Southern Alberta Planning Study

Study Scope

February 8, 2008

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1 Introduction

The AESO is currently undertaking a transmission system planning study for the southern Alberta region. This document provides the details of the scope of work for this planning study.

Southern Alberta has emerged as an area with a large expressed interest in wind generation development. The present network in the area does not have the capacity to interconnect the wind generation the AESO is forecasting that will be seeking access in the planning time frame. Nor does the capacity exist on the bulk transmission system to move this generation from the southern parts of the province to the load centres such as Calgary.

The planning study will assess the transmission needs over the period of 2007 to 2017, assess possible transmission alternatives and develop a recommended transmission development plan. However in doing so, the long term planning requirements spanning the next 20 years will have to be taken into consideration.

The study scope addresses the following which will be applied in the transmission development assessment:

- Reliability criteria;
- Planning process;
- Study assumptions;
- Project development and participant involvement program; and
- Study schedule.

After the recommended transmission development in southern Alberta region for the next ten years has been determined, a Needs Identification Document (“NID”) will be filed with the Alberta Utilities Commission (“AUC”) for approval.

2 Study Area

The southern Alberta region consists of ten planning areas which are Strathmore/Blackie (45), Brooks (47), Empress (48), High River (46), Stavely (49), Vauxhall (52), Medicine Hat (4), Fort McLeod (53), Lethbridge (54) and Glenwood (55). It borders the planning areas of Seebee, Calgary, Sheerness and Hanna in the north, Saskatchewan to the east, Montana to the south and British Columbia to the west. The transmission network in southern Alberta region is shown in Figure 2.1.

The southern Alberta transmission system at present consists mostly of 138 kV network with a few 240 kV lines. There are small pockets of 69 kV transmission system as well. The 911L 240 kV line connects Janet 74S to Peigan 59S substations in the southwest. A 240 kV double circuit 923L and 924L from Langdon substation connects to North Lethbridge 370S through the Milo Junction. Another double circuit 240 kV line is tapped off the Milo Junction to West Brooks 28S and onwards to Anderson 801S and Empress 163S substations. There is a HVDC back-to-back intertie between Alberta and Saskatchewan at Empress which is rated at 150

MW. The present export capability of this tie is reduced to 60 MW due to low voltage concerns during high power transfer conditions. The 500 kV intertie to British Columbia traverses the southwest area but is not connected into the south transmission system. The AESO has recently submitted a Southeast Alberta Transmission Development Needs Identification Document that among other items, addresses this issue.

Of the ten planning areas included in the southern Alberta region, the Empress area, located on the border with Saskatchewan, has the largest load with a summer peak of nearly 300 MW. The Lethbridge area includes the City of Lethbridge and the peak load is close to 200 MW. The City of Medicine Hat has its own generation and load and has STS and DTS contracts of 90 MW and 26 MW respectively. The southern Alberta region is a summer peaking region compared to the AIES which is a winter peaking area. The coincidental summer peak for the southern Alberta is forecast to be 1,162 MW for 2008.

At present the southwest Alberta region has approximately 500 MW of wind generation in operation. These plants are mostly located in or near the Pincher Creek area. In addition to the wind generation, there is a small amount of hydro generation installed in the southwest region. In the past few months, the AESO has received generation interconnection applications for a large number of wind power projects. This wind interest is spread throughout the southern Alberta region and is not concentrated in any one area. The total wind interest for the province of Alberta currently stands at over 8,000 MW.

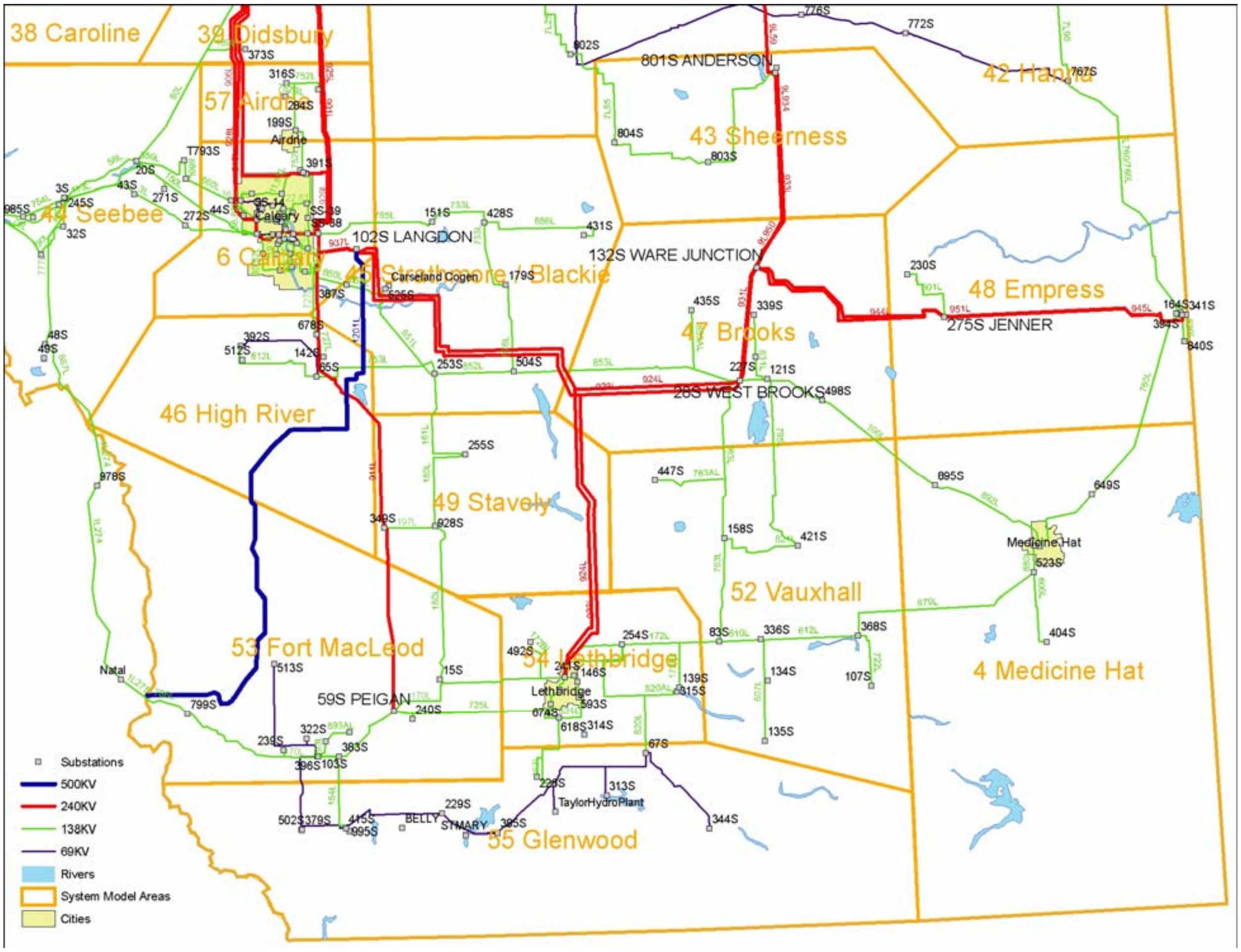


Figure 2-1: **Southern Region Transmission System**

3 Reliability Criteria

The current AESO Transmission Reliability Criteria will be applied in the study to test the transmission system for acceptable performance under Category A (i.e. all elements in service) and Category B (i.e. an element out of service) conditions. Category C events (i.e. two elements out of service) as well as Category D will also be considered in the assessment of transmission development alternatives.

All equipment must operate within its applicable thermal and voltage limits with the required margin and the system must be stable with no cascading outages.

4 Transmission Planning Process

The AESO's transmission planning process relies on quantifiable input assumptions as well as public feedback, the AESO's experience and expertise to perform analysis and employ professional judgment. The approach is iterative, which results in narrowing the list of viable alternatives as the degree of analysis increases. The individual components of the transmission planning process are described below. The participant involvement program is described in Section 7.

4.1 Need assessment

The AESO runs simulations of the transmission system into the future to identify a need for transmission reinforcement. This analysis is based on applying the AESO's Reliability Criteria to test for capacity, security, performance, operability and maintenance management under specified load forecast and future generation assumptions. This analysis produces when, where and the type of criteria violation that is expected to occur, and the implications expected to result from the failure if there is inadequate transmission.

4.2 Alternative screening

Once the need for transmission reinforcement has been identified, the AESO lists the options that are available to address the need. From this list of options, the AESO develops transmission alternatives suitable for the area or region under study. The AESO applies load flow modeling to these alternatives to verify that these are technically and physically feasible. The AESO also applies the reliability criteria to these alternatives to verify capability and identify any additional facilities required to meet the capability requirement. At this stage, preliminary consideration is given to matters such as existing assets, technology risk, project staging, high level capital cost, and policy and regulation.

This resulting set of viable alternatives is then used to formulate transmission development concepts which are subjected to a detailed assessment. The detailed assessment is intended to provide a means of comparability between the concepts so that the AESO can ultimately determine a recommended solution.

4.3 Alternative assessment

Once the list of alternatives has been filtered to the final list for further consideration, the AESO performs a detailed evaluation on each alternative to determine which transmission solution it will recommend.

The detailed assessment includes more technical analysis including dynamic and voltage stability analysis. It also includes detailed financial analysis which includes modeling specific financial assumptions and comparing the alternatives using a discounted cash-flow approach. A high-level land use assessment which considers factors such as population density, agriculture, alignment with existing corridors and environmentally sensitive areas may also be performed. Finally, additional characteristics are compared as appropriate such as project staging, future system flexibility and the timing of capital expenditures.

The section that follows outlines the AESO's standard alternative assessment methodology. This methodology forms the general approach from which the AESO assesses future transmission development in Alberta.

5 Study Approach

5.1 Technical Evaluation

The technical evaluation measures the system performance achieved in the need assessment and by each of the alternatives and determines the extent to which each alternative reduces the risk and consequences of these system events. The technical evaluation includes thermal loading, voltage and dynamic stability analysis. Typically thermal loading and voltage stability analysis is performed in the need assessment on all of the alternatives subject to detailed evaluation and dynamic stability analysis is performed on the alternative selected for recommendation. A brief description of each is provided below.

Thermal Loading: Thermal loading capability is related to the current carrying capacity of the line conductors, transformers and associated equipment. The alternatives are tested for conditions that can result in loading exceeding the thermal loading limits of individual transmission lines and/or transformers.

Voltage Stability: Voltage stability analysis is carried out to see if the alternatives are able to maintain a voltage profile with adequate real and reactive power margins under normal and stressed conditions. For this purpose P-V and/or V-Q analysis are performed to study the voltage stability limits for different alternatives and to calculate the voltage stability margins.

Dynamic Stability: Dynamic stability studies are performed on the alternative selected for recommendation to ensure that the system remains stable under dynamic conditions. Different types of disturbances are simulated at critical locations and relevant system parameters such as relative rotor angles, bus voltages, transmission element power flows and system frequency are monitored to ensure that the system meets the reliability criteria.

5.2 Financial Evaluation

The financial evaluation methodology to be used to compare alternatives is based on calculating the net present value (using a discounted cash flow approach) of the costs and benefits being considered. The revenue requirement resulting from the estimated capital costs and the changes in loss volumes resulting from increased system development are key components to evaluating the financial comparability of transmission alternatives. Typically, the alternative with the lowest comparative net cost is considered optimal from a financial perspective. The comparative net cost or benefit however, is still considered within the overall context of other factors such as technical superiority, corridor land use impact, project flexibility, the short term and long term planning horizon and legislative requirements of the *Transmission Regulation*.

6 Study Assumptions

The primary assumptions that will be considered in the Southern Alberta Planning Studies will consist of the area load forecast, generation scenarios, bulk transmission scenarios and transfers on interconnections with other jurisdictions. The assumptions to be applied in these studies associated with these are presented in the following sections.

6.1 Load forecast

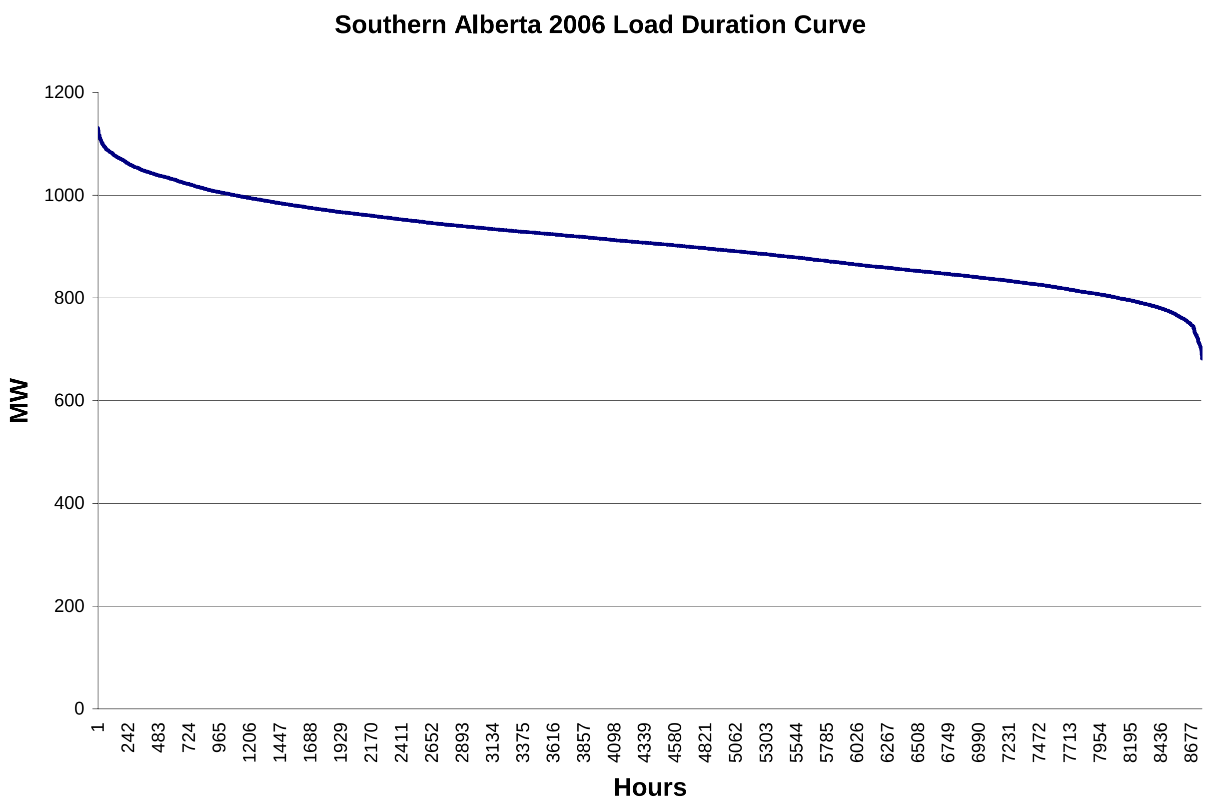
Table 6-1 provides the historical and forecast coincident area peak load for the southern Alberta Region. The table shows that the southern Alberta region is a summer peaking region and the rate of load growth is of the order of 2% for the period of 2007 – 2017 and is based on the FC2007 AESO forecast.

Table 6-1: Southern Alberta Seasonal Historic and Forecast Coincident Peak Load

Southern Alberta	Historical Load (MW)					Forecast Load (MW)									
Season	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**
SUMMER	1064	1090	1114	1131	1232	1162	1189	1213	1229	1252	1274	1295	1322	1349	1376
WINTER	1006	1092	1123	1097	1123	1146	1179	1198	1222	1245	1269	1296	1321	1348	1372

Figure 6-1 provides the load duration curve for the Southern Alberta Region for 2006. It presents the variation of the southern region load over a one year period. The peak load is slightly over 1100 MW and the minimum load is of the order of 700 MW. For most of the time, the load varies between 800 MW and 1,000 MW.

Figure 6-1: Southern Alberta 2006 Load Duration Curve



6.2 Generation scenarios

The AESO has developed several generation scenarios based on existing and future generation technologies, generation developers' plans and future expectations regarding the Alberta electricity market. Over the next ten years major generation additions in the province are expected to come from the following existing technologies:

- Cogeneration
- Combined Cycle
- Simple Cycle
- Coal-fired generation
- Wind

It is expected that the technology advancement will provide additional generation options later in the ten year timeframe. The additions common in all of the 10 year scenarios are shown in Table 6.2-1.

Table 6.2-1: Common Additions

Keephills 3	450 MW
Coal Upgrades	150 MW
Simple Cycle	200 MW
Hydro	100 MW
Other Small Additions	100 MW
Total Capacity Additions	**1,000 MW**

The various 10 year generation scenarios developed by the AESO are presented in Table 6.2-2.

Table 6.2-2: 10 Year Scenarios – 2007 – 2017 Major Additions (MW)

Scenario	**1**	**2**	**3**	**4**	**5**
Genesee 4	450	450	450	450	
Keephills 4	450	450	450		450
HR Milner Expansion	450				
ENMAX 1,200 MW			600	1,200	1,200
Cogeneration	1,760	2,260	1,760	1,760	1,760
Simple Cycle	600	600	400	300	
Wind (Installed)	1,600	1,600	1,600	1,600	3,400
Major Additions	**5,310**	**5,360**	**5,260**	**5,310**	**6,810**
Common Additions	1,000	1,000	1,000	1,000	1,000
Total Additions	**6,310**	**6,360**	**6,260**	**6,310**	**7,810**

Starting from column 1 the generation scenarios focus on the generation development from north to south, with emphasis shifting to generation development in the south as the scenarios increase to scenario 5. For the southern planning study, scenario 5 shown in the shaded column will be considered the base scenario as it will stress the southern transmission system the most. Scenario 1 will also be tested as a sensitivity to assess any impact that this will have on the transmission plan for scenario 5.

The planning study will also consider the 20 year generation scenario for the ultimate development of the system in the 20 year planning horizon. These 20 year scenarios are included in Table 6.2-3. For the southern planning study scenario B will be considered the base scenario, again because it stresses the southern transmission system the most.

Table 6.2-3 – 20 Year Generation Scenarios (MW)

Scenario	**A**	**B**
Battle River 6	450	450
Bow City		1,000
IGCC	600	
Combined Cycle	500	500
Simple Cycle	300	300
Wind	2,000	4,000
Hydro	1,400	1,400
Nuclear	2,200	2,200
Cogeneration	1,400	600
2017 – 2027 Additions	**6,550**	**6,550**
2007 – 2017 Additions	**5,000**	**5,000**
Total 20 Year Additions	**8,850**	**10,450**

6.3 System Operation

The base generation scenario assumes an additional 3,400 MW of wind power in Alberta during the next ten years. This amount of additional wind power on the Alberta Interconnected Electric System (AIES) will only be possible with the Market and Operational Framework which is now in place and in the process of being implemented. It is therefore assumed that the operation of the system will not have any technical issues with the additional 3,400 MW of wind power generation.

6.4 Bulk Transmission System

The bulk transmission system north of the southern Alberta region can have a small impact on the transmission recommendations for the southern region. At present planning studies for the bulk system are being carried out for the Wabamun, Fort Saskatchewan and Fort McMurray areas. These studies involve 500 kV as well as 240 kV alternatives. For the purpose of the southern planning study the following future major bulk transmission projects will be included in the planning models;

- 500 kV Genesee to Langdon

- 500 kV Ellerslie to McMillan initially operated at 240 kV

- 240 kV Ellerslie to Fort Saskatchewan

- 240 kV McMillan to Brintnell

- 240 kV McMillan to Ruth Lake

- 240 kV McMillan to Kinosis Tap

6.5 Years of Study

The planning study will be carried out for the following years and load conditions.

2010 – with the southwest transmission reinforcements

- Summer low load with maximum wind
- Winter peak load

2012 – with the southeast transmission reinforcements

- Summer low load with maximum wind
- Winter peak load

2017

- Summer low load with maximum wind
- Winter peak load

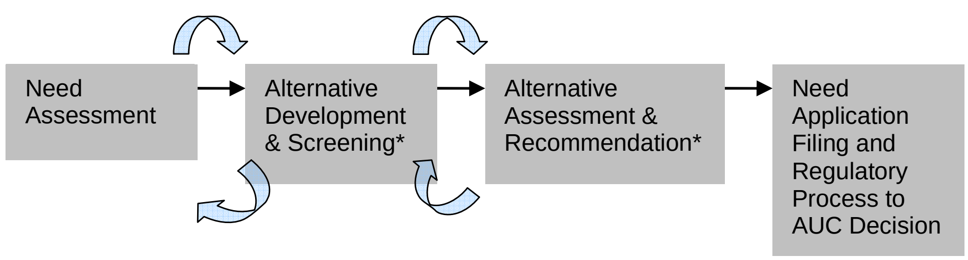
The year 2010 represents the system immediately after the southwest transmission reinforcement and will be the starting point of the studies. 2012 represents the five year scenario with the southeast transmission reinforcements in service. The 2017 model will represent the 10 year scenario when all of the wind generation shown in the generation scenarios is expected to be in service.

The summer low load condition represents the worst case for this planning study as the line ratings are lower in summer and the transmission line flows in general will be higher due to the lower loads. Winter peak load condition will test the system for the other extreme. A 20 year scenario for the year 2027 will also be studied to demonstrate how the 10 year transmission plan will fit in to the longer term picture.

7 Consultation Plan

The AESO will be applying the transmission planning process identified in Figure 7-1 and described in Section 4 for the southern Alberta planning study. The stages of the planning process will incorporate a participant involvement program to continue throughout the planning process.

Figure 7-1 Transmission Planning Process



The study results from each stage will be posted on the AESO's web site for public/stakeholder comments. The AESO will provide responses to any public/stakeholder comments within a transparent comment matrix which will also be posted on the AESO web site. Within the transmission planning process, the AESO may combine two stages if there is a benefit to public/stakeholder consultation to do so.

For the southern Alberta planning study, a participant involvement program has been developed and is currently underway. This program will utilize numerous communication vehicles for the AESO to have the opportunity to receive public/stakeholder input into the transmission plans, including industry, municipal and provincial representatives, First Nations and the public throughout the entire planning process.

Two phases of public open houses have been planned at the appropriate stage of transmission planning. The AESO is in the final stages of concluding the first phase. The second phase of consultation will combine the Alternative Development & Screening stage with Alternative Assessment work in order to provide the necessary information for public/stakeholder feedback.

8 Schedule

Provided below is the proposed schedule for the southern Alberta planning study. This schedule may need to be adjusted depending on the results of the public consultation process. Incorporating concepts, material, or changes resulting from stakeholder feedback could result in additional process time being required.

Project Scoping		
Load Forecast	Nov 30, 2007	AESO
Base Case Development (2007, 2012 and 2017)	Feb 15, 2008	AESO
Finalized Study Scope	Feb 8, 2008	AESO
Need Assessment and Alternative Development		
Need stage consultation	Jan 18, 2008	AESO
Zone formulation & existing system analysis	Jan 31, 2008	AESO
Need Assessment Report	Feb 22, 2008	AESO
Alternative Development	Mar 01, 2008	AESO
Alternative Development Report	Mar 15, 2008	AESO
Alternative Screening Stakeholder Consultation	Apr 18, 2008	AESO
Alternative Assessment and Recommendation		
Power flow analysis	Mar 28, 2008	AESO
Cost Estimates	May 2, 2008	ALM
Dynamic and short circuit analysis	May 9, 2008	AESO
Preferred Alternative and Recommendation	May 16, 2008	AESO
Regulatory Application		
Needs Identification Document Development	May 30, 2008	AESO
NID Filing with AUC	May 30, 2008	AESO