Technical Support Document:
Resource Adequacy and Reliability Analysis
August 2015

This document describes resource adequacy and reliability impacts of the final rule emission guidelines issued under section 111(d) of the Clean Air Act, also known as the Clean Power Plan. As used here, the term *resource adequacy* is defined as the provision for adequate generating resources to meet projected load and generating reserve requirements in each power region[1], while *reliability* includes the ability to deliver the resources to the loads, such that the overall power grid remains stable.

It is important to recognize that the final rule provides multiple flexibilities that preserve the ability of responsible authorities to maintain electric reliability, as well as a provision to ensure that electric reliability is adequately maintained in the case of extreme circumstances, amongst other changes to the final rule that will assist states and other authorities with ensuring adequate supplies of electricity and maintaining electric reliability. For more detail on how the final CPP addresses reliability, see Section VIII of the final rule preamble. The results presented in this document show that power system impacts of the final rule on system operations, under conditions preserving resource adequacy, are modest and manageable.

First, the final rule includes critical timing adjustments in response to comment about resource adequacy and reliability. In particular, the start date for the first compliance period was moved from 2020 to 2022. In addition, building block 2 and building block 3 are both gradually phased in starting in 2022 to give EGUs additional time to make adjustments, including any investments needed for the purpose of ensuring resource adequacy and reliability.

Second, as with the proposal, the final rule offers considerable flexibility to both states and EGUs. States are given broad latitude to design plans that fit their unique circumstances, including taking into account any resource adequacy or reliability constraints they may face. One particularly important example of this latitude is that states are encouraged to implement mass-based or rate-based plans that allow EGUs to take advantage of trading both within each

[1] As analyzed in this document, power regions correspond to aggregates of IPM regions corresponding to NERC assessment areas.

state and across states. Moreover, states are given additional flexibility to manage any near-term resource adequacy constraints by taking advantage of averaging provisions during the interim multi-year compliance period from 2022-2029.

Finally, the Reliability Safety Valve (RSV) provisions in the final rule provide additional flexibilities and provisions that assure states can adequately manage any specific reliability challenges that may arise.

In sum, states can choose different ways of implementing the rule guidelines to meet their targets while meeting their specific needs and maintaining electric reliability. For more detail on the RSV and other ways in which the how the final CPP addresses reliability, see Section VIII of the final rule preamble.

The results presented in this document further demonstrate, for the specific cases illustrated in the Regulatory Impact Analysis (RIA), that the implementation of this rule can be achieved without undermining resource adequacy or reliability. The focus of the analysis is on comparing two illustrative state plan scenarios from the RIA to a base case (absent the rule requirements) that is assumed to be adequate and reliable. In this framework, the emphasis is on the incremental changes in the power system that are projected to occur under the presence of the rule.[2] The EPA uses the Integrated Planning Model (IPM) to project likely future electricity market conditions with and without the proposed rule.[3]

IPM is a multi-regional, dynamic, deterministic linear programming model of the U.S. electric power sector. It provides forecasts of least cost capacity expansion, electricity dispatch, and emission control strategies while meeting energy demand and environmental, transmission, dispatch, and reliability constraints. The model is designed to reflect electricity markets as accurately as possible. The EPA uses the best available information from utilities, industry experts, gas and coal market experts, financial institutions, and government statistics as the basis for the detailed power sector modeling in IPM. The model documentation provides additional

[2] Both the base and policy cases start from input data on the expected state of the fleet of power plants in 2016 and assume certain planned retirements and additions happen by the end of 2015; the analysis focuses on the impacts of retirements that are projected by the IPM model in the 2020, 2025 and 2030. See the documentation of the NEEDS data base at epa.gov/powersectormodeling for information on what retirements and additions are assumed to occur by the end of 2015.

[3] See final rule Regulatory Impact Analysis for more detail on the power sector impacts of the final CPP.

information on the assumptions discussed here as well as all other model assumptions and inputs.[4]

IPM's least-cost dispatch solution is designed to ensure generation resource adequacy, either by using existing resources or through the construction of new resources. IPM addresses reliable delivery of generation resources for the delivery of electricity between the 64 IPM regions, based on current and planned transmission capacity, by setting limits to the ability to transfer power between regions using the bulk power transmission system. Within each model region, IPM assumes that adequate transmission capacity exists to deliver any resources located in, or transferred to, the region. This document focusses on key regional results important to management of the power system. For a more complete presentation of the broad power sector impacts of the proposed rule, see the Regulatory Impact Analysis.

Overview

In the final rule, the EPA is establishing emission guidelines for states to use in developing plans to address greenhouse gas emissions from existing fossil fuel-fired electric generating units. Specifically, the EPA is proposing category-specific performance rates for CO_2 emissions from power plants, as well goals for states to use in developing plans to meet the guidelines. See final rule preamble for more detail on the final CPP structure and rule requirements. This TSD uses the same scenarios and years of analysis contained in the RIA.[5] The scenarios include a base case (no CPP), a rate-based state plan scenario and a mass-based state plan scenario. For purposes of this resource adequacy and reliability assessment, estimates and projections are taken from those same scenarios and years as shown in the RIA (2020, 2025, and 2030).

[4] Detailed information and documentation of EPA's Base Case using IPM (v5.13), including all the underlying assumptions, data sources, and architecture parameters can be found on EPA's website at: http://www.epa.gov/powersectormodeling/BaseCasev513.html

[5] See Chapter 3 of the RIA for additional detail on the scenarios analyzed.

CPP Rate-Based Scenarios

Summary of Changes in Operational Capacity

Total operational capacity is lower in the CPP scenario, primarily from the reduced need for existing and new capacity as a result of increases in energy efficiency. These increases in energy efficiency make possible increases in retirements compared to the base case. Since most regions currently have capacity above their target reserve margins, most of these retirements are absorbed by a reduction in excess reserves in the early years. For illustrative purposes, the 2025 projection period, the first period to fall entirely within the compliance period, is discussed first, followed by discussion of 2020 and 2030. Operational generating capacity[6] changes from the base case in 2025 are summarized below:

Table 1. Operational Capacity Summary in 2025

Base case operational capacity (MW)	1,037,223
Minus Retirements in CPP Rate Case:	
(-) Coal	-22,984
(-) Oil-Gas Steam	-9,264
(-) Combustion Turbine	-1,942
(-) Combined Cycle	-1,643
(-) Nuclear	-1,128
(-) Less New Capacity due to EE Reduction	-12,626
Equals Policy Case Operational Capacity	988,764[7]

Since the model must maintain adequate reserves in each region, a portion of the reduced operational capacity in the CPP rate based policy case is taken from reduced need for reserves compared to the base case. In order to maintain resource adequacy in each region where existing resources retire, the model relies on any excess reserve that are available from continuing to operate existing capacity, additions of new capacity, reduced total resource requirements from increases in energy efficiency, and the ability to shift transmission among regions as the

[6] Operational capacity is any existing, new or retrofitted capacity that is not retired.
[7] Numbers in this table may not sum to numbers in Table A1 due to independent rounding and small classification differences between the base and policy cases.

generating capacity mix changes. As the table shows, the reduced resource needs permit lower capacity additions even though there are substantial increases in retirements. Each of these CPP rate based policy case changes is discussed further below.

Reduction in Reserve Requirements and Excess Reserves

IPM uses a target reserve margin in each region[8] as the basis for determining how much capacity to keep operational in order to preserve resource adequacy. IPM retires capacity if it is no longer needed to provide energy for load or to provide capacity to meet reserve margin during the planning horizon of the projections. Since current regional reserves are generally higher than the target reserve margin for the region, and increased energy efficiency will reduce the need for reserves, IPM may retire reserve capacity in 2025 if it is not economic to use it to maintain adequate reserve margins. Existing resources may also be more expensive, compared to alternatives such as building new capacity or transferring capacity from another region. As a result, many of the plants that are projected to retire in 2025 will not need to be replaced. Because existing plants eventually retire in most regions, and IPM builds no more than what it needs to maintain a target reserve margin in each region, the actual reserve margins tend to approach the target reserve margins over time.

Table 1 above shows that operational *generating* capacity is reduced by 48,587MW (4.8 percent) nationwide in 2025 under the policy.[9] The majority of this reduction is the result of decreases in the reserve requirements from energy efficiency under the final rule; in 2025 new energy efficiency under the final rule contributes 45,085 MW to reserve capacity[10] (see Table B1 for regional detail). Moreover, these reductions are from energy efficiency that is available in all hours, not just at peak, so it can substitute for existing or new baseload capacity. A reduction of 4.7 percent in 2025 will therefore have little overall impact, particularly given the length of time

[8] Reserve margin targets are generally based on the NERC 2010 10 Year Assessments for the region, except in cases where there are more stringent state requirements or other exceptions.
[9] Regional data on operational capacity is shown in Table A1 of the Appendix.
[10] The reserve contribution to reserve capacity requirements from energy efficiency is determined by the reduced peak demand and the target reserve margin in each region. For example, if peak demand in reduced by 100 MW and the reserve margin percentage in a region is 15%, the reduction in reserve capacity requirements is 115MW.

available to plan for any system changes. Moreover, retirements are distributed throughout the power grid, so any impacts are expected to be small at the regional level.[11]

Although there are substantial existing regional variations in reserve margin, IPM adjusts regional operating capacities in 2025 to meet the specific target reserve margin in each region, through changes in the level of retirements, construction of new generating capacity, or transfers of capacity among regions to meet the specific reserve margin in each region. Each of these adjustments in the 2025 projections is described below.

Changes in Retirements and New Capacity Additions in the CPP Scenarios[12]

The incremental retirements in the final rule case are shown above in Table 1; the 36,931 MW of retirements are in addition to 69,254MW of coal and 12,973MW of oil/gas retirements already occurring in the base case.

By 2025, the increased level of energy efficiency in the CPP case, compared to the base case, leads to lower levels of overall new capacity additions (shown regionally in Table A5). Renewable additions are approximately the same in both the base and policy cases, largely a result of reduced demand compared to the base case. The largest decreases in new capacity are in NGCC (7,808MW) and CT (3,131MW). Although there can be local grid reliability issues in replacing some units, these are expected to be manageable within the normal reliability planning and management time frames provided by the flexible resource options and time frames in the rule. These retirements and additions in the projections are the result of economic planning for energy and capacity needs modeled in the projections, they are not forced on individual units. In particular, new additions in a base case scenario that do not occur in the policy scenario projections might, in reality, be retained under a policy if local reliability conditions rendered this the most appropriate choice. This rule does not prevent generation owners from shifting retirements and additions among specific sources to ensure reliability in such circumstances.

[11] See maps of IPM regions and NERC Assessment Regions, and the table of target and projected reserve margins in the Appendix C. IPM regions are based on the regions NERC uses for regional assessments. These Assessment Regions are used for the Appendix tables in this document.

[12] Retirement and additions in this section are all incremental to the base case in 2025; the MW values represent model projections of responses to the imposition of the policy, not currently announced retirements or additions that are currently planned or under construction.

Reserve Transfers

In cases where it is economic to transfer reserves from a neighboring region, rather than supply reserves from within a region, IPM will transfer reserves, subject to summer and winter limits that are designed to ensure that these reserves can be transferred reliably. The transfer of reserves can occur, for example, if a region retires capacity that was used in the base case to meet reserve requirements, but a neighboring region has lower cost reserves that are not needed for its own reserve requirements. To examine these transfers, the EPA analyzed the change in net transfers from each region, where the net transfer for the base and policy cases is measured by the reserves sent to neighboring regions. In these cases, a positive value signifies the reserve capacity sent to other regions is larger than the reserve capacity received from other regions (sending and receiving regions can be different), while a negative value signifies that the capacity received is larger than the capacity sent. Thus, the value measures the degree to which resources in the region were reserved for use by other regions (positive value), or where the capacity to meet load in the region was served by resources in other regions (negative value). In each case these reserve transfers represent the use of the transmission system on a firm basis for at least a season.

To look at the impact of the CPP case on transfers, the measure used was the change in the summer reserves sent in the policy case compared to the base case. To develop a relative measure of the impact of the policy, the change in reserves was measured as a percentage of load in the sending region. This percentage gives an indication of the significance of the policy for changes in the grid. In general, the percentage changes in the final rule are below the changes in the proposed rule, and all are below 5%.[13]

Using this measure, the largest percentage changes in reserve transfers are in the Northwest (4.3%), SERC-North (-3.5%), and FRCC (3.1%). The change in the Northwest is attributable primarily to change in transfers from the Pacific Northwest IPM region to California, where an additional 2000MW are transferred to Northern California, including 1000MW shifted

[13] See the Resource Adequacy and Reliability Analysis for the proposed rule. A level of 5% was used as a screen in that analysis; given the length of time to plan for compliance with this rule, a 5% shift is expected to be manageable within normal system planning timeframes. In the proposed rule TSD, there were three regions above the 5% threshold.

from Southern California (LADWP). The net change of 1,134(MW) occurs, in part, as a result of additional operating capacity made available by increased energy efficiency in the policy case compared to the base case. This shift does not indicate any reliability challenges, as the total transfers of 3,499MW in the policy case remain substantially below the transfer limit of 4,200MW.

The SERC regions and FRCC have shifts around three percent, with some areas increasing net transfers and others decreasing. These areas also saw shifts in transfers in the modeling for the proposed rule, but the changes in this final rule have reduced these shifts to modest transfers compared to the proposal. In general, the shifts under the final rule show transfers from the Southeastern areas with greater natural gas resources available – FRCC and SERC-SE – toward northern areas with greater amounts of coal -- TVA and Kentucky. These transfers in the modeling remain well below the interregional transfers limits and 3 percent or less of the regional load in each case, and it is reasonable to expect them to be manageable, if needed, given the length of time available.

CPP Rate-Based Scenario in 2020 and 2030

There are other model projection periods that include years that fall in the period for compliance with the rule. The 2020 projections include the years 2019 through 2022, so one of the years in the period falls in the compliance period. EPA examined the information for the rate scenario for 2020 corresponding to the rate scenario in 2025. This information is shown the tables in Appendix A, which correspond to the tables for the 2025 case in Appendix B. Since the projections are representative of the entire four year period, it is difficult to draw firm conclusions with regard to impacts on reliability resulting from the rule. This is because most of the period is outside the compliance period of the final rule, and there can be no direct conflict with the rule except in the very last year of the projection period. The results can be compared below with the 2025 results for purposes of illustration.

The differences between 2020 and 2025 in the CPP rate scenario are driven by the fact that IPM modeling retires capacity from the start of the modeling period in 2016, based on projections that assume complete information about the future and precise economic planning. It thus assumes that capacity retires at the earliest possible moment that it becomes possible to do

so, so that excess reserves are used up and reserve margins can fall to target levels earlier than expected in practice. Nevertheless, in 2020, seven regions maintain margins above their levels in 2025 (See Table A3). This is consistent with the lower level of overall retirements in 2020 compared to 2025 (24,567MW compared to 36,961MW in 2025), so the modeling confirms that the any potential resource adequacy pressures from the final rule are not seen until the projections for 2025.

Results for the rate scenario in 2030 are contained in Appendix C. Reserve margins in the policy case in 2030 are essentially unchanged (less than 0.5% difference in all regions) from 2025, reflecting the fact that most regions were already at their target margins in 2025 rate scenario. Base case margins decline from 2025 to 2030, as margins above targets are reduced, so that the base case and policy case overall national margins are less than 1 percent different (Table C3). There continue to be more retirements in the policy case relative to the base case in 2030 (Incremental retirements of 41,009MW in 2030 compared to 36,961MW in 2025, an increase of 5,048 MW). These retirements are offset by a corresponding combination of new energy efficiency and changes in new capacity. In 2025, there were 12,626 MW fewer new capacity additions in the CPP case; in 2030 there were 16,964 MW fewer: a net decrease of an incremental 4,338 MW (over the base case) in the 2030 case compared to the comparable 2025 figure. However, the increase in the contribution of energy efficiency to reserve margin capacity was considerably greater than the combined decrease in new capacity additions and increase in retirements in 2030: the contribution of new energy efficiency to reserve margin in 2030 was 77,741 MW compared to 45,085 MW in 2025 (See Tables B1 and C1 in the Appendices), an increase of 22,656 MW.

The generation mix in incremental capacity changes compared to 2025: compared to the base case there less NGCC capacity (7,808 MW less in 2025, 30,080 MW in 2030) and more solar (1,628 less in 2025, 19,970 more in 2030). Given the long planning horizon of 2030, there will be adequate time to plan for potential shifts in the mix of demand and supply resources as these evolve over time. None of these results suggest there will be reasons for concern over the management of resource adequacy

CPP Mass-Based Scenarios

The EPA also examined the mass scenario modeling results to identify differences with the rate scenario potential impacts. The results for the CPP mass-based scenarios are contained in Appendices D through F for the projection years 2020, 2025 and 2030. These tables correspond to the tables for the CPP Rate-Based scenarios in Appendices A through C.

As expected, rate and mass cases showed very similar patterns in total operating and reserve capacity, since the IPM model must serve the same loads and ensure the same reserve margins in each case. In 2025, total operating capacity between rate and mass cases differs by less than one percent and regional operating capacities are within 5 percent except for the BASN regions, where the percentage difference is 8.6%, the result of retirement of a resource (coal) in Utah, which is offset by increased transmission capacity transfers. Reserve capacity and projected reserve margins for the mass scenario (Tables E2 and E3) follow a pattern similar to operating capacity: totals are within 1% of the projections for the corresponding outputs rate scenario and regional reserve capacities are under 5 percent.

Differences between the scenarios develop in the types of capacity that are retired and in the amount and types of new capacity built in 2025. The mass scenario results show more incremental retirements of coal capacity (29,319 MW compared to 22,984 MW in the rate scenario) and in Oil-Gas capacity (10,421 MW compared to 9,264 MW). The mass scenario also results in more new NGCC and CT capacity, and less new wind and solar capacity. The mass scenario still is projected to have a decrease in new capacity compared to the base case, but the decrease is only 9,971 MW compared to the 12,626 MW in the rate scenario. No reliability concerns are raised by these differences.[14]

The patterns of transfers are also similar. In the mass scenario, there is somewhat more variation in net transfers than in the rate case. In particular there are two regions with shifts of more than 5% in the mass scenario: the Northwest and BASN, both in WECC. These two shifts are linked. The Northwest reserve transfers include the transfers in the rate scenario discussed above, plus additional transfers from the Northwest to BASN to compensate for the coal

[14] For more detail on differences between these scenarios, including the specific scenarios modeled, the modeling assumptions, and impacts, see the Regulatory Impact Analysis, Chapter 3.

retirements in BASN discussed above. The two cases with the largest percentage shift examined above are reduced in magnitude. These transfers in the mass scenario remain below the interregional transfer limits in the modeling and do not appear to present significant reliability related concerns.

The same general patterns noted here for 2025 are also present in 2020 and 2025: only minor variations in total operating capacity, somewhat higher fossil steam retirements, more NGCC and CT capacity. These differences do not raise further issues of resource adequacy. Details can be found in the Appendices.

Appendix A: Tables by IPM Region for CPP Rate-Based Scenario in 2020

(Note: All Results Cumulative through Projection Year)

A1. Projected Operational Capacity

A2. . Summary of Summer Peak Loads and Reserve Capacity

A3. Summary of Target and Projected Reserve Margins

A4. Policy Case Retired Capacity Incremental to Base Case

A5. New Capacity in Policy Case Incremental to Base Case

A6. Net Reserves Sent by NERC Assessment Region

A1. Projected Operational Capacity Year= 2020

	All Generation Sources		EE Capacity	Overall		Coal Only
Region	Base	Policy	Contribution	Change	Base	Policy
Basin (BASN)	14,448	14,340	84	-25	5,064	5,244
Desert Southwest (DSW)	42,114	40,826	296	-992	8,380	8,218
ERCOT	95,496	95,624	162	289	17,937	17,939
FRCC	56,419	55,755	88	-576	7,479	7,162
ISO-NE	32,558	31,167	262	-1,130	0	0
MAPP	9,545	9,114	7	-424	3,007	2,328
MISO	122,247	120,021	958	-1,269	45,045	42,237
Northern California (CALN)	30,690	28,804	220	-1,667	71	71
Northwest (NORW)	51,014	48,641	330	-2,043	2,406	2,354
NYISO	38,484	36,199	365	-1,921	0	68
PJM	183,187	181,901	1,288	1	50,144	49,739
Rockies (Rock)	23,250	22,140	135	-976	9,327	8,365
SERC-E	52,103	52,251	262	411	11,045	10,611
SERC-N	47,143	46,949	138	-56	13,722	12,298
SERC-SE	59,679	57,508	110	-2,061	14,035	11,864
SERC-W	39,074	38,286	52	-737	4,733	3,418
Southern California (CALS)	40,576	37,823	358	-2,395	57	57
SPP	77,768	76,421	153	-1,195	22,966	20,372
Grand Total	1,015,797	993,767	5,267	-16,763	215,416	202,344

A2. Summer Peak Loads and Reserve Capacity in 2020

Projected Reserve Margins

Assessment Region	Peak Demand Base	Peak Demand Policy	Reserve Capacity Base	Reserve Capacity Policy
Basin (BASN)	11,953	11,880	13,926	13,567
Desert Southwest (	29,612	29,352	34,074	33,314
ERCOT	73,948	73,806	84,116	83,955
FRCC	44,324	44,253	56,200	55,193
ISO-NE	26,475	26,248	30,446	30,185
MAPP	5,330	5,324	6,603	6,123
MISO	90,719	89,895	106,505	104,548
Northern California	21,282	21,090	25,399	24,193
Northwest (NORW)	25,414	25,175	39,507	34,859
NYISO	30,058	29,744	34,868	34,503
PJM	150,553	149,437	173,738	172,450
Rockies (Rock)	14,156	14,042	17,609	16,654
SERC-E	42,195	41,966	48,524	48,261
SERC-N	38,518	38,398	44,296	44,158
SERC-SE	48,110	48,014	55,327	55,217
SERC-W	29,095	29,052	37,890	34,798
Southern California	28,108	27,797	33,588	32,085
SPP	51,995	51,865	63,790	60,946
US Total	**761,845**	**757,338**	**906,407**	**885,008**

A3. Summary of Target and Projected Reserve Margins in 2020

Projected Reserve Margins

NERC Assessment Region	Target Reserve Margin	Base Case	Policy Case	Policy % Above Margin	Policy Change from Base
Basin (BASN)	12.60%	16.51%	14.21%	1.6%	-2.3%
Desert Southwest (DSW)	13.50%	15.07%	13.50%	0.0%	-1.6%
ERCOT	13.75%	13.75%	13.75%	0.0%	0.0%
FRCC	19.25%	26.79%	24.72%	5.5%	-2.1%
ISO-NE	15.00%	15.00%	15.00%	0.0%	0.0%
MAPP	15.00%	23.87%	15.00%	0.0%	-8.9%
MISO	16.30%	17.40%	16.30%	0.0%	-1.1%
Northern California (CALN)	14.71%	19.35%	14.71%	0.0%	-4.6%
Northwest (NORW)	17.90%	31.61%	25.25%	7.4%	-6.4%
NYISO	16.00%	16.00%	16.00%	0.0%	0.0%
PJM	15.40%	15.40%	15.40%	0.0%	0.0%
Rockies (Rock)	14.65%	24.39%	18.60%	3.9%	-5.8%
SERC-E	15.00%	15.00%	15.00%	0.0%	0.0%
SERC-N	15.00%	15.00%	15.00%	0.0%	0.0%
SERC-SE	15.00%	15.00%	15.00%	0.0%	0.0%
SERC-W	15.00%	30.23%	19.78%	4.8%	-10.5%
Southern California (CALS)	15.14%	19.50%	15.42%	0.3%	-4.1%
SPP	13.60%	22.69%	17.51%	3.9%	-5.2%
Grand Total	15.30%	18.98%	16.86%	1.6%	-2.1%

A4. Policy Case Retired Capacity Incremental to the Base Case (MW) **Year= 2020**

	CC	Coal	CT	NU	OG Steam	Total
Basin (BASN)	180	-179	0	0	108	109
Desert Southwest (DSW	616	162	0	0	513	1,290
ERCOT	0	0	0	0	0	0
FRCC	59	317	0	0	288	664
ISO-NE	0	0	0	0	1,725	1,725
MAPP	0	679	0	0	0	679
MISO	0	2,822	0	0	0	2,822
Northern California (CA	0	0	1,898	0	0	1,898
Northwest (NORW)	1,465	52	0	867	0	2,383
NYISO	81	-68	0	0	1,674	1,687
PJM	0	408	0	0	29	437
Rockies (Rock)	39	963	0	0	55	1,057
SERC-E	0	434	0	0	0	434
SERC-N	0	1,443	0	0	0	1,443
SERC-SE	0	2,171	0	0	0	2,171
SERC-W	-434	1,328	0	0	-92	802
Southern California (CA	0	0	43	0	2,440	2,484
SPP	-362	2,619	0	0	226	2,483
Grand Total	1,643	13,149	1,942	867	6,966	24,567

A5. New Capacity Policy Case Incremental to Base Case(MW) **Year= 2020**

Region	CC	CT	Wind	Solar	Other	Total
Basin (BASN)	0	0	0	0	0	0
Desert Southwest (DSW)	0	0	3	0	0	3
ERCOT	-196	0	323	0	0	127
FRCC	0	0	0	0	0	0
ISO-NE	0	0	334	0	0	334
MAPP	0	0	247	0	0	247
MISO	320	0	-38	-6	305	581
Northern California (CALN)	0	0	12	0	0	12
Northwest (NORW)	0	0	10	0	0	10
NYISO	0	0	-386	0	-213	-599
PJM	767	-1,692	175	12	-115	-852
Rockies (Rock)	0	0	0	-54	0	-54
SERC-E	612	0	0	-29	0	583
SERC-N	1,203	0	3	0	23	1,229
SERC-SE	0	0	0	0	0	0
SERC-W	0	0	0	0	0	0
Southern California (CALS)	0	0	-270	0	0	-270
SPP	0	0	1,110	0	0	1,110
Grand Total	2,705	-1,692	1,523	-78	0	2,459

A6. Net Reserves Sent by NERC Assessment Region(MW) in 2020

NERC Assessment Region	Base	Policy	Change from Base to Policy	Change as Percent of Summer Peak
Basin (BASN)	-1,772	-1,522	251	2.1%
Desert Southwest (DSW	3,869	3,340	-529	-1.8%
ERCOT	-1,942	-1,942	0	0.0%
FRCC	0	342	342	0.8%
ISO-NE	-1,823	-3,212	-1,388	-5.2%
MISO	-2,775	-3,249	-474	-0.5%
Northern California (CAL	0	-692	-692	-3.3%
Northwest (NORW)	407	2,675	2,268	8.9%
NYISO	320	-1,303	-1,623	-5.4%
PJM	-4,614	-4,702	-88	-0.1%
Rockies (Rock)	1,417	1,298	-118	-0.8%
SERC-E	-981	-547	434	1.0%
SERC-N	1,502	1,435	-67	-0.2%
SERC-SE	3,800	1,739	-2,061	-4.3%
SERC-W	1,112	3,416	2,304	7.9%
Southern California (CAL	-3,761	-4,884	-1,124	-4.0%
SPP	2,191	2,872	682	1.3%

Appendix B: Tables by IPM Region for CPP Rate-Based Scenario in 2025

(Note: All Results Cumulative through Projection Year)

B1. Projected Operational Capacity

B2 . Summary of Summer Peak Loads and Reserve Capacity

B3. Summary of Target and Projected Reserve Margins

B4. Policy Case Retired Capacity Incremental to Base Case

B5. New Capacity in Policy Case Incremental to Base Case

B6. Net Reserves Sent by NERC Assessment Region

B1. Projected Operational Capacity Year= 2025

	All Generation Sources		EE Capacity	Overall		Coal Only
Region	Base	Policy	Contribution	Change	Base	Policy
Basin (BASN)	14,293	13,888	687	282	4,802	4,685
Desert Southwest (DSW)	42,265	40,855	2,300	890	8,380	8,096
ERCOT	99,864	96,751	3,345	232	17,937	17,647
FRCC	56,336	55,672	2,080	1,417	7,479	7,162
ISO-NE	32,685	31,294	1,644	252	0	0
MAPP	9,627	8,993	207	-428	3,007	2,190
MISO	125,625	118,165	6,127	-1,333	45,036	39,567
Northern California (CALN)	29,389	27,503	1,321	-565	71	71
Northwest (NORW)	51,181	48,711	2,036	-434	2,406	2,354
NYISO	38,484	36,082	2,173	-229	0	0
PJM	188,212	179,396	9,367	551	50,144	44,546
Rockies (Rock)	23,663	22,284	1,041	-339	9,216	8,363
SERC-E	55,904	52,022	2,556	-1,326	11,045	9,478
SERC-N	50,217	46,755	2,051	-1,411	13,141	11,557
SERC-SE	57,354	56,571	2,192	1,409	11,655	10,871
SERC-W	40,012	37,823	1,069	-1,121	4,733	3,418
Southern California (CALS)	43,405	39,826	2,159	-1,420	57	50
SPP	78,704	75,121	2,733	-850	22,966	19,113
Grand Total	1,037,223	987,713	45,085	-4,425	212,075	189,169

B2. Summer Peak Loads and Reserve Capacity in 2025

Projected Reserve Margins

Assessment Region	Peak Demand Base	Peak Demand Policy	Reserve Capacity Base	Reserve Capacity Policy
Basin (BASN)	12,466	11,856	14,036	13,349
Desert Southwest (	31,887	29,861	36,192	33,892
ERCOT	77,606	74,665	88,276	84,932
FRCC	46,355	44,611	55,279	53,199
ISO-NE	26,701	25,272	30,706	29,063
MAPP	5,539	5,360	6,370	6,164
MISO	93,625	88,356	108,885	102,758
Northern California	22,305	21,155	25,592	24,301
Northwest (NORW)	26,489	24,955	36,672	33,098
NYISO	30,051	28,179	34,860	32,687
PJM	154,841	146,724	178,686	169,319
Rockies (Rock)	15,223	14,315	17,676	16,412
SERC-E	44,263	42,040	50,902	48,346
SERC-N	40,450	38,666	46,517	44,466
SERC-SE	50,430	48,524	57,994	55,802
SERC-W	30,589	29,660	35,644	34,109
Southern California	29,473	27,605	34,006	31,922
SPP	54,332	51,926	62,673	58,988
US Total	**792,624**	**753,693**	**920,969**	**872,809**

B3. Summary of Target and Projected Reserve Margins in 2025

NERC Assessment Region	Target Reserve Margin	Projected Reserve Margins		
		Base Case	Policy Case	Policy % Above Margin
Basin (BASN)	12.60%	12.60%	12.60%	0.0%
Desert Southwest (DSW)	13.50%	13.50%	13.50%	0.0%
ERCOT	13.75%	13.75%	13.75%	0.0%
FRCC	19.25%	19.25%	19.25%	0.0%
ISO-NE	15.00%	15.00%	15.00%	0.0%
MAPP	15.00%	15.00%	15.00%	0.0%
MISO	16.30%	16.30%	16.30%	0.0%
Northern California (CALN)	14.71%	14.74%	14.87%	0.2%
Northwest (NORW)	17.90%	27.05%	25.71%	7.8%
NYISO	16.00%	16.00%	16.00%	0.0%
PJM	15.40%	15.40%	15.40%	0.0%
Rockies (Rock)	14.65%	16.12%	14.65%	0.0%
SERC-E	15.00%	15.00%	15.00%	0.0%
SERC-N	15.00%	15.00%	15.00%	0.0%
SERC-SE	15.00%	15.00%	15.00%	0.0%
SERC-W	15.00%	16.52%	15.00%	0.0%
Southern California (CALS	15.14%	15.38%	15.64%	0.5%
SPP	13.60%	15.35%	13.60%	0.0%
Grand Total	15.29%	16.19%	15.80%	0.5%

B4. Policy Case Retired Capacity Incremental to the Base Case (MW) **Year= 2025**

	CC	Coal	CT	NU	OG Steam	Total
Basin (BASN)	180	118	0	0	108	405
Desert Southwest (DSW	616	284	0	0	513	1,412
ERCOT	0	291	0	0	0	291
FRCC	59	317	0	0	288	664
ISO-NE	0	0	0	0	1,725	1,725
MAPP	0	817	0	0	0	817
MISO	0	5,484	0	0	0	5,484
Northern California (CA	0	0	1,898	0	0	1,898
Northwest (NORW)	1,465	52	0	867	0	2,383
NYISO	81	0	0	261	1,674	2,016
PJM	0	5,601	0	0	19	5,620
Rockies (Rock)	39	855	0	0	55	949
SERC-E	0	1,566	0	0	0	1,566
SERC-N	0	1,603	0	0	0	1,603
SERC-SE	0	783	0	0	0	783
SERC-W	-434	1,328	0	0	1,309	2,203
Southern California (CA	0	7	43	0	2,514	2,565
SPP	-362	3,878	0	0	1,060	4,576
Grand Total	1,643	22,984	1,942	1,128	9,264	36,961

B5. New Capacity Policy Case Incremental to Base Case(MW) Year= 2025

Region	CC	CT	Wind	Solar	Other	Total
Basin (BASN)	0	0	0	0	0	0
Desert Southwest (DSW)	0	0	3	0	0	3
ERCOT	-2,003	-1,142	323	0	0	-2,823
FRCC	0	0	0	0	0	0
ISO-NE	0	0	334	0	0	334
MAPP	0	0	182	0	0	182
MISO	-1,534	0	-404	-53	0	-1,991
Northern California (CALN)	0	0	12	0	0	12
Northwest (NORW)	0	0	10	0	-96	-86
NYISO	0	0	-386	0	0	-386
PJM	-382	-1,988	-696	-133	0	-3,199
Rockies (Rock)	0	0	0	-432	0	-432
SERC-E	-2,008	0	0	-308	0	-2,316
SERC-N	-1,881	0	3	0	0	-1,878
SERC-SE	0	0	0	0	0	0
SERC-W	0	0	0	0	0	0
Southern California (CALS)	0	0	-270	-706	-39	-1,015
SPP	0	0	965	4	0	969
Grand Total	-7,808	-3,131	75	-1,628	-135	-12,626

B6. Net Reserves Sent by NERC Assessment Region(MW) in 2025

NERC Assessment Region	Base	Policy	Change from Base to Policy	Change as Percent of Summer Peak
Basin (BASN)	-2,052	-1,769	283	2.3%
Desert Southwest (DSW	1,846	2,734	888	2.8%
ERCOT	-1,931	-1,942	-11	0.0%
FRCC	838	2,254	1,417	3.1%
ISO-NE	-2,009	-1,999	10	0.0%
MISO	-2,502	-4,017	-1,515	-1.5%
Northern California (CAL	-1,490	-2,095	-606	-2.7%
Northwest (NORW)	3,345	4,480	1,134	4.3%
NYISO	249	296	47	0.2%
PJM	-6,877	-5,637	1,240	0.8%
Rockies (Rock)	1,419	1,619	201	1.3%
SERC-E	-402	-1,492	-1,091	-2.5%
SERC-N	2,141	728	-1,413	-3.5%
SERC-SE	-1,213	196	1,409	2.8%
SERC-W	3,806	3,149	-657	-2.1%
Southern California (CAL	-3,309	-4,091	-782	-2.7%
SPP	3,631	3,059	-572	-1.1%

Appendix C: Tables by IPM Region for CPP Rate-Based Scenario in 2030

(Note: All Results Cumulative through Projection Year)

C1. Projected Operational Capacity

C2. Summary of Summer Peak Loads and Reserve Capacity

C3. Summary of Target and Projected Reserve Margins

C4. Policy Case Retired Capacity Incremental to Base Case

C5. New Capacity in Policy Case Incremental to Base Case

C6. Net Reserves Sent by NERC Assessment Region

C1. Projected Operational Capacity Year= 2030

	All Generation Sources		EE Capacity	Overall		Coal Only
Region	Base	Policy	Contribution	Change	Base	Policy
Basin (BASN)	14,346	13,942	1,135	731	4,802	4,685
Desert Southwest (DSW)	42,265	40,855	3,911	2,501	8,380	8,096
ERCOT	107,231	111,864	6,856	11,490	17,937	17,339
FRCC	61,471	55,847	4,357	-1,267	7,414	6,325
ISO-NE	32,688	31,294	2,518	1,124	0	0
MAPP	9,627	9,322	464	159	3,007	2,190
MISO	126,164	119,045	9,389	2,269	45,036	39,567
Northern California (CALN)	29,389	27,503	1,976	90	71	71
Northwest (NORW)	51,415	49,030	3,171	786	2,406	2,354
NYISO	39,032	35,323	3,220	-489	0	0
PJM	203,408	185,630	15,258	-2,519	50,129	43,483
Rockies (Rock)	24,105	22,666	1,777	337	9,216	8,363
SERC-E	59,039	53,920	4,304	-814	11,045	7,952
SERC-N	52,505	48,091	3,916	-498	13,141	11,084
SERC-SE	60,658	60,265	4,470	4,076	11,655	10,692
SERC-W	40,602	40,391	2,247	2,037	4,733	3,418
Southern California (CALS)	49,260	44,898	3,238	-1,124	57	50
SPP	79,238	74,663	5,534	958	22,506	18,653
Grand Total	1,082,444	1,024,551	77,741	19,847	211,536	184,322

C2. Summer Peak Loads and Reserve Capacity in 2030

Projected Reserve Margins

Assessment Region	Peak Demand Base	Peak Demand Policy	Reserve Capacity Base	Reserve Capacity Policy
Basin (BASN)	12,961	11,953	14,594	13,459
Desert Southwest (	34,589	31,144	39,259	35,348
ERCOT	82,455	76,428	93,793	86,936
FRCC	49,145	45,491	58,606	54,248
ISO-NE	27,433	25,243	31,547	29,029
MAPP	5,732	5,329	6,592	6,128
MISO	96,428	88,354	112,145	102,756
Northern California	23,372	21,650	26,810	24,834
Northwest (NORW)	27,515	25,023	33,947	31,852
NYISO	30,694	27,918	35,605	32,385
PJM	160,273	147,051	184,955	169,696
Rockies (Rock)	16,419	14,869	18,824	17,047
SERC-E	46,801	43,058	53,821	49,517
SERC-N	42,204	38,799	48,534	44,619
SERC-SE	52,944	49,057	60,886	56,416
SERC-W	32,436	30,482	37,301	35,054
Southern California	30,929	28,127	35,684	32,494
SPP	57,092	52,221	64,857	59,323
US Total	**829,421**	**762,176**	**957,760**	**881,143**

C3. Summary of Target and Projected Reserve Margins in 2030

NERC Assessment Region	Target Reserve Margin	Projected Reserve Margins			
		Base Case	Policy Case	Policy % Above Margin	Policy Change from Base
Basin (BASN)	12.60%	12.60%	12.60%	0.0%	0.0%
Desert Southwest (DSW)	13.50%	13.50%	13.50%	0.0%	0.0%
ERCOT	13.75%	13.75%	13.75%	0.0%	0.0%
FRCC	19.25%	19.25%	19.25%	0.0%	0.0%
ISO-NE	15.00%	15.00%	15.00%	0.0%	0.0%
MAPP	15.00%	15.00%	15.00%	0.0%	0.0%
MISO	16.30%	16.30%	16.30%	0.0%	0.0%
Northern California (CALN)	14.71%	14.71%	14.71%	0.0%	0.0%
Northwest (NORW)	17.90%	23.38%	25.07%	7.2%	1.7%
NYISO	16.00%	16.00%	16.00%	0.0%	0.0%
PJM	15.40%	15.40%	15.40%	0.0%	0.0%
Rockies (Rock)	14.65%	14.65%	14.65%	0.0%	0.0%
SERC-E	15.00%	15.00%	15.00%	0.0%	0.0%
SERC-N	15.00%	15.00%	15.00%	0.0%	0.0%
SERC-SE	15.00%	15.00%	15.00%	0.0%	0.0%
SERC-W	15.00%	15.00%	15.00%	0.0%	0.0%
Southern California (CALS)	15.14%	15.37%	15.53%	0.4%	0.2%
SPP	13.60%	13.60%	13.60%	0.0%	0.0%
Grand Total	15.28%	15.47%	15.61%	0.3%	0.1%

C4. Policy Case Retired Capacity Incremental to the Base Case (MW) **Year= 2030**

	CC	Coal	CT	NU	OG Steam	Total
Basin (BASN)	180	118	0	0	108	405
Desert Southwest (DSW	616	284	0	0	513	1,412
ERCOT	0	600	0	0	0	600
FRCC	59	1,089	0	0	288	1,436
ISO-NE	0	0	0	0	1,725	1,725
MAPP	0	817	0	0	0	817
MISO	0	5,484	0	0	0	5,484
Northern California (CA	0	0	1,898	0	0	1,898
Northwest (NORW)	1,465	52	0	867	0	2,383
NYISO	81	0	0	1	1,674	1,756
PJM	0	6,652	0	-1	19	6,669
Rockies (Rock)	39	855	0	0	55	949
SERC-E	0	3,093	0	0	0	3,093
SERC-N	0	2,076	0	0	0	2,076
SERC-SE	0	962	0	0	0	962
SERC-W	-434	1,328	0	0	1,309	2,203
Southern California (CA	0	7	43	0	2,514	2,565
SPP	-362	3,878	0	0	1,060	4,576
Grand Total	1,643	27,294	1,942	867	9,264	41,009

C5. New Capacity Policy Case Incremental to Base Case(MW) **Year= 2030**

Region	CC	CT	Wind	Solar	Other	Total
Basin (BASN)	0	0	1	0	0	1
Desert Southwest (DSW)	0	0	3	0	0	3
ERCOT	-6,330	-4,182	323	15,421	0	5,232
FRCC	-4,189	0	0	0	0	-4,189
ISO-NE	0	0	331	0	0	331
MAPP	0	0	497	0	15	511
MISO	-1,234	0	-330	-86	0	-1,650
Northern California (CALN)	0	0	12	0	0	12
Northwest (NORW)	0	0	-2	0	0	-2
NYISO	-1,567	0	-386	0	0	-1,953
PJM	-6,179	-2,899	-864	-1,172	0	-11,114
Rockies (Rock)	0	0	0	-529	37	-492
SERC-E	-1,838	0	0	-188	0	-2,026
SERC-N	-2,360	0	3	0	0	-2,357
SERC-SE	-3,304	0	0	3,873	0	569
SERC-W	-589	0	0	2,569	0	1,979
Southern California (CALS)	-1,603	0	-270	79	-3	-1,797
SPP	-887	0	859	4	0	-24
Grand Total	-30,080	-7,081	177	19,970	50	-16,964

C6. Net Reserves Sent by NERC Assessment Region(MW) in 2030

NERC Assessment Region	Base	Policy	Change from Base to Policy	Change as Percent of Summer Peak
Basin (BASN)	-2,563	-1,826	738	5.7%
Desert Southwest (DSW	-1,245	1,269	2,514	7.3%
ERCOT	-40	-389	-349	-0.4%
FRCC	2,646	1,379	-1,267	-2.6%
ISO-NE	-2,848	-1,949	900	3.3%
MISO	-5,473	-3,076	2,397	2.3%
Northern California (CAL	-2,709	-2,630	80	0.3%
Northwest (NORW)	6,225	5,945	-279	-1.0%
NYISO	26	-63	-90	-0.3%
PJM	-5,123	-6,100	-977	-0.6%
Rockies (Rock)	399	1,097	698	4.3%
SERC-E	-506	-1,177	-670	-1.4%
SERC-N	2,412	1,912	-500	-1.2%
SERC-SE	-800	326	1,126	2.1%
SERC-W	2,732	2,844	112	0.3%
Southern California (CAL	-2,124	-3,120	-997	-3.2%
SPP	1,933	2,271	337	0.6%

Appendix D: Tables by IPM Region for CPP Mass-Based Scenario in 2020

(Note: All Results Cumulative through Projection Year)

D1. Projected Operational Capacity

D2. Summary of Summer Peak Loads and Reserve Capacity

D3. Summary of Target and Projected Reserve Margins

D4. Policy Case Retired Capacity Incremental to Base Case

D5. New Capacity in Policy Case Incremental to Base Case

D6. Net Reserves Sent by NERC Assessment Region

D1. Projected Operational Capacity Year= 2020

	All Generation Sources		EE Capacity	Overall		Coal Only
Region	Base	Policy	Contribution	Change	Base	Policy
Basin (BASN)	14,448	14,475	84	111	5,064	5,244
Desert Southwest (DSW)	42,114	40,168	296	-1,650	8,380	7,501
ERCOT	95,496	95,339	162	4	17,937	17,550
FRCC	56,419	55,636	88	-695	7,479	7,131
ISO-NE	32,558	30,383	262	-1,914	0	0
MAPP	9,545	9,022	7	-516	3,007	2,545
MISO	122,247	118,757	958	-2,533	45,045	39,926
Northern California (CALN)	30,690	28,522	220	-1,948	71	71
Northwest (NORW)	51,014	49,408	330	-1,276	2,406	2,354
NYISO	38,484	36,626	365	-1,494	0	0
PJM	183,187	181,488	1,288	-411	50,144	49,784
Rockies (Rock)	23,250	22,246	135	-869	9,327	8,407
SERC-E	52,103	52,109	262	269	11,045	11,176
SERC-N	47,143	47,672	138	667	13,722	12,696
SERC-SE	59,679	57,662	110	-1,907	14,035	12,018
SERC-W	39,074	38,826	52	-196	4,733	3,918
Southern California (CALS)	40,576	38,137	358	-2,082	57	57
SPP	77,768	75,481	153	-2,135	22,966	20,139
Grand Total	1,015,797	991,956	5,267	-18,575	215,416	200,515

D2. Summer Peak Loads and Reserve Capacity in 2020

Projected Reserve Margins

Assessment Region	Peak Demand Base	Peak Demand Policy	Reserve Capacity Base	Reserve Capacity Policy
Basin (BASN)	11,953	11,878	13,926	13,375
Desert Southwest (	29,612	29,352	34,074	33,314
ERCOT	73,948	73,806	84,116	83,955
FRCC	44,324	44,253	56,200	55,045
ISO-NE	26,475	26,248	30,446	30,185
MAPP	5,330	5,324	6,603	6,123
MISO	90,719	89,895	106,505	104,548
Northern California	21,282	21,090	25,399	24,193
Northwest (NORW)	25,414	25,181	39,507	35,702
NYISO	30,058	29,744	34,868	34,503
PJM	150,553	149,437	173,738	172,450
Rockies (Rock)	14,156	14,045	17,609	16,994
SERC-E	42,195	41,966	48,524	48,261
SERC-N	38,518	38,398	44,296	44,158
SERC-SE	48,110	48,014	55,327	55,217
SERC-W	29,095	29,053	37,890	35,696
Southern California	28,108	27,797	33,588	32,053
SPP	51,995	51,864	63,790	60,300
US Total	**761,845**	**757,343**	**906,407**	**886,072**

D3. Summary of Target and Projected Reserve Margins in 2020

NERC Assessment Region	Target Reserve Margin	Projected Reserve Margins			
		Base Case	Policy Case	Policy % Above Margin	Policy Change from Base
Basin (BASN)	12.60%	16.51%	12.60%	0.0%	-3.9%
Desert Southwest (DSW)	13.50%	15.07%	13.50%	0.0%	-1.6%
ERCOT	13.75%	13.75%	13.75%	0.0%	0.0%
FRCC	19.25%	26.79%	24.39%	5.1%	-2.4%
ISO-NE	15.00%	15.00%	15.00%	0.0%	0.0%
MAPP	15.00%	23.87%	15.00%	0.0%	-8.9%
MISO	16.30%	17.40%	16.30%	0.0%	-1.1%
Northern California (CALN)	14.71%	19.35%	14.71%	0.0%	-4.6%
Northwest (NORW)	17.90%	31.61%	28.79%	10.9%	-2.8%
NYISO	16.00%	16.00%	16.00%	0.0%	0.0%
PJM	15.40%	15.40%	15.40%	0.0%	0.0%
Rockies (Rock)	14.65%	24.39%	21.00%	6.4%	-3.4%
SERC-E	15.00%	15.00%	15.00%	0.0%	0.0%
SERC-N	15.00%	15.00%	15.00%	0.0%	0.0%
SERC-SE	15.00%	15.00%	15.00%	0.0%	0.0%
SERC-W	15.00%	30.23%	22.87%	7.9%	-7.4%
Southern California (CALS)	15.14%	19.50%	15.31%	0.2%	-4.2%
SPP	13.60%	22.69%	16.27%	2.7%	-6.4%
Grand Total	15.30%	18.98%	17.00%	1.7%	-2.0%

D4. Policy Case Retired Capacity Incremental to the Base Case (MW) **Year= 2020**

	CC	Coal	CT	NU	OG Steam	Total
Basin (BASN)	43	-179	0	0	108	-28
Desert Southwest (DSW	553	881	0	0	513	1,948
ERCOT	0	391	0	0	0	391
FRCC	148	348	0	0	288	784
ISO-NE	0	0	0	0	1,910	1,910
MAPP	0	462	0	0	0	462
MISO	0	5,146	0	-1,112	0	4,034
Northern California (CA	141	0	1,898	0	0	2,039
Northwest (NORW)	675	52	0	860	0	1,588
NYISO	81	0	0	0	1,330	1,411
PJM	0	363	0	0	377	740
Rockies (Rock)	0	921	0	0	0	921
SERC-E	0	-132	0	0	0	-132
SERC-N	0	1,042	0	0	0	1,042
SERC-SE	0	2,017	0	0	0	2,017
SERC-W	-434	823	0	0	-92	297
Southern California (CA	2	0	75	0	2,942	3,019
SPP	-206	2,845	0	-554	98	2,184
Grand Total	1,004	14,981	1,974	-806	7,474	24,627

D5. New Capacity Policy Case Incremental to Base Case(MW) **Year= 2020**

Region	CC	CT	Wind	Solar	Other	Total
Basin (BASN)	0	0	-1	0	0	-1
Desert Southwest (DSW)	0	0	-1	0	0	-1
ERCOT	233	0	-3	0	0	230
FRCC	0	0	0	0	0	0
ISO-NE	0	0	-265	0	0	-265
MAPP	0	0	-62	0	0	-62
MISO	905	0	-688	-6	305	516
Northern California (CALN)	0	0	-19	0	-110	-128
Northwest (NORW)	0	0	-19	0	0	-19
NYISO	0	0	-448	0	0	-448
PJM	1,380	-1,797	-292	-16	-237	-962
Rockies (Rock)	0	0	0	-84	0	-84
SERC-E	0	0	0	-125	0	-125
SERC-N	1,554	0	0	0	0	1,554
SERC-SE	0	0	0	0	0	0
SERC-W	0	0	0	0	41	41
Southern California (CALS)	834	0	-255	0	0	580
SPP	0	0	-121	0	0	-121
Grand Total	4,906	-1,797	-2,172	-231	0	706

D6. Net Reserves Sent by NERC Assessment Region(MW) in 2020

NERC Assessment Region	Base	Policy	Change from Base to Policy	Change as Percent of Summer Peak
Basin (BASN)	-1,772	-1,194	579	4.8%
Desert Southwest (DSW	3,869	2,684	-1,185	-4.0%
ERCOT	-1,942	-1,942	0	0.0%
FRCC	0	371	371	0.8%
ISO-NE	-1,823	-3,534	-1,710	-6.5%
MISO	-2,775	-3,958	-1,183	-1.2%
Northern California (CAL	0	-909	-909	-4.3%
Northwest (NORW)	407	2,617	2,210	8.7%
NYISO	320	-906	-1,226	-4.1%
PJM	-4,614	-4,697	-84	-0.1%
Rockies (Rock)	1,417	1,091	-325	-2.3%
SERC-E	-981	-616	365	0.9%
SERC-N	1,502	2,169	667	1.7%
SERC-SE	3,800	1,893	-1,907	-4.0%
SERC-W	1,112	3,043	1,931	6.6%
Southern California (CAL	-3,761	-4,543	-782	-2.8%
SPP	2,191	3,440	1,250	2.4%

Appendix E: Tables by IPM Region for CPP Mass-Based Scenario in 2020

(Note: All Results Cumulative through Projection Year)

E1. Projected Operational Capacity

E2. Summary of Summer Peak Loads and Reserve Capacity

E3. Summary of Target and Projected Reserve Margins

E4. Policy Case Retired Capacity Incremental to Base Case

E5. New Capacity in Policy Case Incremental to Base Case

E6. Net Reserves Sent by NERC Assessment Region

E1. Projected Operational Capacity Year= 2025

	All Generation Sources		EE Capacity	Overall		Coal Only
Region	Base	Policy	Contribution	Change	Base	Policy
Basin (BASN)	14,293	12,687	687	-919	4,802	3,345
Desert Southwest (DSW)	42,265	40,374	2,300	409	8,380	7,501
ERCOT	99,864	96,691	3,345	171	17,937	16,950
FRCC	56,336	55,647	2,080	1,391	7,479	7,131
ISO-NE	32,685	30,497	1,644	-545	0	0
MAPP	9,627	9,028	207	-393	3,007	2,407
MISO	125,625	118,290	6,127	-1,209	45,036	37,169
Northern California (CALN)	29,389	27,278	1,321	-791	71	17
Northwest (NORW)	51,181	48,752	2,036	-393	2,406	1,513
NYISO	38,484	36,517	2,173	205	0	0
PJM	188,212	178,002	9,367	-843	50,144	43,013
Rockies (Rock)	23,663	21,906	1,041	-717	9,216	7,797
SERC-E	55,904	52,622	2,556	-727	11,045	10,907
SERC-N	50,217	48,098	2,051	-68	13,141	11,405
SERC-SE	57,354	56,885	2,192	1,722	11,655	11,185
SERC-W	40,012	38,007	1,069	-936	4,733	3,918
Southern California (CALS)	43,405	39,745	2,159	-1,501	57	57
SPP	78,704	74,286	2,733	-1,685	22,966	18,522
Grand Total	1,037,223	985,310	45,085	-6,828	212,075	182,836

E2. Summer Peak Loads and Reserve Capacity in 2025

Projected Reserve Margins

Assessment Region	Peak Demand Base	Peak Demand Policy	Reserve Capacity Base	Reserve Capacity Policy
Basin (BASN)	12,466	11,856	14,036	13,349
Desert Southwest (	31,887	29,861	36,192	33,892
ERCOT	77,606	74,665	88,276	84,932
FRCC	46,355	44,611	55,279	53,199
ISO-NE	26,701	25,272	30,706	29,063
MAPP	5,539	5,360	6,370	6,164
MISO	93,625	88,356	108,885	102,758
Northern California	22,305	21,155	25,592	24,301
Northwest (NORW)	26,489	24,909	36,672	32,084
NYISO	30,051	28,179	34,860	32,687
PJM	154,841	146,724	178,686	169,319
Rockies (Rock)	15,223	14,315	17,676	16,412
SERC-E	44,263	42,040	50,902	48,346
SERC-N	40,450	38,666	46,517	44,466
SERC-SE	50,430	48,524	57,994	55,802
SERC-W	30,589	29,660	35,644	34,109
Southern California	29,473	27,604	34,006	31,897
SPP	54,332	51,927	62,673	58,997
US Total	**792,624**	**753,649**	**920,969**	**871,777**

E3. Summary of Target and Projected Reserve Margins in 2025

NERC Assessment Region	Target Reserve Margin	Projected Reserve Margins			
		Base Case	Policy Case	Policy % Above Margin	Policy Change from Base
Basin (BASN)	12.60%	12.60%	12.60%	0.0%	0.0%
Desert Southwest (DSW)	13.50%	13.50%	13.50%	0.0%	0.0%
ERCOT	13.75%	13.75%	13.75%	0.0%	0.0%
FRCC	19.25%	19.25%	19.25%	0.0%	0.0%
ISO-NE	15.00%	15.00%	15.00%	0.0%	0.0%
MAPP	15.00%	15.00%	15.00%	0.0%	0.0%
MISO	16.30%	16.30%	16.30%	0.0%	0.0%
Northern California (CALN)	14.71%	14.74%	14.87%	0.2%	0.1%
Northwest (NORW)	17.90%	27.05%	25.96%	8.1%	-1.1%
NYISO	16.00%	16.00%	16.00%	0.0%	0.0%
PJM	15.40%	15.40%	15.40%	0.0%	0.0%
Rockies (Rock)	14.65%	16.12%	14.65%	0.0%	-1.5%
SERC-E	15.00%	15.00%	15.00%	0.0%	0.0%
SERC-N	15.00%	15.00%	15.00%	0.0%	0.0%
SERC-SE	15.00%	15.00%	15.00%	0.0%	0.0%
SERC-W	15.00%	16.52%	15.00%	0.0%	-1.5%
Southern California (CALS)	15.14%	15.38%	15.55%	0.4%	0.2%
SPP	13.60%	15.35%	13.62%	0.0%	-1.7%
Grand Total	15.29%	16.19%	15.67%	0.4%	-0.5%

E4. Policy Case Retired Capacity Incremental to the Base Case (MW) **Year= 2025**

	CC	Coal	CT	NU	OG Steam	Total
Basin (BASN)	43	1,458	0	0	108	1,609
Desert Southwest (DSW	553	881	0	0	513	1,948
ERCOT	0	991	0	0	0	991
FRCC	148	348	0	0	288	784
ISO-NE	0	0	0	0	1,910	1,910
MAPP	0	600	0	0	0	600
MISO	0	7,895	0	-1,112	0	6,783
Northern California (CA	141	54	1,898	0	0	2,093
Northwest (NORW)	675	893	0	860	0	2,429
NYISO	81	0	0	109	1,330	1,520
PJM	0	7,134	0	0	367	7,501
Rockies (Rock)	0	1,421	0	0	0	1,421
SERC-E	0	137	0	0	0	137
SERC-N	0	1,753	0	0	0	1,753
SERC-SE	0	470	0	0	0	470
SERC-W	-434	823	0	0	1,957	2,346
Southern California (CA	2	0	75	0	3,016	3,093
SPP	-206	4,462	0	-554	932	4,635
Grand Total	1,004	29,319	1,974	-697	10,421	42,021

E5. New Capacity Policy Case Incremental to Base Case(MW) **Year= 2025**

Region	CC	CT	Wind	Solar	Other	Total
Basin (BASN)	0	0	3	0	0	3
Desert Southwest (DSW)	0	0	55	0	0	55
ERCOT	-52	-2,134	0	0	0	-2,185
FRCC	94	0	0	0	0	94
ISO-NE	0	0	-265	0	-13	-278
MAPP	0	0	0	0	0	0
MISO	-948	0	416	-48	0	-581
Northern California (CALN)	0	0	-19	0	0	-19
Northwest (NORW)	0	0	73	0	-73	0
NYISO	0	0	-448	0	0	-448
PJM	1,447	-2,094	-1,933	-133	0	-2,713
Rockies (Rock)	0	0	0	-375	37	-338
SERC-E	-2,620	0	0	-525	0	-3,145
SERC-N	-383	0	0	0	0	-383
SERC-SE	0	0	0	0	0	0
SERC-W	333	0	0	0	0	333
Southern California (CALS)	834	0	-255	-1,114	-32	-567
SPP	0	0	-66	-1	267	200
Grand Total	-1,295	-4,228	-2,439	-2,197	187	-9,971

E6. Net Reserves Sent by NERC Assessment Region(MW) in 2025

NERC Assessment Region	Base	Policy	Change from Base to Policy	Change as Percent of Summer Peak
Basin (BASN)	-2,052	-2,971	-919	-7.4%
Desert Southwest (DSW	1,846	2,219	372	1.2%
ERCOT	-1,931	-1,760	172	0.2%
FRCC	838	2,229	1,391	3.0%
ISO-NE	-2,009	-2,345	-337	-1.3%
MISO	-2,502	-4,422	-1,920	-1.9%
Northern California (CAL	-1,490	-2,298	-808	-3.6%
Northwest (NORW)	3,345	5,486	2,141	8.1%
NYISO	249	834	585	1.9%
PJM	-6,877	-6,098	779	0.5%
Rockies (Rock)	1,419	1,175	-243	-1.6%
SERC-E	-402	-727	-325	-0.7%
SERC-N	2,141	2,074	-68	-0.2%
SERC-SE	-1,213	509	1,722	3.4%
SERC-W	3,806	3,330	-476	-1.6%
Southern California (CAL	-3,309	-3,860	-552	-1.9%
SPP	3,631	2,846	-785	-1.4%

Appendix F: Tables by IPM Region for CPP Mass-Based Scenario in 2020

(Note: All Results Cumulative through Projection Year)

F1. Projected Operational Capacity

F2. Summary of Summer Peak Loads and Reserve Capacity

F3. Summary of Target and Projected Reserve Margins

F4. Policy Case Retired Capacity Incremental to Base Case

F5. New Capacity in Policy Case Incremental to Base Case

F6. Net Reserves Sent by NERC Assessment Region

F1. Projected Operational Capacity Year= 2030

	All Generation Sources		EE Capacity	Overall		Coal Only
Region	Base	Policy	Contribution	Change	Base	Policy
Basin (BASN)	14,346	13,573	1,135	361	4,802	3,172
Desert Southwest (DSW)	42,265	40,844	3,911	2,490	8,380	7,115
ERCOT	107,231	113,686	6,856	13,312	17,937	16,619
FRCC	61,471	57,489	4,357	375	7,414	6,324
ISO-NE	32,688	30,510	2,518	340	0	0
MAPP	9,627	9,288	464	125	3,007	2,171
MISO	126,164	117,707	9,389	931	45,036	35,626
Northern California (CALN)	29,389	27,278	1,976	-136	71	17
Northwest (NORW)	51,415	48,834	3,171	589	2,406	1,332
NYISO	39,032	35,605	3,220	-207	0	0
PJM	203,408	185,441	15,258	-2,709	50,129	39,667
Rockies (Rock)	24,105	24,184	1,777	1,855	9,216	7,657
SERC-E	59,039	53,149	4,304	-1,585	11,045	10,405
SERC-N	52,505	49,374	3,916	785	13,141	10,953
SERC-SE	60,658	56,487	4,470	298	11,655	10,221
SERC-W	40,602	38,739	2,247	385	4,733	3,918
Southern California (CALS)	49,260	46,137	3,238	114	57	57
SPP	79,238	75,215	5,534	1,510	22,506	18,036
Grand Total	1,082,444	1,023,537	77,741	18,833	211,536	173,291

F2. Summer Peak Loads and Reserve Capacity in 2030

Projected Reserve Margins

Assessment Region	Peak Demand Base	Peak Demand Policy	Reserve Capacity Base	Reserve Capacity Policy
Basin (BASN)	12,961	11,953	14,594	13,459
Desert Southwest (I	34,589	31,144	39,259	35,348
ERCOT	82,455	76,428	93,793	86,936
FRCC	49,145	45,491	58,606	54,248
ISO-NE	27,433	25,243	31,547	29,029
MAPP	5,732	5,329	6,592	6,128
MISO	96,428	88,354	112,145	102,756
Northern California	23,372	21,652	26,810	24,867
Northwest (NORW)	27,515	25,057	33,947	32,335
NYISO	30,694	27,918	35,605	32,385
PJM	160,273	147,051	184,955	169,696
Rockies (Rock)	16,419	14,869	18,824	17,047
SERC-E	46,801	43,058	53,821	49,517
SERC-N	42,204	38,799	48,534	44,619
SERC-SE	52,944	49,057	60,886	56,416
SERC-W	32,436	30,482	37,301	35,054
Southern California	30,929	28,127	35,684	32,494
SPP	57,092	52,245	64,857	59,639
US Total	**829,421**	**762,235**	**957,760**	**881,975**

F3. Summary of Target and Projected Reserve Margins in 2030

NERC Assessment Region	Target Reserve Margin	Projected Reserve Margins: Base Case	Projected Reserve Margins: Policy Case	Policy % Above Margin	Policy Change from Base
Basin (BASN)	12.60%	12.60%	12.60%	0.0%	0.0%
Desert Southwest (DSW)	13.50%	13.50%	13.50%	0.0%	0.0%
ERCOT	13.75%	13.75%	13.75%	0.0%	0.0%
FRCC	19.25%	19.25%	19.25%	0.0%	0.0%
ISO-NE	15.00%	15.00%	15.00%	0.0%	0.0%
MAPP	15.00%	15.00%	15.00%	0.0%	0.0%
MISO	16.30%	16.30%	16.30%	0.0%	0.0%
Northern California (CALN)	14.71%	14.71%	14.85%	0.1%	0.1%
Northwest (NORW)	17.90%	23.38%	25.23%	7.3%	1.9%
NYISO	16.00%	16.00%	16.00%	0.0%	0.0%
PJM	15.40%	15.40%	15.40%	0.0%	0.0%
Rockies (Rock)	14.65%	14.65%	14.65%	0.0%	0.0%
SERC-E	15.00%	15.00%	15.00%	0.0%	0.0%
SERC-N	15.00%	15.00%	15.00%	0.0%	0.0%
SERC-SE	15.00%	15.00%	15.00%	0.0%	0.0%
SERC-W	15.00%	15.00%	15.00%	0.0%	0.0%
Southern California (CALS)	15.14%	15.37%	15.53%	0.4%	0.2%
SPP	13.60%	13.60%	14.15%	0.6%	0.6%
Grand Total	15.28%	15.47%	15.71%	0.4%	0.2%

F4. Policy Case Retired Capacity Incremental to the Base Case (MW) **Year= 2030**

	CC	Coal	CT	NU	OG Steam	Total
Basin (BASN)	43	1,630	0	0	108	1,782
Desert Southwest (DSW	553	1,267	0	0	513	2,334
ERCOT	0	1,321	0	0	0	1,321
FRCC	148	1,089	0	0	288	1,525
ISO-NE	0	0	0	0	1,910	1,910
MAPP	0	836	0	0	0	836
MISO	0	9,437	0	-521	0	8,916
Northern California (CA	141	54	1,898	0	0	2,093
Northwest (NORW)	675	1,074	0	860	0	2,610
NYISO	81	0	0	1	1,330	1,412
PJM	0	10,469	0	-1	367	10,835
Rockies (Rock)	0	1,561	0	0	0	1,561
SERC-E	0	639	0	0	0	639
SERC-N	0	2,205	0	0	0	2,205
SERC-SE	0	1,433	0	0	0	1,433
SERC-W	-434	823	0	0	1,957	2,346
Southern California (CA	2	0	75	0	3,016	3,093
SPP	-206	4,488	0	-554	932	4,660
Grand Total	1,004	38,328	1,974	-215	10,421	51,512

F5. New Capacity Policy Case Incremental to Base Case(MW) Year= 2030

Region	CC	CT	Wind	Solar	Other	Total
Basin (BASN)	479	0	6	523	0	1,008
Desert Southwest (DSW)	0	0	57	853	0	911
ERCOT	-4,378	-5,173	0	17,325	0	7,773
FRCC	-2,458	0	0	0	0	-2,458
ISO-NE	0	0	-268	0	0	-268
MAPP	0	0	497	0	0	497
MISO	-543	0	1,054	-80	0	431
Northern California (CALN)	0	0	-19	0	0	-19
Northwest (NORW)	0	0	28	0	0	28
NYISO	-1,567	0	-448	0	0	-2,015
PJM	-325	-3,004	-2,207	-1,602	0	-7,139
Rockies (Rock)	0	0	0	1,601	37	1,638
SERC-E	-4,418	0	0	-833	0	-5,250
SERC-N	-943	0	0	0	0	-943
SERC-SE	-2,739	0	0	0	0	-2,739
SERC-W	476	0	0	0	0	476
Southern California (CALS)	117	0	-255	79	29	-30
SPP	-505	0	859	-2	267	619
Grand Total	-16,804	-8,177	-696	17,864	334	-7,479

F6. Net Reserves Sent by NERC Assessment Region(MW) in 2030

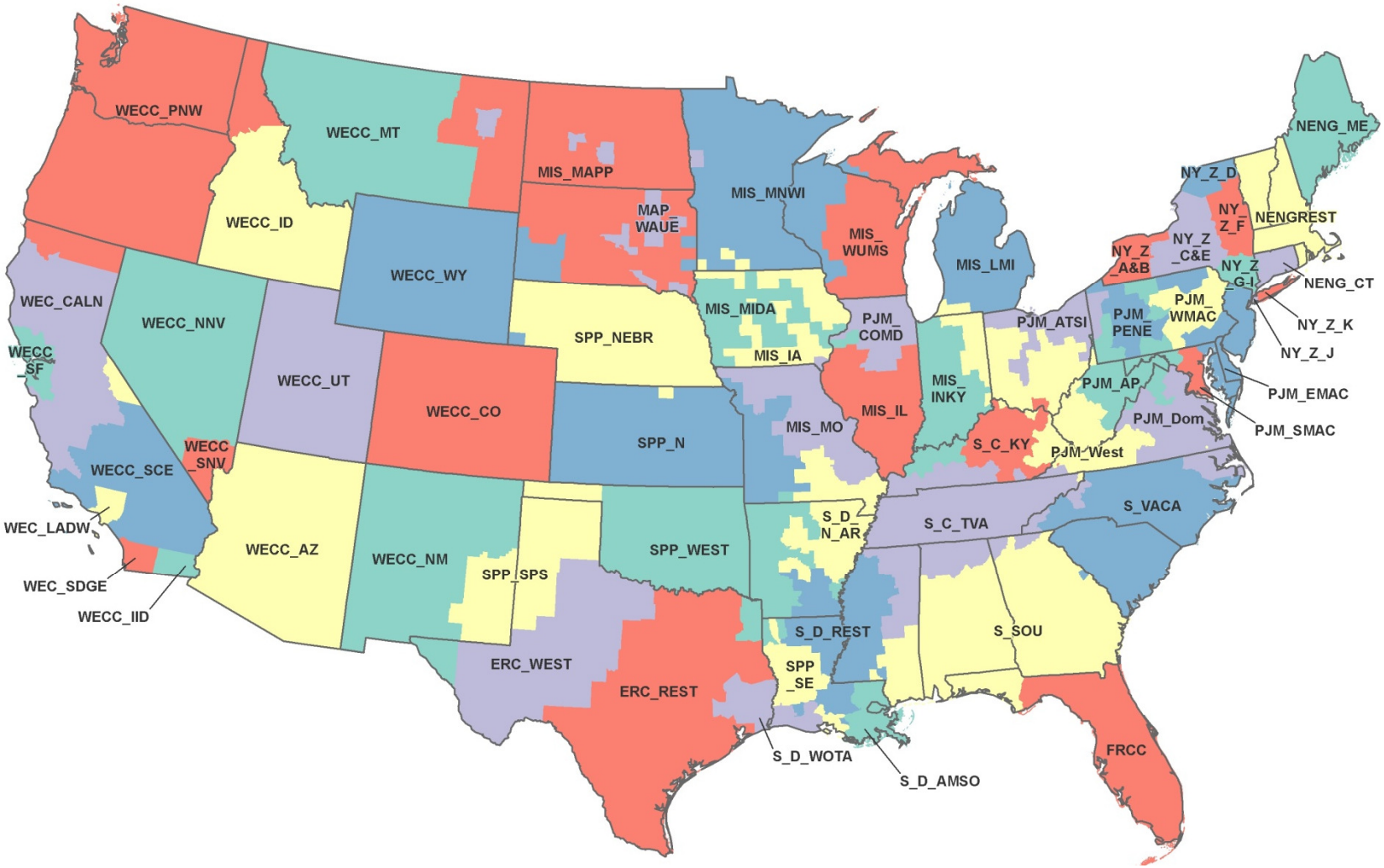
NERC Assessment Region	Base	Policy	Change from Base to Policy	Change as Percent of Summer Peak
Basin (BASN)	-2,563	-2,563	1	0.0%
Desert Southwest (DSW	-1,245	631	1,877	5.4%
ERCOT	-40	260	301	0.4%
FRCC	2,646	3,021	375	0.8%
ISO-NE	-2,848	-2,282	567	2.1%
MISO	-5,473	-5,470	2	0.0%
Northern California (CAL	-2,709	-2,864	-154	-0.7%
Northwest (NORW)	6,225	5,246	-979	-3.6%
NYISO	26	301	275	0.9%
PJM	-5,123	-4,891	232	0.1%
Rockies (Rock)	399	1,114	715	4.4%
SERC-E	-506	-1,455	-948	-2.0%
SERC-N	2,412	3,197	785	1.9%
SERC-SE	-800	-503	298	0.6%
SERC-W	2,732	3,122	390	1.2%
Southern California (CAL	-2,124	-1,859	264	0.9%
SPP	1,933	2,389	456	0.8%

Appendix C: Maps

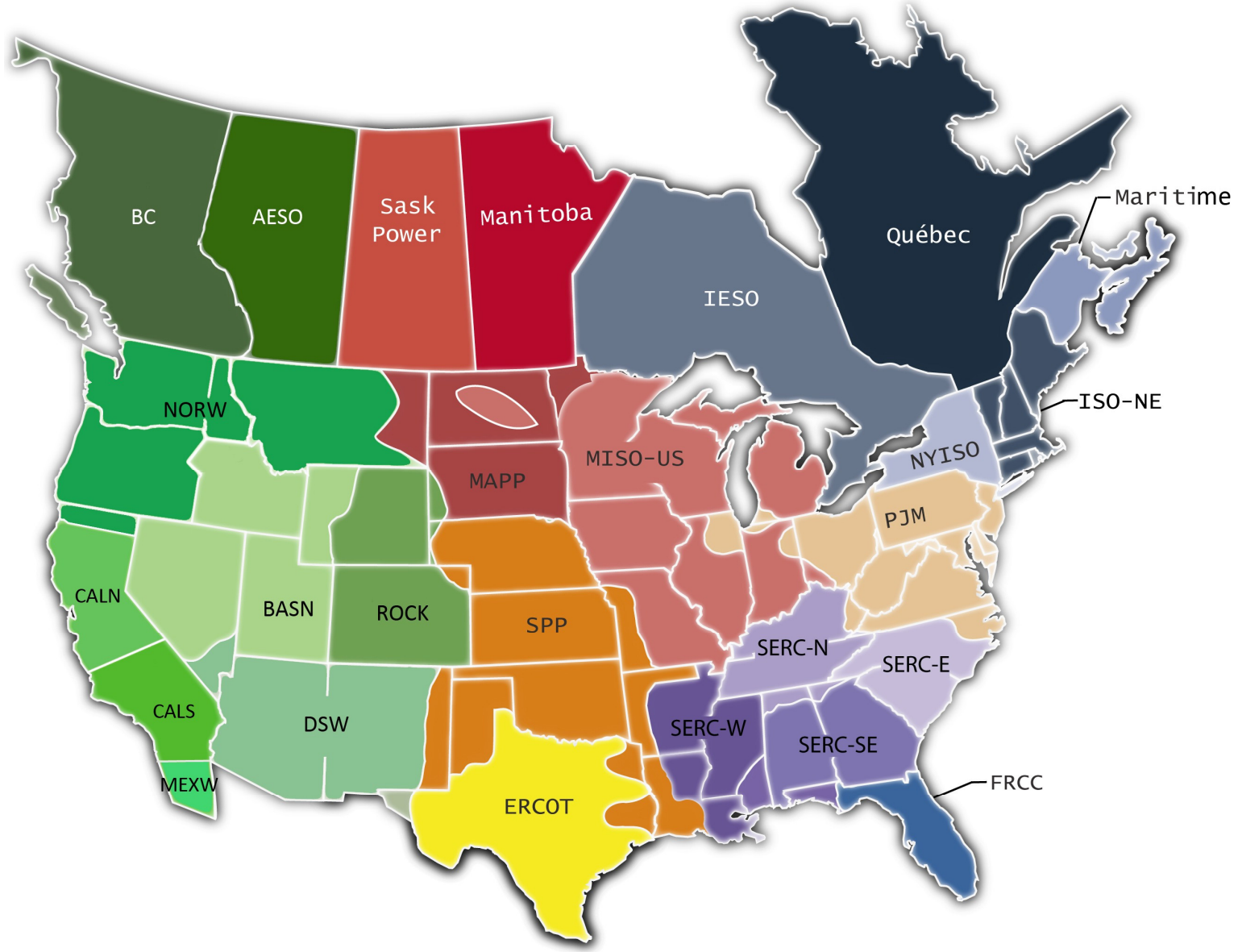
C1. IPM Regions

C2. . NERC Assessment Regions

C1: IPM v5.13 Regions



C2: NERC Assessment Areas in Long Term Reliability Assessment.



Source: NERC 2012 Long Term Reliability Assessment