

NERC

NORTH AMERICAN ELECTRIC
RELIABILITY CORPORATION

2018/2019 Winter Reliability Assessment



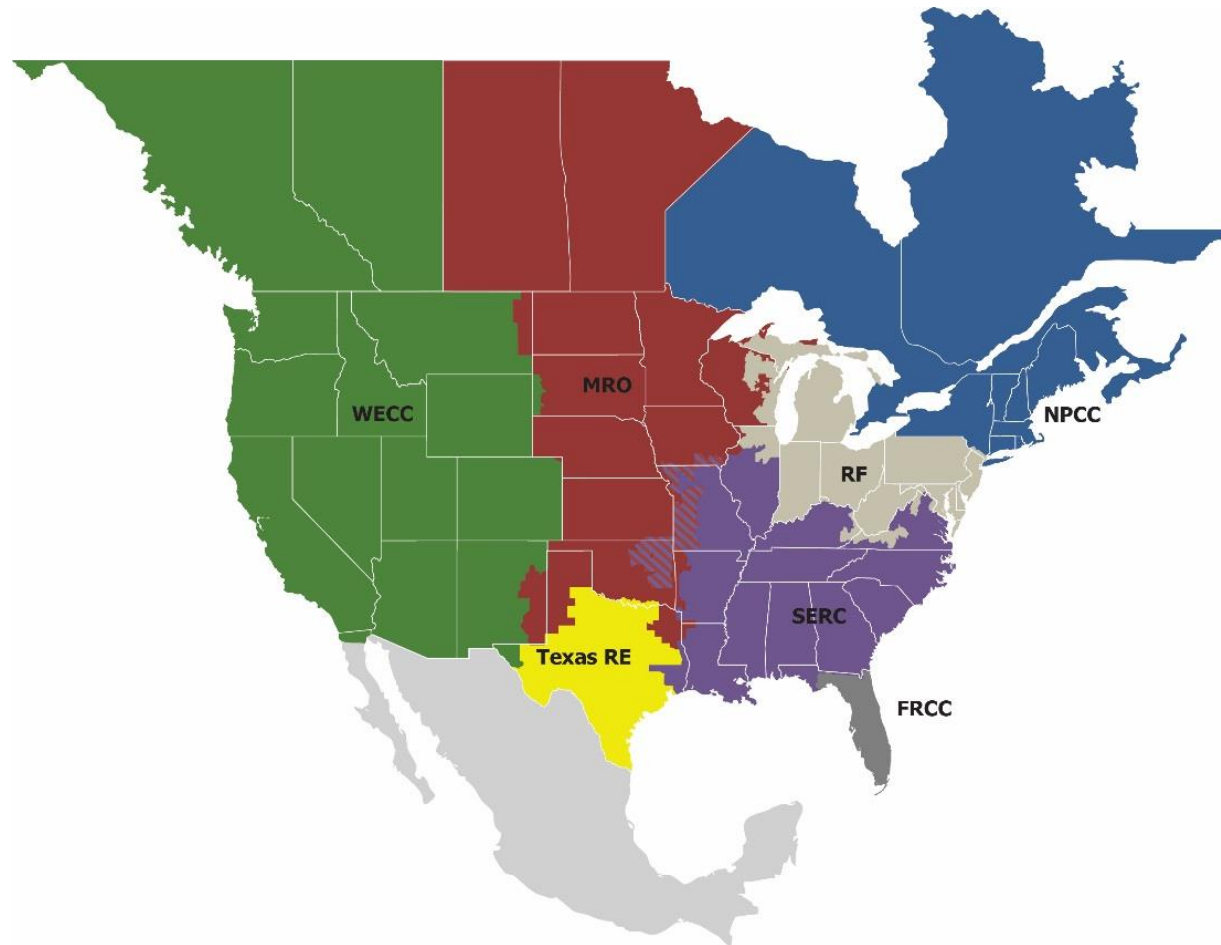
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Preface

The vision for the Electric Reliability Organization (ERO) Enterprise, which is comprised of the North American Electric Reliability Corporation (NERC) and the seven Regional Entities (REs), is a highly reliable and secure North American bulk power system (BPS). Our mission is to assure the effective and efficient reduction of risks to the reliability and security of the grid. The North American BPS is divided into seven RE boundaries as shown in the map below. The multicolored area denotes overlap as some load-serving entities participate in one Region while associated Transmission Owners/Operators participate in another. Refer to the [Data Concepts and Assumptions](#) section for more information. A map and list of the assessment areas can be found in the [Regional Assessments Dashboards](#) section.



About this Report

The objectives for NERC's *Winter Reliability Assessment* (WRA) are to identify, assess, and report details about the reliability of the North American BPS and to make recommendations as necessary. The WRA identifies potential resource deficiencies and operating reliability concerns, determines peak electricity demand and supply changes, and highlights unique regional challenges. The WRA represents the results of collaborative efforts that involve the Reliability Assessment Subcommittee (RAS), the Regions, and NERC staff to develop sound technical bases for understanding these potential concerns, changes, and challenges. The WRA is intended to enable entities to discuss their plans for the upcoming winter period to ensure BPS reliability.

Key Findings

NERC's annual WRA covers the three-month (December–February) 2018/2019 winter period. This assessment provides an evaluation of the generation resource and the transmission system adequacy necessary to meet projected winter peak demands. This assessment also monitors and identifies potential reliability issues of interest and regional areas of concern that pertain to meeting projected customer demands. The following key findings represent NERC's independent evaluation of electric generation capacity and potential operational concerns that may need to be addressed:

- **Adequate Resources for Winter:** Anticipated resources in all assessment areas meet or exceed their respective Reference Margin Levels for the upcoming winter period.¹
- **Continued Emphasis on Winter Preparedness Programs:** Generator unit winter preparedness programs continue to receive significant attention in assessment areas as a means to mitigate seasonal reliability risks. Cold weather events can trigger generator and transmission facility outages while simultaneously driving electrical demand to seasonal peaks. Across North America, NERC Regional Entities, Reliability Coordinators, and independent system operators/regional transmission organizations conduct various activities aimed at ensuring generator unit reliability under extreme winter weather conditions (see the [Regional Assessments Dashboards](#) section of this report). Through webinars, workshops, seasonal studies, and operator checklists, entities are encouraged to incorporate best practices and lessons from previous winter operations.
- **Incentives in Market Areas Target Generator Performance:** Market mechanisms are a useful tool for incentivizing generator performance during extreme weather conditions. According to PJM's analysis of generating unit performance data from the last week of 2017 and first week of 2018 (a period referred to as the Cold Snap, when extreme cold temperatures and winter weather across eastern North America led to high electric demand and tight fuel supplies), overall capacity performance (CP) units had fewer forced outages than non-CP units. This program continues in the PJM market area for the upcoming winter season. In ISO New England, a similar program known as pay-for-performance (PFP) is fully implemented for the coming winter and provides strong incentives for all suppliers of generation capacity to maximize unit availability and performance during scarcity conditions on the BPS.
- **Entities Focus on Reducing Risks of Generator Fuel Supply Issues:** Entities are implementing processes and strategies to promote fuel assurance and reduce risks to the BPS from seasonal generator fuel supply issues. During the 2017/2018 Cold Snap, some areas faced generator fuel supply concerns as dual-fueled generators turned to fuel oil over higher-priced natural gas. As fuel oil reserves declined, replenishment was impacted by inclement weather. Below are some noteworthy actions that entities are taking to mitigate generator fuel supply risk for the upcoming winter season:
 - ISO New England is implementing new periodic energy assessments aimed at providing market participants with early indication of potential fuel scarcity conditions that can help inform generator fuel procurement decisions. The new periodic assessments complement existing fossil fuel surveying and monitoring activities and natural-gas-fired generator day-ahead confirmations that are employed to promote fuel assurance in the area.
 - In New York ISO, seasonal generator fuel surveys indicate oil-burning units have sufficient start-of-winter inventories and arrangements for replacement fuel. Emergency protocols are in place for communicating electric reliability concerns to pipelines and natural gas operators during tight electric operating conditions.

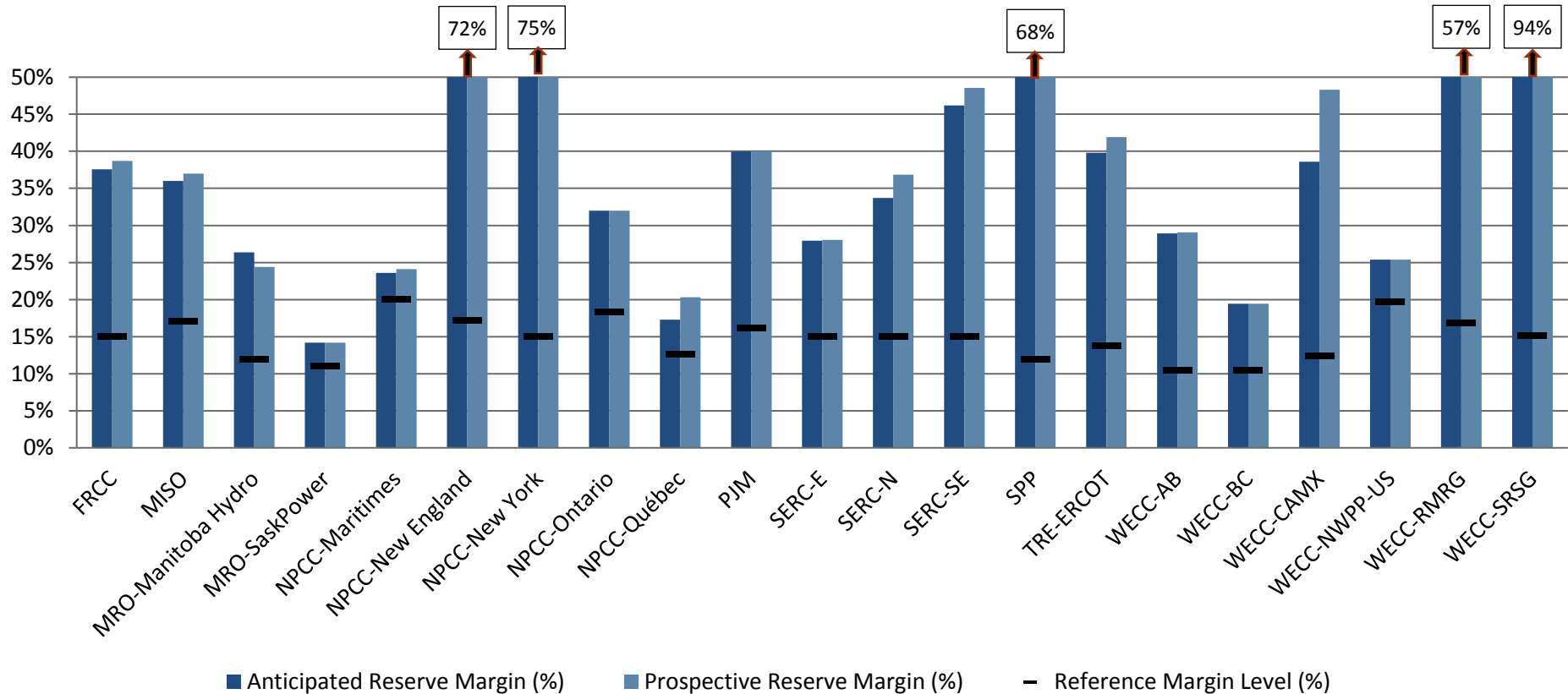
¹ The Reference Margin Level is typically based on load, generation, and transmission characteristics for each assessment area. In some cases, the Reference Margin Level is a requirement implemented by the respective state(s), provincial authorities, ISO/RTO, or other regulatory bodies. See [Data Concepts and Assumptions](#) section of this report.

- In PJM, daily natural gas infrastructure analysis is performed to project transmission and generation reserve impacts to the PJM system from natural gas pipeline contingencies.
- **Natural Gas Constraints in Southern California Continue to Have the Potential to Impact Electric Generators in Extreme Conditions:** Natural gas storage and transportation limitations associated with the Aliso Canyon storage facility and natural gas transmission pipelines in the area persist for Winter 2018/2019. The Aliso Canyon technical assessment group found the risk of natural gas service curtailment to be unchanged for the coming winter despite an increase in authorized natural gas inventory at Aliso Canyon. Although natural gas supplies are assessed to be sufficient for anticipated conditions and potential short, single-day demand spikes, there is risk that an extended multi-day period of high demand could reduce storage inventories to a point where natural gas curtailment is needed.² As in the two preceding winter seasons, mitigating measures at California Independent System Operator, including demand response, generation redispatching, and increased electricity imports to affected areas, remain in place.

² See the *Aliso Canyon Risk Assessment Technical Report Winter 2018/19 Supplement*, which is available from the California Public Utilities Commission. The technical assessment group is composed of experts from CPUC, California Energy Commission, the California Independent System Operator, and the Los Angeles Department of Water and Power.

Resource Adequacy

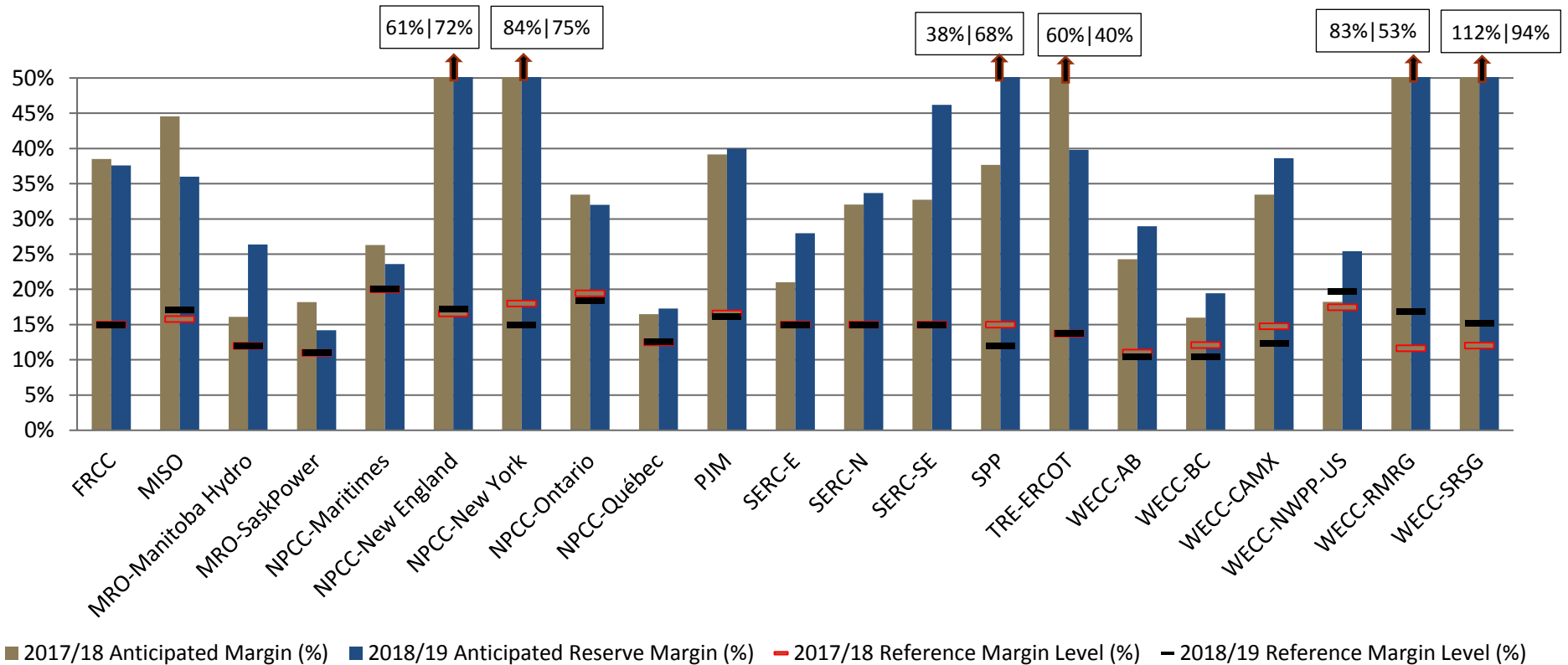
The Anticipated Reserve Margin, based on resource capacity, is a metric used to evaluate resource adequacy by comparing the projected capability of anticipated resources to serve forecasted peak load.³ Large year-to-year changes in anticipated resources or forecasted peak load (net internal demand) can greatly impact Planning Reserve Margin calculations. All assessment areas have sufficient Anticipated Reserve Margins to meet or exceed their Reference Margin Level for the 2018/2019 winter as shown in the figure below.



Winter 2018/2019 Anticipated/Prospective Reserve Margins Compared to Reference Margin Level

³ Generally, anticipated resources include generators and firm capacity transfers that are expected to be available to serve load during electrical peak loads for the season. Prospective resources are those that could be available but do not meet criteria to be counted as anticipated resources. Refer to the [Data Concepts and Assumptions](#) section for additional information on anticipated/prospective reserve margins, anticipated/prospective resources, and Reference Margin Levels.

The figure below provides the relative change in Anticipated Reserve Margin from the 2017/2018 winter period to the 2018/2019 winter period. Significant changes can indicate potential operational issues that emerge between reporting years. Additional details concerning specific areas of interest to NERC are provided in the [Regional Assessments Dashboards](#) section of this report.

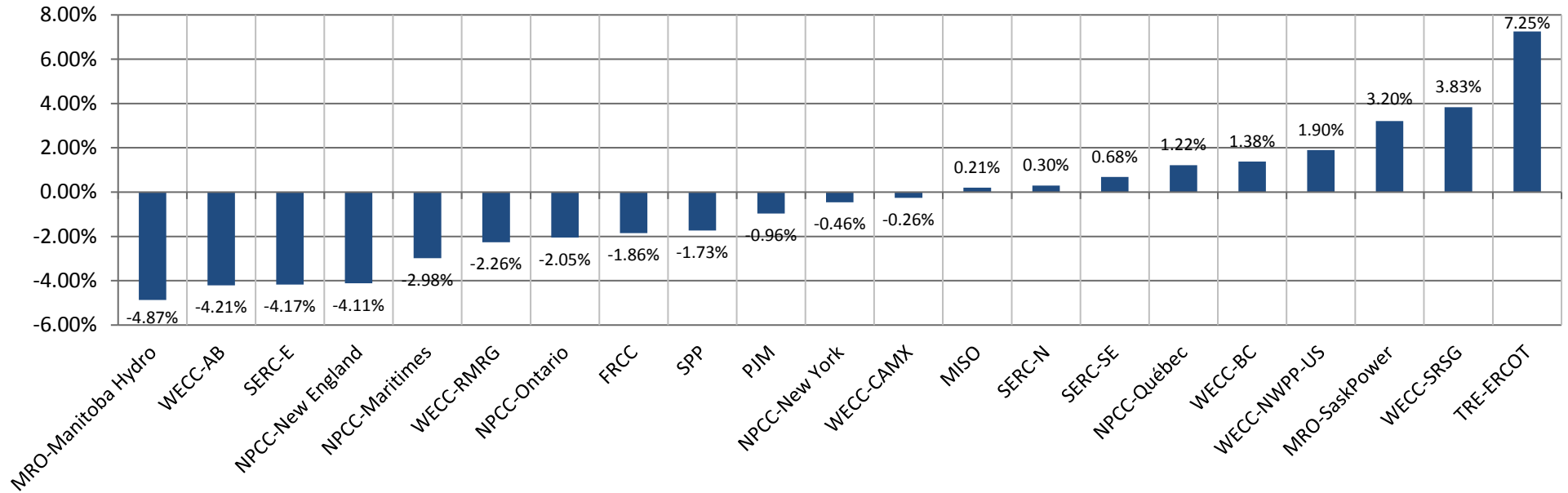


Year-to-Year Change in Anticipated Reserve Margins: Winter 2017/2018 to Winter 2018/2019

While Anticipated Reserve Margins indicate adequate resources for winter throughout the North American BPS, fuel assurance risk remains a reliability concern in some assessment areas. Demand for natural gas is growing both for use as a generator fuel source and for winter heating needs. Winter peak electrical demand can coincide with peak natural gas demand and potentially exceed capacity of natural gas supplies or delivery infrastructure. Generating units that lack alternate fuel sources or firm commitments for natural gas supply may not be able to deliver their full capacity. Operators have implemented steps to mitigate fuel assurance risks, such as generator performance market mechanisms, communications protocols between electric and natural gas operators, and new energy forecasts in ISO New England that provide fuel supply information to wholesale electricity market participants.

Internal Demand

Peak demand forecast for most assessment areas has decreased or remained flat compared to prior assessments. Some assessment areas are forecasting growth in net internal demand of over three percent. The increases in forecasted net internal demand for each assessment area are shown in the figure below.⁴

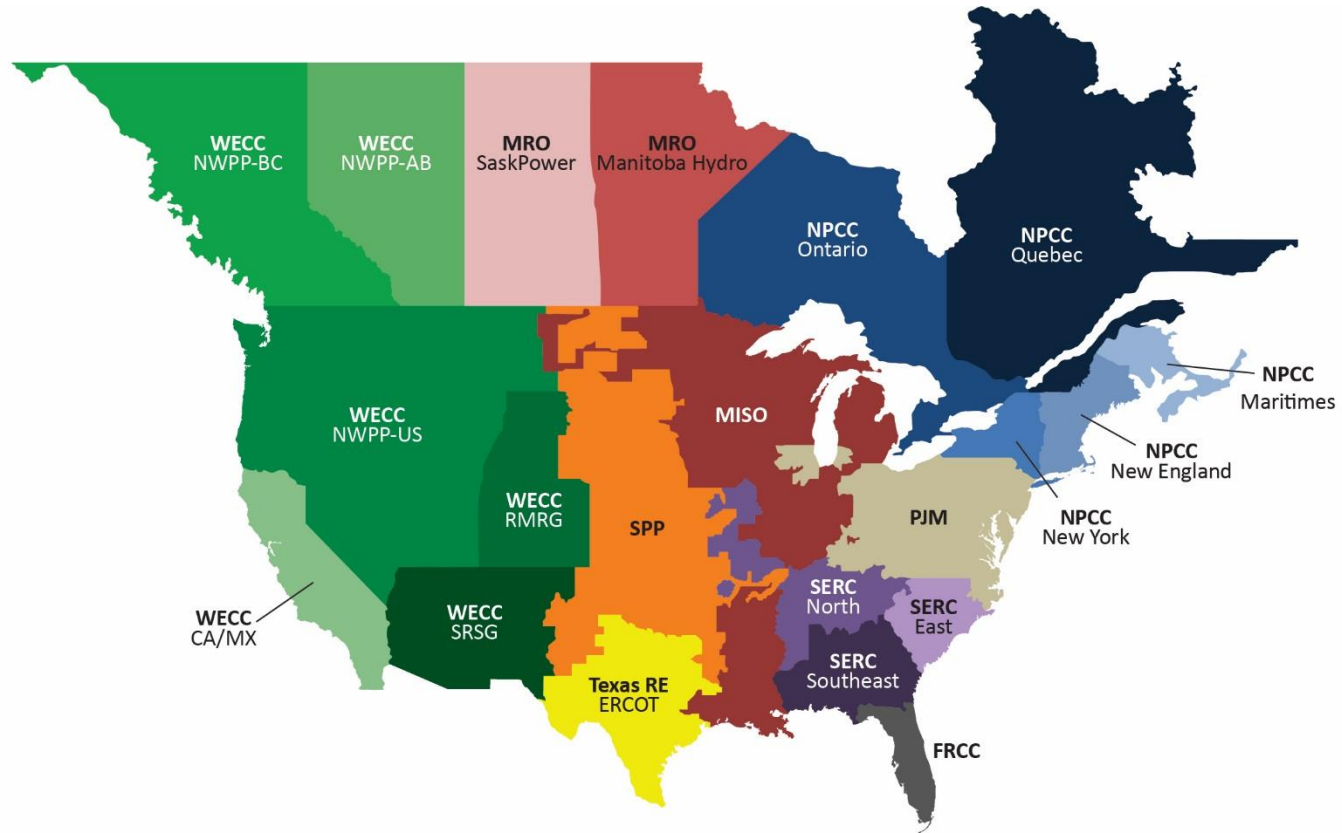


Change in Net Internal Demand: 2018/2019 Winter Forecast Compared To 2017/2018 Winter Forecast

⁴ Changes in modeling and methods may also contribute to year-to-year changes in forecasted net internal demand projections.

Regional Assessments Dashboards

The following assessment area dashboards and summaries were developed based on data and narrative information collected by NERC from the seven Regional Entities on an assessment area basis.



FRCC – Florida Reliability Coordinating Council
 ■ FRCC

MRO – Midwest Reliability Organization
 ■ MISO
 ■ MRO-Manitoba Hydro
 ■ MRO-SaskPower

NPCC – Northeast Power Coordinating Council
 ■ NPCC-Maritimes
 ■ NPCC-New England
 ■ NPCC-New York
 ■ NPCC-Ontario
 ■ NPCC-Québec

RF – ReliabilityFirst
 ■ PJM

SERC – SERC Reliability Corporation
 ■ SERC-East
 ■ SERC-North
 ■ SERC-Southeast

SPP – Southwest Power Pool
 ■ SPP

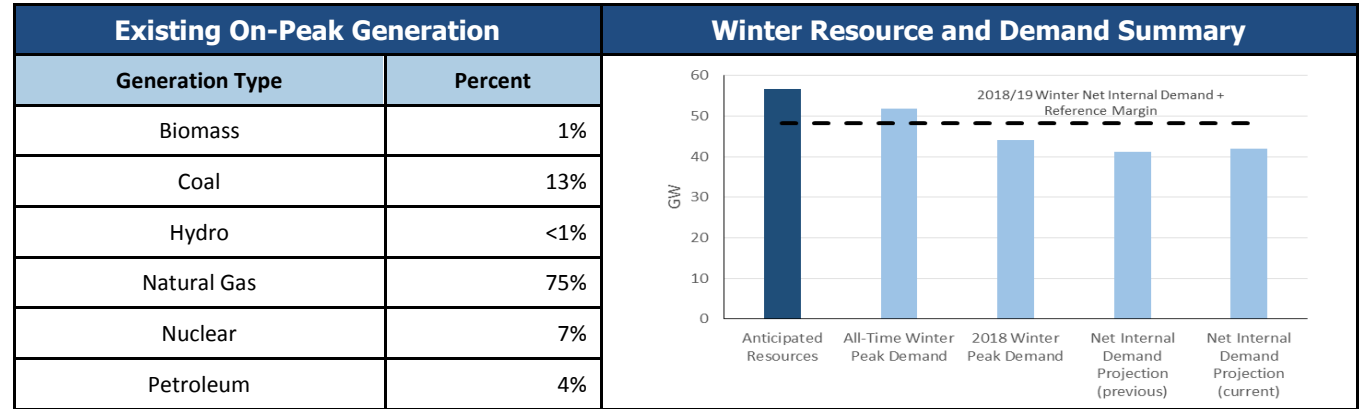
Texas RE – Texas Reliability Entity
 ■ Texas RE-ERCOT

WECC – Western Electricity Coordinating Council
 ■ WECC-CA/MX
 ■ WECC-NWPP-AB
 ■ WECC-NWPP-BC
 ■ WECC-NWPP-US
 ■ WECC-RMRG
 ■ WECC-SRSG



FRCC

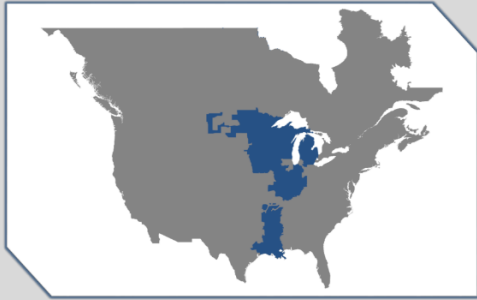
The Florida Reliability Coordinating Council's (FRCC) membership includes 32 Regional Entity Division members and 22 Member Services Division members composed of investor-owned utilities (IOUs), cooperatives, municipal utilities, power marketers, and independent power producers. FRCC is divided into 10 Balancing Authorities with 36 registered entities (including both members and non-members) performing the functions identified in the NERC Reliability Functional Model and defined in the NERC Reliability Standards. The Region contains a population of over 16 million people and has a geographic coverage of about 50,000 square miles over Florida.



FRCC Resource Adequacy Data			
Demand, Resource, and Reserve Margins	2017/2018 WRA	2018/2019 WRA	2017/2018 vs. 2018/2019 WRA
Demand Projections	Megawatts (MW)	Megawatts (MW)	Net Change (%)
Total Internal Demand (50/50)	44,836	44,190	-1.4%
Demand Response: Available	2,842	2,975	4.7%
Net Internal Demand	41,994	41,215	-1.9%
Resource Projections	Megawatts (MW)	Megawatts (MW)	Net Change (%)
Existing-Certain Capacity	56,190	53,340	-5.1%
Tier 1 Planned Capacity	715	1,912	-
Net Firm Capacity Transfers	1,253	1,453	16.0%
Anticipated Resources	58,158	56,705	-2.5%
Existing-Other Capacity	535	457	-14.6%
Prospective Resources	58,693	57,162	-2.6%
Reserve Margins	Percent (%)	Percent (%)	Annual Difference
Anticipated Reserve Margin	38.5%	37.6%	-0.9
Prospective Reserve Margin	39.8%	38.7%	-1.1
Reference Margin Level	15.0%	15.0%	0.0

Highlights

- The FRCC Region does not anticipate reliability issues for the upcoming winter season from resource adequacy.
- The net change in existing capacity for the upcoming winter is a result of retirements in coal-fired and older natural gas units (4,700 MW) and addition of over 1,900 MW in new natural gas and solar resources.
- Generator fuel assurance attributes in the Region include the following:
 - A majority of the natural gas pipeline capacity into Florida is contractually allocated to electric generators.
 - Generator operators maintain liquid backup fuel inventories at multiple locations to mitigate fuel supply risks from potential natural gas supply interruptions and peak demand conditions.
- FRCC continues to promote winter preparedness and performs a detailed winter operational transmission assessment and operational seasonal study to assess the reliability of the BPS during forecasted winter peak load.



MISO

The Midcontinent Independent System Operator, Inc. (MISO) is a not-for-profit, member-based organization administering wholesale electricity markets that provide customers with valued service; reliable, cost-effective systems and operations; dependable and transparent prices; open access to markets; and planning for long-term efficiency. MISO manages energy, reliability, and operating reserve markets that consist of 36 local Balancing Authorities and 394 market participants, serving approximately 42 million customers. Although parts of MISO fall in three NERC Regions, MRO is responsible for coordinating data and information submitted for NERC’s reliability assessments.

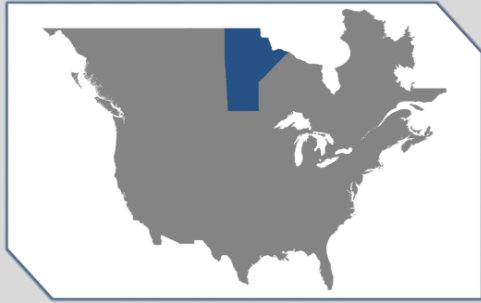
**For this NERC 2018/2019 WRA, resource projections are based on data provided by MISO from its winter resource assessment. In the previous NERC WRA, resource projections were provided by MISO in its input to the NERC Long-term Reliability Assessment. Some net change from the prior-year NERC WRA is attributed to resource adequacy calculation differences.*

Existing On-Peak Generation		Winter Resource and Demand Summary	
Generation Type	Percent		
Biomass	<1%		
Coal	42%		
Hydro	1%		
Natural Gas	42%		
Nuclear	9%		
Petroleum	2%		
Pumped Storage	2%		
Solar	<1%		
Wind	2%		

MISO Resource Adequacy Data			
Demand, Resource, and Reserve Margins	2017/2018 WRA	2018/2019 WRA	2017/2018 vs. 2018/2019 WRA
Demand Projections	Megawatts (MW)	Megawatts (MW)	Net Change (%)
Total Internal Demand (50/50)	103,731	102,587	-1.1%
Demand Response: Available	4,347	2,715	-37.5%
Net Internal Demand	99,384	99,872	0.5%
Resource Projections	Megawatts (MW)	Megawatts (MW)	Net Change (%)
Existing-Certain Capacity	144,108	135,995	-5.6%*
Tier 1 Planned Capacity	1,559	176	-
Net Firm Capacity Transfers	-1,994	-8	-99.6%
Anticipated Resources	143,673	136,163	-5.2%
Existing-Other Capacity	2,194	1,067	-51.4%
Prospective Resources	147,642	137,230	-7.1%
Reserve Margins	Percent (%)	Percent (%)	Annual Difference
Anticipated Reserve Margin	45.0%	36.3%	-8.7*
Prospective Reserve Margin	48.6%	37.4%	-11.2*
Reference Margin Level	15.8%	17.1%	1.3

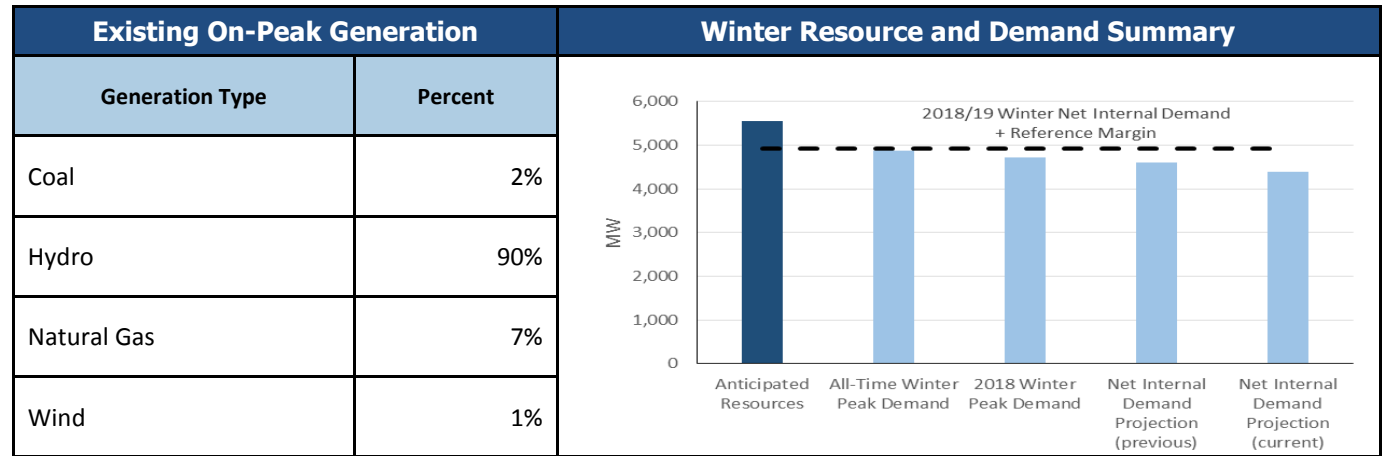
Highlights

- MISO anticipates that reliability will be maintained during the upcoming season.
- MISO is working with neighboring Reliability Coordinators (SPP, Southeastern, and TVA) to put in place enhanced communication and operating procedures to address lessons learned from the January 2018 cold weather event.
- MISO hosted its annual a Winter Readiness Workshop on October 29, 2018, to prepare operators for the upcoming season. Topics presented at the workshop include forecasted reserve margin under various scenarios, transmission assessment, and a review of emergency operating procedures. Operating tools and resources for natural gas-electric situational awareness were reviewed as well as preparedness measures and winterization for generator owners. An enhanced winterization review process is being implemented that includes communicating lessons learned.



MRO-Manitoba Hydro

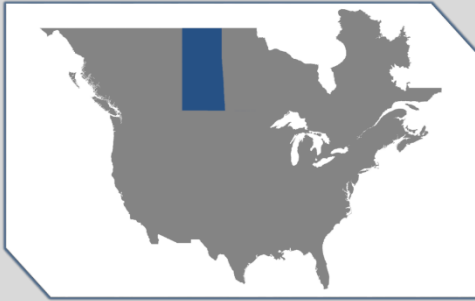
Manitoba Hydro is a provincial crown corporation that provides electricity to about 573,000 customers throughout Manitoba and natural gas service to about 279,000 customers in various communities throughout southern Manitoba. The Province of Manitoba has a population of about 1.3 million people in an area of 250,946 square miles. Manitoba Hydro is winter peaking. No change in the footprint area is expected during the assessment period. Manitoba Hydro is its own Planning Coordinator and Balancing Authority. Manitoba Hydro is a coordinating member of MISO. MISO is the Reliability Coordinator for Manitoba Hydro.



MRO - Manitoba Hydro Resource Adequacy Data			
Demand, Resource, and Reserve Margins	2017/2018 WRA	2018/2019 WRA	2017/2018 vs. 2018/2019 WRA
Demand Projections	Megawatts (MW)	Megawatts (MW)	Net Change (%)
Total Internal Demand (50/50)	4,612	4,388	-4.9%
Demand Response: Available	0	0	0.0%
Net Internal Demand	4,612	4,388	-4.9%
Resource Projections	Megawatts (MW)	Megawatts (MW)	Net Change (%)
Existing-Certain Capacity	5,497	5,583	1.6%
Tier 1 Planned Capacity	0	0	-
Net Firm Capacity Transfers	-142	-38	-73.2%
Anticipated Resources	5,355	5,545	3.5%
Existing-Other Capacity	122	5	-95.9%
Prospective Resources	5,477	5,458	-0.3%
Reserve Margins	Percent (%)	Percent (%)	Annual Difference
Anticipated Reserve Margin	16.0%	26.4%	10.4
Prospective Reserve Margin	18.7%	24.4%	5.7
Reference Margin Level	12.0%	12.0%	0.0

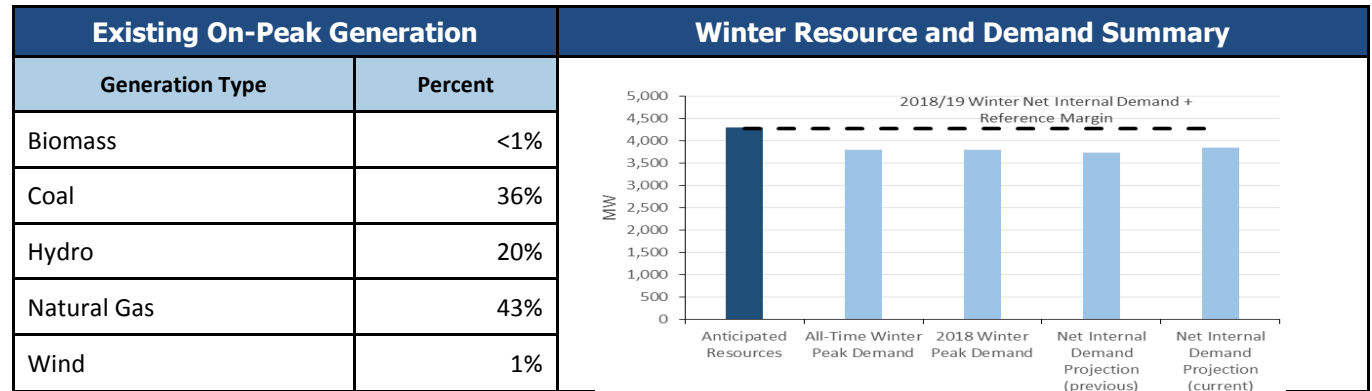
Highlights

- There are no reliability issues for the upcoming season that are unique to this assessment area. Resource adequacy concerns are not anticipated.
- The Bipole III high voltage direct current transmission line was placed in service in 2018, providing increased redundancy in transmission capacity. The line connects generation in northern Manitoba with the majority of Manitoba’s load in southern Manitoba.
- There are no changes to the assessment area’s winter prepared programs.



MRO-SaskPower

Saskatchewan is a province of Canada and comprises a geographic area of 651,900 square kilometers (251,700 square miles) with approximately 1.1 million people. Peak demand is experienced in the winter. The Saskatchewan Power Corporation (SaskPower) is the Planning Coordinator and Reliability Coordinator for the province of Saskatchewan and is the principal supplier of electricity in the province. SaskPower is a provincial crown corporation and, under provincial legislation, is responsible for the reliability oversight of the Saskatchewan BPS and its interconnections.



MRO - SaskPower Resource Adequacy Data			
Demand, Resource, and Reserve Margins	2017/2018 WRA	2018/2019 WRA	2017/2018 vs. 2018/2019 WRA
Demand Projections	Megawatts (MW)	Megawatts (MW)	Net Change (%)
Total Internal Demand (50/50)	3,726	3,843	3.1%
Demand Response: Available	85	85	0.0%
Net Internal Demand	3,641	3,758	3.2%
Resource Projections	Megawatts (MW)	Megawatts (MW)	Net Change (%)
Existing-Certain Capacity	4,279	4,266	-0.3%
Tier 1 Planned Capacity	0	0	-
Net Firm Capacity Transfers	25	25	0.0%
Anticipated Resources	4,304	4,291	-0.3%
Existing-Other Capacity	0	0	0.0%
Prospective Resources	4,304	4,291	-0.3%
Reserve Margins	Percent (%)	Percent (%)	Annual Difference
Anticipated Reserve Margin	18.2%	14.2%	-4.0
Prospective Reserve Margin	18.2%	14.2%	-4.0
Reference Margin Level	11.0%	11.0%	0.0

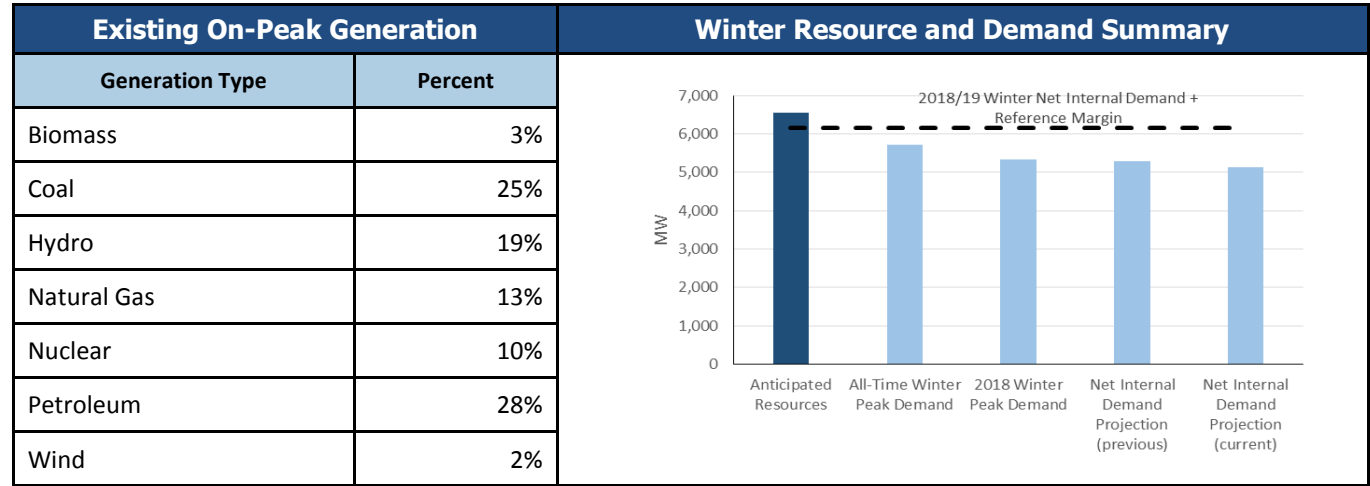
Highlights

- SaskPower anticipates that it will maintain system reliability during the upcoming season.
- There are no known operational challenges anticipated for the upcoming season.
- There are no emerging reliability issues anticipated that will affect resource adequacy for the upcoming season.
- There are no changes to winter preparedness programs.



NPCC-Maritimes

The Maritimes assessment area is a winter-peaking NPCC subregion that contains two Balancing Authorities. It is comprised of the Canadian provinces of New Brunswick, Nova Scotia, and Prince Edward Island, and the northern portion of Maine, which is radially connected to the New Brunswick power system. The area covers 58,000 square miles with a total population of 1.9 million people.



NPCC - Maritimes Resource Adequacy Data			
Demand, Resource, and Reserve Margins	2017/2018 WRA	2018/2019 WRA	2017/2018 vs. 2018/2019 WRA
	Megawatts (MW)	Megawatts (MW)	Net Change (%)
Demand Projections			
Total Internal Demand (50/50)	5,555	5,387	-3.0%
Demand Response: Available	263	253	-3.8%
Net Internal Demand	5,292	5,134	-3.0%
Resource Projections			
Existing-Certain Capacity	6,676	6,560	-1.7%
Tier 1 Planned Capacity	8	0	-
Net Firm Capacity Transfers	0	0	0.0%
Anticipated Resources	6,684	6,560	-1.9%
Existing-Other Capacity	20	0	-100.0%
Prospective Resources	6,704	6,560	-2.1%
Reserve Margins			
Anticipated Reserve Margin	26.3%	27.8%	1.5
Prospective Reserve Margin	26.7%	27.8%	1.1
Reference Margin Level	20.0%	20.0%	0.0

Highlights

- The Maritimes area anticipates system reliability will be maintained during the upcoming season.
- Maritimes is a winter-peaking system with few planned transmission or generator outages. Operators are equipped with procedures and mitigations to address unplanned outages and maintain system reliability.



NPCC-New England

ISO New England (ISO-NE) Inc. is a regional transmission organization that serves Connecticut, Maine, Massachusetts, New Hampshire, Rhode Island, and Vermont. It is responsible for the reliable day-to-day operation of New England’s bulk power generation and transmission system, and it also administers the area’s wholesale electricity markets and manages the comprehensive planning of the regional BPS. The New England regional electric power system serves approximately 14.5 million people over 68,000 square miles.

Existing On-Peak Generation		Winter Resource and Demand Summary	
Generation Type	Percent	GW	
Biomass	3%		
Coal	3%		
Hydro	5%		
Natural Gas	50%		
Nuclear	12%		
Petroleum	21%		
Pumped Storage	5%		
Solar	<1%		
Wind	1%		

NPCC - New England Resource Adequacy Data			
Demand, Resource, and Reserve Margins	2017/2018 WRA	2018/2019 WRA	2017/2018 vs. 2018/2019 WRA
Demand Projections	Megawatts (MW)	Megawatts (MW)	Net Change (%)
Total Internal Demand (50/50)	21,197	20,357	-4.0%
Demand Response: Available	388	403	3.9%
Net Internal Demand	20,809	19,954	-4.1%
Resource Projections	Megawatts (MW)	Megawatts (MW)	Net Change (%)
Existing-Certain Capacity	31,540	32,939	4.4%
Tier 1 Planned Capacity	780	301	-
Net Firm Capacity Transfers	1,232	986	-20.0%
Anticipated Resources	33,551	34,226	2.0%
Existing-Other Capacity	210	204	-2.8%
Prospective Resources	33,790	34,437	1.9%
Reserve Margins	Percent (%)	Percent (%)	Annual Difference
Anticipated Reserve Margin	61.2%	71.5%	10.3
Prospective Reserve Margin	62.4%	72.6%	10.2
Reference Margin Level	16.6%	17.2%	0.6

Highlights

- ISO-NE expects to meet its regional resource adequacy requirements this 2018/2019 winter period; however, a growing concern is whether there will be sufficient energy available to satisfy electricity demand during an extended cold spell given the evolving resource mix and fuel delivery infrastructure.
- Since the previous winter, 1,650 MW of natural-gas-fired generation has been added, including an 850 MW dual-fueled unit.
- ISO-NE is implementing a periodic 21-day energy assessment, which will be published to provide market participants with early indication of potential fuel scarcity conditions and help inform fuel procurement decisions. ISO-NE continues to survey fossil fueled generators for fuel inventory data monthly and more frequently when warranted.
- Pay-for-performance market design is implemented for the upcoming winter to provide strong financial incentives for all suppliers of capacity to maximize availability during scarcity conditions.
- Despite having sufficient capacity resources, power system operations could become challenging during periods of cold weather if fuel constraints impact the ability of generators to obtain fuel to produce electricity.

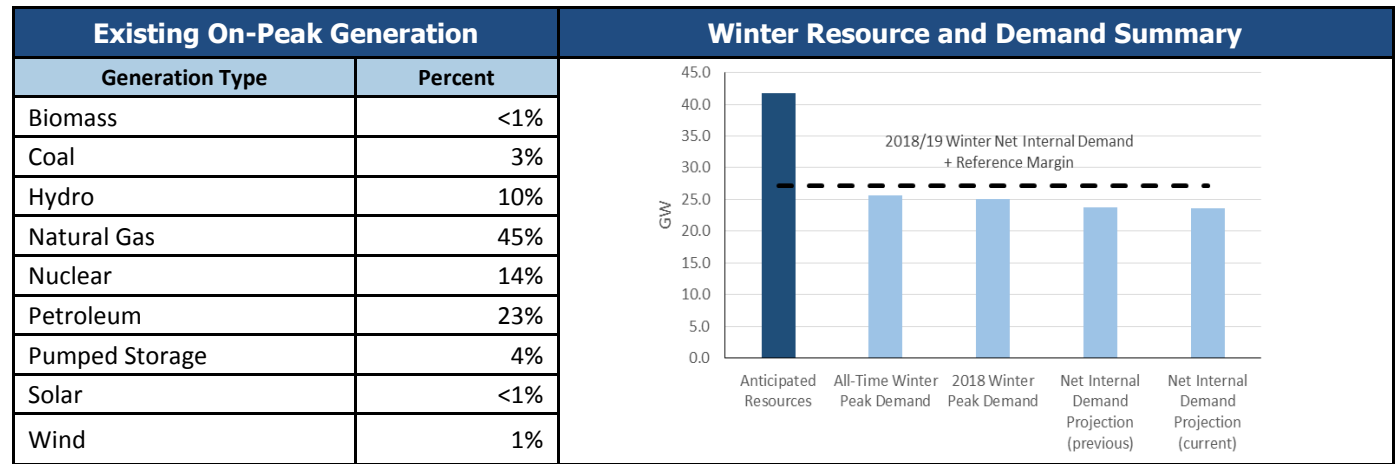


NPCC-New York

The New York Independent System Operator (NYISO) is the only Balancing Authority (NYBA) within the state of New York. NYISO is a single-state ISO that was formed as the successor to the New York Power Pool—a consortium of the eight IOUs—in 1999. NYISO manages the New York State transmission grid encompassing approximately 11,000 miles of transmission lines, over 47,000 square miles, and serving the electric needs of 19.5 million people. New York experienced its all-time peak load of 33,956 MW in the summer of 2013.

** Wind, solar, and run-of-river hydro resource projected capacity for 2017/2018 WRA was based on nameplate resource capacity. To more accurately project winter resource capacity, variable generation resources have been derated for the 2018/2019 WRA based on NYISO's unforced capacity values. This change in reporting for the 2018/2019 WRA results in a lower capacity value for a similar resource mix.*

***Changed per NERC assessment default level of 15 percent used in the NERC 2017 Long-Term Reliability Assessment*



NPCC - New York Resource Adequacy Data			
Demand, Resource, and Reserve Margins	2017/2018 WRA	2018/2019 WRA	2017/2018 vs. 2018/2019 WRA
Demand Projections	Megawatts (MW)	Megawatts (MW)	Net Change (%)
Total Internal Demand (50/50)	24,365	24,269	-0.4%
Demand Response: Available	625	637	1.9%
Net Internal Demand	23,740	23,632	-0.5%
Resource Projections	Megawatts (MW)	Megawatts (MW)	Net Change (%)
Existing-Certain Capacity	41,257*	39,861*	-3.4%*
Tier 1 Planned Capacity	106	0	-
Net Firm Capacity Transfers	2,311	1,519	-34.3%
Anticipated Resources	43,674	41,380*	-5.3%*
Existing-Other Capacity	0	0	0.0%
Prospective Resources	44,190	41,596*	-5.9%*
Reserve Margins	Percent (%)	Percent (%)	Annual Difference
Anticipated Reserve Margin	84.0%	75.1%*	-8.9*
Prospective Reserve Margin	86.1%	76.0%*	-10.1*
Reference Margin Level	18.0%	15.0%	N/A**

Highlights

- As New York is a summer-peaking area, it does not anticipate any emerging reliability issues during the 2018/2019 winter assessment period and is projecting adequate surplus capacity margins above its operating reserve requirements.
- Seasonal generator fuel surveys indicate oil-burning units have sufficient start-of-winter inventories and arrangements for replacement fuel. Emergency communication protocol is in place to communicate electric reliability concerns to pipelines and natural gas operators during tight electric operating conditions.
- New York's winter preparedness programs have been effective in ensuring reliable operation of the BPS during cold weather months.



NPCC-Ontario

The Independent Electricity System Operator (IESO) is the Balancing Authority and Reliability Coordinator for the province of Ontario. In addition to administering the area’s wholesale electricity markets, the IESO plans for Ontario’s future energy needs. Ontario covers more than 415,000 square miles and has a population of over 14 million people. Ontario is interconnected electrically with Québec, MRO-Manitoba, states in MISO (Minnesota and Michigan), and NPCC-New York.

Existing On-Peak Generation		Winter Resource and Demand Summary
Generation Type	Percent	
Biomass	2%	
Hydro	25%	
Natural Gas/Petroleum	24%	
Nuclear	43%	
Solar	<1%	
Wind	6%	

NPCC - Ontario Resource Adequacy Data			
Demand, Resource, and Reserve Margins	2017/2018 WRA	2018/2019 WRA	2017/2018 vs. 2018/2019 WRA
	Megawatts (MW)	Megawatts (MW)	Net Change (%)
Demand Projections			
Total Internal Demand (50/50)	21,761	21,334	-2.0%
Demand Response: Available	752	795	5.7%
Net Internal Demand	21,009	20,539	-2.2%
Resource Projections			
Existing-Certain Capacity	27,068	27,666	2.2%
Tier 1 Planned Capacity	22	40	-
Net Firm Capacity Transfers	-500	-500	0.0%
Anticipated Resources	26,590	27,206	2.3%
Existing-Other Capacity	0	0	0.0%
Prospective Resources	26,590	27,206	2.3%
Reserve Margins			
Anticipated Reserve Margin	33.4%	32.0%	-1.4
Prospective Reserve Margin	33.4%	32.0%	-1.4
Reference Margin Level	19.4%	18.4%	-1.0

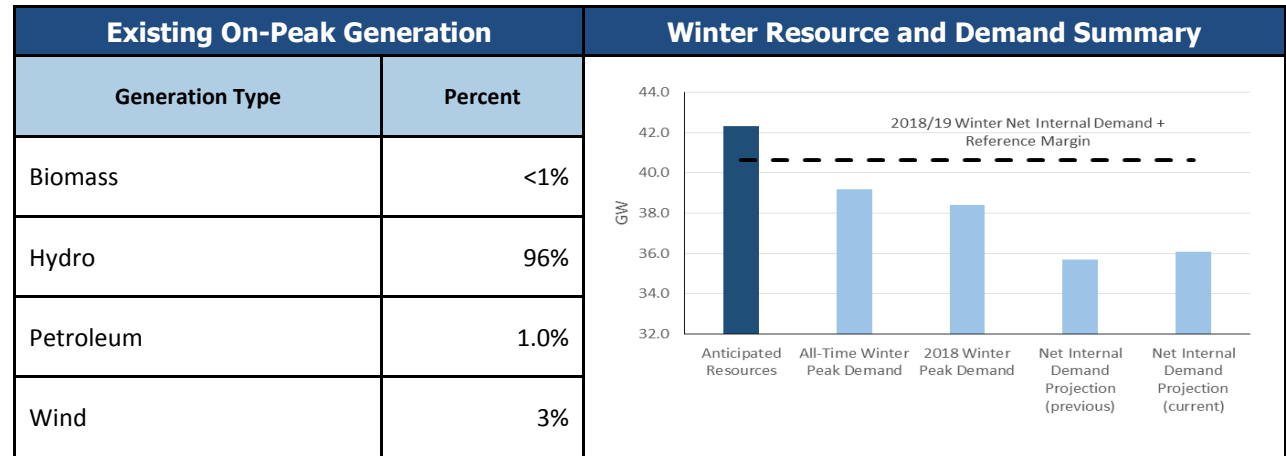
Highlights

- IESO anticipates that it will maintain reliability on its system during the upcoming season.
- Import and export may be reduced between New York and Ontario due to long-term interconnection equipment outage at the St. Lawrence Transmission Station. Efforts are underway to manage this outage and to consider longer-term solutions. The in-service date for the Napanee Generating Station (985 MW) is delayed to after this winter period.
- The IESO is enhancing its planning reports and processes to give market participants greater transparency and to provide longer-term certainty on outage requests.
- No changes are anticipated to the IESO’s Seasonal (Unit) Readiness Program.



NPCC-Québec

The Québec assessment area (Province of Québec) is a winter-peaking NPCC subregion that covers 595,391 square miles with a population of eight million. Québec is one of the four NERC interconnections in North America, with ties to Ontario, New York, New England, and the Maritimes, consisting of either HVDC ties, radial generation, or load to and from neighboring systems.



NPCC - Québec Resource Adequacy Data			
Demand, Resource, and Reserve Margins	2017/2018 WRA	2018/2019 WRA	2017/2018 vs. 2018/2019 WRA
Demand Projections	Megawatts (MW)	Megawatts (MW)	Net Change (%)
Total Internal Demand (50/50)	37,921	38,461	1.4%
Demand Response: Available	2,248	2,354	4.7%
Net Internal Demand	35,673	36,107	1.2%
Resource Projections	Megawatts (MW)	Megawatts (MW)	Net Change (%)
Existing-Certain Capacity	41,340	42,046	1.7%
Tier 1 Planned Capacity	541	0	-
Net Firm Capacity Transfers	-330	299	190.6%
Anticipated Resources	41,551	42,345	1.9%
Existing-Other Capacity	0	0	0.0%
Prospective Resources	42,651	43,445	1.9%
Reserve Margins	Percent (%)	Percent (%)	Annual Difference
Anticipated Reserve Margin	16.5%	17.3%	0.8
Prospective Reserve Margin	19.6%	20.3%	0.7
Reference Margin Level	12.5%	12.6%	0.1

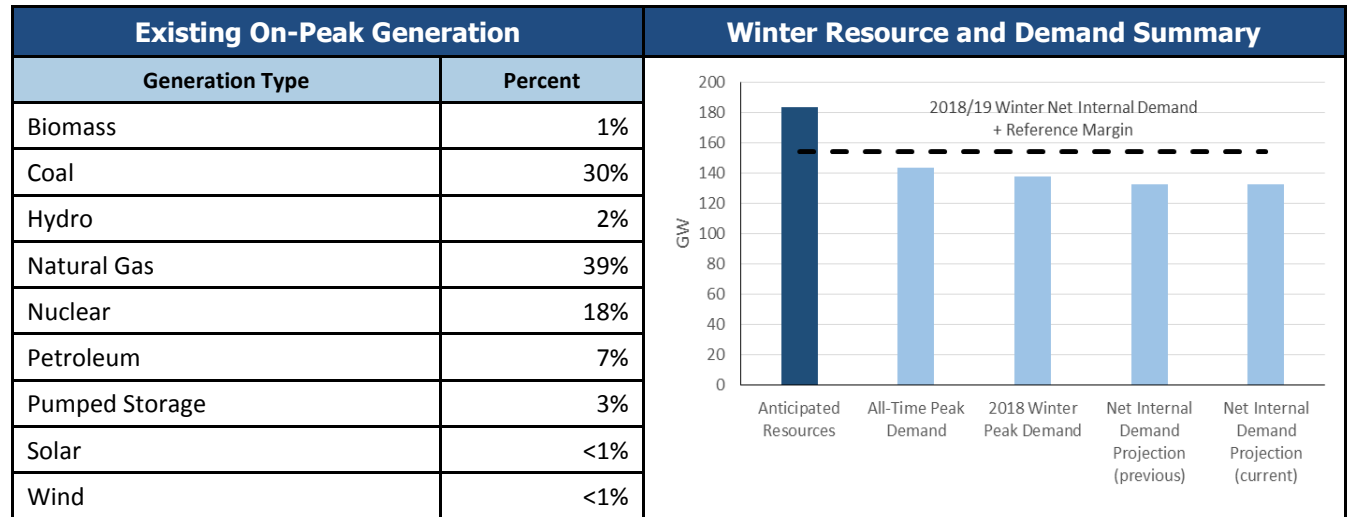
Highlights

- Québec predicts that it will maintain system resource adequacy this winter.
- The Québec area is a winter-peaking system with predominately hydroelectric generation resources. Adequate capacity margins above its reference reserve requirements are projected for the 2018/2019 winter assessment period.
- No changes have been made to the assessment area’s winter preparedness programs.
- Delays to a new 735 kV line planned for 2018 are not expected to impact reliability during the upcoming winter season. A temporary remedial action scheme is implemented to prevent potential voltage issues that could arise during specific events.



PJM

PJM Interconnection is a regional transmission organization (RTO) that coordinates the movement of wholesale electricity in all or parts of Delaware, Illinois, Indiana, Kentucky, Maryland, Michigan, New Jersey, North Carolina, Ohio, Pennsylvania, Tennessee, Virginia, West Virginia, and the District of Columbia. PJM serves 61 million people and covers 243,417 square miles. PJM is a Balancing Authority, Planning Coordinator, Transmission Planner, Resource Planner, Interchange Authority, Transmission Operator, Transmission Service Provider, and Reliability Coordinator.



PJM Resource Adequacy Data			
Demand, Resource, and Reserve Margins	2017/2018 WRA	2018/2019 WRA	2017/2018 vs. 2018/2019 WRA
Demand Projections	Megawatts (MW)	Megawatts (MW)	Net Change (%)
Total Internal Demand (50/50)	132,652	132,357	-0.2%
Demand Response: Available	355	1,331	274.9%
Net Internal Demand	132,297	131,026	-1.0%
Resource Projections	Megawatts (MW)	Megawatts (MW)	Net Change (%)
Existing-Certain Capacity	179,768	181,864	1.2%
Tier 1 Planned Capacity	0	0	-
Net Firm Capacity Transfers	4,304	1,535	-64.3%
Anticipated Resources	184,072	183,399	-0.4%
Existing-Other Capacity	350	0	-100%
Prospective Resources	184,422	183,399	-0.6%
Reserve Margins	Percent (%)	Percent (%)	Annual Difference
Anticipated Reserve Margin	39.1%	40.0%	0.9
Prospective Reserve Margin	39.4%	40.0%	0.6
Reference Margin Level	16.6%	16.1%	-0.5

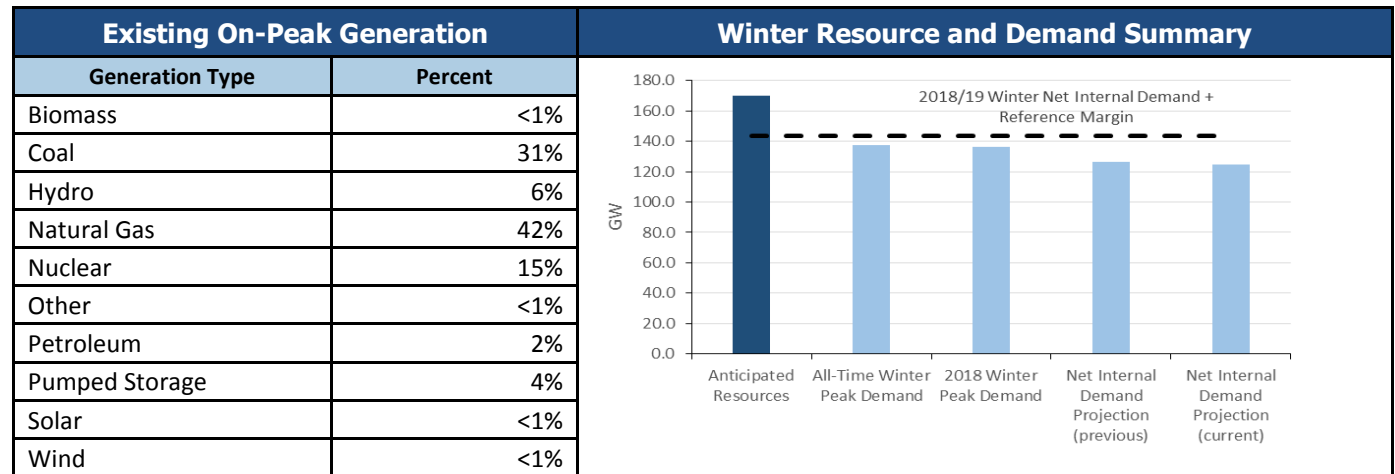
Highlights

- PJM anticipates that it will maintain system reliability during the upcoming season.
- PJM has no emerging reliability issues.
- The PJM capacity performance initiative provides resource performance requirements in the PJM energy market with very limited allowances for nonperformance or not producing when called upon. Nonperformance charges during peak-load hours can amount to significant financial penalties to generators. Opportunity for increased capacity market revenues, such as payments for dual-fuel capability and firm fuel service, are also part of the initiative.



SERC

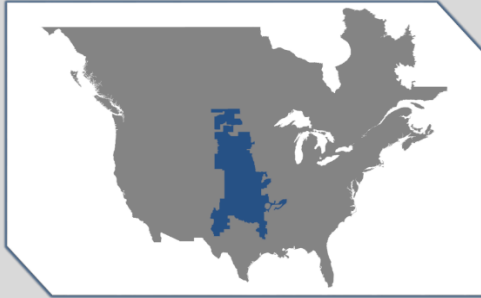
SERC’s assessment areas are traditionally summer-peaking and cover approximately 72,000 circuit miles and serve a population estimated at 23 million. For NERC’s assessment, the Region is divided into three assessment areas: SERC- E, SERC-N, and SERC-SE. The assessment areas include 12 Balancing Authorities: Cube Hydro Carolinas LLC, Associated Electric Cooperative, Inc. (AECI), Duke Energy Carolinas (DEC), Duke Energy Progress (DEP), Electric Energy, Inc. (EEI), LG&E and KU Services Company (as agent for Louisville Gas and Electric and Kentucky Utilities (LG&E/ KU)), PowerSouth Energy Cooperative (PowerSouth), South Carolina Electric & Gas Company (SCE&G), South Carolina Public Service Authority (SCPSA), Southern Company Services, Inc. (SOCO), Southeastern Power Administration (SPA), and Tennessee Valley Authority (TVA).



SERC Resource Adequacy Data						
Demand, Resource, and Reserve Margins	SERC-E	SERC-N	SERC-SE	2017/2018 WRA SERC Total	2018/2019 WRA SERC Total	2017/2018 vs. 2018/2019 WRA
Demand Projections	Megawatts (MW)	Megawatts (MW)	Megawatts (MW)	Megawatts (MW)	Megawatts (MW)	Net Change (%)
Total Internal Demand (50/50)	43,284	41,274	45,042	131,045	129,600	-1.1%
Demand Response: Available	942	1,663	2,111	4,727	4,716	-0.2%
Net Internal Demand	42,342	39,611	42,931	126,318	124,884	-1.1%
Resource Projections	Megawatts (MW)	Megawatts (MW)	Megawatts (MW)	Megawatts (MW)	Megawatts (MW)	Net Change (%)
Existing-Certain Capacity	53,992	54,055	64,162	162,958	172,209	5.7%
Tier 1 Planned Capacity	0	0	40	2,142	40	-
Net Firm Capacity Transfers	184	-1,099	-1,445	-2,898	-2,360	-18.6%
Anticipated Resources	54,176	52,955	62,758	162,203	169,889	4.7%
Existing-Other Capacity	42	1,242	924	1,953	2,208	13.1%
Prospective Resources	54,218	54,197	63,782	164,155	172,197	4.9%
Planning Reserve Margins	Percent (%)	Percent (%)	Percent (%)	Percent (%)	Percent (%)	Annual Difference
Anticipated Reserve Margin	28.0%	33.7%	46.2%	28.4%	36.0%	7.6
Prospective Reserve Margin	28.1%	36.8%	48.6%	30.0%	37.9%	7.9
Reference Margin Level	15.0%	15.0%	15.0%	15.0%	15.0%	0.0

Highlights

- SERC anticipates that current resources are adequate to meet the peak winter demand for the Region.
- Entities in SERC-E are currently assessing the impact on the BPS from Hurricane Florence and Hurricane Michael. However, impacts are not expected to threaten reliability for the upcoming winter period.
- Parts of SERC experienced stressed transmission system conditions during the peak of the 2017/2018 winter season due to transfers from the mid-west region of MISO to the southern region of MISO. SERC established a task force to analyze the impact and support coordinated actions to address issues in the future.
- SERC is developing a *Cold Weather Preparedness Guideline* to provide pre-season checklists, emergency plans, communications, and protocols.



SPP

Southwest Power Pool (SPP) Planning Coordinator footprint covers 575,000 square miles and encompasses all or parts of Arkansas, Iowa, Kansas, Louisiana, Minnesota, Missouri, Montana, Nebraska, New Mexico, North Dakota, Oklahoma, South Dakota, Texas and Wyoming. The SPP long-term assessment is reported based on the Planning Coordinator footprint, which touches parts of the Midwest Reliability Organization Regional Entity, and Western Electricity Coordinating Council. The SPP assessment area footprint has approximately 61,000 miles of transmission lines, 756 generating plants, and 4,811 transmission-class substations, and it serves a population of 18 million people.

Existing On-Peak Generation		Winter Resource and Demand Summary	
Generation Type	Percent		
Biomass	<1%		
Coal	35%		
Hydro	7%		
Natural Gas	49%		
Nuclear	3%		
Other	<1%		
Petroleum	3%		
Pumped Storage	<1%		
Solar	<1%		
Wind	3%		

SPP Resource Adequacy Data			
Demand, Resource, and Reserve Margins	2017/2018 WRA	2018/2019 WRA	2017/2018 vs. 2018/2019 WRA
Demand Projections	Megawatts (MW)	Megawatts (MW)	Net Change (%)
Total Internal Demand (50/50)	41,215	40,510	-1.7%
Demand Response: Available	432	432	0.0%
Net Internal Demand	40,783	40,078	-1.7%
Resource Projections	Megawatts (MW)	Megawatts (MW)	Net Change (%)
Existing-Certain Capacity	67,263	67,767	0.7%
Tier 1 Planned Capacity	863	5	-
Net Firm Capacity Transfers	-330	-330	0.0%
Anticipated Resources	67,796	67,442	-0.5%
Existing-Other Capacity	100	100	0.0%
Prospective Resources	68,163	67,542	-0.9%
Reserve Margins	Percent (%)	Percent (%)	Annual Difference
Anticipated Reserve Margin	66.2%	68.3%	2.1
Prospective Reserve Margin	67.1%	68.5%	1.4
Reference Margin Level	12.0%	12.0%	0.0

Highlights

- SPP anticipates planning reserves are adequate for the upcoming winter season.
- SPP is working with Midcontinent ISO and other neighbors to address potential electric deliverability issues associated with extreme weather events, such as those observed during the January 2018 cold snap when transfers from north to south were in excess of levels agreed upon by entities. Efforts are aimed at enhancing communications and operator preparedness.
- Since last winter season, a response team has been established for addressing load forecasting errors and to support operators with real-time decision making to ensure energy capacity adequacy.
- SPP hosted its winter preparedness workshop on October 2, 2018.



Texas RE-ERCOT

The Electric Reliability Council of Texas (ERCOT) is the ISO for the ERCOT Interconnection and is located entirely in the state of Texas; it operates as a single Balancing Authority. It also performs financial settlement for the competitive wholesale bulk-power market and administers retail switching for 7 million premises in competitive choice areas. ERCOT is governed by a board of directors and subject to oversight by the Public Utility Commission of Texas and the Texas Legislature. ERCOT is a summer-peaking Region that covers approximately 200,000 square miles, connects over 46,500 miles of transmission lines, has over 600 generation units, and serves 24 million customers. The Texas Reliability Entity (Texas RE) is responsible for the regional Reliability Entity (RE) functions described in the Energy Policy Act of 2005 for the ERCOT Region.

Existing On-Peak Generation		Winter Resource and Demand Summary	
Generation Type	Percent	GW	
Biomass	<1%	80.0	
Coal	24%	65.0	
Hydro	<1%	65.0	
Natural Gas	62%	52.0	
Nuclear	6%	55.0	
Solar	2%	65.0	
Wind	6%	65.0	
Biomass	<1%	65.0	
Coal	24%	65.0	

Texas RE-ERCOT Resource Adequacy Data			
Demand, Resource, and Reserve Margins	2017/2018 WRA	2018/2019 WRA	2017/2018 vs. 2018/2019 WRA
Demand Projections	Megawatts (MW)	Megawatts (MW)	Net Change (%)
Total Internal Demand (50/50)	55,003	58,229	5.9%
Demand Response: Available	2,494	1,912	-23.3%
Net Internal Demand	52,509	56,317	7.3%
Resource Projections	Megawatts (MW)	Megawatts (MW)	Net Change (%)
Existing-Certain Capacity	82,139	77,628	-5.5%
Tier 1 Planned Capacity	1,214	762	-
Net Firm Capacity Transfers	804	346	-57.0%
Anticipated Resources	84,157	78,735	-6.4%
Existing-Other Capacity	0	840	-
Prospective Resources	84,269	79,921	-5.2%
Reserve Margins	Percent (%)	Percent (%)	Annual Difference
Anticipated Reserve Margin	60.2%	39.8%	-20.4
Prospective Reserve Margin	60.5%	41.9%	-18.6
Reference Margin Level	13.8%	13.8%	0.0

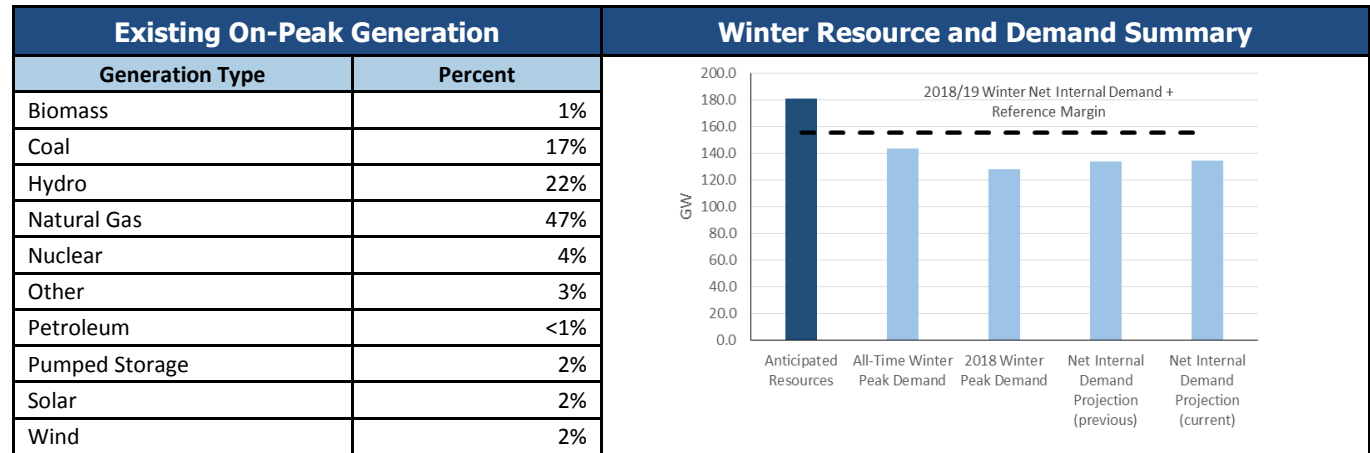
Highlights

- ERCOT currently does not expect any emerging reliability issues for the upcoming winter season. Despite a lower Planning Reserve Margin due to coal unit retirements and delays in planned natural-gas-fired combined-cycle projects, there is sufficient resource capacity to meet demand requirements for the winter season.
- Based on its own preliminary seasonal assessment, ERCOT expects to have sufficient operating reserves under expected system conditions as well as a scenario that assumes extreme peak load conditions with associated natural gas curtailment-related unit outages/deratings in North Texas.
- There are no changes to the ERCOT winter preparedness program. The Winter Weatherization Workshop was held September 6, 2018. Spot checks of conventional generation are conducted throughout winter.
- Natural-gas-fired generation was added in 2018, totaling 615 MW (winter rating). Generation retirements announced in late 2017 took affect totaling over 4,000 MW.
- Enhanced forecasting for wind generation mitigates icing risks and improves planning studies.



WECC

WECC is responsible for coordinating and promoting BES reliability in the Western Interconnection. WECC's 329 members, which include 38 Balancing Authorities, represent a wide spectrum of organizations with an interest in the BES. Serving an area of nearly 1.8 million square miles and more than 82 million people, WECC is geographically the largest and most diverse of the NERC Regional Entities. WECC's service territory extends from Canada to Mexico. It includes the provinces of Alberta and British Columbia in Canada, the northern portion of Baja California in Mexico, and all or portions of the 14 western states in between. The WECC assessment area is divided into five subregions: Rocky Mountain Reserve Group (RMRG), Southwest Reserve Sharing Group (SRSG), California/Mexico (CA/MX), and the Northwest Power Pool (NWPP), which is further divided into the NW-Canada and NW-US areas. These subregional divisions are used for this study as they are structured around reserve sharing groups that have similar annual demand patterns and similar operating practices.



WECC Resource Adequacy Data									
Demand, Resource, and Reserve Margins	WECC AB	WECC BC	CA/MX	NWPP US	RMRG	SRSG	2017/2018 WRA WECC Total	2018/2019 WRA WECC Total	2017/2018 vs. 2018/2019 WRA
Demand Projections	MW	MW	MW	MW	MW	MW	MW	MW	Net Change (%)
Total Internal Demand (50/50)	11,737	11,374	39,542	47,644	10,207	15,647	134,387	136,151	1.3%
Demand Response: Available	0	0	815	307	295	144	1,803	1,561	-13.5%
Net Internal Demand	11,737	11,374	38,727	47,337	9,912	15,503	133,498	134,590	1.5%
Resource Projections	MW	MW	MW	MW	MW	MW	MW	MW	Net Change (%)
Existing-Certain Capacity	15,091	13,206	52,121	58,631	15,342	29,020	182,716	183,411	0.4%
Tier 1 Planned Capacity	43	381	1,569	5	232	1,072	887	3,302	-
Net Firm Capacity Transfers	0	0	0	700	0	0	1,486	700	-52.9%
Anticipated Resources	15,134	13,587	53,690	59,337	15,574	30,092	185,089	187,414	1.3%
Existing-Other Capacity	0	0	0	0	0	0	0	0	0.0%
Prospective Resources	15,149	13,587	57,442	59,337	15,574	30,714	185,089	191,803	3.6%
Planning Reserve Margins	Percent (%)	Percent (%)	Percent (%)	Percent (%)	Percent (%)	Percent (%)	Percent (%)	Percent (%)	Annual Difference
Anticipated Reserve Margin	28.9%	19.5%	38.6%	25.4%	57.1%	94.1%	38.6%	43.9%	5.3
Prospective Reserve Margin	29.1%	19.5%	48.3%	25.4%	57.1%	98.1%	38.6%	46.3%	7.7
Reference Margin Level	10.4%	10.4%	12.4%	19.7%	16.8%	15.1%	15.4%	14.1%	-1.3

Highlights

- WECC anticipates that its six assessment areas and all zones within them will exceed their reference reserve margins and maintain resource adequacy through the 2018/2019 winter season.
- Winterization techniques are implemented throughout the freezing zones to mitigate against severe weather conditions or unexpected equipment failure. National Weather Service models predict mild winter conditions throughout the WECC footprint. A potential El Niño pattern could affect precipitation amounts, bringing above average precipitation in the south and below average precipitation in the north.
- The Aliso Canyon natural gas storage facility has higher storage capacity compared to last winter. However, natural gas infrastructure outages and reduced capacity on key natural gas transmission pipelines continue. Mitigation measures from prior winter seasons remain in place at CAISO and SoCalGas (See NERC 2017/18 WRA).

Data Concepts and Assumptions

The table below explains data concepts and important assumptions used throughout this assessment.

General Assumptions

- Reliability of the interconnected BPS is comprised of both adequacy and operating reliability.
 - Adequacy is the ability of the electric system to supply the aggregate electric power and energy requirements of the electricity consumers at all times taking into account scheduled and reasonably expected unscheduled outages of system components.
 - Operating reliability is the ability of the electric system to withstand sudden disturbances such as electric short-circuits or unanticipated loss of system components.
- The reserve margin calculation is an important industry planning metric used to examine future resource adequacy.
- All data in this assessment is based on existing federal, state, and provincial laws and regulations.
- Differences in data collection periods for each assessment area should be considered when comparing demand and capacity data between year-to-year seasonal assessments.
- *2018 Long-Term Reliability Assessment (LTRA)* data has been used for this 2018/2019 winter assessment period.
- A positive net transfer capability would indicate a net importing assessment area; a negative value would indicate a net exporter.

Demand Assumptions

- Electricity demand projection, or load forecasts are provided by each assessment area.
- Load forecasts include peak hourly load,⁵ or total internal demand, for the summer and winter of each year.⁶
- Total internal demand projections are based on normal weather (50/50 distribution)⁷ and are provided on a coincident⁸ basis for most assessment areas.
- Net internal demand, used in all reserve margin calculations, is equal to total internal demand, reduced by the amount of controllable and dispatchable demand response projected to be available during the peak hour.

Resource Assumptions

- Resource planning methods vary throughout the North American BPS. NERC uses the following categories to provide a consistent approach for collecting and presenting resource adequacy:

Anticipated Resources:

- **Existing-Certain Capacity:** Included in this category are commercially operable generating units, or portions of generating units, that meet at least one of the following requirements when examining the period of peak demand for the winter season: unit must have a firm capability and a power purchase agreement (PPA) with firm

⁵ *Glossary of Terms* Used in NERC Reliability Standards

⁶ The summer season represents June–September and the winter season represents December–February.

⁷ Essentially, this means that there is a 50 percent probability that actual demand will be higher and a 50 percent probability that actual demand will be lower than the value provided for a given season/year.

⁸ Coincident: The sum of two or more peak loads that occur in the same hour. Noncoincident: The sum of two or more peak loads on individual systems that do not occur in the same time interval. Meaningful only when considering loads within a limited period of time, such as a day, a week, a month, a heating or cooling season, and usually for not more than one year. SERC and FRCC calculate total internal demand on a noncoincident basis.

transmission that must be in effect for the unit; unit must be classified as a designated network resource; and/or where energy-only markets exist, unit must be a designated market resource eligible to bid into the market.

- **Tier 1 Capacity Additions:** includes capacity that either is under construction or has received approved planning requirements.
- **Net Firm Capacity Transfers (Imports minus Exports):** transfers with firm contracts.

Prospective Resources: Includes all anticipated resources, plus the following:

- **Existing-Other Capacity:** included in this category are commercially operable generating units, or portions of generating units, that could be available to serve load for the period of peak demand for the summer or winter season but do not meet the requirements of existing-certain.

Reserve Margin Definitions

Reserve Margins: the primary metric used to measure resource adequacy; it is defined as the difference in resources (anticipated or prospective) and net internal demand with the difference divided by net internal demand, shown as a percentile.

Anticipated Reserve Margin =	$\frac{(\text{Anticipated Resources} - \text{Net Internal Demand})}{\text{Net Internal Demand}}$
Prospective Reserve Margin =	$\frac{(\text{Prospective Resources} - \text{Net Internal Demand})}{\text{Net Internal Demand}}$

Reference Margin Level: the assumptions of this metric vary by assessment area. The Reference Margin Level is typically based on load, generation, and transmission characteristics for each assessment area and, in some cases, the Reference Margin Level is a requirement implemented by the respective state(s), provincial authorities, ISO/RTO, or other regulatory bodies. If such a requirement exists, the respective assessment area generally adopts this requirement as the Reference Margin Level. In some cases, the Reference Margin Level will fluctuate over the duration of the assessment period, or may be different for the summer and winter seasons. If one is not provided by a given assessment area, NERC applies a 15 percent Reference Margin Level for predominantly thermal systems and 10 percent for predominantly hydro systems.

On-Peak Expected Capacity Generation Mix: generation mix is aggregated from 2018 LTRA data. Fuel types with nominal quantities were aggregated together as fuel types, renewables, other renewables, or other fuels.

Renewable Nameplate Capacities: these charts include renewable on peak and nameplate (de-rated and expected on peak added together) capacities.