia	Eastern	3.6%
Wyoming	Western	10.4%

The new source complement generation level for a state is defined as:

- State-level new source complement generation = Interconnection-level new source complement generation × 2012 state share of interconnection affected EGU generation
- 2030 Alabama new source complement generation = 29,090 GWh × 5.0% = 1,467 GWh

State-level new source complement generation totals are provided for each state in each year in the 'New Source Complements' spreadsheet.

5. Convert state-level generation to state-level emissions assuming the emissions intensity of the New Source Performance Standard emission rate for NGCC of 1,030 lbs/MWh

Each state-level new source complement generation level is multiplied by the NSPS NGCC emission rate standard of 1,030 lbs/MWh to produce a mass value:

- New source complement = State-level new source complement generation × NSPS NGCC emission rate standard
- 2030 Alabama new source complement = 1,467 GWh × 1,030 lbs/MWh = 755,700 short tons

New source complements are calculated for each year and each state, from 2022 through 2030. The interim period new source complement is equal to the average of the annual values from 2022 through 2029. The final period new source complement is equal to the 2030 value. The interim and final period new source complements are provided in Table 9 below:[14]

[14] Final and interim period new source complements are rounded up to the nearest ton. Total mass values for each period are available in the 'New Source Complements' spreadsheet, available in the docket.

Table 9. Average Annual New Source Complement (Short Tons)		
State	**Interim Period**	**Final Period**
Alabama	856,524	755,700
Arizona	1,424,998	2,209,446
Arkansas	411,315	362,897
California	2,846,529	4,413,516
Colorado	1,239,916	1,922,478
Connecticut	135,410	119,470
Delaware	78,842	69,561
Florida	1,753,276	1,546,891
Georgia	677,284	597,559
Idaho	94,266	146,158
Illinois	818,349	722,018
Indiana	939,343	828,769
Iowa	298,934	263,745
Kansas	260,683	229,997
Kentucky	752,454	663,880
Louisiana	484,308	427,299
Maine	40,832	36,026
Maryland	170,930	150,809
Massachusetts	225,127	198,626
Michigan	623,651	550,239
Minnesota	286,535	252,806
Mississippi	410,440	362,126
Missouri	668,637	589,929
Montana	421,674	653,801
Nebraska	216,149	190,706
Nevada	770,417	1,194,523
New Hampshire	71,419	63,012
New Jersey	313,526	276,619
New Mexico	527,139	817,323
New York	522,227	460,753
North Carolina	692,091	610,623
North Dakota	245,324	216,446
Ohio	949,997	838,170
Oklahoma	581,051	512,654
Oregon	453,663	703,399
Pennsylvania	1,257,336	1,109,330

Rhode Island	70,035	61,791
South Carolina	344,885	304,287
South Dakota	46,513	41,038
Tennessee	358,838	316,598
Texas	5,328,758	8,516,408
Utah	981,947	1,522,500
Virginia	450,039	397,063
Washington	531,761	824,490
West Virginia	602,940	531,966
Wisconsin	364,841	321,895
Wyoming	1,185,554	1,838,190
Lands of the Navajo Nation	809,562	1,255,217
Lands of the Uintah and Ouray Reservation	84,440	130,923
Lands of the Fort Mojave Tribe	37,162	57,619