Technical Support Document:
Resource Adequacy and Reliability Analysis

This document describes resource adequacy and reliability impacts in 2020 for selected policy scenarios from this proposal, compared to a base case without the policy. As used here, the term *resource adequacy* means the provision of adequate generating resources to meet projected load and generating reserve requirements in each region, while *reliability* includes the ability to deliver the resources to the loads, such that the overall power grid remains stable. The focus of the analysis is on the impact of the policy, in the context of a base case 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.[1] The EPA uses the Integrated Planning Model (IPM) to project likely future electricity market conditions with and without the proposed rule.

Although not the focus of this document, it is important to recognize that this proposal provides flexibility in the context of state plan development that preserves the ability of responsible authorities to maintain electric reliability. For example, relevant planning authorities (such as ISOs and RTOs) may consult with states during the formulation of a state plan. ISOs and RTOs have also expressed interest in discussing the facilitation of emission control requirements under multi-state approaches. The flexibility of meeting the state goal over time also allows short-term variation in CO2 emissions that may occur as certain generators run for short periods of time to maintain system reliability. While not discussed further here, these facts further support this document's demonstration that the implementation of this rule can be achieved without undermining resource adequacy or reliability.

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

[1] 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. 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.

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 information on the assumptions discussed here as well as all other model assumptions and inputs.2

IPM is specifically 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, 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. For a more complete presentation of the power sector impacts of the proposed rule, see the Regulatory Impact Analysis.

Overview

The EPA is proposing 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 state-specific rate-based goals for carbon dioxide emissions from the power sector, as well as guidelines for states to use in developing plans to attain the state-specific goals. This rule, as proposed, would set in motion actions to lower the carbon intensity of power generation in the United States. The agency is proposing one option (Option 1) for state-specific goals and requesting comment on a second option (Option 2).[3] For purposes of this resource adequacy and reliability assessment, estimates and projections are taken from the Option 1 State scenario. This option was chosen because it limits compliance choices more than the corresponding regional option, and is more likely than the regional option to pose challenges to resource adequacy.[4] The Option 1 Regional scenario results are discussed relative to the results from the Option 1 State scenario.

---

[2] 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

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

[4] For more detail on the economic impacts, and more discussion of the compliance scenarios, see Chapter 3 of the RIA for this proposal.

Option 1 (State) Policy Scenario

Summary of Changes in Operational Capacity

Total operational capacity is lower in the policy scenario, primarily from 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 over time. Operational capacity[5] changes from the base case in 2020 are summarized below:

Table 1. Operational Capacity Summary in 2020

Base case operational capacity (MW)	1,004,942
Minus Retirements in Policy Case:	
(-) Coal	-48,996
(-) Oil-Gas Steam	-16,131
(-) Combustion Turbine	-2,328
(-) Combined Cycle	-3,455
Plus New Capacity	36,118
Equals Policy Case Operational Capacity	970,150[6]

Since the model must maintain adequate reserves in each region, a portion of the reduced operational capacity in the policy case is taken from reserves that currently exceed the target reserve margin and will not be needed in the future. In order to maintain resource adequacy in each region where existing resources retire, the model relies on this excess reserve reduction, additions of new capacity, and reduced total resource requirements from increases in energy efficiency. As the table shows, the reduced resource needs permit lower capacity additions even though there are substantial increases in retirements. Each of these policy case changes is discussed further below.

[5] Operational capacity is any existing, new or retrofitted capacity that is not retired.
[6] 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.

Reduction in Excess Reserves

IPM uses a target reserve margin in each region[7] 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 2020 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 2020 will not need to be replaced.

Table 1 above shows that operational capacity is reduced by approximately 3.5 percent nationwide in 2020 under the policy.[8] The majority of this reduction is the result of decreases in load; in 2020 summer peak loads are reduced by around 3 percent nationwide, or approximately 24 GW (see Table A1). At the projected reserve margins in 2020 of 19 percent in the base case, these reductions reduce reserve capacity needs by around 28 GW, or about 80 percent of the overall reduction in load of 35 GW shown in Table 1. 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 3.5 percent in 2020 will therefore have little overall impact. Moreover, retirements are distributed throughout the power grid, so there will be only small impacts at the regional level.[9] Excess regional reserves above the target margin can be shared among sub-regions to ensure adequate reserve margins within a larger reliability region. IPM permits these transfers of reserves, but limits their level to ensure the reliability of the bulk power system. These interregional transfers are discussed further below.

Although there are substantial existing regional variations in reserve margin, IPM adjusts regional capacities in 2020 to meet the specific target reserve margin in each region, through

---

[7] 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.
[8] Regional data on operational capacity is shown in Table A1 of the Appendix.
[9] 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.

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 2020 projections is described below.

Changes in Retirements and New Capacity Additions in the Policy Case[10]

Although there are significant retirements of 49 GW of coal and 16 GW of Oil-Gas Steam plants in the policy case in 2020 compared to the base case, these are offset by 28 GW of capacity from load reductions discussed above and by changes in new capacity additions. Retiring coal units are generally older and smaller, and retiring oil/gas steam units are generally older, less efficient and infrequently used units. Where needed for reserve margin, this retiring capacity is replaced by 23 GW of Natural Gas Combined Cycle capacity, 2 GW of Combustion Turbine capacity and 10 GW of wind capacity (See Table A5). This new capacity of 35 GW amounts to approximately 4% of the current reserve capacity (See Table A2 for current summer reserve capacity); adding this amount of capacity to replace retiring coal and oil/gas steam units is unlikely to present resource adequacy concerns. Overall, combined generation from natural gas and coal is projected to fall by less than 5 percent at the national level in 2020 in the policy case compared to the base case; a shift this small in the total capacity of units capable of providing ancillary services to the grid should be entirely manageable within the normal parameters required for maintaining reliable operation. Although there can be local grid reliability issues in replacing some units, these can be managed within the normal reliability planning and management time frames provided by the flexible resource options and time frames in the rule.

The distribution of these retirements and additions across NERC Assessment regions is shown in Appendix C.

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

[10] Retirement and additions in this section are all incremental to the base case in 2020; the GW 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.

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 policy 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. The results of this measurement are shown in Table A6. As the Table shows, only three regions are at or above a 5%. The EPA believes changes below 5% are unlikely to raise concerns over reliability; the three changes at or above 5% are discussed further below.

Using this measure, the largest change in reserves are in the Northeast in ISO-NE, and in the Southeast in SERC-SE and FRCC. In ISO-NE the change in reserves is additional receipts of 1947 MW, increasing net reserves received from 938 MW to 2,885 MW. The majority of this change resulted from a net decrease of 1261MW in the reserves sent from ISO-NE regions to regions in the NYISO; the remainder resulted from a net increase in the reserves received from Canada and from NYISO. In projecting these shifts, IPM is constraining flows within the transfer limits between IPM regions, but also limiting the total flow between all the IPM regions in NYISO (New York State) and ISO-NE (all the states in New England).[11] The modeling thus considers both basic line limits and broader transmission system limits on overall flows. The

[11] For details on these limits, see the IPM documentation.

shifts in grid transfers exhibited in the IPM modeling suggest overall grid adjustment that is shared by these RTOs within manageable limits, and do not appear to be a cause for concern.

In the Southeast, the largest percentage change occurs in SERC-SE. In the base case, SERC-SE *sends* a net 2,071 MW to other regions, while in the policy case it *receives* a net 2,092 MW from other regions. This change amounts to a shift of in increased receipts relative to the base case of 4, 163 MW (8.3% of load in the base case). Although this shift is relatively large compared to other regions, there is little change in the absolute magnitude of transfers that need to be managed, since transfers shift from reserves sent to reserves received – in both cases the transfer is around 2,000 MW. The shift to receipts corresponds to the other large shift in the Southeast, as shift in FRCC from zero MW sent to 3,420 MW sent. All of these transfers are to SERC-SE, the only region to which FRCC is connected. When the larger SERC region is considered[12], combining all the individual SERC regions, the shift as a percentage of load drops to 4.8% of the total SERC load. These overall changes fall within the planning areas of SERC and are related to the placement of new capacity; within this planning area the shifts of this magnitude should be manageable.

Alternative Case: Option 1 (Regional)

As discussed above, the Option 1 (State) was chosen for the basic impact analysis because it provides a stricter test of potential reliability impacts. The EPA also examined the preferred Option 1 (Regional) case to identify differences with the State case and assess potential impacts. Tables B1 through B5 in Appendix B present results that correspond to Option 1 (State) Tables A1 through A5. As expected, both 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. Total operating capacity differs by less than one percent and regional operating capacities are within 5 percent except for MAPP.[13] Reserve capacity and projected reserve margins for Option 1 (Regional) (Tables B2 and B3) follow a pattern similar to

[12] This the entire SERC region, consisting of SERC-SE, SERC-N, SERC-E and SERC-W. See map in Appendix for details.
[13] MAPP has only 9 GW and the policy cases differ by 9.0 percent. An additional 848 MW of Wind capacity is added in the regional scenario compared to the state scenario.

operating capacity: totals are within 1% of the projections for the corresponding outputs from Option 1 (State) and regional reserve capacities are under 5 percent.

Differences between the cases develop in the types of capacity that are retired and in the amount and types of new capacity built in2020. The Regional results show fewer incremental retirements of coal capacity (46.1 GW compared to 49.0 GW) and in the total retired capacity (68.4 GW compared to 70.6 GW). Retirements of Oil-Gas capacity remain essentially unchanged between the two cases (16.3 GW) and other retirements are small (see Tables A4 and B4.) The decrease in retired coal capacity of 2.8 GW are offset by a decrease in new combined cycle capacity of the 2.1 GW. Overall, these results indicate a greater flexibility in the choice of which units are used to serve capacity needs, a result that indicates general flexibility over capacity choices. Managing these increases and decreases should raise no reliability issues. Retirements of Oil/Gas Steam capacity remain unchanged between the options and no further reliability issues arise in the regional case.

A similar indication of greater flexibility is seen in the transfers. The two cases with the largest percentage shift examined above are reduced in magnitude. The shift in ISO-NE is reduced from -7.7% to -5.4%, and the shift in SERC-SE is reduced from -8.3% to -6.7%.

Appendix A: Tables by IPM Region

Option 1 (State)

A1. Projected Operational Capacity in 2020

A2. . Summary of Summer Peak Loads and Reserve Capacity in 2020

A3. Summary of Target and Projected Reserve Margins in 2020

A4. Policy Case Retired Capacity Incremental to Base Case in 2020

A5. New Capacity in Policy Case Incremental to Base Case in 2020

A6. Net Reserves Sent by NERC Assessment Region in 2020

A1. Projected Operational Capacity in 2020(MW)

	All Generation Sources			Coal Only	
Region	Base	Policy	Change	Base	Policy
Basin (BASN)	14,163	12,864	-1,298	5,315	4,133
Desert Southwest (DSW)	42,191	39,847	-2,344	9,278	6,894
ERCOT	89,531	89,277	-255	19,052	10,734
FRCC	54,766	56,723	1,956	7,893	2,291
ISO-NE	30,239	28,533	-1,706	141	141
MAPP	9,176	9,090	-85	3,424	3,339
MISO	121,440	117,492	-3,948	50,983	45,646
Northern California (CALN)	32,878	31,092	-1,786	71	71
Northwest (NORW)	51,947	49,373	-2,574	2,354	2,354
NYISO	38,779	37,227	-1,552	443	594
PJM	180,193	175,676	-4,517	55,964	51,175
Rockies (Rock)	23,509	22,163	-1,346	10,584	9,239
SERC-E	52,311	52,086	-225	14,056	10,055
SERC-N	47,824	48,498	675	16,260	15,786
SERC-SE	60,084	55,023	-5,061	15,794	9,670
SERC-W	41,035	35,965	-5,069	6,909	3,224
Southern California (CALS)	43,004	40,920	-2,084	57	57
SPP	71,871	68,188	-3,683	23,704	17,877
Grand Total	1,004,942	970,037	-34,905	242,283	193,279

A2. Summary of 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)	11,893	11,487	13,739	12,935
Desert Southwest (DSW)	34,249	32,675	39,549	37,086
ERCOT	72,034	70,790	81,938	80,523
FRCC	45,199	44,260	54,595	53,131
ISO-NE	25,142	24,040	28,913	27,646
MAPP	5,383	5,304	6,943	6,099
MISO	90,613	87,001	106,325	101,182
Northern California (CALN)	22,308	21,295	28,451	26,667
Northwest (NORW)	25,442	24,350	40,590	37,994
NYISO	29,876	28,504	34,656	33,065
PJM	155,743	150,641	179,728	173,839
Rockies (Rock)	16,025	15,446	19,952	17,991
SERC-E	44,545	43,525	51,227	50,054
SERC-N	40,177	39,390	46,203	45,299
SERC-SE	50,246	49,465	57,783	56,885
SERC-W	29,834	29,514	37,940	33,941
Southern California (CALS)	29,514	27,866	36,244	32,798
SPP	51,336	50,440	62,225	57,300
US Total	**779,558**	**755,995**	**927,000**	**884,435**

A3. 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%	15.52%	12.60%	0.0%	-2.9%
Desert Southwest (DSW)	13.50%	15.47%	13.50%	0.0%	-2.0%
ERCOT	13.75%	13.75%	13.75%	0.0%	0.0%
FRCC	19.25%	20.79%	20.04%	0.8%	-0.7%
ISO-NE	15.00%	15.00%	15.00%	0.0%	0.0%
MAPP	15.00%	28.99%	15.00%	0.0%	-14.0%
MISO	16.30%	17.34%	16.30%	0.0%	-1.0%
Northern California (CALN)	14.71%	27.54%	25.23%	10.5%	-2.3%
Northwest (NORW)	17.90%	35.58%	32.63%	14.7%	-2.9%
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%	24.51%	16.48%	1.8%	-8.0%
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%	27.17%	15.00%	0.0%	-12.2%
Southern California (CALS)	15.14%	22.80%	17.70%	2.6%	-5.1%
SPP	13.60%	21.21%	13.60%	0.0%	-7.6%
Grand Total	15.29%	18.91%	16.99%	1.7%	-1.9%

A4. Policy Case Retired Capacity Incremental to the Base Case in 2020 (MW)

	CC	Coal	CT	NU	OG Steam	Total
Basin (BASN)	46	1,175	0	0	345	1,567
Desert Southwest (DSW)	0	2,392	0	0	0	2,392
ERCOT	0	8,358	0	0	0	8,358
FRCC	243	5,602	0	0	3,395	9,239
ISO-NE	1,029	0	0	0	2,671	3,700
MAPP	0	85	0	0	0	85
MISO	0	5,350	0	-261	0	5,089
Northern California (CALN)	209	0	1,592	0	0	1,800
Northwest (NORW)	1,885	0	690	0	0	2,574
NYISO	81	-151	0	0	1,656	1,586
PJM	0	4,622	0	0	0	4,622
Rockies (Rock)	0	1,349	0	0	0	1,349
SERC-E	0	4,004	0	0	0	4,004
SERC-N	0	468	0	0	0	468
SERC-SE	0	6,148	0	0	0	6,148
SERC-W	-513	3,718	-7	0	4,417	7,615
Southern California (CALS)	766	0	54	0	1,493	2,313
SPP	-292	5,874	0	0	2,154	7,737
Grand Total	3,455	48,996	2,328	-261	16,131	70,649

A5. New Capacity Policy Case Incremental to Base Case in 2020 (MW)

Region	CC	CT	Wind	Other	Total
Basin (BASN)	0	-8	4	271	267
Desert Southwest (DSW)	0	0	6	34	40
ERCOT	6,831	0	1,233	0	8,064
FRCC	11,196	0	0	-95	11,101
ISO-NE	99	-7	1,903	-33	1,961
MAPP	0	-110	0	0	-110
MISO	0	-65	1,161	-63	1,033
Northern California (CALN)	0	0	1	13	14
Northwest (NORW)	-11	-17	0	-5	-33
NYISO	0	-14	-37	0	-52
PJM	-912	-1,729	1,633	-295	-1,304
Rockies (Rock)	-1,023	265	537	0	-221
SERC-E	2,242	-56	0	1,524	3,709
SERC-N	500	0	9	0	509
SERC-SE	1,062	0	0	0	1,062
SERC-W	2,512	-31	0	0	2,481
Southern California (CALS)	183	0	6	38	227
SPP	47	-283	3,961	-3	3,722
Grand Total	22,724	-2,056	10,416	1,385	32,470

A6. Net Reserves Sent by NERC Assessment Region in Base and Policy Scenarios in 2020 (MW)

NERC Assessment Region	Base	Policy	Change from Base to Policy	Change as Percent of Summer Peak
Basin (BASN)	-1,430	-1,926	-496	-4.2%
Desert Southwest (DSW)	204	289	86	0.3%
ERCOT	-1,942	-1,913	29	0.0%
FRCC	0	3,420	3,420	7.6%
ISO-NE	-938	-2,885	-1,947	-7.7%
MISO	1,135	1,470	335	0.3%
Northern California (CALN)	0	0	0	0.0%
Northwest (NORW)	309	330	21	0.1%
NYISO	1,397	1,295	-102	-0.3%
PJM	-12,061	-11,872	189	0.1%
Rockies (Rock)	208	426	217	1.4%
SERC-E	-256	-570	-314	-0.7%
SERC-N	807	2,379	1,572	3.9%
SERC-SE	2,071	-2,092	-4,163	-8.3%
SERC-W	3,011	1,928	-1,084	-3.6%
Southern California (CALS)	251	1,622	1,371	4.6%
SPP	3,528	1,818	-1,709	-3.3%

Appendix B: Tables by IPM Region

Option 1 (Regional)

B1. Projected Operational Capacity in 2020

B2. Summer Peak Loads and Reserve Capacity in 2020

B3. Summary of Target and Projected Reserve Margins in 2020

B4. Policy Case Retired Capacity Incremental to Base Case in 2020

B5. New Capacity in Policy Case Incremental to Base Case in 2020

B1. Projected Operational Capacity in 2020(MW)

	All Generation Sources			Coal Only		
Region	Base	Policy	Change	Base	Policy	Change
Basin (BASN)	14,163	13,467	-696	5,315	4,838	-478
Desert Southwest (DSW)	42,191	41,810	-382	9,278	8,433	-845
ERCOT	89,531	88,511	-1,020	19,052	13,246	-5,806
FRCC	54,766	56,372	1,606	7,893	3,094	-4,799
ISO-NE	30,239	27,928	-2,311	141	141	0
MAPP	9,176	9,972	796	3,424	3,372	-52
MISO	121,440	115,908	-5,532	50,983	45,609	-5,374
Northern California (CALN)	32,878	30,909	-1,969	71	17	-54
Northwest (NORW)	51,947	49,473	-2,474	2,354	2,354	0
NYISO	38,779	36,716	-2,063	443	55	-388
PJM	180,193	175,000	-5,193	55,964	50,082	-5,882
Rockies (Rock)	23,509	22,342	-1,167	10,584	9,889	-695
SERC-E	52,311	52,522	212	14,056	8,264	-5,792
SERC-N	47,824	48,516	692	16,260	15,119	-1,142
SERC-SE	60,084	55,797	-4,287	15,794	11,390	-4,404
SERC-W	41,035	35,710	-5,325	6,909	2,352	-4,557
Southern California (CALS)	43,004	40,091	-2,913	57	57	0
SPP	71,871	69,754	-2,117	23,704	17,853	-5,851
Grand Total	1,004,942	970,799	-34,143	242,283	196,164	-46,118

B2. Summary of 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)	11,893	11,487	13,739	12,935
Desert Southwest (DSW)	34,249	32,675	39,549	37,765
ERCOT	72,034	70,790	81,938	80,523
FRCC	45,199	44,260	54,595	52,781
ISO-NE	25,142	24,040	28,913	27,646
MAPP	5,383	5,304	6,943	6,099
MISO	90,613	87,001	106,325	101,182
Northern California (CALN)	22,308	21,295	28,451	25,654
Northwest (NORW)	25,442	24,350	40,590	37,962
NYISO	29,876	28,504	34,656	33,065
PJM	155,743	150,641	179,728	173,839
Rockies (Rock)	16,025	15,446	19,952	18,722
SERC-E	44,545	43,525	51,227	50,054
SERC-N	40,177	39,390	46,203	45,299
SERC-SE	50,246	49,465	57,783	56,885
SERC-W	29,834	29,514	37,940	33,941
Southern California (CALS)	29,514	27,866	36,244	33,752
SPP	51,336	50,440	62,225	57,300
US Total	**779,558**	**755,995**	**927,000**	**885,404**

B3. 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%	15.52%	12.60%	0.0%	-2.9%
Desert Southwest (DSW)	13.50%	15.47%	15.58%	2.1%	0.1%
ERCOT	13.75%	13.75%	13.75%	0.0%	0.0%
FRCC	19.25%	20.79%	19.25%	0.0%	-1.5%
ISO-NE	15.00%	15.00%	15.00%	0.0%	0.0%
MAPP	15.00%	28.99%	15.00%	0.0%	-14.0%
MISO	16.30%	17.34%	16.30%	0.0%	-1.0%
Northern California (CALN)	14.71%	27.54%	20.47%	5.8%	-7.1%
Northwest (NORW)	17.90%	35.58%	32.57%	14.7%	-3.0%
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%	24.51%	21.21%	6.6%	-3.3%
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%	27.17%	15.00%	0.0%	-12.2%
Southern California (CALS)	15.14%	22.80%	21.12%	6.0%	-1.7%
SPP	13.60%	21.21%	13.60%	0.0%	-7.6%
Grand Total	15.29%	18.91%	17.12%	1.8%	-1.8%

B4. Policy Case Retired Capacity Incremental to the Base Case in 2020 (MW)

	CC	Coal	CT	NU	OG Steam	Total
Basin (BASN)	104	479	0	0	244	827
Desert Southwest (DSW)	0	848	0	0	0	848
ERCOT	0	5,832	0	0	0	5,832
FRCC	135	4,799	0	0	2,248	7,182
ISO-NE	621	0	0	0	2,100	2,722
MAPP	0	52	0	0	0	52
MISO	21	5,405	0	-70	384	5,740
Northern California (CALN)	697	54	1,291	0	0	2,042
Northwest (NORW)	2,071	0	690	0	0	2,761
NYISO	254	388	0	0	1,903	2,545
PJM	0	5,730	0	0	0	5,730
Rockies (Rock)	0	696	0	0	0	696
SERC-E	0	5,796	0	0	0	5,796
SERC-N	0	1,145	0	0	0	1,145
SERC-SE	0	4,428	0	0	0	4,428
SERC-W	-513	4,596	-7	0	4,036	8,112
Southern California (CALS)	963	0	-32	0	3,109	4,041
SPP	-292	5,906	0	0	2,243	7,857
Grand Total	4,062	46,152	1,941	-70	16,268	68,353

B5. New Capacity Policy Case Incremental to Base Case in 2020 (MW)

Region	CC	CT	Wind	Other	Total
Basin (BASN)	0	-8	0	130	122
Desert Southwest (DSW)	0	0	277	186	463
ERCOT	4,661	0	125	0	4,786
FRCC	8,788	0	0	-95	8,693
ISO-NE	0	-7	418	-33	377
MAPP	0	-110	848	0	738
MISO	0	-65	199	-52	82
Northern California (CALN)	0	0	30	42	73
Northwest (NORW)	-11	-17	162	119	254
NYISO	357	-14	53	0	396
PJM	-677	-1,729	1,832	-313	-887
Rockies (Rock)	-1,210	370	147	0	-693
SERC-E	4,387	-56	0	1,606	5,937
SERC-N	1,183	0	11	0	1,194
SERC-SE	117	0	0	0	117
SERC-W	2,749	-31	0	0	2,717
Southern California (CALS)	263	0	812	52	1,126
SPP	171	-283	5,515	-3	5,401
Grand Total	20,777	-1,951	10,430	1,638	30,894

B6. Net Reserves Sent by NERC Assessment Region in Base and Policy Scenarios in 2020 (MW)

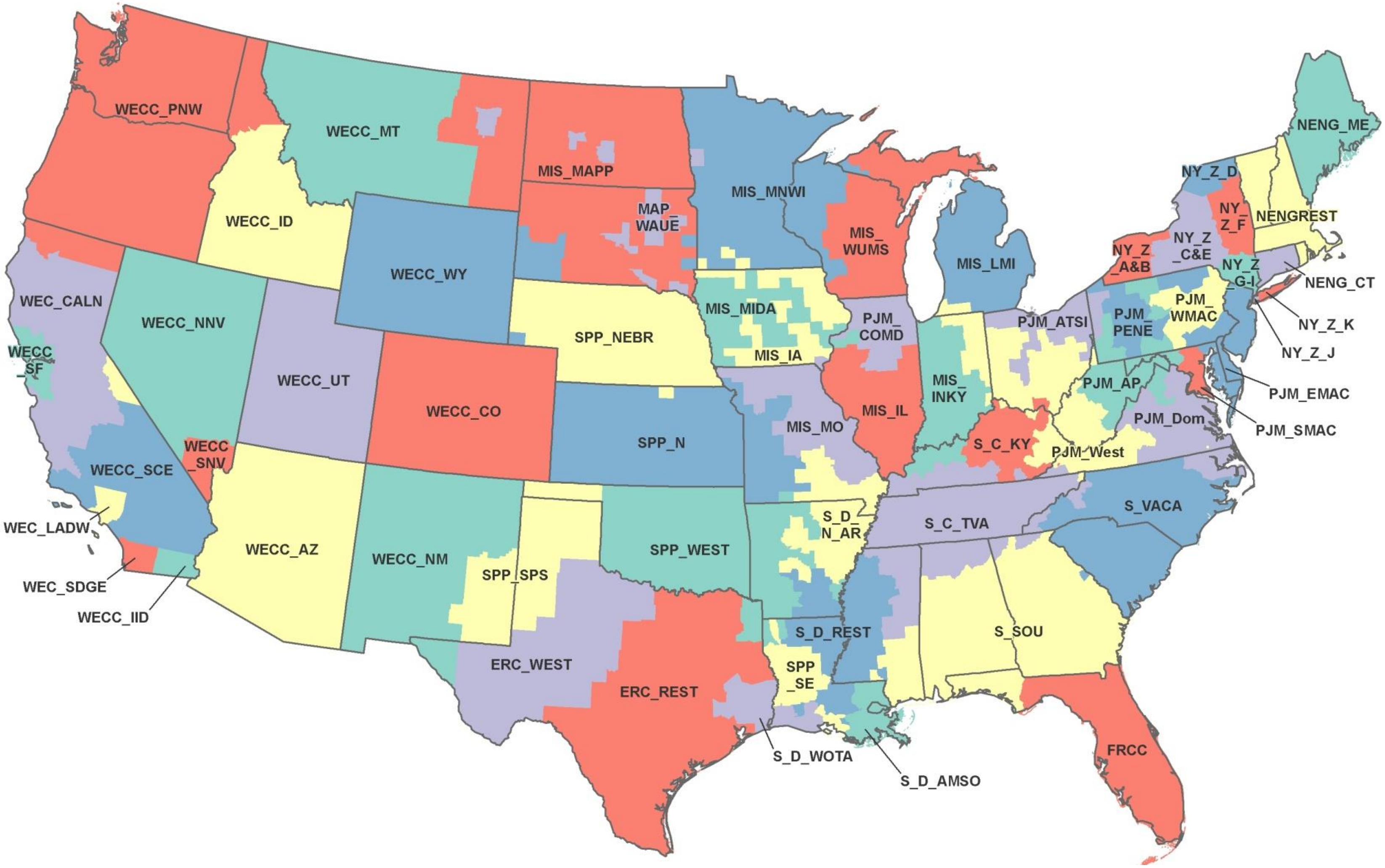
NERC Assessment Region	Base	Policy	Change from Base to Policy	Change as Percent of Summer Peak
Basin (BASN)	-1,430	-1,316	114	1.0%
Desert Southwest (DSW)	204	1,388	1,185	3.5%
ERCOT	-1,942	-1,658	284	0.4%
FRCC	0	3,420	3,420	7.6%
ISO-NE	-938	-2,305	-1,367	-5.4%
MISO	1,135	558	-577	-0.6%
Northern California (CALN)	0	808	808	3.6%
Northwest (NORW)	309	345	36	0.1%
NYISO	1,397	752	-645	-2.2%
PJM	-12,061	-12,723	-662	-0.4%
Rockies (Rock)	208	163	-46	-0.3%
SERC-E	-256	-192	64	0.1%
SERC-N	807	2,395	1,589	4.0%
SERC-SE	2,071	-1,318	-3,389	-6.7%
SERC-W	3,011	1,681	-1,330	-4.5%
Southern California (CALS)	251	-785	-1,036	-3.5%
SPP	3,528	2,238	-1,290	-2.5%

Appendix C: Maps

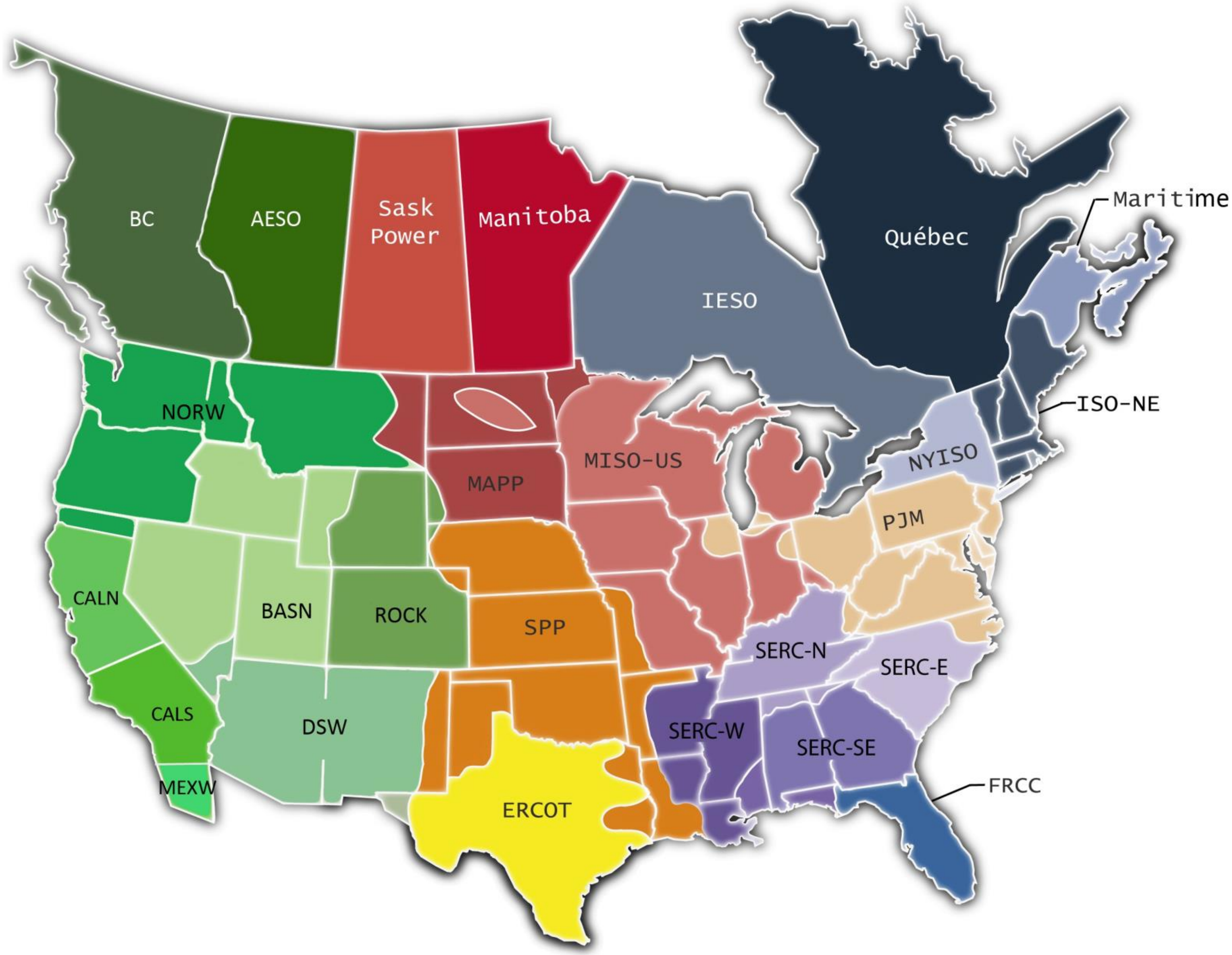
C1. IPM Regions

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