



FUTURE DEMAND AND ENERGY REQUIREMENTS

(Period: 2006 – 2027)

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EXECUTIVE SUMMARY

As required under the *Electric Utilities Act*, each year the Alberta Electric System Operator (AESO) updates its Future Energy and Demand Requirements. This outlook provides important input into transmission planning, and other functions within the AESO. This report is provided for the information of all stakeholders.

The overview of the economic and demographic conditions that influence electricity consumption in Alberta provided in this report is the result of a review of external sources, which include the Conference Board of Canada, Statistics Canada, Canada Mortgage and Housing Corporation, Alberta Economic Development and trade journals.

The outlook for Alberta is positive for the entire forecast period. In the short term, Alberta's solid economic prospects will continue and the Conference Board of Canada forecasts gross domestic product (GDP) to grow by 3.7% in 2006 and 3.4% in 2007, and average 3.2% per year for the remainder of the decade, and 2.6% per year through the end of the forecast period. The energy sector should remain the primary economic driver.

Population growth is forecast to slow from the record highs in the last 10 years. Still, over the next 20 years Alberta's population is forecast to increase by nearly 21% to almost 3.9 million. With positive economic growth forecasts, job creation should advance above the national average for most of the forecast period.

The AESO develops an economic outlook including forecasts for economic and demographic variables that materially impact electricity consumption in Alberta. This report focuses on a 'most-likely estimate'—from an economic standpoint—of future demand and energy requirements to the year 2027. The AESO employs a top-down modeling approach that ensures a consistency in assumptions that could not be achieved through an aggregation of industry projections from other sources. The assumptions, methodology, and processes employed to reach this estimate are explained in the report.

It is imperative to note that although this load forecast is an important input into the AESO's long-term transmission planning process, the AESO must and will additionally factor in all of the specific plans of its transmission customers. This load forecast represents a picture in time—specific peak periods—whereas in planning the transmission system the AESO uses information that is regularly updated as customer project plans evolve. It is expected that this will result in a discrepancy between the 'picture-in-time' data cited in this report and the 'real-time' information available to and used by the AESO's transmission planners. The economic model used in this report recognizes a strong linear relationship between economic growth and demand growth and, in doing so, the economic model establishes boundaries based on what is most likely to occur. However, the AESO has made no assumptions concerning any specific project in the queue. Further, the AESO accepts and acts on all information provided by transmission customers in planning the system and will itself not be bound by any limitations implied in this report.

1.0 **BACKGROUND**

The *Electric Utilities Act*, S.A. 2003 c.E-5.1 requires the Independent System Operator (ISO) to (i) assess the current and future needs of market participants; and (ii) collect and disseminate information relating to the current and future electricity needs of Alberta.

In fulfilling its role as the ISO, each year the Alberta Electric System Operator (AESO) updates its outlook for demand and energy requirements. This outlook is an important input into the 10-year system plan, the 20-year system outlook ('strategic plan'), and regulatory filings (trading charges, ancillary services costs, transmission losses).

2.0 **INTRODUCTION**

This document describes the assumptions, methodology, and processes the AESO employed to assess future demand and energy requirements. It contains a most-likely estimate of future Alberta demand and energy requirements from 2006-2027 to provide a sufficient timeline for transmission planning. The report contains several sections including:

Economic Outlook: Overview of economic and demographic conditions that influence electrical consumption in Alberta.

Methodology: High-level process methodology map used to prepare the outlook.

Forecasts: Energy requirements and demand forecast for the province.

In this document, 'peak demand' represents the highest electrical demand over a certain period of time. Historically, peak demand usually occurs during the winter months from November to February. Knowing when the peak demand may occur is important for planning purposes since electricity cannot be economically produced and stored for use during times of maximum consumption.

3.0 ALBERTA ECONOMIC OUTLOOK

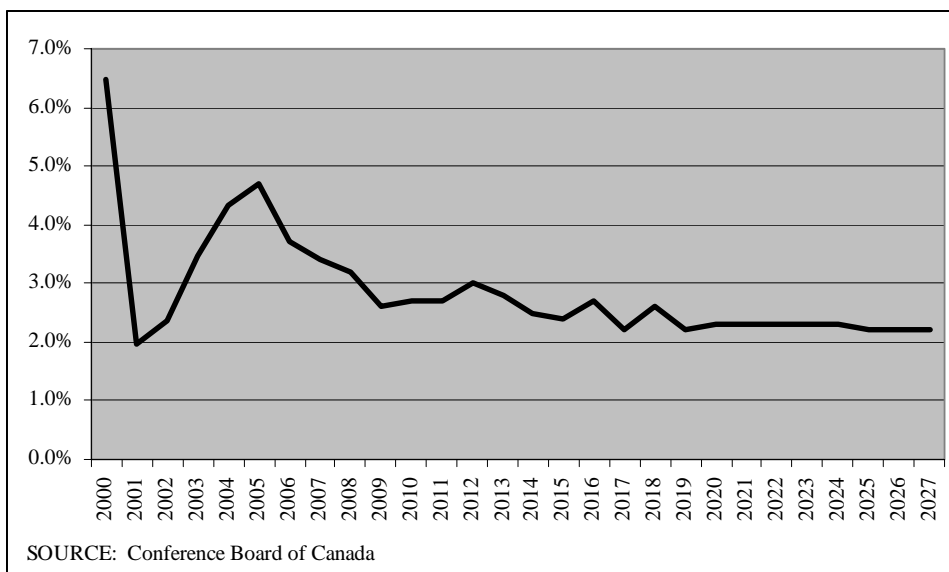
The AESO uses external sources to formulate its economic outlook. These sources include The Conference Board of Canada (Conference Board), Statistics Canada, Canada Mortgage and Housing Corporation, Alberta Economic Development, trade journals, and others. The AESO uses external agencies because they represent (i) subject-matter experts with respect to economic forecasting; and (ii) independent, objective sources.

The AESO relies largely on composite forecasts produced by the Conference Board¹ to ensure consistency of assumptions. Although the outlook contains significant complexity and detail, the following sections address only the key drivers relating to Alberta's electricity needs.

In the short term, a positive employment outlook and strong immigration continue to provide the foundation for the economy. Alberta's solid economic prospects will continue and the Conference Board forecasts gross domestic product (GDP) to grow by 3.7% in 2006 and 3.4% in 2007.

For the remainder of the decade, economic growth should remain strong and average 3.2% per year. Over the forecast horizon, Alberta's economy should show good GDP growth and expand at an average annual rate of 2.6%. The energy sector should remain the primary economic drivers due to sustained high commodity prices, an enormous non-conventional oil supply (i.e. oil sands), and extraction technology improvements.

Figure 1: Growth in Alberta Gross Domestic Product

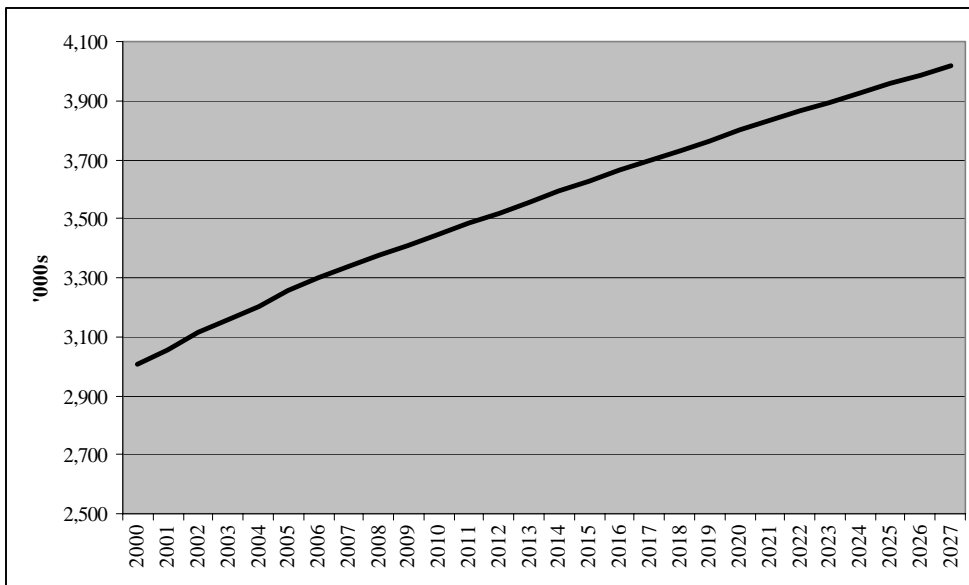


¹ Conference Board documents include: [Canadian Outlook 2006, Long-term Economic Forecast](#); [Provincial 2006, Long-term Economic Forecast](#)

The long-term potential of the Alberta economy is greatly affected by demographic conditions. Some of the key assumptions from the Conference Board include a shift in the demographic profile of the province to an aging population, which affects potential output. By 2025 the share of population over 65 will increase substantially.

Population growth in Alberta is forecast to slow from the record highs in the last 10 years. Alberta's sound fiscal position and a positive job market will continue attracting labour and businesses migration, thus boosting population growth. A continued decline in the natural growth rate (births minus deaths) will offset this inflow. Over the next 20 years, Alberta's population is forecast to increase by nearly 21% to almost 3.9 million.

Figure 2: Alberta Population Growth

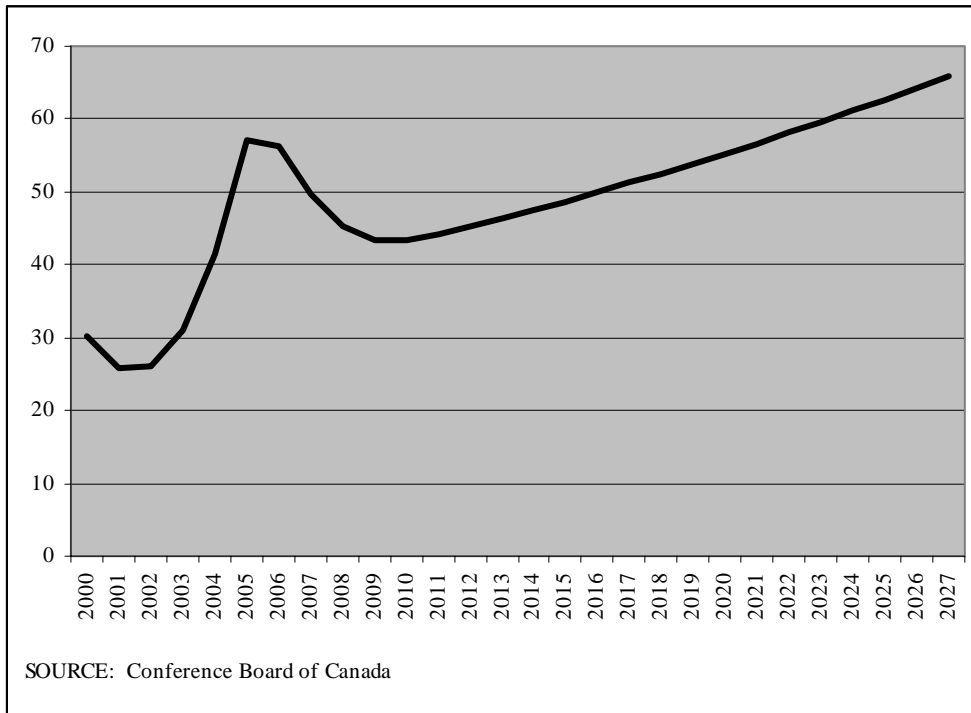


SOURCE: Conference Board of Canada

Although the long-term outlook is favourable, an aging population may constrain future growth. Over the next 20 years, the share of Alberta's population in the over-65 demographic will increase significantly. The aging population will weaken consumer spending as baby boomers enter retirement, thereby requiring more services and showing lower demand for consumer durables.

In the longer term, market fundamentals should drive oil prices higher as rising world demand increases pressure on world supply. In Alberta, conventional reserves should continue to decline although total provincial production should rise with huge investments in non-conventional extraction. The Conference Board expects \$60 billion of investment in western Canada's oil sands.

Figure 3: Crude Oil Price (West Texas Intermediate \$US)



The natural gas outlook is optimistic as supply and demand fundamentals help maintain historically high natural gas prices. Even with recent strong natural gas drilling, production should decline over the forecast horizon as the Western Canadian Sedimentary Basin matures. This supply reduction should create a situation of continued higher prices. A potential downward price risk for natural gas is a rapid acceleration of Liquefied Natural Gas (LNG) terminals and associated infrastructure in North America.

With positive economic growth forecasts, job creation should advance well throughout the long-term—above the national average for most of the forecast period. In the near term, employment opportunities should be abundant with strong consumer demand and an expanding energy sector.

4.0 METHODOLOGY

There are several methodologies employed in the electric industry to estimate future demand and energy requirements. The more prevalent approaches include econometric top-down modeling, system-wide customer segment projections, and bottom-up 'regional' approaches.

The AESO employs a top-down modeling approach in its analysis in order to ensure a consistency in assumptions that could not be achieved through the aggregation of different analyses from other sources with the industry. The diagram in Appendix A provides a high-level overview of the AESO's approach to creating an outlook of future demand and energy requirements.

Process Description

1. The forecast process begins with an analysis of historical load and customer consumption characteristics to identify drivers the AESO can use to estimate future electrical needs. For each customer segment, the future needs forecast is a function of variables related to electrical consumption in that sector (economic or demographic variables). This analysis identifies relationships between customer segment electrical consumption and demographic or economic variables. For example, residential consumption is a function of the number of households (population and average persons per household) and the average use per household dwelling.
2. As previously outlined, the AESO develops an economic outlook including forecasts for economic and demographic variables that materially impact electrical consumption in Alberta. The estimate of future energy requirements by customer segment is a product of the economic outlook and the customer segment models.
3. The AESO uses the customer segment growth rates to develop 'geographical area' forecasts. That is, some areas will experience higher-than-average or lower-than-average growth and will be grouped accordingly. The geographically grouped points will be adjusted up or down to account for economic differences throughout the province. The adjustments, though, will balance so that the total growth of the province matches the economic outlook as described above. The methodology uses the segment growth rates and customer characteristics in each geographical area to create a forecast for each Metering Point Identifier (MP_ID) load in Alberta. This results in a 20-year energy requirements outlook for almost 500 MP_ID load points. The forecast includes any new, incremental industrial loads identified in a particular area (added based on available information regarding size and timing).

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4. The AESO derives a unique ‘typical’ load shape for each MP_ID load in Alberta. This involves detailed analysis of the historical hourly load profiles for each point and results in an 8,760 hour ‘typical’ load shape for each MP_ID.
 5. The AESO applies the specific future MP_ID energy requirements estimate by year to the ‘typical’ load shape. The result is an 8,760 hourly load profile for each year and each MP_ID until 2025. These shapes are critical elements to support technical planning and analysis. Since the AESO uses actual hourly data to create the typical load shapes, they represent more ‘realistic’ demand profiles with the inherent high-load and low-load days—not flat average values or a typical weekday and weekend approach.
 6. The summation of the MP_ID forecasts plus loss estimates (provided by the AESO’s planning area) yields the aggregate Alberta Grid Demand forecast. This forecast represents the net load on the Alberta grid. As a ‘reasonableness’ check, there is a comparison of the aggregated MP_ID plus losses forecast to a system level ‘test’ forecast.
 7. To forecast total Alberta demand, the AESO estimates ‘behind the fence’ load using typical operating characteristics of each self-served generation (and related load) based on actual historical data. The total Alberta demand outlook is the sum of the future Alberta grid demand outlook and the future ‘behind the fence’ outlook. This represents the total demand in the province without regard for how the load is served.
 8. Weather is an important function in electrical consumption. The outlook contains an explicit relationship between load and weather conditions. The accuracy of weather forecasts is good in the short-term (i.e., up to five days), but no accurate long-term weather forecast is available. The AESO assumes weather conditions around the peak hours are similar to those present during previous ‘peak conditions’. For example, the forecast assumes colder-than-average weather during winter peak periods and warmer-than-average conditions during summer peak periods. This is accomplished through the creation of ‘typical’ load shapes that better represent actual consumption patterns than would an average shape.

5.0 DEFINITIONS

5.1 Alberta Interconnected Electric System

In this document, Alberta Interconnected Electric System (AIES) is:

$$\text{AIES} = \text{Sales} + \text{Losses}$$

where:

Sales - total grid consumption by the residential, farm, commercial, and industrial customer segments

Losses - total distribution and transmission losses

5.2 Alberta Internal Load

In this document, Alberta Internal Load (AIL) is:

$$\text{AIL} = \text{AIES} + \text{BTF Load}$$

where:

AIES - Alberta Interconnected Electric System

BTF Load - behind the fence load

6.0 FUTURE ALBERTA MARKET OUTLOOK

The following figure shows the AESO's AIES outlook for 2006-2027. As shown in the table, energy requirements are forecast to increase by 2.3% per year over the next five years, and by 2.1% per year over the next 10 years. Peak demand is forecast to increase by 2.1% per year over the next five years, and by 2.0% per year over the next 10 years.

The table also shows the AESO AIL outlook for 2006-2027. As shown in the table, energy requirements are forecast to increase by 3.0% per year over the next five years, and by 2.6% per year over the next 10 years. Peak demand is forecast to increase by 2.9% per year over the next five years, and by 2.5% per year over the next 10 years.

The higher growth rate (for both peak demand and energy requirements) in AIL results from an expectation of more large industrial load being served by on-site generation.

Figure 4: Alberta Interconnected Electric System (AIES) Market Outlook

Seasonal Year (SY)	fc2006 (MW)*	SY over SY Growth	Year	fc2006 (GWh)	SY over SY Growth
1999/00 A	7,360	---	1999 A	50,174	---
2000/01 A	7,633	3.7%	2000 A	53,088	5.8%
2001/02 A	7,472	-2.1%	2001 A	52,479	-1.1%
2002/03 A	7,552	1.1%	2002 A	53,673	2.3%
2003/04 A	7,650	1.3%	2003 A	53,169	-0.9%
2004/05 A	7,874	2.9%	2004 A	54,669	2.8%
2005/06 F	8,066	2.4%	2005 F	55,697	1.9%
2006/07 F	8,286	2.7%	2006 F	56,825	2.0%
2007/08 F	8,369	1.0%	2007 F	57,589	1.3%
2008/09 F	8,620	3.0%	2008 F	59,012	2.5%
2009/10 F	8,725	1.2%	2009 F	60,539	2.6%
2010/11 F	8,865	1.6%	2010 F	61,198	1.1%
2011/12 F	8,910	0.5%	2011 F	62,262	1.7%
2012/13 F	8,951	0.5%	2012 F	62,504	0.4%
2013/14 F	9,156	2.3%	2013 F	63,479	1.6%
2014/15 F	9,349	2.1%	2014 F	64,579	1.7%
2015/16 F	9,560	2.3%	2015 F	66,049	2.3%
2016/17 F	9,843	3.0%	2016 F	67,880	2.8%
2017/18 F	10,075	2.3%	2017 F	69,448	2.3%
2018/19 F	10,300	2.2%	2018 F	70,902	2.1%
2019/20 F	10,527	2.2%	2019 F	72,364	2.1%
2020/21 F	10,831	2.9%	2020 F	73,796	2.0%
2021/22 F	10,999	1.6%	2021 F	75,382	2.1%
2022/23 F	11,379	3.5%	2022 F	77,213	2.4%
2023/24 F	11,681	2.7%	2023 F	78,802	2.1%
2024/25 F	11,808	1.1%	2024 F	80,427	2.1%
2025/26 F	12,110	2.6%	2025 F	82,046	2.0%
2026/27 F	12,377	2.2%	2026 F	83,716	2.0%

*Note: Demand is winter peak demand (Nov. - Apr.)

Average Annual Growth Rates

00/01-05/06	1.1%
05/06-10/11	1.9%
05/06-15/16	1.7%
05/06-25/26	2.1%

2000-2005	1.0%
2005-2010	1.9%
2005-2015	1.7%
2005-2025	2.0%

Note: The average annual growth rates for the five-year historical period 2001-2005 are lower for the AIES than AIL. This does not represent a slowing of the growth rate for grid demand, rather a reclassification of grid load to non-grid with the creation of industrial site designations. Evidence of the growth is that energy distribution sales by customer class grew by an average of more than 2% per year over the last 10 years.

fc = forecast

Figure 5: Alberta Internal Load (AIL) Market Outlook

Seasonal Year	fc2006 (MW)*	SY over SY Growth	Year	fc2006 (GWh)	SY over SY Growth
1999/00 A	7,408	---	1999 A	50,851	---
2000/01 A	7,785	5.1%	2000 A	54,054	6.3%
2001/02 A	7,934	1.9%	2001 A	54,467	0.8%
2002/03 A	8,570	8.0%	2002 A	59,437	9.1%
2003/04 A	8,967	4.6%	2003 A	62,716	5.5%
2004/05 A	9,236	3.0%	2004 A	65,259	4.1%
2005/06 F	9,580	3.7%	2005 F	66,268	1.5%
2006/07 F	10,045	4.9%	2006 F	68,550	3.4%
2007/08 F	10,262	2.2%	2007 F	70,727	3.2%
2008/09 F	10,650	3.8%	2008 F	73,534	4.0%
2009/10 F	10,911	2.5%	2009 F	76,204	3.6%
2010/11 F	11,283	3.4%	2010 F	77,886	2.2%
2011/12 F	11,467	1.6%	2011 F	80,419	3.3%
2012/13 F	11,684	1.9%	2012 F	82,371	2.4%
2013/14 F	11,986	2.6%	2013 F	84,315	2.4%
2014/15 F	12,308	2.7%	2014 F	86,462	2.5%
2015/16 F	12,560	2.1%	2015 F	88,363	2.2%
2016/17 F	12,859	2.4%	2016 F	90,654	2.6%
2017/18 F	13,148	2.3%	2017 F	92,728	2.3%
2018/19 F	13,431	2.2%	2018 F	94,637	2.1%
2019/20 F	13,667	1.8%	2019 F	96,584	2.1%
2020/21 F	14,071	3.0%	2020 F	98,520	2.0%
2021/22 F	14,316	1.7%	2021 F	100,553	2.1%
2022/23 F	14,705	2.7%	2022 F	102,890	2.3%
2023/24 F	15,087	2.6%	2023 F	104,995	2.0%
2024/25 F	15,226	0.9%	2024 F	107,180	2.1%
2025/26 F	15,548	2.1%	2025 F	109,298	2.0%
2026/27 F	15,878	2.1%	2026 F	111,511	2.0%

*Note: Demand is winter peak demand (Nov. - Feb.)

+2002 redefinition added approx. 400 MW of 'behind the fence load'

Average Annual Growth Rates

00/01-05/06	4.2%
05/06-10/11	3.3%
05/06-15/16	2.7%
05/06-25/26	2.5%

2000-2005	4.2%
2005-2010	3.3%
2005-2015	2.9%
2005-2025	2.5%

Figure 6: Alberta Energy Forecast

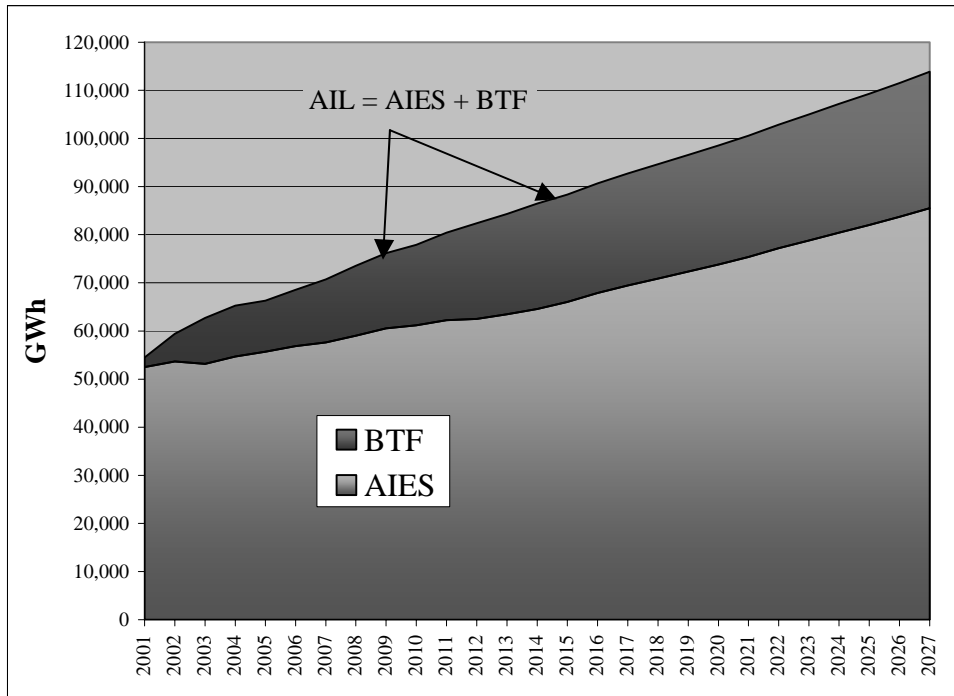
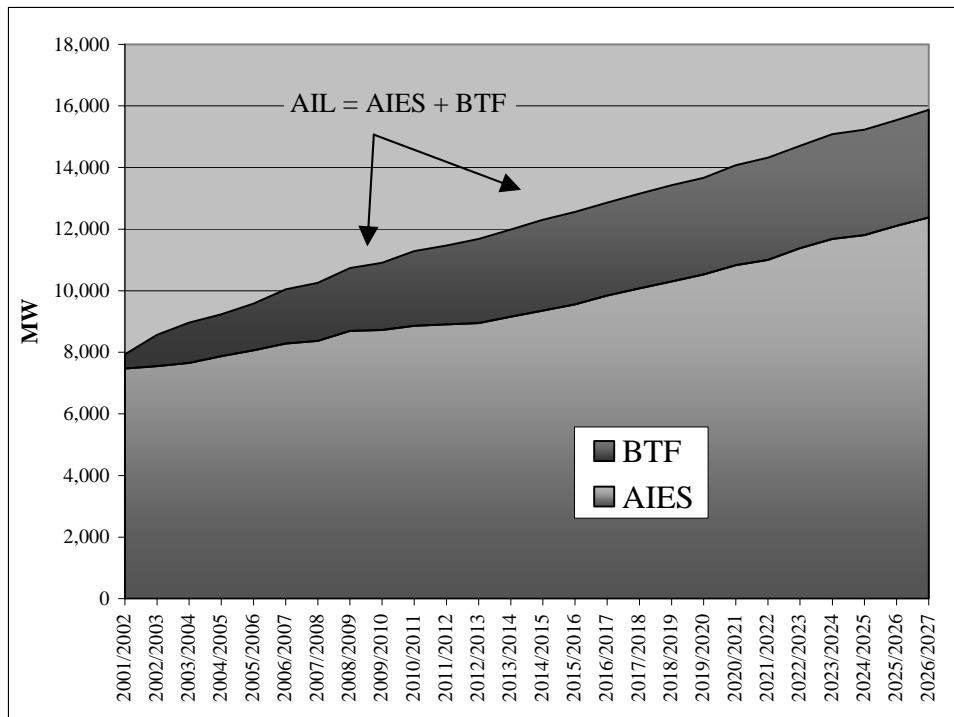


Figure 7: Alberta Winter Peak Demand Forecast



APPENDIX A: METHODOLOGY FLOW DIAGRAM

