NORTHWEST POWER POOL AREA
ASSESSMENT OF RELIABILITY AND ADEQUACY
2017-2018 WINTER OPERATING CONDITIONS

October, 2017

EXECUTIVE SUMMARY

In view of the present overall power conditions, including the forecasted water condition, the area represented by the Power Pool is estimating that it will be able to meet firm loads including the required operating reserve, for the upcoming winter season. Should any resources be lost to the area beyond the contingency reserve requirement and or loads are greater than expected as a result of extreme weather, the Power Pool area may have to look to alternatives which may include emergency measures to meet obligations.

DEMAND

The Northwest Power Pool (Power Pool) sub-region has 22 Balancing Authority Areas and is comprised of all or major portions of the states of Washington; Oregon; Idaho; Wyoming; Montana; Nevada; and, Utah; a small portion of Northern California; and, the Canadian provinces of British Columbia and Alberta. The 2017-2018 coincidental winter peak forecast of 70,000 MW, is projected to occur during the period November through January and is 1.5% greater than last winter's coincidental peak of 69,787 MW, which occurred on January 6, 2017. Adjusting for the colder winter, the temperature adjusted 2016-2017 peak was 69,000 MW. The Power Pool's projected planning margin is greater than 20%, individual areas (U.S. only or Canada) or individual Balancing Authorities will have different projected planning margins.

DEMAND-SIDE MANAGEMENT

The twenty-two Balancing Authorities Ares within the Power Pool have a wide assortment of demand-side management ranging from smart grid, and smart meters to programmatic conservation with general concentration on a range of aspects from advanced volt/VAr control to control and energy management. In addition, several entities are required to examine demand-side management options as part of their Integrated Resource Planning (IRP) process. The approximate total of dispatchable and controllable demand-side response is 200 MW.

GENERATION

The installed Capacity for the Power Pool is over 115,000 MW, including approximately 20,500 MW of variable resources (1,500 MW expected on peak). The overall deliverable capacity over a sustained period is dependent upon the availability of water. The Power Pool anticipates having enough deliverable capacity including its operating reserve margin to meet the winter peak requirements.

TRANSMISSION

There are no concerns associated with transmission during the winter season.

OPERATIONAL ISSUES

Various Balancing Authorities have established operating protocols for variable generators to assure reliability is maintained. The Power Pool does not anticipate any reliability concerns or any other unusual operating conditions that could significantly affect reliability for the upcoming winter.

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INTRODUCTION

The Northwest Power Pool (Power Pool) area is one of the four sub-regions of the Western Electricity Coordinating Council (WECC) and is comprised of all or major portions of the states of Washington, Oregon,; Idaho, Wyoming, Montana, Nevada, Utah, and a small portion of Northern California; and, the Canadian provinces of British Columbia and Alberta. The Power Pool in collaboration with it members (twenty-two Balancing Authority Areas (BAA)) has conducted an assessment of reliability in response to questions raised regarding the ability of the Power Pool to meet the load requirements during the winter 2017-2018. Since the Power Pool is a large and diverse area of the Western Interconnection, its members face unique issues in the day-to-day coordinated operations of the system. The Power Pool area in aggregate is a winter peaking sub-region with a large amount of hydro resources.

Analyses indicate the Power Pool area will have adequate generation capacity, energy, required operating reserve (regulating reserve, contingency reserve and frequency response reserve), and available transmission to be able to meet the forecasted firm loads for the 2017-2018 winter operations, assuming normal ambient temperature and normal weather conditions.

This assessment is valid for the Power Pool area as a whole; however, these overall results do not necessarily apply to all sub-areas (individual members, balancing authorities, states, and/or provinces) when assessed separately.

Report Details

- Historic Demand and Energy

  The Northwest Power Pool 2016-2017 coincidental winter peak of 69,787 MW occurred on January 6, 2017. The 2016-2017 coincidental winter peak was 102.6% of the forecast; the coincidental peak occurred during colder than normal temperature conditions.

- Forecasted Demand and Energy

  The 2017-2018 winter peak forecast for the Power Pool area, as one single entity, of 70,000 MW is based on normal weather, reflects the prevailing economic climate (slight improvement), and has a 50% probability of not being exceeded.

  The Power Pool area has approximately 600 MW of interruptible demand capability and load management, of which about 200 MW is dispatchable and controllable. In addition, the load forecast incorporates any benefit (load reduction) associated with demand-side resources, not controlled by the individual utilities. Some of the entities within the Power Pool area have specific programs to manage peak issues during extreme conditions. Normally these programs are used to meet the entities' operating reserve requirements and have no discernable impact on the projected Power Pool area peak load.

  Under normal weather conditions, the Power Pool area does not anticipate dependence on imports from external areas during winter peak demand periods. However, if much lower than normal precipitation were to occur, it may be extremely advantageous to maximize the import transfer capabilities from outside the Northwest Power Pool area to reduce reservoir drafts.

- Resource Assessment

Approximately 60% of the Power Pool resource capability is from hydro generation. The remaining generation is produced from conventional thermal plants and miscellaneous resources, such as non-utility owned gas-fired cogeneration or renewable resources, such as wind and solar.

Hydro Capability

Northwest power planning is done by sub-area. Balancing Authority Areas in Idaho, Nevada, Wyoming, Utah, British Columbia and Alberta individually optimize their resources to their demand. The Coordinated System (Oregon, Washington and western Montana) coordinates the operation of its hydro resources to serve its demand. The Coordinated System hydro operation is based on critical water planning assumptions (currently the 1936-1937 water year). Critical water in the Coordinated System equates to approximately 11,000 average megawatts of firm energy load carrying capability, when reservoirs start full. Under Average water year conditions, the additional non-firm energy available is approximately 3,000 average megawatts.

The Coordinated System hydro reservoirs refilled to approximately 100% of the Energy Content Curve by July 31, 2017.

April through July

This period is the refill season when reservoirs store spring runoff. The water fueling associated with hydro powered resources can be difficult to manage because there are several competing purposes including but not limited to: current electric power generation, future (winter) electric power generation, flood control, biological opinion requirements resulting from the Endangered Species Act, maintenance activities associated with requirements for varying reservoir levels, as well as, special river operations for recreation, irrigation, navigation, and the refilling of the reservoirs each year. Any time precipitation levels are below normal, balancing these interests becomes even more difficult.

With the competition for the water, power operations for the 2017-2018 period may be difficult. The goal is to manage all the competing requirements while refilling the reservoirs to the highest extent possible.

Sustainable Hydro Capability

Operators of the hydro facilities optimize the hydrology throughout the year while assuring all the competing purposes are evaluated. Although available capacity margin at time of peak can be calculated to be greater than 20%, this can be misleading. Since hydro can be limited due to conditions (either lack of water or imposed restrictions), the expected sustainable capacity must be determined before establishing a representative capacity margin. In other words, the firm energy load carrying capability (FELCC) is the amount of energy that the system may be called on to produce on a firm or guaranteed basis during actual operations. The FELCC is highly dependent upon the availability of water for hydro-electric generation.

The Power Pool has developed the expected sustainable capacity based on the aggregated information and estimates that the members have made with respect to their own hydro generation. Sustainable capacity is for periods at least greater than two-hours during daily peak periods assuming various conditions. This aggregated information yields a reduction for sustained capability of approximately 7,000 MW. This reduction is more relative to the Northwest in the winter.

Thermal Generation

No thermal plant or fuel problems are anticipated. To the extent that existing thermal resources are not scheduled for maintenance, thermal and other resources should be available as needed during the winter peak.

Fuel

The thermal plants within the Power Pool footprint include gas-fired units as well as coal-fired units. The operators of these plants are active in the daily, monthly and annual assessments of deliveries, storage balances and readily accessible supply sources. In addition, several of the coal-fired units are mine-mouth operations eliminating transportation issues.

In addition, within the Northwest, a Northwest Mutual Assistance Agreement is in place to provide coordination between regional gas pipelines and entities in the event of a pipeline disruption.

Also, some entities maintain an inventory of distillate fuel at their combined cycle plants. In addition, they maintain an inventory of fuel for fuel switching ability.

Thermal Generation and Hydro Generation Integration

The diversity of the Power Pool provides operational efficiencies. The northwest area of the Power Pool peaks in the winter whereas the Rocky Mountain, California and Nevada areas peak in the summer. Also, the eastern area of the Power Pool has the majority of the thermal-generation whereas the western area of the Power Pool has the majority of the hydro-generation. This allows the maximum integration of the resources to meet the Power Pool coincidental peak for both the winter and the summer. In addition, this allows the twenty BAs to maximize the use of the transmission while meeting firm customer load. The thermal generation in the east integrated with the hydro generation in the west, improves the total available firm energy and increases the Power Pool's area system reliability.

Having the flexibility to use hydro generation to meet peak and base-loaded thermal generation to meet the firm energy requirements is predicated on availability of transmission; refer to the Transmission Operating Issues below.

Variable Generation

Several states have enacted renewable portfolio standards which will require some Power Pool members within the next few years to satisfy at least 20% of their load with energy generated from qualifying renewable resources. This has resulted in a significant increase in variable generation within the Power Pool area, creating new operational challenges which will have to be addressed soon and appropriate systems need to be in place. Some of the safety net programs such as balancing resources, contingency reserve, and under frequency load shedding will be re-evaluated for effectiveness.

The Power Pool area estimated installed variable generation capacity for 2017-2018 winter season is approximately 20,500 MW (11,700 MW wind, 3,100 MW solar, 2,000 MW biomass, 3,800 MW other) contributing only approximately 1,500 MW on-peak. The 20,500 MW includes approximately 1,200 MW behind the meter resources. With the increasing variable generation, conventional operation of the existing hydro and thermal resources are being impacted.

The wind generation manufactures' standard operating temperature for wind turbines range from -10° C to + 40° C (14° F to 104° F). During the winter peaking period, the temperature in the areas where the majority of the wind turbines are located can go below 14°F, leaving no capability from the wind generation during those periods.

In addition, there is a risk of over-generation in the spring and fall. When both the wind and hydro generation are both in high generation mode, and given the environmental constraints on total dissolved gases in the river, there are times when generation may exceed load plus the ability to export.

Biomass Generation

The installed capacity of biomass generation within the Power Pool area is approximately 2,000 MW.

Other Resources

Within the Power Pool area there is an underground natural gas storage facility. This storage is located near many of the gas plants located in the Power Pool area, minimizing any effect that a regional gas problem may cause. In addition, one BA in the Power Pool area has an excess of 700 MW of generation that can be fired on diesel fuel.

External Resources

No external resources to the Power Pool area are assumed for the winter season. However, within the Power Pool area, there are resources that may be operated on either the Western Interconnection (WI) or the Eastern Interconnection (EI) based on sectionalizing and switching arrangements. Normally, the resource is operated on the WI but has not been included as a WI resource. However, it is available if necessary.

Over Supply Issues

With the enactment of renewable portfolio standards both within the Power Pool footprint and in other areas of the west, under certain conditions there may be an oversupply of resources causing operating challenges to meet demand and resources. The entities within both the Power Pool footprint and California will coordinate their efforts to minimize any reliability impact resulting from such an oversupply. The over frequency generation shedding safety net program will be reviewed as these situations present themselves.

Energy Imbalance Market

Several Power Pool entities are participating the California Energy Imbalance Market (EIM). This assessment does not reflect resources outside the NWPP entities and how participation in EIM may influence the Northwest.

- Transmission Assessment

There are various transmission maintenance and equipment replacement activities that are planned leading up to and during the 2017-2018 winter operating season, however, these activities are not expected to impact voltage stability, dynamic stability, or availability and deliverability of resources. Planned transmission maintenance and associated outages will impact transfer capabilities, however, will not impact the ability to meet the NWPP area's 2017-2018 demand. In addition, all outage are subject to the applicable NERC Reliability Standards which in some cases involves planned outages being scheduled at least 21 days in advance.

There are several local transmission projects planned to be completed and in service during the 2017-2018 period, providing local enhancements.

Constrained paths within the Power Pool area are known and operating studies modeling these constraints have been performed. As a result of these studies operating procedures have been developed to assure safe and reliable operations.

System Operating Limits

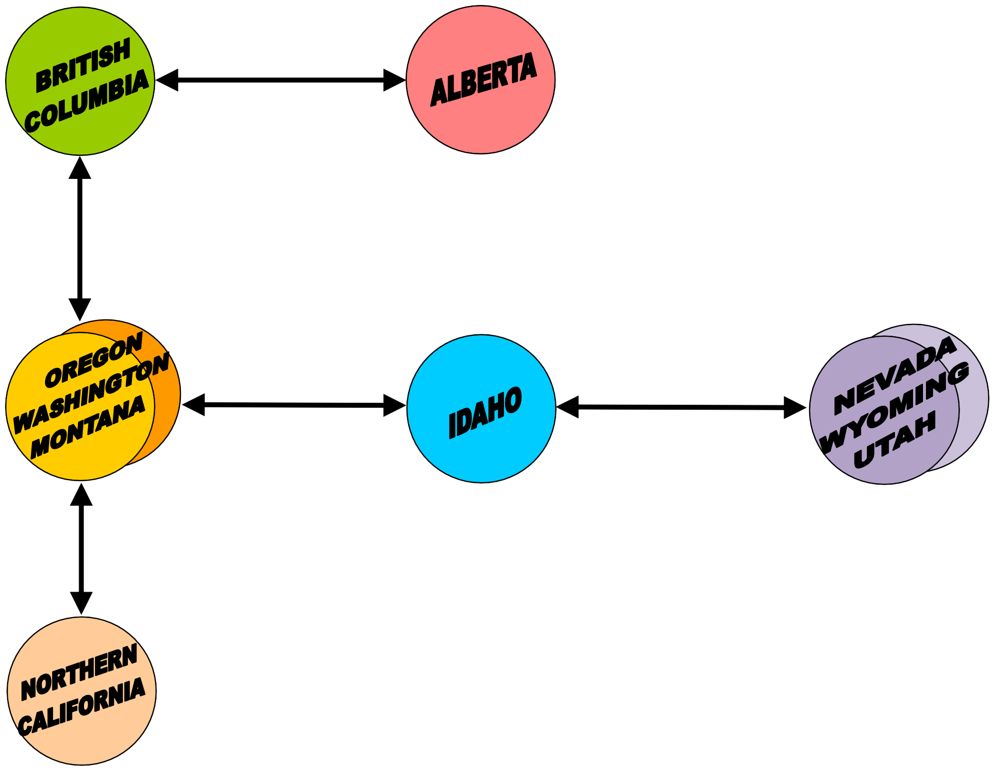
The interregional transmission transfer capabilities based on System Operating limits (SOLs) as determined by Transmission Operators, reviewed by the Northwest Operational Planning Group (NOPSG) and passed to the WECC's Reliability Coordinator for the 2017-18 winter season are available. Listed below are the approved 2017-18 winter TTCs/SOLs:

Path Name	Path #	Rating (MW)	2017-18 Winter TTC/SOL (MW)
Alberta-BC (E-W)	1	1000 (E-W)	450-1000 (E-W)
Alberta-BC (W-E)	1	1200 (W-E)	600-800/1200 (W-E)
NW-Canada (N-S)	3	3150 (N-S)	3150 (N-S)
NW-Canada (S-N)	3	3000 (S-N)	850-2750 (S-N)
West of Cascades North (E-W)	4	10,200 (E-W)	10,200 (E-W)
West of Cascades North (W-E)	4	10,200 (W-E)	10,200 (W-E)
West Of Cascades South (E-W)	5	7000 (E-W)	7000 (E-W)
West Of Cascades South (W-E)	5	7000 (W-E)	7000 (W-E)
West of Hatwai (E-W)	6	4277 (E-W)	4250 (E-W)
West of Hatwai (W-E)	6	NA (W-E)	NA (W-E)
Montana to Northwest (E-W)	8	2200 (E-W)	2200 (E-W)
Montana to Northwest (W-E)	8	1350 (W-E)	1330-1350 (W-E)
Idaho-Northwest (W-E)	14	1200 (W-E)	1200 (W-E)
Idaho-Northwest (E-W)	14	2400 (E-W)	2400 (E-W)
Sierra-Idaho (N-S)	16	500 (N-S)	478 (N-S)
Sierra-Idaho (S-N)	16	360 (S-N)	262 (S-N)
Borah-West (E-W)	17	2557 (E-W)	2557 (E-W)
Borah-West (W-E)	17	Not Rated	Not Rated
Idaho-Montana (N-S)	18	383 (N-S)	383 (N-S)
Idaho-Montana (S-N)	18	337 (S-N)	256 (S-N)
Bridger West (E-W)	19	2400 (E-W)	2400 (E-W)
Bridger West (W-E)	19	Not Rated	Not Rated
Path C (N-S)	20	1600 (N-S)	1600 (N-S)
Path C (S-N)	20	1250 (S-N)	900-1250 (S-N)

Path Name	Path #	Rating (MW)	2017-18 Winter TTC/SOL (MW)
TOT 2C (N-S)	35	400/600 (N-S)	470 (N-S)
TOT 2C (S-N)	35	580 (S-N)	470 (S-N)
Brownlee East (W-E)	55	1915 (W-E)	1915 (W-E)
Brownlee East (E-W)	55	Not Rated	Not Rated
PDCI (N-S)	65	3220 (N-S)	3220 (N-S)
PDCI (S-N)	65	3100 (S-N)	2200 (S-N)
NWACI (N-S)	66/76	4800 (N-S)	4800 (N-S)
NWACI (S-N)	66/76	3675 (S-N)	3675 (S-N)
N of John Day (N-S)	73	Not Rated	7700 (N-S)
N of John Day (S-N)	73	Not Rated	Not Rated
Hemingway-Summer Lake (E-W)	75	1500 (E-W)	1500 (E-W)
Hemingway-Summer Lake (W-E)	75	550 (W-E)	550 (W-E)
NW-Sierra (S-N)	76	300 (S-N)	300 (S-N)
NW-Sierra (N-S)	76	300 (N-S)	300 (N-S)
TOT 2B1 (N-S)	78	626-647 (N-S)	625 (N-S)
TOT 2B1 (S-N)	78	700 (S-N)	650 (S-N)
TOT 2B2 (N-S)	79	265 (N-S)	250 (N-S)
TOT 2B2 (S-N)	79	300 (S-N)	300 (S-N)
Montana Alberta Tie Line (N-S)	83	325 (N-S)	325 (N-S)
Montana Alberta Tie Line (S-N)	83	300 (S-N)	300 (S-N)

Transmission Operating Issues

The vast area of the Power Pool presents unique operating issues associated with transmission constraints. Recognizing these constraints may result in limitation of the Power Pool operating programs. The critical transmission constraints are known and result in the following zones within the Power Pool.



The Balancing Authorities constantly monitor critical cut planes to assure availability of room on the transmission system for flow of contingency reserve from one zone to another. Seven critical cut planes allow for the Power Pool to enjoy maximum efficiency and reliability. These critical cut planes are: Alberta to British Columbia; British Columbia to Oregon-Washington-Montana; Oregon-Washington-Montana to Northern California; Oregon-Washington-Montana to Idaho; Idaho to Nevada-Wyoming-Utah. If any of these cut planes become constrained, the ability to maximize efficiency and reliability is significantly reduced within the Power Pool area.

Depending upon the constraint, the above zones may become isolated and therefore dependent upon the resource within the zone to meet the reliability requirements. Operational constraints are seldom a limiting factor. However, when they are limiting, the operating programs are designed to assure reliability is met all the time, even under transmission constraints.

Voltage Stability

The WECC-1-CR System Performance Criteria, requirement WRS3 is used to plan adequate voltage stability margin in the Northwest Power Pool area as appropriate. Simulations are utilized to assure system performance is adequate and meets the required criteria. The Western Interconnection Reliability Coordinator has identified one potential IROL associated with voltage stability in the Power Pool region that may impact transfers. The Northwest Washington (Puget Sound) IROL is monitored by the entities involved and by the Reliability Coordinator System Operators and procedures and tools are in place to mitigate any conditions that may develop in real-time.

- Operating Issues

The Power Pool area does not anticipate any operating issues for the 2017-2018 winter season.

- Reliability Assessment Analysis

The Northwest Power Pool area does not have one explicit methodology for determining an adequacy margin.

Since no one method exists for the entire Northwest Power Pool area, we have elected to use the NERC's reserve margin analysis for the winter assessment. The 2017-2018 Power Pool area generating capability is projected to be 90,000 MW, prior to adjusting for maintenance. Based on prior operating season, we have assumed zero contributions from wind resources during peak conditions. In determining planning margin for the current winter season one must further adjust for operating reserve requirement, which is approximately 6,000 MW. At this point, based on a load of 50% probability not to exceed, the planning margin is approximately 20%. However, the ability to sustain such margin over any length of time is highly dependent upon availability of fuel, such as water. Non-coordinated use of the water over time will cause substantial problems in the future.

A severe weather event for the entire Power Pool area will add approximately 6,000 MW of load while at the same time under extreme water restrictions the sustained hydro generation would reduce the capability by 7,000 MW. In addition, under the severe weather, wind generation is expected to be minimal. However, accounting for the severe weather event and the available generation, the Power Pool area will meet the peak load requirements with no minimal margin.

- Contingency Reserve Sharing Procedure

As permitted by NERC and WECC criteria and standards, the Operating Committee of the NWPP has instituted a Reserve Sharing Program for contingency reserve. Those who participate in a reserve sharing group are better positioned to meet the NERC disturbance control standard because they have access to a deeper and more diverse pool of shared reserve resources. Also, an increase in efficiency is obtained since the shared reserve obligation for the group as a whole is less than the sum of each participant's reserve obligation computed separately.

By sharing contingency reserve, the participants are entitled to use not only their own "internal" reserve resources, but to call on other participants for assistance if internal reserve does not fully cover a contingency. The reserve sharing process for the NWPP is automated. A manual backup process is in place if communication links between members are down or the computer system for reserve sharing is not functioning correctly.

The NWPP is designated as a reserve sharing group (RSG) as provided under the NERC Reliability Standards. Each member of the RSG submits its contingency reserve obligation (CRO) and most severe single contingency (MSSC) to a central computer. The combined member CRO must be larger than the RSG MSSC. If not, then each member's CRO is proportionally increased until this requirement is met. When any RSG member loses generation they have the ability to call upon reserves from the other RSG members as long as they have first committed their own CRO. A request for contingency reserve must be sent within four minutes after the resource loss and the received contingency reserve can only be utilized for 60 minutes. A request is sent via the member's energy management system to the central computer. The central computer then distributes the request proportionally among appropriate members within the RSG. Each member may be called to provide reserve up to its CRO. Critical transmission paths are monitored in this process to ensure SOL limits are not exceeded. If a transmission path

SOL is exceeded the automated program redistributes the CRO and any request among RSG members that can deliver reserve along non-congested paths. The WECC RC continuously monitors the adequacy of the RSG reserve obligation, MSSC, and the deployment of reserve. If a reserve request fails due to various reasons, backup procedures are in place to fully address the requirements.

- Reliability Coordinator

  The Reliability Coordinator (RC) is responsible for monitoring, advising, and directing action when necessary, in order to preserve the reliability of transmission service between and within the interconnected systems of all balancing authorities within the Western Interconnection.

STRATEGIC UNDERTAKINGS

- Adequacy Response Team

  The Northwest has developed an Adequacy Response Process whereby a team addresses the area's ability to avoid a power emergency by promoting regional coordination and communications. Essential pieces of that effort include timely analyses of the power situation and communication of that information to all parties including but not limited to utility officials, elected officials and the general public.

- Emergency Response Team (ERT)

  In the fall of 2000, the area developed an Emergency Response Process to address immediate power emergencies. The ERT remains in place and would be utilized in the event of an immediate emergency. The ERT would work with all parties in pursuing options to resolve the emergency including but not limited to load curtailment and or imports of additional power from other areas outside of the Power Pool.

- Lessons Learned and Recent Power Outages

  The entities within the area that comprise the NWPP continuously review significant outages within the NWPP area and the Western Interconnection. This review is to understand the effects of such outages and obtained 'lessons learned' that may be implemented to minimize the possibility of similar outages in the future. The goal of the entities is to learn and, when necessary, make changes to assure a reliable interconnection now and into the future.

  With respect to recent power outages, some entities have increased situational awareness while others continue to review outage reports to ascertain lessons learned in order to implement any necessary changes to assure a reliable operation.

LARGEST RISK

The largest risk facing Balancing Authorities within the Power Pool area is a significant weather event that would last over a five-day period and have temperatures at 20° F below normal. This type of an event would increase the overall Power Pool load by 6,000 MW. Any additional contingency during such a weather event could cause loss of local load.

CONCLUSIONS

In view of the present overall power conditions, including the forecasted water condition, the area represented by the Power Pool is estimating that it will be able to meet firm loads including the required operating reserve. Should any resources be lost to the area beyond the contingency reserve requirement and or loads are greater than expected as a result of extreme weather, the Power Pool area may have to look to alternatives which may include emergency measures to meet obligations.

SUPPLEMENTAL INFORMATION

Winter Preparation

A large portion of the Power Pool is a cold weather area and is therefore designed for operation as such. However, preventative maintenance is undertaken to assure heat tracing is operational, ventilation systems are set appropriately, thermal insulation is intact, fuel handling system cold weather system are operational and cold weather procedures are reviewed.

Since such a large potion of the Power Pool is a cold weather area, plants are designed to operate in the cold weather. Some entities have implemented a program to test each of its peaking thermal generation plants during the winter months.

As highlighted above under Strategic Undertakings, the Power Pool has various programs in place to address abnormal weather. These programs include Energy Emergency Plan and Abnormal Winter Coordination plans. These plans are designed to allow for the communication, coordination and implementation of necessary actions associated with unexpected energy emergencies which may be related to extreme weather conditions. The Power Pool participants conduct simulation exercises to test the process at least annually.

Also, all of the Power Pool Participants have their own emergency procedures and process in place and test such processes in accordance with their specific needs.