



FUTURE DEMAND AND ENERGY REQUIREMENTS

(Period: 2005 – 2025)

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1.0 **BACKGROUND**

The Electric Utilities Act, S.A. 2003 c.E-5.1 requires the Independent System Operator to (i) assess the current and future needs of market participants; and (ii) to collect and disseminate information relating to the current and future electricity needs of Alberta. The proposed transmission regulation provides additional clarity around this responsibility requiring the Independent System Operator to make assumptions about future load growth and anticipate future electricity demand.

In fulfilling its role as the ISO, the Alberta Electric System Operator (“AESO”) annually updates its outlook for market participant’s demand and energy requirements. This outlook is an important input into the ten year system plan, the twenty year system outlook (‘strategic plan’), and regulatory filings (trading charges, Ancillary Services costs, transmission losses). This estimated future need of the market participants helps facilitate Alberta’s competitive market.

2.0 **INTRODUCTION**

This document describes the assumptions, methodology and processes the AESO employed to assess the future demand and energy requirements. This document contains a most likely estimate of future Alberta demand and energy requirements from 2005-2026 to provide a sufficient timeline for transmission planning. The report contains several sections including:

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

Methodology: High-level process methodology map used in preparation of the outlook.

Forecasts: The final sections detail the energy requirements and demand forecast. This document contains two aggregate Alberta level forecasts: i) grid demand; and ii) total demand (as defined later in this document).

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 can not be economically produced and stored for use during times of maximum consumption.

3.0

ECONOMIC OUTLOOK

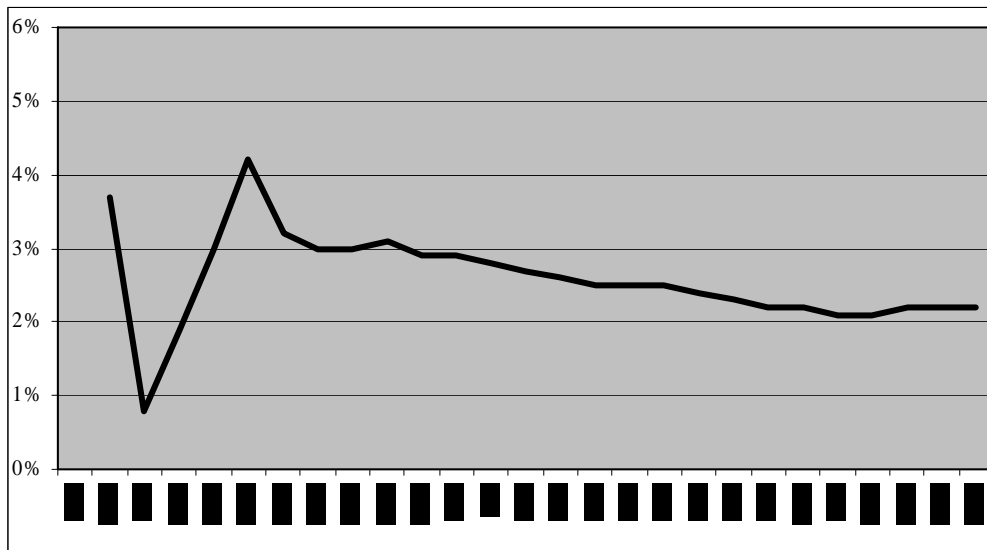
The *AESO* uses external sources to formulate its economic outlook. These sources include The Conference Board of Canada (“Conference Board”), Statistics Canada, Canadian Mortgage and Housing Corporation, Alberta Economic Development, trade journals, and others. The *AESO* uses external agencies as they 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 only address key drivers relating to Alberta’s electric needs.

3.1 United States

With the job market finally showing signs of strength, the United States economy could be moving toward an entrenched recovery. The United States economic growth rate slowed in the last few years after driving the global economy throughout the last decade. In late 2003, the United States economy began expanding with solid growth in all areas except job creation, and in the first quarter of 2004, job growth finally materialized. The United States economy appears poised for good economic expansion and the Conference Board forecasts Gross Domestic Product (“GDP”) to grow by 3.2% growth in 2005.

Figure 1: Growth in United States Gross Domestic Product



¹ Conference Board documents include: [Canadian Outlook 2005, Long-term Economic Forecast](#); [Provincial 2005, Long-term Economic Forecast](#)

In the medium term, growth expectations should match the economy's non-inflationary potential as the markets exhaust the surplus capacity created early in this decade. In the longer term, United States growth should trend about its long term potential with annual GDP growth expectations between 2.1% - 2.8%. There are a number of economic factors supporting this outlook including:

- Stronger export growth from a lower United States dollar and the benefits of trade liberalization particularly in East Asia and Latin America.
- Long-term domestic demand growth constrained by an aging population (common issue in the United States and Canada). An aging population: i) constrains demand for housing and consumer durables (new cars, household furnishings, and other large purchases); and ii) reduces the labour force.
- Elevated energy and commodity prices are potential major drags on the United States economy. The uncertainty in the Persian Gulf, strong Asian demand, and an expanding United States economy should increase oil price volatility.
- Recent weak economic activity, major spending on security measures and in Iraq, and significant tax cuts will produce large deficits. This may affect the governments operating flexibility going forward.
- Business investment is slowing after average annual growth near 14% per year in the late 1990s. In the near term, growth should remain solid at about 3.4%, but will slow as computer innovation declines.

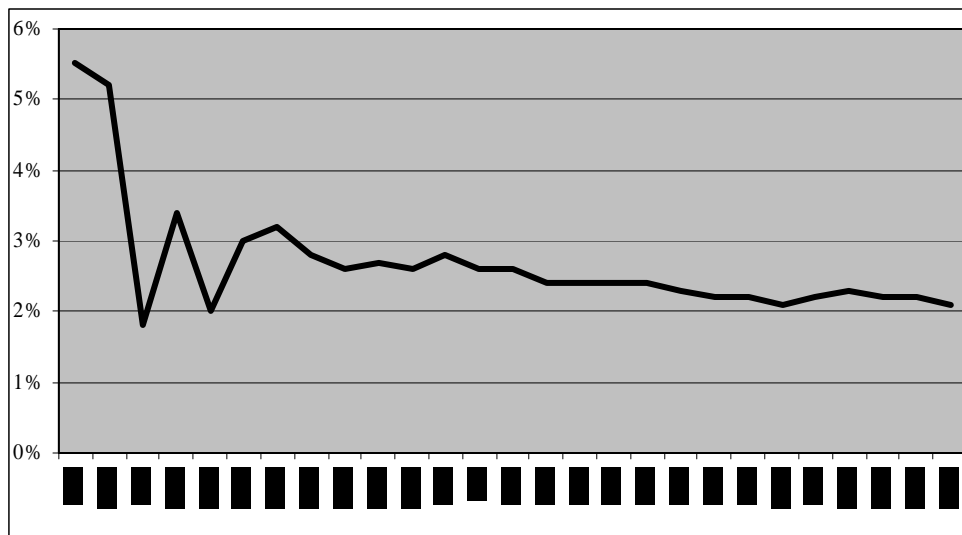
3.2

Canada

The strong growth in the second half of the last decade slowed in the new millennium. In 2003, a rising currency, several economic disruptions (SARS, BSE, forest fires, black out) and sluggish United States economic growth hobbled Canada's economy. Although the Canadian economy did not reach a 'traditional' recessionary phase, the economy slowed and the absence of a typical boom-recession cycle increases the difficulty in predicting future economic conditions.

In the near term, Canada's economic performance should improve. Canada's economy is highly dependent on the United States, and the optimistic United States forecasts should provide a positive stimulus for Canada. The Canadian dollar's strong appreciation will dampen exports, and as such, the forecast is for modest GDP growth in the Canadian economy over the next few years (2005 = 3.2%, 2006 = 2.8%).

Figure 2: Growth in Canadian Gross Domestic Product



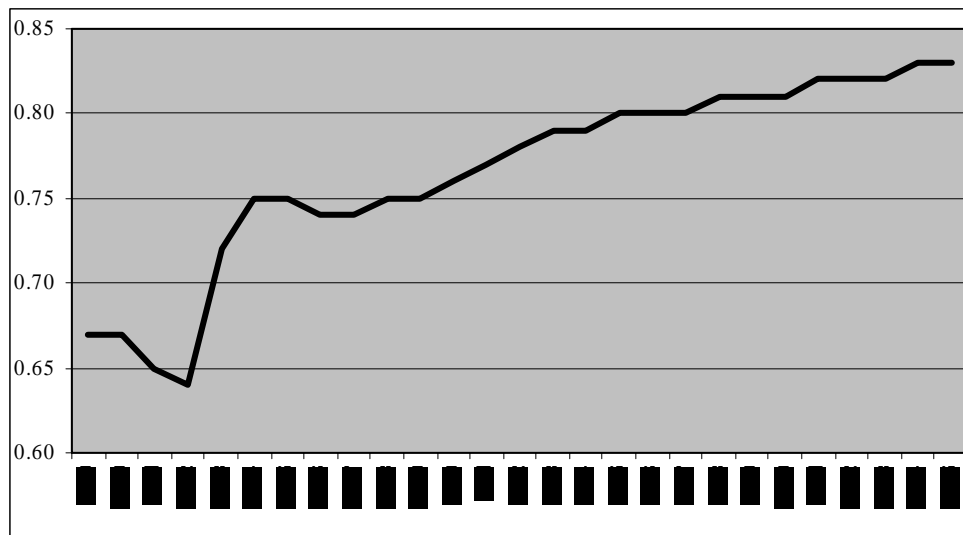
“With the job market finally showing signs of strength, the U.S. economy could be moving toward an entrenched recovery. Unfortunately, the Canadian economy will not be able to fully capitalize on developments south of the border. At the same time as U.S. growth was erupting, the Canadian dollar started a rapid ascent, putting a damper on export prospects. In addition, the Bank of Canada is expected to roll back the monetary stimulus currently in place, raising short-term interest rates by 200 basis points through 2005 and 2006. More aggressive interest rate moves in the United States will narrow the spread between Canadian and U.S. short rates, taking a fair amount of wind out of our dollar’s sails.”

Consequently, the dollar is expected to settle back down over the medium term”²

Over the longer term, a gradual slowing in growth will characterize the Canadian economy. The constraints are similar to the United States as slower population growth and an aging population moderate Canada’s economic capacity. Some additional factors include:

- Price stability will likely remain the Bank of Canada’s focus. Inflation should remain within the target range of 1% - 3% as expected output is close to potential over the forecast period.
- Widening interest rate spreads between United States and most major economies depreciated the United States dollar against most currencies - Canadian dollar ‘ran-up’ almost 20% between 2002 and 2003. In the next few years, a narrowing in the Canada / United States short-term interest rate spread should devalue the Canadian dollar. Beyond the near term correction, the Canadian dollar should appreciate modestly based on interest rate differentials, capital flows, commodity prices, and relative purchasing power. By the forecast horizon, Canadian dollar expectations are near \$0.83.

Figure 3: United States / Canada Exchange Rate



² Conference Board of Canada – Canadian Outlook 2005 – Long-term Economic Forecast, p i.

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- An aging population's shifting spending patterns will impact business sector growth. Tightening labor markets from an aging population and high real wage growth should lead large business to substitute capital for labor. As a result, business investment should remain robust over the next twenty years.
 - Over the past five years, the federal government created significant surpluses to facilitate tax cuts and increased program spending. In the longer term, Canada's changing demographics will increase spending pressure, especially to meet the needs of an aging population. The federal government should continue surpluses throughout the horizon period.
 - A major concern for Canada's economy is the fiscal situation of the Provinces. Collectively, the Provinces will run deficits beyond this decade and the situation may not be sustainable given the significant debt levels of some Provinces. There may be increasing pressure for federal transfers to support the Provinces' finances – although Alberta's debt free status lessens this risk.

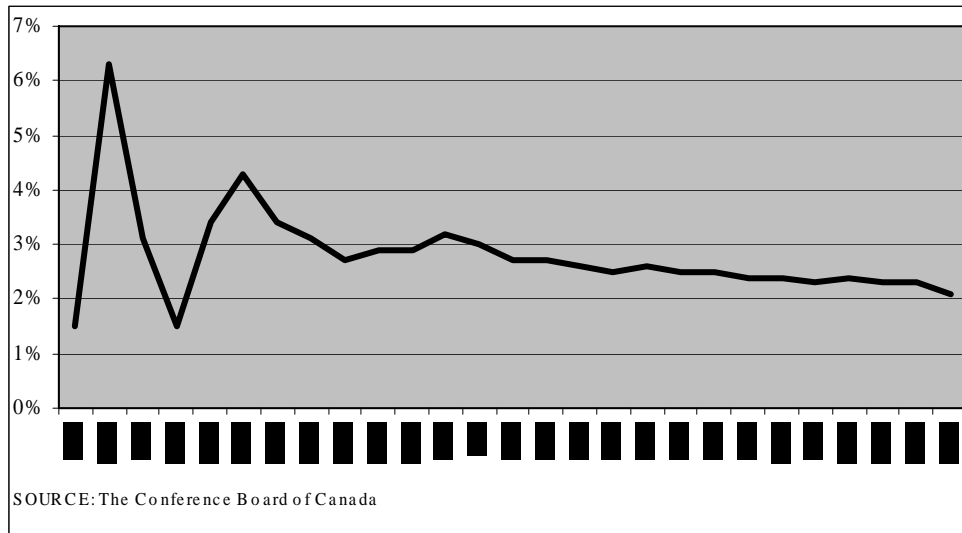
3.3 Alberta

Over the last ten years, Alberta created an 'Alberta Advantage' with the strongest economy, fastest growing population, lowest overall taxes, and nine consecutive balanced budgets. This creates a more optimistic outlook for Alberta than for many of the other Provinces.

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 to grow by 3.4% in 2005 and 3.1% in 2006.

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 2.7%. The energy sector should remain the primary economic drivers with sustained high commodity prices, an enormous non-conventional oil supply, and extraction technology improvements.

Figure 4: Growth in Alberta Gross Domestic Product

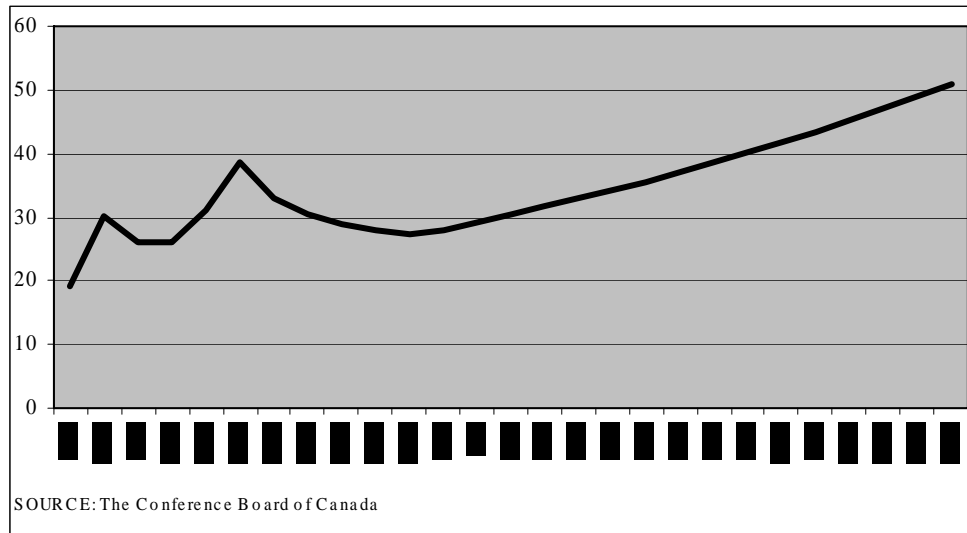


Population growth is forecast to slow from the record highs in the last ten years. The government's sound fiscal position and Alberta's positive job market will continue attracting labour and businesses migration - boosting population growth. A continued decline in the natural growth rate (births minus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

Although the long-term outlook is favorable, an aging population may constrain future growth. Over the next twenty 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 move into their retirement years, thereby requiring more services and lower demand for consumer durables.

In the longer term, market fundamentals should drive oil prices higher as growing world demand increase 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 an additional \$60 billion of investment in western Canada's tar sands.

Figure 5: Crude Oil Price (WTI \$US)



The natural gas outlook is optimistic as supply and demand fundamentals helps maintain historically high natural gas prices. Even with recent strong natural gas drilling, production should decline over the forecast horizon as the Western Canada 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. In the near term, employment opportunities should be abundant with strong customer demand and an expanding energy sector.

The largest single risk factor for Alberta is the Kyoto Protocol. This outlook does not account for the impacts of the accord, but ratification could significantly impair Alberta’s economy.

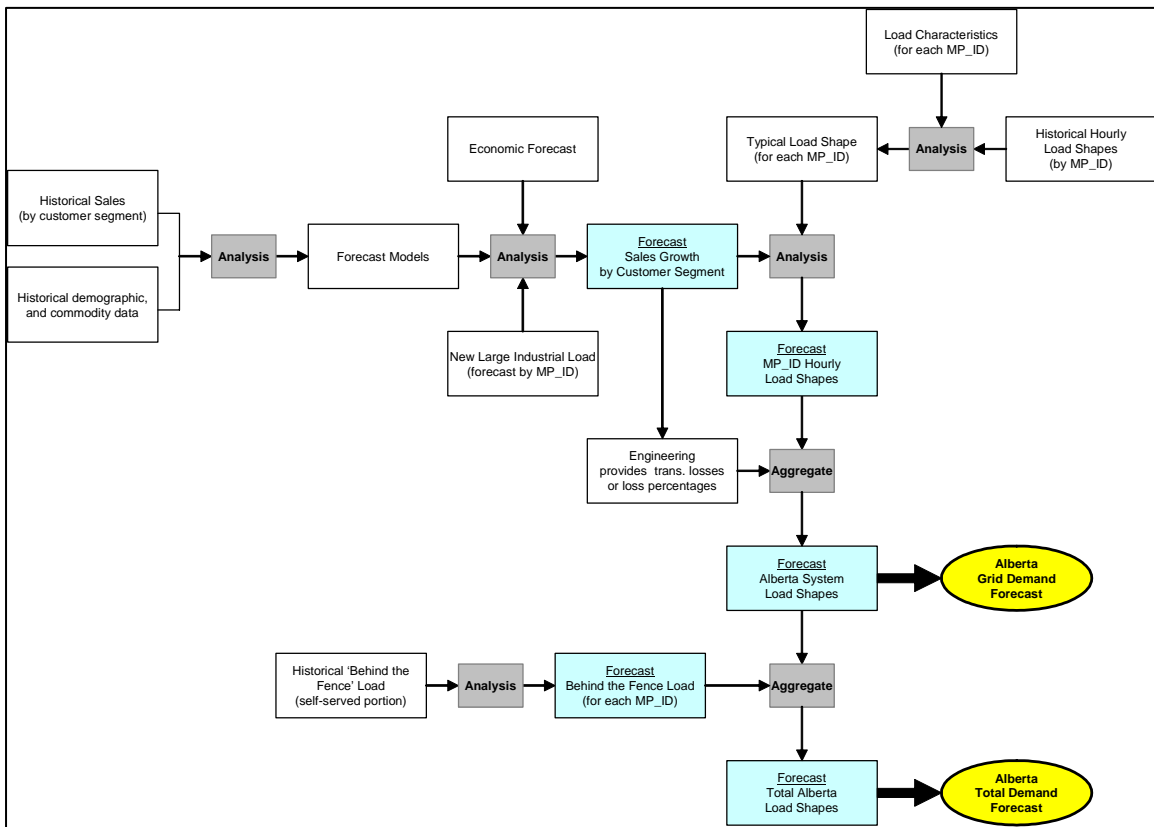
4.0

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 following diagram provides a high level overview of the *AESO* approach to create a future demand and energy requirements outlook. A larger version of this diagram appears in Appendix A.

Figure 6: Methodology Flow Diagram



Process Description

1. The forecast process begins with analysis of historical load and customer consumption characteristics to identify drivers the *AESO* can use 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 demographics 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. 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 twenty 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).
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 8760 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 8760 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.

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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 system. 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 which better represent actual consumption patterns than would an average shape.

5.0

DEFINITIONS

5.1 Alberta Grid Demand

In this document, Alberta Grid Demand (“AGD”) is:

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

where:

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

Losses - total distribution and transmission losses

5.2 Alberta Total Demand

In this document, Alberta Total Demand (“ATD”) is:

$$\text{ATD} = \text{AGD} + \text{BFL}$$

where:

AGD - Alberta Grid Demand

BFL - behind the fence load

6.0 FUTURE MARKET OUTLOOK

The following table shows the *AESO* Alberta Grid Demand outlook for 2005-2026. As shown in the table, energy requirements are forecast to increase by 2.3% per year over the next five years, and 2.1% per year over the next ten years. Peak demand is forecast to increase by 2.1% per year over the next five years, and 2.0% per year over the next ten years.

The table also shows the *AESO* Alberta Total Demand outlook for 2005-2025. As shown in the table, energy requirements are forecast to increase by 3.0% per year over the next five years, and 2.6% per year over the next ten years. Peak demand is forecast to increase by 2.9% per year over the next five years, and 2.5% per year over the next ten years.

The higher growth rate (for both peak demand and energy requirements) in Alberta Total Demand results from an expectation for greater increase in large industrial load served by on-site generation.

Figure 7: Alberta Future Market Outlook

Table A: Alberta Grid Demand

Year	Peak Demand (MW)*	Year	Energy (GW.h)
1999/00 A	7,360	1999 A	50,174
2000/01 A	7,633	2000 A	53,088
2001/02 A	7,502	2001 A	52,386
2002/03 A	7,598	2002 A	53,655
2003/04 A	7,678	2003 A	53,171
2004/05 A	7,916	2004 A	54,677
2005/06 F	8,165	2005 F	56,873
2006/07 F	8,450	2006 F	59,067
2007/08 F	8,553	2007 F	59,812
2008/09 F	8,801	2008 F	61,736
2009/10 F	8,939	2009 F	62,486
2010/11 F	9,245	2010 F	64,619
2011/12 F	9,546	2011 F	66,769
2012/13 F	9,747	2012 F	68,321
2013/14 F	9,944	2013 F	69,447
2014/15 F	10,106	2014 F	70,682
2015/16 F	10,337	2015 F	72,261
2016/17 F	10,511	2016 F	73,698
2017/18 F	10,691	2017 F	74,660
2018/19 F	10,864	2018 F	75,823
2019/20 F	11,003	2019 F	76,899
2020/21 F	11,171	2020 F	78,187
2021/22 F	11,299	2021 F	78,949
2022/23 F	11,446	2022 F	79,982
2023/24 F	11,580	2023 F	80,916
2024/25 F	11,704	2024 F	82,059
2025/26 F	11,812	2025 F	82,539

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

Table B: Alberta Total Demand⁺

Year	Peak Demand (MW)*	Year	Energy (GW.h)
1999/00 A	7,408	1999 A	50,851
2000/01 A	7,785	2000 A	54,054
2001/02 A	7,934	2001 A	54,466
2002/03 A	8,570	2002 A	59,379
2003/04 A	8,967	2003 A	62,420
2004/05 A	9,236	2004 A	64,511
2005/06 F	9,537	2005 F	66,429
2006/07 F	10,069	2006 F	70,488
2007/08 F	10,287	2007 F	72,099
2008/09 F	10,665	2008 F	75,753
2009/10 F	10,948	2009 F	77,545
2010/11 F	11,290	2010 F	80,465
2011/12 F	11,675	2011 F	83,067
2012/13 F	12,007	2012 F	85,664
2013/14 F	12,277	2013 F	87,362
2014/15 F	12,449	2014 F	88,666
2015/16 F	12,690	2015 F	90,289
2016/17 F	12,855	2016 F	91,780
2017/18 F	13,037	2017 F	92,773
2018/19 F	13,217	2018 F	93,988
2019/20 F	13,372	2019 F	95,020
2020/21 F	13,530	2020 F	96,312
2021/22 F	13,690	2021 F	97,105
2022/23 F	13,851	2022 F	98,160
2023/24 F	13,996	2023 F	99,137
2024/25 F	14,124	2024 F	100,245
2025/26 F	14,225	2025 F	100,661

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

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

Average Annual Growth Rates

99/00-04/05	1.5%	1999-2004	1.7%
04/05-09/10	2.5%	2004-2009	2.7%
04/05-14/15	2.5%	2004-2014	2.6%
04/05-24/25	2.0%	2004-2024	2.1%

Average Annual Growth Rates

99/00-04/05	4.5%	1999-2004	4.9%
04/05-09/10	3.5%	2004-2009	3.7%
04/05-14/15	3.0%	2004-2014	3.2%
04/05-24/25	2.1%	2004-2024	2.2%

Note: The average annual growth rates for the five year historical period 1999-2004 are lower for Alberta Grid Demand than Alberta Total Demand. 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 energy distribution sales by customer class grew by an average of over two percent per year over the last ten years.

Appendix A - Methodology Flow Diagram

