aeso
ALBERTA
ELECTRIC
SYSTEM
OPERATOR

24-Month Reliability Outlook (2009 – 2011)

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Outlook Summary

Most Albertans take electricity for granted. We flip the switch and the power is there. It gets us out of bed on time, keeps our food cold, cleans our clothes and lets us read long after the sun has gone down. But behind that simple action is a complex and well coordinated structure – one that includes control systems and system operators that constantly monitor flows on the transmission system and balance the supply of electricity with demand for power across the province to ensure we have a strong, competitive and reliable electricity system.

The Alberta Electric System Operator (AESO) is the organization responsible for making that happen. We operate the province's $9-billion wholesale power market where companies buy and sell large volumes of electricity. Our job is also to make sure the transmission system is reinforced to keep pace with demand for power as our population and economy continue to grow.

As part of fulfilling our mandate to keep the lights on in Alberta, we are moving forward on a number of significant transmission reinforcements required to meet the increasing demand for reliable electricity.

WHAT IS THE 24-MONTH RELIABILITY OUTLOOK?

The ability of Alberta to meet load growth and realize its full economic potential is partially dependent upon the ongoing availability of competitively priced, reliable electricity required to fuel the industrial base. If the electric supply is not seen to be cost-effective and reliable, future economic growth could be negatively affected. The ongoing provision of competitively priced and reliable electricity is essential to ensure long-term growth, a high standard of living and prosperity for Albertans.

When we talk about electric system reliability, we are really talking about two components: supply adequacy and transmission reliability. Supply adequacy is ensuring there is enough electric supply (generation) to meet the demand for power from consumers. Transmission reliability is the ability to withstand sudden disturbances or the unanticipated loss of facilities on the system. The AESO's job is to ensure the electric system can do both. So how are we doing? We launched the *24-Month Reliability Outlook* to help answer that question. This second edition covers the 24-month period from November 2009 to November 2011 and includes information about:

- Expected load conditions, supply adequacy and transmission reliability of the Alberta Interconnected Electric System (AIES).
- Transmission system upgrades being put in place to improve reliability.
- Current operating conditions, constraints and potentially adverse conditions that could be avoided through coordinated maintenance plans for generation and transmission facilities.
- Key market initiatives underway.

WHERE ARE WE TODAY?

During the last 10 years, Alberta's reputation as being business-friendly has contributed to the province having a strong economy, fast-growing population and low overall taxes. According to The Conference Board of Canada, economic growth, as measured by the provincial gross domestic product (GDP), is expected to be strong in the coming decade, ranging from 2.1 to 5.5 per cent. GDP was forecast to be -2.4 per cent in 2009. Over the past five years, Alberta has had the highest rate of GDP growth in Canada, averaging 3.8 per cent per year.

While new generation has been able to keep pace with demand, the tremendous growth of the past 10 years has placed pressure on the existing transmission system, which is now carrying a much higher level of power. Although the economic downturn beginning in 2008 and continuing through 2009 has reduced provincial energy consumption, the long-term prospect for growth remains strong. This means we have some time for transmission development to catch up. Even with the economic downturn, parts of the electric system continue to experience congestion and constraints on the transmission grid that limit the ability to transmit power between various locations in Alberta. In some parts of the province, congested transmission lines can strand electricity supplies, making them unavailable to the market, while in other areas congestion occurs when there is not enough transmission capacity to serve the load. For example:

- Transmission must-run (TMR) services are required in the Rainbow Lake, northwest Alberta and Calgary areas to maintain system reliability.
- Wind generation constraints occur relatively often in the Southwest region due to delayed reinforcement of the transmission system in that area.
- Several areas experience generation or load constraints when transmission facilities are taken out of service, whether for planned maintenance or forced outages such as during lightning storms.

While additional congestion and constraints on the electric system mean the effects of system outages are becoming more obvious, we are meeting this challenge through:

- Ongoing emphasis on coordination of planned outages.
- Developing and implementing improved reliability standards, operating tools and procedures.
- Augmenting training and introducing new programs for system operators to manage and maintain system reliability.
- Developing operating limits and tools in advance of each milestone of a transmission development plan.

The level of congestion on Alberta's electric grid is expected to intensify until additional transmission is built. Table 1 lists a summary of transmission congestion events and the percentage of time area transfer limits were affected by planned and forced outages for the different areas.

The addition of generation to meet demand growth will increase congestion until new transmission is built. From our perspective, timely approval and implementation of these proposed transmission upgrades remains a priority. Currently, the total installed capacity is 12,623 megawatts (MW).

Table 1: Summary of Transmission Congestion Events from 2007 to September 30, 2009

Area	2007	2008	Jan. 1 – Sept. 30, 2009	Notes
Fort McMurray	3 events	2 events	7 events	Number of times Fort McMurray area in-merit generation was constrained during real-time operation.
	5%	5%	12%	Percentage of time planned and forced transmission outages reduced the transfer capability out of Fort McMurray.
Rainbow Lake	99.5%	99.4%	99.8%	Percentage of time TMR required to support the area.
Grande Prairie	52%	66%	54%	Percentage of time TMR required to support the area.
Keephills-Ellerslie-Genesee (KEG)	1 event	1 event	2 events	Number of times KEG generation was curtailed.
South of KEG (SOK)	3 events	1 events	1 event	Number of times SOK flow violation triggered north generation curtailment or TMR to south generation.
	6%	7%	8%	Percentage of time planned and forced outages reduced the transfer capability on the SOK path.
Southwest Wind	24 events	89 events	69 events	Number of times SW wind received curtailments.
	100 hours	800 hours	730 hours	Number of hours SW wind generation was constrained during real-time operation.
Medicine Hat	0 events	28 events	23 events	Number of times City of Medicine Hat in flow was contained due to planned and forced transmission outages.
	0 hours	500 hours	160 hours	Number of hours the City of Medicine Hat was constrained from importing from the AIES.

The following sections look at aspects of the electric system as they relate to overall reliability and include expected load conditions, supply adequacy, transmission reliability, system constraints, system upgrades and market initiatives spanning the November 2009 to November 2011 timeframe.

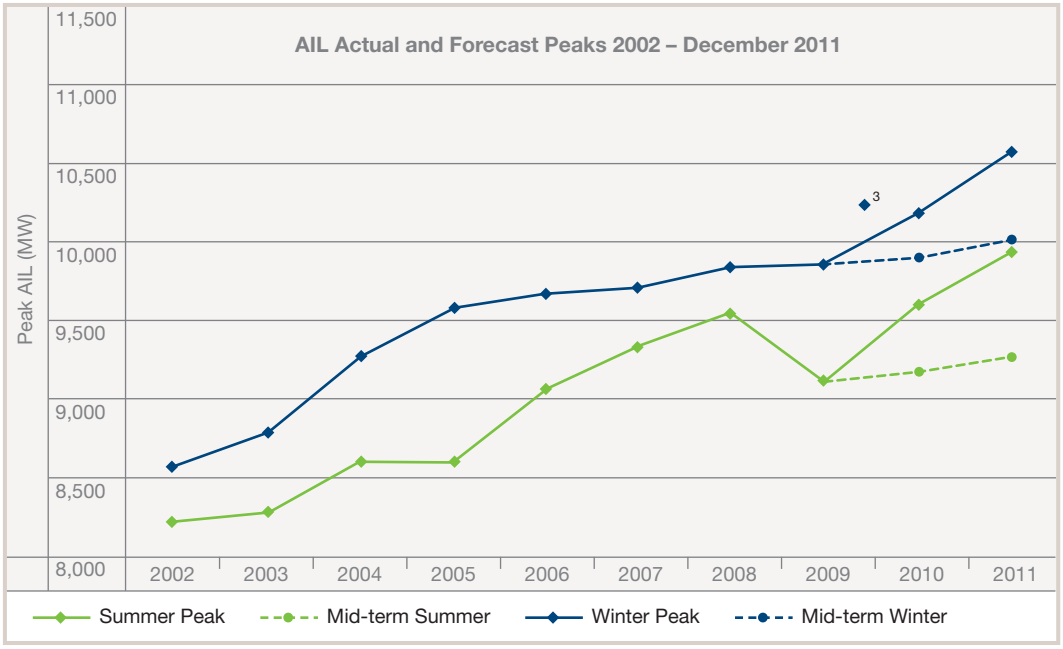
EXPECTED LOAD CONDITIONS

Each month the AESO produces an hourly, 26-month mid-term forecast[1] that we use to assess electric system supply and demand balance in the near term and to help coordinate planned generator outages.

In 2008/2009, the Alberta Internal Load (AIL)[2] winter peak demand was 9,806 MW and the 2009 summer peak was 9,108 MW. The 2009 summer peak was 433 MW lower than the 2008 peak of 9,541 MW. Based on the AESO's long-term load forecast, peak demand is projected to be 9,846 MW for winter 2009/2010[3] and 10,170 MW for winter 2010/2011. The forecast summer peaks for 2010 and 2011 are 9,589 MW and 9,912 MW respectively. Alberta energy growth has been impacted by the global economic recession with delays in the development of oilsands projects and slowdowns in other industrial and commercial expansion. Slow growth is expected to be short term with strong provincial economic growth expected to return in 2010 and 2011.

Figure 1 shows AIL yearly actual and forecast peak loads from 2003 to 2011. A review of Figure 1 shows forecast peak loads may trend lower as indicated in the mid-term forecast. The 2009 actual summer and 2008/09 winter peak and recent daily peak load history confirm the trend indicated in the mid-term forecast.

Figure 1: Yearly Actual and Forecast Peak Loads (Summer and Winter)



[1] *Historical load patterns, calendar events and weather variables are the dominant factors in the mid-term forecast. The long-term forecast is based on econometric principles.*

[2] *Alberta Internal Load (AIL) is defined as the province's total electricity consumption including losses through transmission and distribution, as well as load served by behind-the-fence generation.*

[3] *On December 14, 2009 extremely cold weather and market conditions resulted in a new peak demand of 10,236 MW, shattering the previous peak by 4.4%.*

On a year-over-year basis, Alberta's total energy consumption for the first nine months of 2009 was 0.2 per cent lower than energy consumption for the same period in 2008 (taking into consideration the Leap Year effect). Given that actual energy consumption for 2008 and January to September 2009 was lower than forecast, the 2009/2010 winter and 2010 summer peaks are also expected to be lower than indicated in the previous assessment.

Actual loads, however, for the period November 2009 to November 2011 will depend on a number of factors such as:

- weather conditions
- energy market responsiveness
- actions of price responsive load (approximately 175 to 300 MW)
- amount of wind generation on the system
- new oilsands projects and associated industry coming on stream

SUPPLY ADEQUACY

Supply adequacy is the ability of generation capacity to supply the total electrical demand and energy requirements of customers at all times. It also considers scheduled and reasonably expected unscheduled transmission and generation outages on the electricity system.

In Alberta's electricity market, the amount of generation added to the electrical system in the next two years will be determined by market conditions. The AESO collects information on new generation to assess the system's ability to meet growing demand requirements. As a general trend, Alberta has seen investment in new generation projects over the previous few years. This investment is expected to continue and produce reserve margins that are similar to historic reserve margins. Currently, there are approximately 1,150 MW of generation that have been recently energized or that are under construction and expected to come online in the next two years. In addition, there are 188 MW of generation projects that have received Alberta Utilities Commission (AUC) approval, and 652 MW of projects that have been corporately announced or have applied for regulatory approval that are stated to start within the next two years. This excludes approved and planned wind generation. As projects under construction move into commercial operation and projects with regulatory approval proceed, supply levels will increase.

Capital Power's Rossdale plant (209 MW) was decommissioned in May 2009 as a new transmission line into central Edmonton was placed in service in October 2008. TransAlta's 279 MW Wabamun #4 generator is scheduled for decommissioning in March 2010. New generation will more than offset the retirements of these older generators.

Overall supply reserve margins are expected to be adequate over the next two years, although it will be necessary to continue to closely coordinate generator and transmission outages to ensure transmission congestion does not strand a significant amount of generation.

The AESO developed rules regarding generator outage cancellation as per the Province of Alberta's 86/2007 *Transmission Regulation*, and filed them with the AUC. These rules define the steps we must take and issues to consider when cancelling a planned outage to maintain supply adequacy and reliable operation. The rules also outline the compensation generation owners may receive if the AESO directs generators to cancel their planned outage.

The AESO performs a number of assessments to monitor supply adequacy to serve firm demand and satisfy contingency requirements in the mid term (one day to one year) and long term (up to five years). Further information can be found at **www.aeso.ca**

TRANSMISSION RELIABILITY

We describe transmission reliability (sometimes referred to as operating reliability or system security) as the ability of the electric system to withstand sudden disturbances or the unanticipated failure of system elements.

As it relates to reliability, risk is the likelihood that an event (i.e., an outage or change in operating conditions) will reduce the reliability of the power system to the point that consequences are unacceptable (e.g., equipment damage or cascading outages). Since unforeseen events (i.e., sudden disturbances or the unanticipated failure of system elements) cannot be prevented, the AESO plans and operates the electric system so when these events occur, the effects are manageable and consequences are acceptable as defined in Alberta Reliability Standards and AESO reliability criteria. It is critical to effectively manage risk to ensure reliable operation of the power system.

To do this, we regularly perform operations planning studies to assess the operability and reliability of the transmission system under a broad range of conditions. System operators use the results to establish operating limits and procedures that protect generation and transmission equipment from damage that could jeopardize reliability for weeks or even months. The results are also used to support integration of new generation and transmission facilities and to facilitate coordination of outages.

Reliable system operations depend on a continuously connected and managed power system with synchronized generation, transmission and load. System operators monitor the overall reliability of the power system on a moment-to-moment basis by keeping flows within limits while matching supply with demand.

Another safeguard of Alberta's electric system reliability is the AESO's adherence to criteria developed by the North American Reliability Corporation (NERC) and the Western Electricity Coordinating Council (WECC). The NERC/WECC reliability standards and criteria are also central to assessing the adequacy of the future transmission system. With an adequately planned system and prudent operating criteria, we can operate the AIES reliably while facilitating an open and competitive market.

To ensure adequacy and reliability of the transmission system, the AESO carries out studies that apply the NERC/WECC reliability criteria. In addition, we support implementation of North America-wide reliability standards to maintain and improve reliability of the North American grid and a program of mandatory and enforceable reliability standards in Alberta.

Over the past year, the AESO has undertaken an initiative to adopt NERC reliability standards as Alberta Reliability Standards. The development of a more consistent set of standards is also essential to maintaining and improving the reliability of the North American electric grid.

The AESO's approach to adopting reliability standards involves a detailed review of the standards by subject matter experts and carrying out extensive stakeholder consultation prior to making a recommendation and seeking approval from the AUC.

At present, over 120 standards have been approved by NERC. 24 reliability standards have been adopted for Alberta and are posted at **www.aeso.ca/rulesprocedures/17006.html**. Several standards have been assessed as not applicable in Alberta as they apply to the WECC. The remaining standards will be reviewed in 2010 and the AESO will continue to assess ongoing changes to NERC and WECC standards beyond 2010.

TRANSMISSION SYSTEM UPGRADES

Alberta's transmission system is an essential part of a large and interconnected North American electric system that connects the supply of power from generators to customers who need it. All large power generators, whether they use coal, natural gas, wind, water, biomass or solar energy to produce electricity, connect to the transmission system to deliver their power.

As part of this larger system, Alberta's electric system must be able to respond to instant changes in the supply and demand for power at any given time. As a result, transmission planners balance a long list of factors when deciding how to reinforce and upgrade the provincial power system in the best interests of Albertans.

Timely approval and implementation of proposed transmission upgrades remains a priority for the AESO to meet future demand, interconnect generation and satisfy reliability needs. These proposed upgrades also include improving the capability of interties that connect Alberta's transmission system to neighbouring jurisdictions such as Saskatchewan and B.C. and a new intertie to Montana. The province's electric system reliability is enhanced by these connections, which allow us to import power to meet peak demand in the summer and winter and help prevent power outages by providing access to additional back-up power in case of sudden equipment failure. The operation of interties is governed by enforceable mandatory reliability standards throughout North America that are similar to ones already in place in Alberta.

To keep pace with continued growth in load and generation in Alberta and enhance reliability, several transmission upgrades were completed in 2009. These include:

- Two new capacitor banks and a static VAr compensator (SVC) in the Northwest region.
- A new 240 kilovolt (kV) transmission line into the Northwest region.
- Two new oilsands interconnections in the Fort McMurray area.
- Several 138/25 and 144/25 kV transformer additions to serve increased distribution loads.

Additional upgrades planned for the transmission system over the next two years include:

- Two new SVCs in the Northwest region.
- New 144 kV transmission lines in the Northwest region.
- New 240 kV transmission lines in the Southwest region.
- Transmission additions, new Points of Delivery and re-configurations in the City of Calgary.
- Re-termination of a 240 kV line between Ellerslie and Clover Bar.
- 240/138 kV transformation capacity increases at West Brooks and North Lethbridge.
- New switching station (Cypress) in the Amoco Empress area along with the reconfiguration of 240 and 138 kV lines.
- Conversion of the south 69 kV system to 138 kV operation in the City of Calgary.
- Wabamun Lake area re-configuration of 240 kV lines to increase transfer capability.
- Conversion of 1202L to 500 kV operation by the second quarter of 2010.
- Hardisty area 138 kV and 240 kV transmission capacity additions.
- Addition of several capacitor banks in the East Central region.
- A 240 kV line from A876s Britnell to a new substation south of A888s Dover.
- A new 240/138 kV source south and/or southwest of the City of Edmonton.
- Several new substations and capacitor bank additions in the east central region to serve new pipeline loads.
- Montana-Alberta intertie (a merchant transmission line).

If these projects are significantly delayed, additional constraints will be placed on the transmission system and further work will need to be done to assess operating reliability and develop plans to offset these limits.

CURRENT OPERATING CONDITIONS, CONSTRAINTS AND POTENTIALLY ADVERSE CONDITIONS

This section looks at the operating conditions, limits and potentially adverse conditions that might occur throughout the winter 2009/10 operating season and over the November 2009 to November 2011 timeframe of the *24-Month Reliability Outlook*.

While the peak demand and thermal ratings[4] of transmission equipment are higher in the winter, planned maintenance generally occurs on transmission and generating assets in the summer. This often results in more stress on the transmission system during the summer electricity season. During times when the overall Alberta supply reserve margin is low, it is expected that all generators will be in merit[5]. High market prices for energy are likely to attract imports, which will bring power into the south central part of the transmission system. Higher winter thermal ratings and all supply being in merit during peak periods should create an overall sufficient level of transmission reliability for winter 2009/2010. Another factor contributing to increased transmission reliability on the system is the reduced flow on the south KEG 240 kV cutplane[6] due to south gas generation in merit during high load periods in the south part of Alberta.

In general, as system load continues to grow, the effects of contingencies (sudden failures or outages on the system) become increasingly pronounced. Sustained outages to transmission facilities may result in additional constraints on transfer capabilities to preserve reliability.

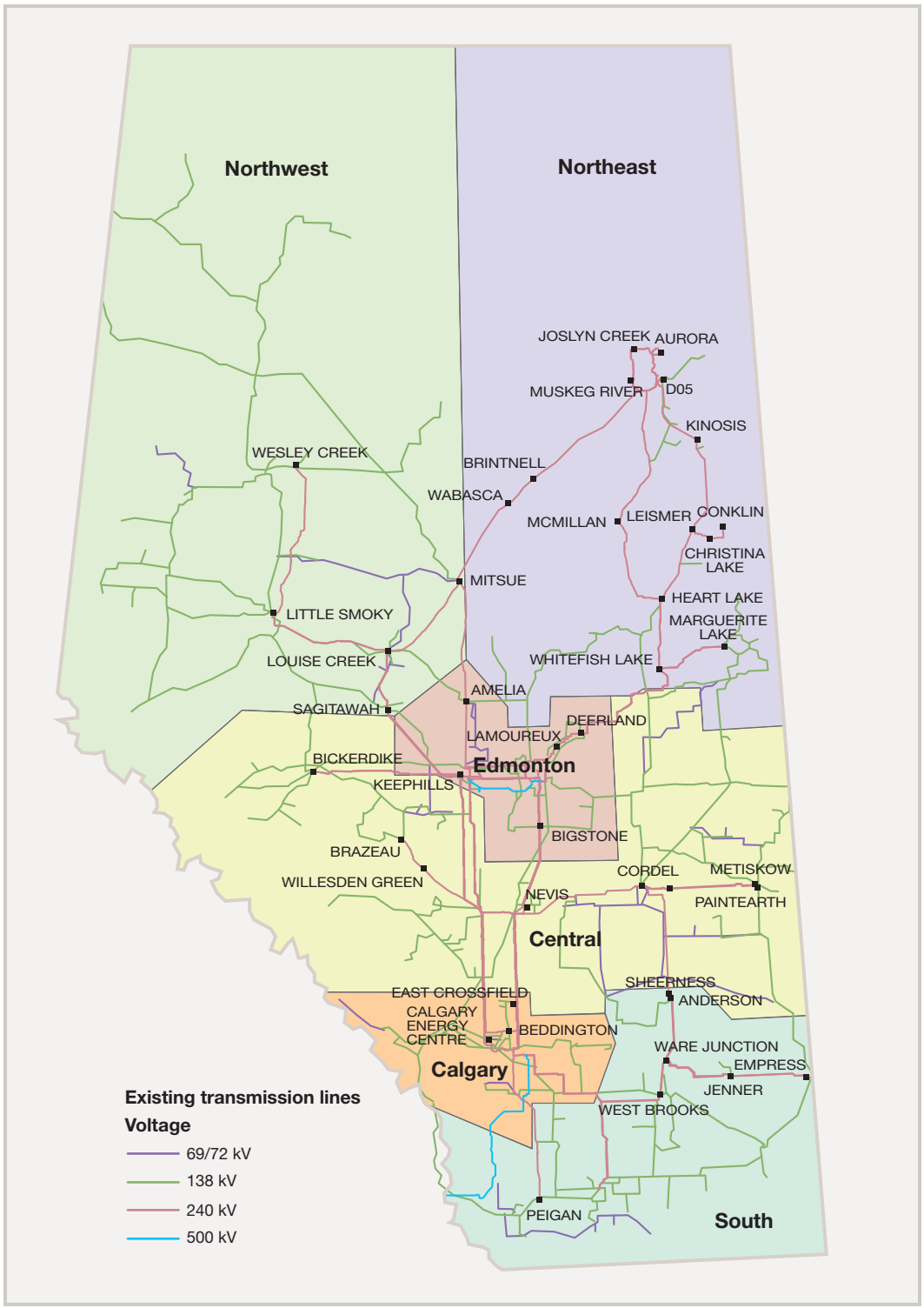
The AESO is meeting this challenge through continued emphasis on coordination of outages and developing improved operating tools, procedures and training for our system controllers, and ongoing emphasis on comprehensive analysis and follow up should disturbances occur. There are immediate and significant operating challenges in the Northwest, Southeast and Southwest regions of the province that require congestion management and special operating procedures, use of TMR generation, remedial action schemes and coordination of transmission and generation outages. These are described on the following pages.

[4] *Thermal ratings are the maximum amount of electrical current transmission facilities can conduct over a period of time without overheating and causing permanent damage or violating equipment safety margins.*

[5] *Generation assets dispatched by the system controller and eligible to set the pool price are described as being in merit.*

[6] *An imaginary line that cuts across the transmission lines connecting two or more areas. The loading on these lines is summed together to measure the power flow across the cutplane.*

Figure 2: Alberta Transmission Regions



NORTHWEST REGION

The Northwest region of Alberta is a geographically large area northwest of the City of Edmonton. It is bordered by Fort McMurray and Athabasca to the east, Hinton and Wabamun to the south, B.C. to the west, and the Northwest Territories to the north. While the Northwest region represents approximately one-third of the area of the province, it represents only one-tenth of the total demand on the electric system.

The region includes the Rainbow Lake, High Level, Peace River, Grande Prairie, High Prairie, Grande Cache, Valleyview, Fox Creek and Swan Hills planning areas but not the Wabamun Lake area. It is connected to the Wabamun Lake area primarily through three 240 kV transmission lines and to the Fort McMurray area through one new 240 kV transmission line. The Northwest region contains approximately 1,100 MW or 11 per cent of the provincial peak load, but only 770 MW of installed generating capacity. Due to the imbalance of load and generation, the region typically imports between 530 and 755 MW from the Wabamun Lake and Fort McMurray areas. The AESO has contracted TMR services to ensure a minimum amount of generation stays online to ensure that power transfers into the region are kept within operating limits.

Within the Northwest region, the Grande Prairie area also does not have sufficient local transmission capacity and TMR services are required about 54 per cent of the time for both MW support and dynamic VAr support. In addition, the Rainbow Lake area lacks sufficient transmission capacity to support area load and TMR services are required 100 per cent of the time. Future northwest system reinforcements are expected to be in service by mid-2012 into the Rainbow Lake area and are expected to reduce the need for TMR. Future generator interconnections in this area may also reduce the need for TMR.

Transmission resources added to the northwest in 2009 include: two capacitor banks totalling 60 MVAr, a +/- 30 MVAr SVC at Cranberry Lake, and a new 240 kV transmission line between Wesley Creek and Brintnell. Other planned improvements for the next two years include additional 144 kV transmission lines within the Northwest region and two SVCs. These additions will improve area transfer capability and voltage control.

NORTHEAST REGION

The Northeast region of Alberta is bounded on the north by the Northwest Territories, on the east by the Saskatchewan border, on the west by the Fifth Meridian, and on the south by Township 60. This region includes Fort McMurray, Athabasca/Lac La Biche and Cold Lake areas.

The Northeast region is forecast to experience the greatest load growth over the next 10 years. This is due in large part to the oilsands, forestry industries and related secondary service industries in the municipalities.

The load in the Northeast region is predominantly industrial and makes up approximately 1,700 MW or 17 per cent of the provincial peak load. The majority of the electrical load and generation is located in oilsands developments north of the City of Fort McMurray and in Cold Lake. Generation in the region is entirely gas-fired and accounts for about 18 per cent or 2,440 MW of Alberta's 12,623 MW of total installed generation capacity.

The Fort McMurray area is connected to the transmission system by three 240 kV transmission lines and under typical operating conditions, average exports are approximately 285 MW. The area continues to experience high load growth related to oilsands development; however, the economic downturn of 2008/2009 has delayed several oilsands-related new loads by at least one year, and uncertainty remains. It is expected that new load and on-site generation developments will effectively balance out in the short term. This should result in relatively minor changes to existing transfer levels between the Fort McMurray area and the AIES.

The current transmission system does not have the capacity to supply the entire firm load in the Fort McMurray area without support from local generation. However, a significant amount of the area generation is baseloaded industrial cogeneration and under normal operating conditions is adequate to support reliable operation.

The Fort McMurray area experienced real-time congestion three times in 2008 and seven congestion events from January to September 2009. Enhancing the transfer capabilities into the Fort McMurray area will be achieved by adding more voltage support devices during the next two years. Longer-term plans are constructing 500 kV lines into the Fort McMurray area.

The Cold Lake area has surplus generation and thermal constraints on the transmission system are managed through special protection schemes. Over the next 10 years, new oilsands extraction and processing related loads are projected to unload the area transmission system. Additional local facilities may be required to interconnect the new loads.

EDMONTON REGION

The Edmonton region is located around the City of Edmonton and includes the Wetaskiwin, Fort Saskatchewan, Wabamun and Edmonton areas. The region is the hub of Alberta's electric system and comprises 2,557 MW or 25.8 per cent of the provincial peak load and has 5,286 MW or 41.9 per cent of Alberta's generation capacity. Most of the generation is baseload coal-fired located around Wabamun Lake. The majority of the generation in the Wabamun Lake area flows east and south with smaller amounts flowing north and west.

The transmission system in the Edmonton region has the capacity to serve area load when all transmission elements are in service and baseloaded generation is available in the Fort Saskatchewan area. When one transmission element is out of service due to planned or forced outages, there are several local area constraints on the 138 kV systems. The 138 kV system contingencies only affect the local areas within the region. Planned outages occur about 25 per cent of the time and have the potential to create congestion on the area transmission system.

In 2008, two existing 240 kV transmission lines were upgraded to 500 kV and an additional 240 kV underground cable into Edmonton city centre went into service. Transmission upgrades for the near future include the re-termination of a 240 kV line between Ellerslie and Clover Bar substations and a large transmission development project re-configuring 240 kV lines to increase transfer capacity. This project is needed to add transmission capacity for the new 450 MW coal-fired generator at Keephills as well as to alleviate current constraints when all area coal generation is producing at full capacity. Wabamun Lake area generation may be constrained during the duration of the construction of new transmission.

WABAMUN LAKE/KEG AND EDMONTON/FORT SASKATCHEWAN AREA BULK TRANSMISSION

The Wabamun Lake area contains much of Alberta's coal-based generation. Four 240 kV lines transport electricity from the Sundance and Wabamun generating plants to the Edmonton area. Two 500 kV lines and one 240 kV line connect the Keephills and Genesee generating plants to the Edmonton area. Several 240 kV lines encircle the City of Edmonton, serving the City of Edmonton load and transporting power across the city to the Fort Saskatchewan industrial area.

The bulk transmission system in this area is approaching capacity limits during high load periods when all area generation is online. With several companies announcing plans to locate bitumen upgraders in the Fort Saskatchewan area, new transmission is required to meet growing demand. Commencing construction in summer 2010, proposed transmission capacity upgrades include converting another existing 240 kV line to 500 kV, moving the termination of a 240 kV line from Sundance to Keephills, upgrading the capacity of several 240 kV lines and installing a phase-shifting transformers. This major transmission development in the Wabamun Lake area will remove congestion in the area and facilitate interconnection of the new Keephills 3 generator. The Keephills 3 unit is expected to start commissioning in 2010 and participate fully in the Alberta energy market in 2011. All these upgrades along with the generator interconnection are expected to be in service in the third quarter of 2011.

This area was congested for several months in 2008 during the line conversion project. Congestion is expected in 2010 and 2011 during the transmission line outages needed to complete the planned transmission upgrades in the Wabamun Lake area.

CENTRAL REGION

The Central region is located between Edmonton and Calgary. The region includes the Lloydminster, Hinton/Edson, Drayton Valley, Wainwright, Abraham Lake, Red Deer, Alliance/ Battle River, Provost, Caroline, Didsbury, Hanna and Vegreville areas. This region contains approximately 1,590 MW or 16.1 per cent of the provincial peak load and generation capacity totals 13.5 per cent or 1,705 MW of Alberta's total installed generation capacity. The generation is a mix of hydro, coal-fired and industrial gas-fired cogeneration.

The transmission system in the Central region has the capacity to serve the load when all elements are in service during normal operation. However, when one transmission element is out of service, a number of contingencies can result in voltage violations and/or overloads in parts of the region. In 2008, one element was out of service for planned maintenance approximately 20.7 per cent of the time although there were no congestion events. This lack of congestion events are attributed to effective outage coordination. During January to September 2009, planned maintenance outages occurred three per cent of the time.

CALGARY REGION

Included in this region are the Calgary, Strathmore/Blackie, Seebe, High River and Airdrie areas. The region makes up approximately 2,060 MW or 20.9 per cent of the province's peak load (mainly residential) but produces only 7.4 per cent or 935 MW of Alberta's total installed generation capacity. The generation is approximately one-third hydroelectricity and two-thirds gas-fired generation.

The north-south 240 kV transmission lines transmit coal-fired generation from the north and east and wind generation from the south into the Calgary region. The Alberta-B.C. intertie ends near Calgary and provides the capability to export and import power to and from the B.C. transmission system.

Under normal system conditions with all elements in service in the Calgary region, the transmission system has the capacity to serve the regional load. However, in the City of Calgary, there is an issue related to the capability during times of planned or forced maintenance on the existing transmission equipment. When specific transmission equipment is removed from service for maintenance, there are single contingencies that could result in loss of load. This condition occurs in the south area of the Calgary system and the central business district.

To manage this risk, planned outages are coordinated and scheduled during lower load periods, which resulted in no congestion events in 2008. Transmission additions and re-configurations planned for the near future are expected to increase capacity in the region.

SOUTH REGION

The South region of Alberta has as its south boundary the Canada-U.S. border. The region is bordered on the north by the Seebe, Calgary, Hanna and Sheerness areas. The region is also bordered by B.C. and Saskatchewan on the west and east respectively. Large load centres include Lethbridge, Medicine Hat and the Empress industrial area. Total load accounts for 9.5 per cent or 945 MW of provincial peak load and there is an abundance of regional generation (13.4 per cent or 1,685 MW of Alberta's total) made up of coal, wind, gas and hydro generation. A significant amount of wind generation additions are planned for interconnection in this region.

Recent AESO studies for the Sheerness area determined that the Sheerness generator can be unstable following a contingency when the flow from the Anderson substation to West Brooks/Ware Junction on 240 kV lines exceeds a specific limit based on the number of lines in service. AESO is currently drafting an operating policy and procedure to implement cutplane flow management procedures on the 240 kV lines at Anderson to ensure real-time system operation is within safe limits.

The South region transmission system experiences frequent constraints. Currently, overloads occur on the southwest transmission system when wind generation is high coincident with high B.C. imports or exports. Transmission maintenance outages also increase constraints. Curtailments on wind farms are expected to continue until approved transmission upgrades in the southwest area of the region are completed in 2010.

To help reduce transmission congestion in the southwest area, a dynamic thermal line rating (DTLR) system was installed on the 170L line between Pincher Creek 396s and Peigan 59s substations. The DTLR calculates line ratings in real time and takes advantage of the increased conductor cooling caused by high wind speeds. The DTLR performance review throughout 2008 and 2009 indicates that DTLR operation has increased transmission capacity in the area. However, wind curtailments were not completely alleviated. Congestion in the area is expected to continue until the major southwest transmission upgrade is implemented in 2010. Ultimately, planned upgrades to the southwest transmission system expected to be in service in 2013/14 should mitigate any remaining congestion.

Export capability on the Alberta-Saskatchewan intertie is currently constrained by Alberta transmission. Planned or forced outages to transmission facilities in the area result in further constraints.

The AUC has approved new transmission development, and upgrades to the existing 240 and 138 kV transmission lines in the Southeast region are under construction to meet load requirements, accommodate additional wind generation and restore the McNeill intertie transfer between Alberta to Saskatchewan to 150 MW capacity. This transmission development is expected to be fully commissioned in the third quarter of 2010.

There are thermal constraints on the 240/138 kV transformers at West Brooks and North Lethbridge, on the 138 kV system serving the City of Lethbridge and in the Medicine Hat area. Transformer replacements and line upgrades are currently underway to address these constraints. Additional wind generation has also been connected in the area east of Lethbridge.

The current 240 kV bulk system between Calgary and the south of the province is also approaching capacity and will require substantial reinforcement to accommodate south-to-north transfers related to new wind generation. The AUC approved the Needs Identification Document (NID) in the third quarter of 2009 for major transmission development to the South region bulk system. The AESO and AltaLink are currently developing project specifications for the first phase of the project expected to be in service in 2012/13.

Planned outages occurred about 40 per cent of the time in the south during 2008 and approximately 14 per cent during the first nine months of 2009. Congestion events included 28 periods during 2008 and 23 periods from January to September 2009 where the City of Medicine Hat's ability to import from the grid was limited. There were also 803 hours of wind curtailments in 2008 and 731 hours from January to September 2009.

NORTH-SOUTH TRANSMISSION

The Edmonton to Calgary bulk transmission system is comprised of six 240 kV lines between the Wabamun Lake/Edmonton area and Calgary. These six circuits are collectively referred to as the South of Keephills-Ellerslie-Genesee (SOK) cutplane. These lines transfer baseloaded coal generation and Brazeau hydro generation to the southern part of the province and the Calgary region, which is a major load centre in the south. In addition, these lines provide the transmission path for energy exports through the 500 kV intertie to B.C. during periods of low to medium load on the Alberta system.

The power flow across the SOK cutplane and minimum voltage levels at several key busses of the north-south path are used to define the transfer capability of the north-to-south flow. Toward the end of the next two-year period, the delay of the north-south upgrade poses a significant concern to the operability and reliability of the AIES. To mitigate the impacts of the delays, the AESO has developed a comprehensive plan that identifies short-term measures to support the existing transmission system. This includes necessary operating procedures, application of new technologies and the use of demand-side response programs[7].

As load increases, the SOK constraint, especially during area transmission and generation outages, will result in Alberta becoming increasingly reliant on imported energy and southern generation.

DELAY IN UPGRADES TO THE NORTH-SOUTH TRANSMISSION CAPABILITY

Operation of the north-south transmission system will continue to be constrained during outages. The lines that make up the existing north-south transmission system will continue to require maintenance outages to ensure the level of service reliability they have provided for 30 years.

During planned and forced generation and transmission outages, Alberta will become increasingly reliant on imported energy and southern generation.

[7] *Demand-side response programs are activities that occur on the demand (customer) side of the meter to reduce consumption and are implemented by the customer directly or by distribution companies.*

ALBERTA INTERCHANGE CAPACITY

There is currently one 500 kV circuit and two 138 kV circuits between Alberta and B.C.

These three circuits are defined by the Western Electricity Coordinating Council (WECC) as Path 1. The current path rating of the B.C. intertie is 1,000 MW in an export mode and 1,200 MW in an import mode. However, the actual operating limit is much lower because of the need to maintain acceptable levels of frequency in Alberta in the event of intertie separation while importing, and voltage concerns in the Calgary area in the event of 240 kV line trips in the Calgary area while exporting. The intertie with B.C. currently has maximum import and export capabilities of 675 and 735 MW respectively. Transmission upgrades in Alberta and B.C. and an Alberta generator tripping scheme are required to increase export capacity to B.C. from the current limit of 800 MW.

To protect against a single generator contingency of up to 450 MW from cascading and tripping the intertie, a maximum of 780 MW of capacity may be imported on the Alberta-B.C. intertie. This import capability is made available through the use of the interruptible load remedial action scheme (ILRAS) and load shed services (LSS) programs. The AESO is currently reviewing the design and use of these programs with stakeholders.

The McNeill back-to-back alternating current (AC) to direct current (DC) converter station that connects Alberta and Saskatchewan is referred to as WECC Path 2. Although the intertie is rated at 150 MW in both directions, the maximum operating capability from Alberta to Saskatchewan is currently limited to 35 MW until Empress area transmission upgrades are completed in mid 2010. Then the export capability will be restored to the converter rating of 150 MW. Import capability from Saskatchewan to Alberta has a maximum equipment rating of 150 MW.

Alberta continues to be a net importer of electricity as has been the case for a number of years. In 2008, Alberta imported 1,689 gigawatt hours (GWh) of net energy compared to net energy import of 494 GWh of electricity in 2007. The net energy import for the period January to September 2009 was 1,279 GWh as compared to 1,141 GWh for the same period in 2008.

The Montana-Alberta Tie Line (MATL) 230 kV intertie between Alberta and Montana is expected to be in service in 2011. This intertie will provide an alternate source of energy exchange between Alberta and the northwest U.S. It is not expected to increase the net import and export limits between Alberta and B.C.

WIND INTEGRATION

Wind power in Alberta has seen substantial growth in the last few years. As of October 2009, Alberta had 563 MW of transmission-connected wind power from 11 wind farms. Wind power facilities provided 2.2 per cent of the total energy consumed in Alberta in 2008. Wind power is a variable source of energy, but Alberta wind facilities have relatively high capacity factors, with some reaching as high as 35 per cent on an annual basis. Alberta was the first jurisdiction in Canada to develop wind interconnection standards and conduct detailed studies on forecasting wind patterns.

The AESO's Market and Operational Framework for Wind Integration (MOF) forms the foundation for initiatives required to further refine and define rules, standards, information technologies and tools needed to integrate as much wind power into the Alberta system as feasible without compromising system reliability or the fair, efficient and openly competitive operation of the market. There continues to be strong interest to build wind generation and as of December 1, 2009, there was over 1,700 MW new wind generation planned to be in service by the end of November 2011.

Alberta provides an attractive environment for future development of wind resources because of the market structure, significant wind resources and the AESO's forward-looking actions developed in consultation with wind industry stakeholders. More information about the AESO's wind integration initiative can be found at **www.aeso.ca**

The AESO has been working closely with stakeholders and industry throughout North America to ensure we are up-to-date with wind integration initiatives and to share what we are doing in Alberta. The AESO continues to be a leader in wind integration and in 2008 we received two awards for our work.

The AESO was recognized by the Utility Wind Integration Group (UWIG) for addressing the challenges of integrating wind into the Alberta electricity market. The UWIG press release stated "the AESO, working with stakeholders, developed a clear set of rules to guide participation of wind generators in the market. This coupled with work moving forward on a wind forecasting pilot project to assist system operators in dealing with the variable nature of wind generation, enabled lifting of the market cap and moving forward on integrating an ever increasing amount of wind into the Alberta power system."

The AESO also received the R.J. Templin award from the Canadian Wind Energy Association (CanWEA), which recognizes outstanding scientific, technical, engineering or policy work supporting the development of wind energy in Canada. CanWEA recognized the AESO for developing the MOF, for undertaking the May 2008 wind forecasting pilot project, and for advancing transmission system reinforcements to interconnect wind.

The AESO has continued to adopt a leadership position in wind integration by chairing the NERC Integration of Variable Generation Task Force. This task force prepared a report describing the variable characteristics of wind generation and recommended approaches, standards and procedures to accommodate wind generation on a large scale on the bulk power system. The report is available on the NERC website **www.nerc.com**

The AESO system controllers rely on complex systems, tools and procedures to ensure reliable operation of the grid and market. On the tools and technology side, the AESO developed a system operator tool called the dispatch decision support tool. This tool supports the system operator with the volume and timing of energy market dispatches over a 60-minute period to ensure supply-demand balance based on real-time information of energy market offers, energy market ramping capabilities, regulating reserve ramping capability, forecast load, forecast wind and interconnection schedule activities. The tool also provides a six-hour outlook on market conditions.

DEMAND RESPONSE

Recognizing that electricity demand is responsive to the real-time price of electricity, the AESO offers a combination of programs to allow load to participate in the wholesale electricity market and contribute to reliable system operation.

Approximately 175 to 300 MW of load participates in the market by voluntarily reducing demand when pool prices exceed their own self-defined price threshold. Load also has the opportunity to participate in the supplemental reserve market by reducing demand when directed by the AESO following a significant loss of generation in Alberta.

In addition, the AESO offers a demand opportunity service rate for transmission customers able to reduce demand when transmission capacity is restricted.

We are currently working with stakeholders to provide further opportunities for load to participate in the market to maintain transmission reliability. In particular, transmission constraints, supply shortfall and wind ramps are areas where increased demand response could benefit system reliability.

HIGHLIGHTS

- Alberta's Interconnected Electric System (AIES) provides an adequate level of reliability; however, the level of congestion on the system is expected to increase until more transmission is built.
- Timely approval and implementation of proposed transmission upgrades remain priorities for the AESO to meet future reliability needs.
- Supply reserve margins will be adequate during the next two years, but will continue to require close coordination of generator and transmission outages to ensure reliable operation. As a general trend, the AIES is expected to become increasingly reliant on imported energy during generator outages and derates to meet demand over the next few years.
- Emphasis will be maintained on operating procedures, system analysis and the availability of training and tools to equip system controllers to manage the reliability of the Alberta system.

IN SUMMARY

Information in the *24-Month Reliability Outlook* is provided from the perspective of assessing the AESO's ability to operate the AIES in a reliable manner over the 2009/2010 winter season and the next two years. Supporting information and forecasts are available separately on the AESO website (www.aeso.ca) and are referred to throughout this document. The AESO publishes the *24-Month Reliability Outlook* every year at the beginning of each winter operational season. This document complements the AESO's existing publications and supports our commitment to sharing information with market participants, stakeholders and all Albertans in a timely, open and transparent manner. Readers are invited to provide comments or suggestions for future reports.

For more information or to give us your feedback, contact:
corporate.communications@aeso.ca

24-Month Reliability Outlook (2009 – 2011)

OUR VISION IS:

The AESO will be seen as a significant contributor to the development of Alberta and the quality of life for Albertans, through our leadership role in the facilitation of competitive electricity markets and the reliable operation and development of the Alberta Interconnected Electric System.

OUR MISSION STATEMENT IS:

The AESO facilitates a fair, efficient and openly competitive market for electricity and provides for the safe, reliable and economic operation of the Alberta Interconnected System.

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