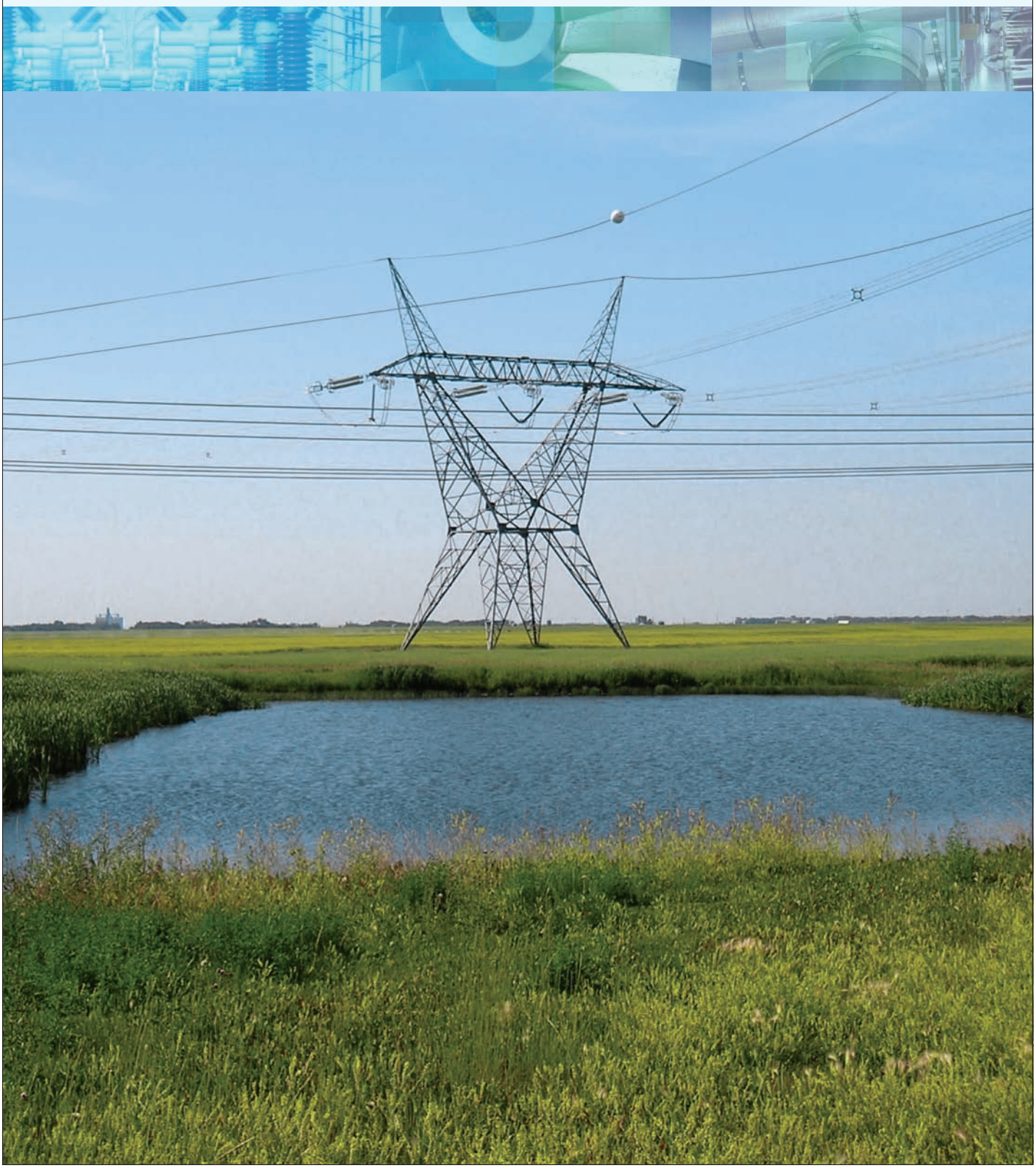
Alberta
24 Month Reliability Outlook
2008-2010

aeso
ALBERTA ELECTRIC SYSTEM OPERATOR



A 500 kV transmission tower near the Langdon substation.

Photo courtesy of AltaLink.

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. Electricity virtually powers every business and industry in Alberta and helps create almost every product we use in our lives. System operators constantly monitor the flow of electricity on the transmission system, balancing supply and demand across the province on a real time basis to ensure we maintain 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 $8-billion wholesale power market, where organizations buy and sell large volumes of electricity. Our job is also to make sure the transmission system is reinforced to keep pace with the demand for power as our population and economy continue to grow.

Photo courtesy of AESO.

We continue to move forward on a number of significant transmission reinforcements required to meet the growing demand for reliable electricity in Alberta.

What is the *Alberta Seasonal 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 to fuel businesses and the industrial base. If the electric supply is not 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 that 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 electric system. The AESO's job is to ensure the electric system can do both to keep the lights on for Albertans.

So how are we doing? We have launched this *Alberta 24 Month Reliability Outlo*ok to help answer that question. This first edition covers the 24 month period from November 2008 to November 2010 and includes information about:

- Expected load conditions, supply adequacy and 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

Photo courtesy of AltaLink.

Upgrading overhead shield on a transmission line west of Edmonton.

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 2.6 to 4.6 per cent. GDP is forecast to be 3.7 per cent in 2009. Over the past two decades, Alberta has had the highest rate of GDP growth in Canada, averaging 3.8 per cent per year.

The AESO is responsible for ensuring that the electric system remains reliable while keeping pace with the province's strong economic growth. And indeed, our plans include ensuring the transmission system can accommodate the addition of 1,900 megawatts (MW) of new generation to the system over the next two years.

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. Parts of the electric system are experiencing congestion and constraints on the transmission grid that can 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 some parts of the province (Rainbow Lake, Northwest Alberta and Calgary area) to support system reliability
- Wind generation constraints occur relatively often in the Southwest region due to the need to reinforce 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 pronounced, we are meeting this challenge through:

- Ongoing emphasis on outage coordination
- Improving reliability standards, operating tools and procedures
- Augmenting training and introducing new programs for system operators to maintain system reliability

The level of congestion on Alberta's electric grid is expected to increase until additional transmission is built. Generator developers are planning to connect 1,900 MW of new generation to the system and it will become more congested until new transmission is built. From our perspective, timely approval and implementation of these proposed transmission upgrades is imperative and remains a priority.

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 2008 to November 2010 timeframe.

Expected load conditions

Each month the AESO produces an hourly 24-month[1] mid-term forecast that we use to assess electric system supply and demand balance in the near term and to help coordinate planned generator outages.

In 2007/2008, the Alberta Internal Load (AIL)[2] winter peak demand was 9,806 MW and the summer peak was 9,541 MW. Based on the AESO's long-term load forecast, peak demand is projected to be 10,467 MW for winter 2008/2009 and 10,793 MW for winter 2009/2010. Forecast summer peaks for 2009 and 2010 are 9,996 MW and 10,314 MW respectively.

Summer peaks are getting higher in Alberta. To a large extent, this is being driven by the population growth in southern Alberta and Calgary in particular. As the population grows, there are more users, and, frequently, more users who are using more electricity. In a general sense, the increase in summer peaks is attributable to increased air-conditioning load.

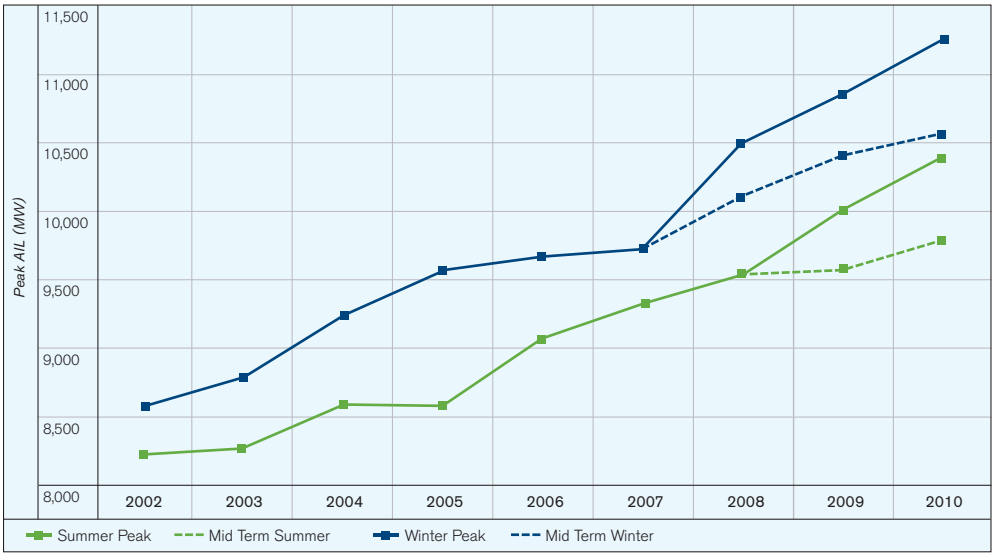
Figure 1 shows AIL yearly actual and forecast peak loads from 2002 to 2010. A review of Figure 1 shows forecast peak loads may trend lower as indicated in the mid-term forecast. The 2007 actual summer and winter peak and recent daily peak load history confirm the trend indicated in the mid-term forecast.

On a year-over-year basis, Alberta's total energy consumption for the first nine months of 2008 (taking into consideration the Leap Year effect) was 0.4 per cent higher than energy consumption for the same period in 2007. Given that actual energy consumption for 2007 and January to September 2008 was lower than forecast, the 2008/2009 winter and 2009 summer peaks are also expected to be lower than indicated in the long-term forecast.

Actual loads, however, for the period November 2008 to November 2010 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

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.*

Supply adequacy

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

As mentioned earlier, generation developers in Alberta plan to add over 1,900 MW of new generation between 2008 and 2010. If many of these projects go ahead as anticipated, supply reserve margins should be adequate over the next two years although it will be necessary to continue to closely coordinate generator and transmission outages to ensure reliable system operation.

In 2008, as required by the Province of Alberta's 2007 *Transmission Regulatio*n, the AESO developed rules regarding generator outage coordination and filed them with the Alberta Utilities Commission (AUC). These rules define the steps we must take and issues to consider when cancelling a planned outage to maintain supply adequacy and reliability operation. The rules also outline the terms of compensation to generation owners if the AESO directs generators to cancel a planned outage.

The AESO expects EPCOR's Rossdale plant (209 MW) will be decommissioned at the start of 2009 as a new transmission line into central Edmonton was placed in service in October 2008.

As a general trend, Alberta is expected to become increasingly reliant on imported energy to meet demand over the next few years until new in-province generation is connected to the electric system.

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 (one to five years). Further information can be found at **www.aeso.ca**

Photo courtesy of TransCanada Corporation.

TransCanada's Bear Creek Cogeneration Plant uses natural gas and wood waste to generate electricity and steam.

Transmission reliability

We describe transmission reliability (sometimes called 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 that when these events occur, the effects are manageable and consequences are acceptable. 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 the coordination of planned 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 and standards 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 a fair, efficient and openly competitive market.

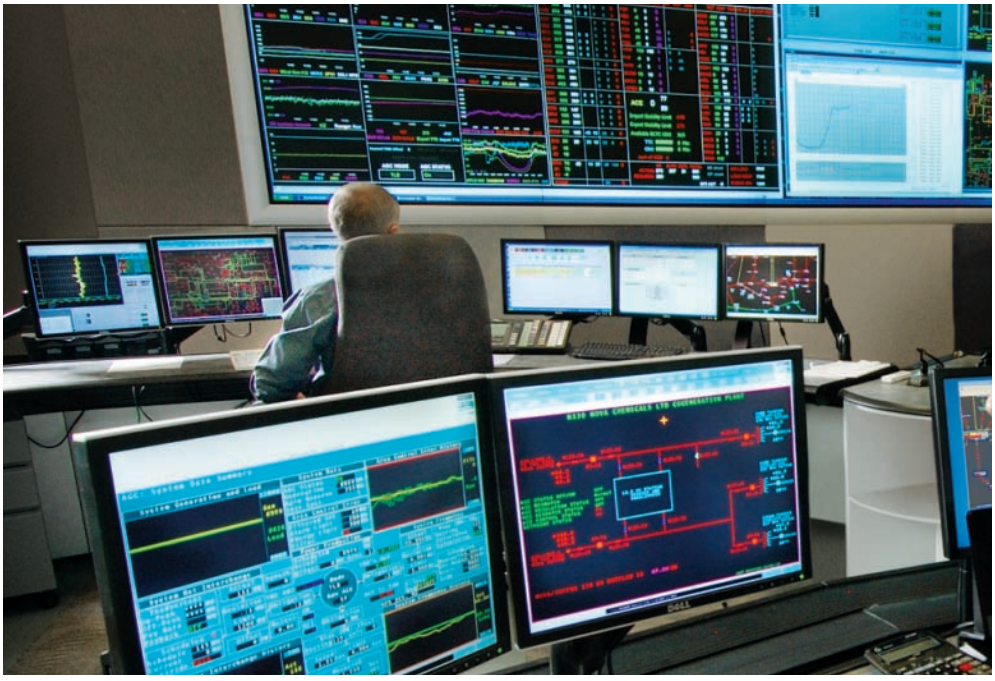


Photo courtesy of AESO.

The AESO's system controllers monitor the Alberta's Interconnected Electric System 24 hours a day seven days a week to ensure the supply and demand of electricity is in constant balance.

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

In 2008, the AESO filed a set of reliability standards with the AUC that includes modifications to those developed by NERC to ensure the standards are properly aligned with the industry structure and adapted for Alberta. In doing this, we consulted extensively with market participants most likely to be directly affected in accordance with section 19(4)(a) of the *Transmission Regulation*. More information on the mandatory reliability standards initiative can be found at **www.aeso.ca**

The AESO also underwent a NERC Reliability Readiness Evaluation in 2008[3] that outlined a number of positive observations regarding our overall commitment to reliability as well as our ability to maintain the reliable operation of Alberta's bulk power system. NERC's final report for the AESO is available at **www.nerc.com**

Photo courtesy of ATCO Electric.

ATCO Electric contractors install the top section of a 240-kilovolt, double-circuit steel lattice transmission tower.

[3] *The NERC program conducts an independent evaluation of key industry entities (e.g. balancing authorities, transmission operators etc.) to assess their preparedness to meet assigned reliability responsibilities.*

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.

The AESO prepares long term transmission plans to provide market participants, customers and interested stakeholders with an overall view of necessary upgrades to the transmission system.

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. 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 similar to procedures and practices 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 2008. These include:

- South of Keephills-Ellerslie-Genesee (KEG) upgrade
- Several new capacitor banks in the Northwest Region
- Several new oilsands interconnections in the Fort McMurray area
- A new 240 kV underground cable to supply central Edmonton load

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

- Several new capacitor banks and new static VAR compensators (SVC) in the Northwest region
- New 144 kV and 240 kV transmission lines in the Northwest region
- New 240 kV transmission lines in the Southwest region
- Transmission additions and re-configurations in the City of Calgary
- Re-termination of a 240kV line between Ellerslie and Cloverbar
- 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
- 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 manage these conditions.

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 2008/09 operating season and over the November 2008 to November 2010 timeframe of the *Alberta 24 Month Reliability Outlook*.

Different seasons of the year place pressure on the electric system in different ways. In winter, peak demand is at its highest, energy supply is tighter and supply margins are generally low, however, thermal ratings[4] on transmission equipment are high. By contrast, load is lower during the summer, but thermal ratings are also lower and maintenance on transmission and generating assets (which requires temporary outages) is generally planned for the summer due to the warmer weather and longer days. Overall, contrary to what some might think, there is more stress on the transmission system in the summer than during the winter.

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 2008/2009. Another factor contributing to increased transmission reliability on the system is the reduced flow on the South KEG 240 kV cutplane[6] and the availability and operation of in-merit gas generation 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 outage coordination, providing 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.

Stock photograph.

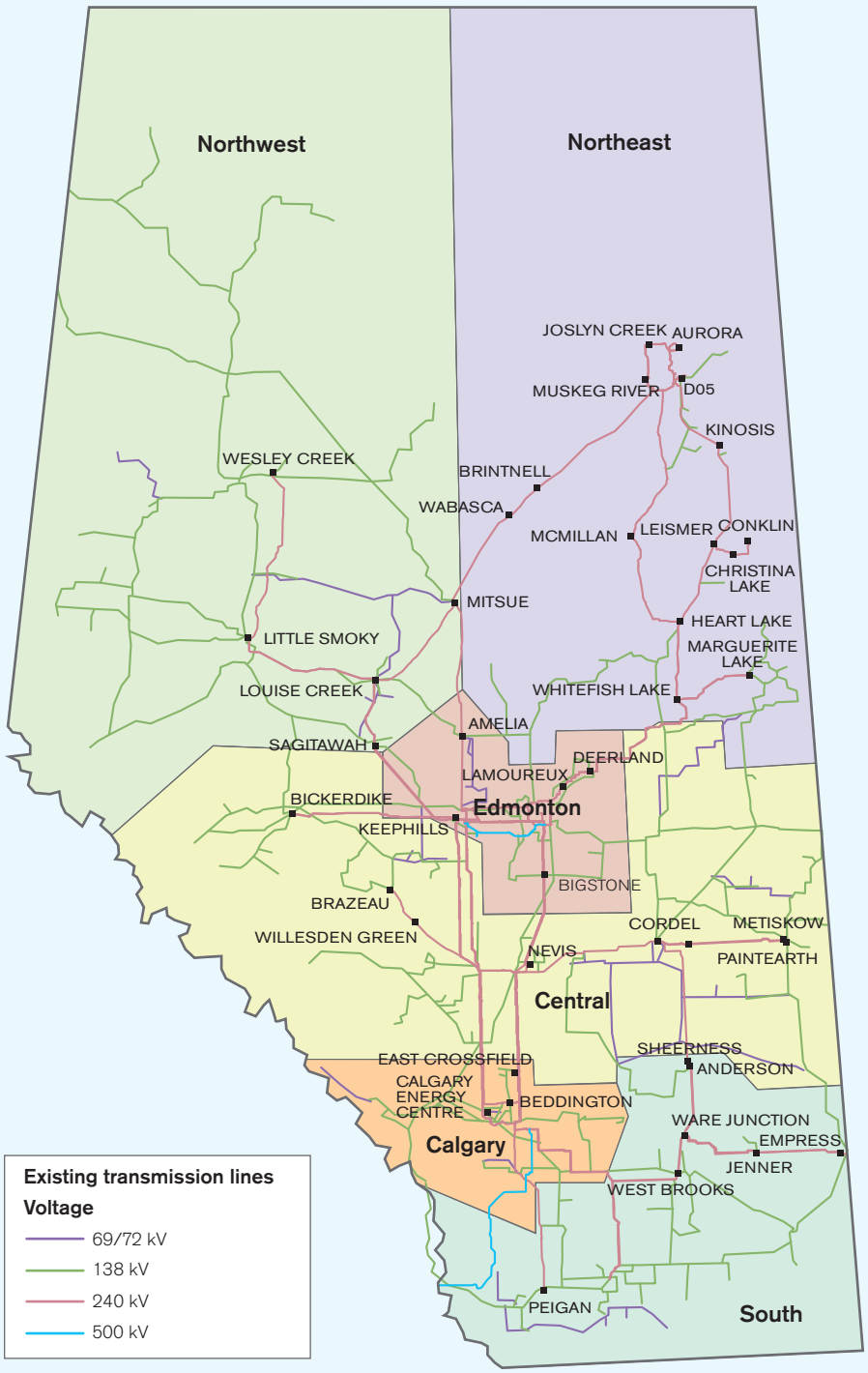
The ongoing provision of competitively priced and reliable electricity is essential to ensure long-term growth, a high standard of living and prosperity for Albertans.

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 that connect 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 large geographic 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 N.W.T. to the north. While the Northwest region represents approximately one-third of the area of the province, it represents about 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, Fox Creek and Swan Hills planning areas. It is connected to the Lake Wabamun area primarily through three 240 kV transmission lines.

This Northwest region contains approximately 1,200 MW or 11 per cent of the provincial peak load. Generation in the area accounts for about 6 per cent or 770 MW of Alberta's total installed generation capacity. Due to the imbalance of load and generation, the region typically imports between 600 and 750 MW from the Lake Wabamun area. The AESO has contracted TMR services to ensure a minimum amount of generation stays on line to ensure that power transfers into the region are kept within safe limits.

Within the Northwest region, the Grande Prairie area also does not have sufficient local transmission capacity and TMR services are required about 70 per cent of the time. 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.

Near the end of 2007, the AESO arranged to supply an additional 10 MW of load in the Fort Nelson area. To reliably supply this additional load, the amount of TMR services was increased and a load shedding scheme was implemented to curtail the new load in situations where there is insufficient generation to maintain reliability. This is a temporary arrangement that will be addressed by the approved transmission developments for the area planned to be in service by 2011.

In 2008 additional capacitor banks totalling 120 mega-volt ampere reactive (MVAR) were installed in the Northwest region. Other planned improvements include additional 144 kV and 240 kV transmission lines within and to the Northwest region, a synchronous condenser near Rainbow Lake and three static VAR compensators. These additions will improve area transfer capability and voltage control.

Northeast region

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 Northeast region includes the Fort McMurray, Athabasca/ Lac La Biche and Cold Lake planning areas.

The load in the Northeast region is predominantly industrial and makes up approximately 2,100 MW or 21 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 17 per cent or 2,144 MW of Alberta's 12,368 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, exports approximately 300 MW. The area continues to experience high load growth related to oilsands development and it is expected that load additions and onsite generation development will effectively balance out. 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 baseload industrial co-generation and under normal operating conditions is enough to support reliable operation.

The Fort McMurray area was congested three times in 2007 and experienced three events from January to November 2008. Enhancing the transfer capabilities into the Fort McMurray area will be achieved by adding more voltage support devices.

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 will remove generation constraints in the area. Additional local facilities may also be required to interconnect the new loads.

Photo courtesy of the Long Lake Project.

The Long Lake oilsands project is a 50/50 joint venture of OPTI Canada Inc. and Nexen Inc.

Edmonton region

The Edmonton region includes the Wetaskiwin, Fort Saskatchewan, Wabamun and Edmonton planning areas. The region is the hub of Alberta's electric system and comprises 2,800 MW or 27 per cent of the provincial peak load and has 5,235 MW or 42.3 per cent of Alberta's generation capacity. Most of the generation is baseload coal-fired located around Lake Wabamun. The majority of the generation in the Lake Wabamun 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 baseload generation is available in the Fort Saskatchewan area. When one transmission element is out of service due to planned or forced outages, there are numerous local area constraints on the 138 kV system. 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 240 kV transmission lines were upgraded to 500 kV and an additional 240kV underground cable into Edmonton city centre went into service. Other upgrades for the near future include the re-termination of a 240 kV line between Ellerslie and Cloverbar substations and a project to remove the bottleneck by adding transmission capacity for the new 450 MW coal-fired generator at Keephills.

Photo courtesy of TransAlta Corporation.

The coal-fired Keephills power plant is 70 kilometres west of Edmonton.

Lake Wabamun/KEG and Edmonton/Fort Saskatchewan area

The Lake Wabamun 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 circle the City of Edmonton, serving Edmonton load and carrying 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 generation is on line. With several companies announcing plans to locate bitumen upgraders in the Fort Saskatchewan area, new transmission is required to meet growing demand.

In June 2008, two of the three existing 240 kV transmission lines from Keephills and Genesee power plants were converted to 500 kV. This project and the installation of 330 MVAR capacitor banks in 2007 resulted in capacity improvements to the area transmission system; however, more capacity is needed for the new Keephills generator expected in 2010.

Proposed transmission capacity upgrades include converting another line to 500 kV, moving the termination of a 240kV line from Sundance to Keephills, upgrading the capacity of several 240 kV lines, installing phase-shifting transformers and implementing a remedial action scheme to trip Keephills 3 under certain contingencies.

This area was congested for several months in 2008 during the line conversion project. More congestion is expected during the outages needed to complete the planned transmission upgrades.

Photo courtesy of EPCOR.

EPCOR Genesee Generating Station with the addition at left of Unit 3.

Central region

The Central region is 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 planning areas. This region contains approximately 1,400 MW or 13 per cent of the provincial peak load and generation capacity totals 14 per cent or 1,700 MW of Alberta's total installed generation capacity. The generation is a mix of hydro, coal-fired and industrial gas-fired co-generation.

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 2007, one element was out of service approximately 18 per cent of the time although there were only four congestion events. This relatively small number of congestion events is attributed to effective outage coordination.

Calgary region

Included in this region are the Calgary, Strathmore/Blackie, Seebe, High River and Airdrie planning areas. The region makes up approximately 2,000 MW or 19 per cent of the province's peak load (mainly residential load) but produces only 7 per cent or 900 MW of generation of Alberta's total installed generation capacity. The generation is approximately one-third hydroelectricity and two-thirds gas-fired generation.

Transmission lines bring 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, area transmission system has the capacity to serve area load. In the City of Calgary, when specific transmission equipment is removed from service for maintenance, an outage to another area line can result in the loss of load. When specific transmission equipment is removed from service for maintenance, there are single contingencies that could result in the 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 during lower load periods and there were no congestion events in 2007. 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 planning 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 nine per cent or 950 MW of provincial peak load and there is an abundance of regional generation (13 per cent or 1,613 MW of Alberta's total) made up of coal, wind, gas and hydro generation. A significant amount of wind generation is planned for interconnection in this region.

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 alleviate wind generation curtailments, a dynamic thermal line rating system (DTLR) was commissioned 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. An initial assessment indicates that DTLR operation will increase transmission capacity. However, even with the DTLR wind generation curtailments are expected to continue until the major southwest transmission upgrade is implemented in 2010. Ultimately, planned upgrades to the southwest transmission system should mitigate any remaining overloads.

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. 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. Additional wind generation has also been connected in the area east of Lethbridge.

The AUC has approved a Needs Identification Document (NID) for new transmission development and upgrades to the existing 138 kV transmission lines in the Southeast region that will meet load requirements, accommodate additional wind generation and restore the McNeill intertie transfer capacity of 150 MW from Alberta to Saskatchewan.

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 AESO filed a NID with the AUC at the end of 2008 for this reinforcement.

Planned outages occurred about 30 per cent of the time in the south over the last year. Congestion events included 20 periods where the City of Medicine Hat's ability to import from the grid was limited. There were also 500 hours of wind curtailments over the past year.

North-South transmission

The Edmonton to Calgary bulk transmission system is comprised of six 240 kV lines between the Lake Wabamun/Edmonton area and Calgary. These six circuits are collectively referred to as the South of Keephills–Ellerslie–Genesee (SOK) cutplane. These lines transfer baseload coal generation and Brazeau hydro generation to the southern part of the province and to the Calgary region, which is a major load centre. 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, any delays to the north-south upgrade will pose a significant concern to the operability and reliability of the AIES. To mitigate the impacts of the delays, the AESO is developing 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.

Photo courtesy of Suncor.

The Magrath wind power project in southern Alberta is jointly owned by Suncor Energy, Accino Energy and Enbridge Income Fund.

[7] *Demand-side 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.*

Imports

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 intertie separation while exporting. In 2007, the intertie with B.C. had maximum import and export capabilities of 675 and 735 MW respectively.

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.

Alberta continues to be a net importer of electricity as has been the case for a number of years. In 2007, Alberta imported 494,000 megawatt hours of electricity.

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 limited to 35 MW due to Empress area load. While the import capability from Saskatchewan to Alberta has a maximum equipment rating of 150 MW, the Alberta-to-Saskatchewan export transfer limit is constrained from its full capability by limitations on the local transmission system in southeast Alberta and the Edmonton to Calgary transmission path. The Saskatchewan intertie had a maximum import and export capability in 2007 of 153 and 60 MW respectively.

The AUC has approved a NID for new transmission development and upgrades to the existing 138 kV transmission lines in the Southeast region to meet load requirements, accommodate additional wind generation and restore the McNeill intertie to Saskatchewan to full transfer capacity.

Exports

Alberta's export capability to B.C. is rated at 1,000 MW, however, there is currently only 800 MW of export capability available (during off-peak hours). Transmission upgrades in Alberta and B.C. and an Alberta generator tripping scheme are required to go beyond the current 800 MW limit.

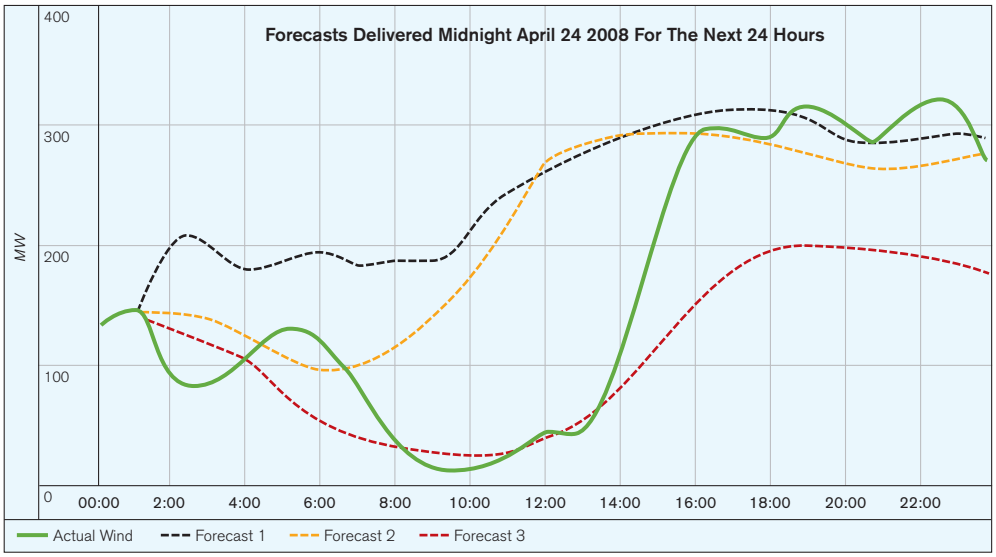
Wind integration

Wind power in Alberta has seen substantial growth in the last few years. As of March 2008, Alberta had 497 MW of transmission-connected wind power from 10 wind farms. Wind power facilities provided approximately two per cent of the total energy consumed in Alberta in 2007.

Wind power is an intermittent source of energy, but Alberta wind facilities have an overall relatively high capacity factor of about 35 per cent. Alberta was the first jurisdiction in Canada to develop wind interconnection standards and to 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, information technology, tools, and the AESO operating policies and procedures (OPPs) needed to integrate as much wind power into the Alberta system as is feasible without compromising system reliability or the fair, efficient and openly competitive operation of the market.

Figure 3: AESO Wind Power Forecasting Pilot Project



As seen in Figure 2, there can be significant differences (e.g. how much and when) between forecast and actual wind generation. Improvements to forecasting techniques used for real-time operation are needed to provide system operators with a useful tool that can be incorporated into existing OPPs, practices and procedures.

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**

In October 2008, the AESO received the R.J. Templin award from the Canadian Wind Energy Association (CanWEA). The award 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 is preparing a report that describes 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 will be released in spring 2009.

Demand response

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

Anywhere from 175 – 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 our stakeholders to provide further opportunities for demand 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 a priority for the AESO to meet and fuel future growth.
- 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 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 *Alberta 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 2008/2009 winter season and the next two years. Supporting information and forecasts are contained separately on the AESO website **(www.aeso.ca)** and are referred to throughout this document.

We will publish the *Alberta 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.

In order to continually improve the value of the information the AESO provides to market participants, stakeholders and other interested parties, we would like to hear your feedback on this *24 Month Reliability Outlook*. Please forward any comments or suggestions you may have to **corporate.communications@aeso.ca**. A copy of this document is located on the AESO's website at **www.aeso.ca**

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