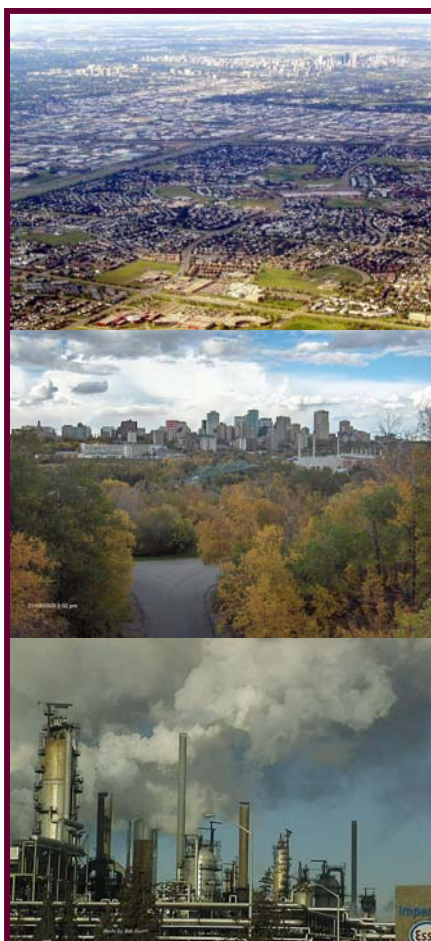


CREATING A STRONGER EDMONTON REGION



TECHNICAL REPORT 1
GROWTH IN THE
EDMONTON REGION:
RESPONDING TO
RAPID EXPANSION
OF THE ENERGY
INDUSTRY

HEMSON Consulting Ltd.

February 2007

TABLE OF CONTENTS

	<i>Page</i>
I INTRODUCTION	1
A. Primary Purpose Is to Provide Input to the Fiscal Analysis and Gain an Understanding of Risks to Region’s Economic Future	1
B. Data Sources	2
II MAJOR COMPONENT OF REGIONAL ECONOMIC FUTURE TIED TO PROPOSED ENERGY INVESTMENTS	3
A. The Oil Sands and Bitumen Industry	3
B. Significant Bitumen Upgrading Capacity Is Proposed	5
C. Economies of Scale from Multiple Upgraders Are a Key Factor in Attracting Downstream Value-added Investment	11
D. Utilities and Infrastructure Could Make Edmonton Region More Attractive to Upgraders and Related Petrochemical Activities	15
E. Service and Support Functions Are an Important Component of the Economic Benefits of Upgrader Investment	18
F. Ex-Alberta Upgrading Is the Largest Threat to the Edmonton Region’s Economic Future	19
III ECONOMIC SCENARIOS BASED ON ABILITY OF REGION TO ATTRACT DOWNSTREAM VALUE ADDED INVESTMENT	21
A. Level of Development in Each Economic Scenario Based on Opportunities and Risks in the Region	22
B. Inputs to the Fiscal Analysis: Capital Investment, Employment and Location	26
C. Scenarios Can Be Summarised by Identifying the Role Governments Will Play in the Overall Level of Investment	33

IV	BROADER ECONOMIC IMPACT ANALYSIS OF THE UPGRADER AND ASSOCIATED INVESTMENTS	34
V	RANGE OF REGIONAL POPULATION AND EMPLOYMENT GROWTH ASSOCIATED WITH THE ECONOMIC SCENARIOS	37
A.	Other Non-energy Related Economic Activities Are Part of the Overall Economic Outlook In the Growth Forecast	37
B.	Basis for Population and Employment Growth Outlook Incorporates Both Demographic and Economic Factors	39
C.	Distribution of Growth Within the Edmonton Region	45
VI	CONCLUSION	58
	APPENDIX A: SELECT BIBLIOGRAPHY	60

I INTRODUCTION

This is one of two technical supporting documents that accompany the report *Creating a Stronger Edmonton Region*, by Hemson Consulting Ltd. It forms part of a review by Hemson of current municipal governance and taxation in the Edmonton region and the region's ability to manage future growth effectively.

As a technical report, *Growth in the Edmonton Region: Responding to Rapid Expansion of the Energy Industry*, examines anticipated energy-related investment in the region and its effect on regional economic and demographic growth. A companion technical report, *Fiscal Problems in a Rapidly Growing Edmonton Region*, addresses fiscal and taxation issues in the region. The Fiscal Report relies heavily on the results of this growth report for its analysis. The results of both technical reports form the basis of the conclusions presented in the main report.

A. PRIMARY PURPOSE IS TO PROVIDE INPUT TO THE FISCAL ANALYSIS AND GAIN AN UNDERSTANDING OF RISKS TO REGION'S ECONOMIC FUTURE

The primary purpose of this technical report is to generate the inputs required for the fiscal impact analysis in the companion technical report. However, it also provides a range of economic outlooks possible for the Edmonton region. To that end the report is structured in four parts:

- A review of the current proposals and components of energy-related economic investment: bitumen upgraders and value-added downstream investments.
- Determination of energy-related investment scenarios based on different economic and policy factors.
- High-level economic impact analysis of the energy-related investments in the Edmonton region for the regional, Albertan and Canadian economies.
- Establishment of a broader economic and demographic outlook for the region and its constituent municipalities, based on the energy-related investment scenarios.

A key theme throughout this report is to highlight where, in each of the economic scenarios, there may be risks and opportunities for the Edmonton region. Special

attention is given to the risks and opportunities which can be influenced by municipal governments.

B. DATA SOURCES

The data collection and analysis for this report was carried out so that future energy-related investment and associated growth could be understood within the context of the fiscal and governance issues facing the Edmonton region. Some of the information presented here will likely be useful for a range of other policy and research purposes. However, the reader is cautioned that the scope and detail used for the current purpose may not be appropriate for other uses. For example, support services and infrastructure needs for the proposed upgraders or the form of down-stream value-added investments presented here should be used as a starting point for analysts and policy makers and not be viewed as definitive conclusions on infrastructure and future investment potential.

That said, Hemson undertook extensive research to prepare these documents. This was necessary in part because there is no single source of information on current investments proposals, related activities, and associated infrastructure needs. Among the challenges of collecting data on these subjects are: proprietary technologies; differing standards and definitions for documentation; a wide range of opinion (even amongst seasoned professionals) on the economics, technologies, processes and outlooks for development; and constant changes to the anticipated scale, need and timing of development.

As a result, our approach was to research any available materials from public, private and association sources, press releases and articles, and to meet with a wide range of professionals to discuss and revise some of our assumptions and conclusions. The information presented in this report synthesizes this research and discusses the assumptions and inferences we needed to make in order to provide a complete picture of the economic outlook. We gratefully acknowledge the assistance of others. However, the final assumptions and opinions expressed here are ours and should not be attributed to other persons or sources.

A partial bibliography of sources on energy-related investments and growth management is in this report's Appendix A. In addition to these published sources, a number of internet-based resources from public, private and association sources were used.

II MAJOR COMPONENT OF REGIONAL ECONOMIC FUTURE TIED TO PROPOSED ENERGY INVESTMENTS

In this analysis, energy-related industrial development that might occur in the Edmonton region is broken down into the following components:

- Upgrading capacity
- Downstream value-added investment
- Utilities and infrastructure to support upgrading and downstream value-added
- Direct service and support functions in the Edmonton region
- Export of Alberta bitumen for upgrading elsewhere

Each component carries its own risks and opportunities for the region and places different pressure on the region's governance structure and fiscal ability to cope with the development.

A. THE OIL SANDS AND BITUMEN INDUSTRY

The production of oil from the oil sands is a two stage process whereby bitumen (a highly viscous petroleum) is first extracted, then is "upgraded" through a refining process into synthetic crude oil. The entire process is very complex, but the following technical knowledge needs to be understood, even in simple terms, for the purpose of this review:

- The initial technology for extraction, long used by Suncor and Syncrude, involves the mining and separation of bitumen from by-products at an on-site plant. This method is suitable for oil deposits that lie close to the surface.
- Newer technologies for *in-situ* (non-mining) extraction have now advanced to the stage that they are now economic for large-scale extraction. Steam assisted gravity drainage (SAGD), where steam heat is pumped below the surface to allow the bitumen to flow to wells and be pumped to the surface, is the most widely used technology in this regard.

- Improvements in technology in recent years, assisted by higher petroleum prices, have made both extraction methods economic for rapid development. This has fuelled the recent growth in extraction projects.
- The bitumen produced by either process then needs to be upgraded into synthetic crude oil. In the simplest sense, this is similar to a standard refining process of cracking long-chain hydrocarbons by “removing carbon” and “adding hydrogen” to transform the bitumen hydrocarbons into more useful shorter chains characteristic of light crude oil. The resulting synthetic crude can then enter the existing conventional oil system for export or further refining.
- Until recently, bitumen needed to be upgraded at the extraction site because it is too viscous for pipeline shipment. Thus, Suncor and Syncrude upgrade at their mine site. Recent technologies have allowed the bitumen to be shipped by diluting it with a “diluent” of either synthetic crude or lighter products, such as naphtha. This method requires a source of diluent. In the case of the Shell Scotford operation, a pair of pipelines ship diluent to the mine site in Wood Buffalo and a larger line ships the dilute bitumen to a plant in the Edmonton region.
- The ability to ship dilute bitumen over short distances is the basis for the Edmonton region’s ability to attract a significant number of proposals for bitumen upgraders within its jurisdiction.
- The increasing capability to ship dilute bitumen over longer distances means that upgrading can now be done as far afield as the United States or even offshore. Losing the upgrader development to other regions is the single most critical economic risk facing the Edmonton region.

This is a simple primer on the oil sands and bitumen industry. The remainder of this chapter provides a detailed look at the prospects for the Edmonton region in this sector of the economy.

B. SIGNIFICANT BITUMEN UPGRADING CAPACITY IS PROPOSED

1. Eleven Major Upgrader Projects in Alberta Would Result under Prevailing Conditions

Information on the existing, under construction and proposed upgraders in Alberta is provided in the tables that follow. In each case, base descriptive information is provided along with the key elements needed as inputs for this review: cost, employment and water infrastructure needs.

These tables are a compilation of readily available published information. Where there are blanks, no reliable information is currently available.

The three projects described as firmly proposed in the third table are those where a significant amount of work has been undertaken by the proponents, including documentation, approaches to approval authorities and land purchases. In these cases, substantial information about the projects is in the public realm.

In addition, there have been a number of other projects which have been suggested as possibilities by the proponents or discussed in the media. In particular, a potential proposal by CNRL in the Edmonton region has been discussed, but has not yet reached the status that we would describe for current purposes as firmly proposed.

It is notable that for many of the projects listed on Tables 2 and 3, a key factor for locating in the Edmonton region is almost certainly a highly restricted labour supply and infrastructure in the Fort McMurray area. Since the announcements of these projects in 2005 and 2006, it is becoming increasingly clear that the Edmonton region is facing similar labour and infrastructure shortages. The size of the Edmonton region means that these shortages are not as acute as in northwestern Alberta. Nevertheless, they are likely already influencing decisions about these projects. Labour and infrastructure constraints are an emerging issue for the Edmonton region and need to be addressed so that the region's economic potential, as laid out in this report, can be realized.

Table 1				
Existing Major Upgrader Facilities				
	Suncor	Syncrude	Husky	Shell Scotford
Location	Fort McMurray	Fort McMurray	Lloydminster	Edmonton Region
Owners	Suncor Energy	Canadian Oil Sands Ltd., Imperial Oil, Petro-Canada, et al	Husky Oil (originally with Governments of Canada, Alberta & Saskatchewan)	Shell
Capacity	Approximately 270,000 bpd with proposed expansion to 500,000 – 550,000 bpd by 2010–12	350,000 bpd once current expansion fully operational; plans for post-2015 expansion to 500,000 bpd	Approximately 80,000 bpd with proposed expansion to 150,000 bpd	155,000 bpd with proposed expansion to 290,000 bpd by 2009
Year	Began as Great Canadian Oil Sands in 1967. Expanded significantly on several occasions	First production in 1978; continuous expansion beginning in 1996	Completed 1992	Construction start in 1999; production in 2003
Feedstock	Mine and new Firebag SAGD development	Mildred Lake Mine (1978) and Aurora Mine (2000)	Lloydminster area heavy oil and Tucker SAGD project at Cold Lake. Sunrise SAGD at Fort McMurray with expansion.	Athabasca Oil Sands Project mine (joint venture with Chevron and Western Oil Sands). Muskeg Mine and Jackpine Mine
Direct Relationship to Other Facilities	Integrated extraction and upgrading operation	Integrated extraction and upgrading operation	Tucker and Sunrise projects in Alberta. Bolney–Celtic thermal extraction project in Saskatchewan. Downstream refinery at Lloydminster.	Mine at Fort McMurray and existing Shell refinery and Shell petrochemical facilities at Scotford
Site Size	n/a	n/a	n/a	365 acres
Water Needs	For expansion: 22,320 cubic metres per day	n/a	n/a	Current 725 tons/hr Current peak 825 t/hr Peak 2009: 1,705 t/hr
Employment	Construction of expansion: 4,000 Additional permanent: 300	4,400 direct (mine, processing and upgrading) plus 1,000 to 1,500 contract maintenance people	n/a	350 full-time jobs. 18,000 person years of employment through construction and operations period to 2039
Reason for Location	On mine site	On mine site	Associated with Lloydminster area heavy oil deposits	Associated with Shell's existing operation

Table 2					
New Upgrader Facilities Under Construction					
Name	Petro-Canada Strathcona	Shell Scotford Expansion	BA Energy	Horizon	Long Lake
Location	Edmonton Region	Edmonton Region	Edmonton Region	Fort McMurray	Fort McMurray
Owners	Petro-Canada	Shell	Value Creation Inc. (Enbridge has minority share)	Canadian Natural Resources Ltd.	Nexen Inc. and OPTI Canada
Cost	\$2.6 billion upgrading and refining	\$2.5 billion	\$900 million first phase and \$1.8 billion for completion of all three phases	\$10.8 billion by 2011 (\$2.2 billion on upgrader; remainder is other facilities)	\$4.6 billion (both SAGD and upgrader facilities)
Capacity	135,000 bpd by 2008	Adds 135,000 bpd bringing total production to 290,000 bpd at Scotford	77,500 bpd in phase 1, rising to 260,000 bpd	110,000 in 2008, 230,000 by 2011 and 500,000 bpd by 2017	70,000 bpd first phase, rising to 140,000 bpd with second phase
Year	Completion 2008	Completion 2009	Built in 3 phases 2006–2012	Completion of first phase in 2008	Completion of first phase in 2007
Feedstock	Mackay River <i>in situ</i> mine	Athabasca Oil Sands Project mine. Muskeg Mine and Jackpine Mine	VCI mine north of Fort McMurray	Horizon Mine	On-site SAGD
Relationship to Other Plants	Conversion of Edmonton Refinery	Expansion of existing Scotford Upgrader	n/a	n/a	n/a
Site Size		365 acres	n/a	n/a	n/a
Water Needs	Plant will use treated Edmonton wastewater to reduce draw from North Sask. River	Approximately 880 additional tons per hour	n/a	n/a	No surface water, based on 90% water recycling process
Employment	n/a	n/a	n/a	2,400 permanent operating after 2012; up to 6,500 at peak construction point in 2007	n/a
Reason for Location	Retrofitting of existing facility	Expansion of existing Scotford Upgrader as well as Shell refinery and Petrochemical operation	Labour and infrastructure limitations in Fort McMurray area, & mine is nearly 100 km from town	Integrated with mine	Integrated with SAGD operation

Table 3			
Firm Proposals for Upgrader Facilities			
Name	Fort Hills	North West	Northern Lights
Location	Edmonton Region	Edmonton Region	Edmonton Region
Owners or Proponents	Petro-Canada, UTS Energy & Teck Cominco	Foundation Energy and Northwest Investment Trust	Synenco Energy and SinoCanada (Sinopec)
Cost		\$2.4 billion phase ; \$4.8 billion at ultimate	\$3.0 billion
Capacity	Phase 1 : 50,000 bpd; to 170,000 bpd at 2011 completion (possible future expansion to an ultimate 350,000 to 400,000 bpd)	50,000 bpd for phase 1 in 2010; potential expansion to 250,000 bpd	50,000 bpd by 2010 and 100,000 bpd by 2012
Year	Construction to begin in late 2007 (subject to approvals) with first production by 2011	To be built in three phases 2006–2010	Construction begins in 2008 to be completed in 2010
Feedstock	Fort Hills Oil Sands Mine	n/a	Northern Lights (Synenco) mine, with capacity to accept bitumen from third parties
Technology Notes	Initial phase uses traditional H ₂ from natural gas, then going to gasification-based process	n/a	Separation stage: diluent recovery unit; vacuum distillation unit; solvent de-asphalting unit. Conversion stage: delayed coker and fixed-bed hydrocracker (combining hydrotreating and hydrocracking)
Relationship to Other Plants	Fort Hills Mine and Petro-Canada Strathcona County Refinery	n/a	Synenco Mine
Site Size	n/a	n/a	1,235 acres
Water Needs	n/a	n/a	n/a
Employment	2,000 construction; 250 to 300 persons initially, then to 500 at full capacity	n/a	Construction: 2,000 Permanent: 750
Reason for Location	These proposed plants (along with BA Energy) are thought to be the first directly resulting from the insufficient labour and infrastructure capacity in the Fort McMurray area		
Additional Comments	Very likely to proceed	Not yet fully financed, higher level of uncertainty of proceeding	Not yet fully financed, higher level of uncertainty of proceeding

2. Summary of Upgrader Capacity and Relationship to Production Potential

The following table summarizes the existing, under construction and proposed upgrading capacity in Alberta, based on the information provided in the previous tables. The years shown are based on original completion dates of the proposals. The information is the best available as of the Fall of 2006. However, until construction actually begins, the project list will always be something of a “moving target,” for example, the following are notable:

- In the later half of 2006 there have been some announcements and a large amount of speculation about possible delays to some of these projects;
- In January 2007 just as this report was being completed:
 - Announcements from Athabasca Oil Sand Project (largely owned by Shell) about significantly larger expansions to Edmonton area upgrading capacity (presumably at the Scotford site).
 - The possible purchase of Nexen Inc. by France’s Total, which could affect the timing (possibly advancing) subsequent phases of Nexen’s Long Lake project.
 - Speculation of Federal tax changes respecting capital cost allowances for oil sands investments, which could ultimately affect the scale or timing of development.

Overall, the listing of projects will inevitably change in timing and scale in the coming years and some projects will be added and others will be dropped. However, as is described in subsequent sections of this report, the total upgrading capacity and the investment it represents is likely to remain similar to that shown here and form a sound basis for the economic and fiscal analysis being undertaken.

The table shows that ultimate development of current and proposed projects would result in approximately 3.3 million bpd of additional upgrading capacity. Factoring in approximately 800,000 to 1.0 million bpd of upgrading outside of Alberta (these are highly speculative figures) would provide for about 4.1 to 4.3 million bpd in total upgrading capacity. It should be noted here that not all bitumen and heavy oil is upgraded as it can be a high quality product for asphalt and some other applications. The small proportion of existing production that is not upgraded is not expected to grow significantly as virtually all new extraction capacity is likely to be upgraded to synthetic crude.

Table 4					
Alberta Upgrading Capacity: Existing and Proposed Projects (in 000s of barrels per day bitumen capacity)					
Status	Project	2006	2011	2016	Ultimate
Existing (with proposed expansions)	Suncor	270	270	525	525
	Syncrude	350	350	500	500
	Husky Lloydminster	80	80	150	150
	Shell Scotford	155	290	290	290
	Imperial	15	15	15	15
	Sub-Total	870	1,005	1,480	1,480
Under Construction (with future proposed expansions)	Petro-Canada Strathcona	0	135	135	135
	BA Energy Heartland	0	78	260	260
	Horizon (CNRL)	0	230	230	500
	Long Lake	0	70	140	140
	Sub-Total	0	513	765	1,035
Proposed	Fort Hills	0	110	110	375
	North West	0	50	50	250
	Northern Lights	0	60	125	125
	CNRL – Edmonton	*	*	*	*
	Sub-Total	0	220	285	750
Total		870	1,738	2,530	3,265

When considering the prospects for these upgrading investments, it is useful to compare the projected upgrading capacity to projections of future levels of oil production in the region. In this regard, current and proposed extraction projects (including conventional heavy oil projects) would result in 3.5 million bpd being produced. The Canadian Association of Petroleum Producers forecast to 2020 give the following additional production figures:

Table 5	
Forecast 2020 Oil Sands and Conventional Heavy Oil Extraction Canadian Association of Petroleum Producers	
Conventional Heavy	263,000 bpd
Oil Sands Mining	2,273,000 bpd
Oil Sands In Situ	1,724,000 bpd
Total Forecast Production in 2020	4,260,000 bpd

At about 4.3 million bpd of upgrading capacity, the upgrading proposals (including exports) to 2020 are therefore roughly in balance with forecast production. This tells us that for the current analysis the project investments are not unreasonable provided that the other conditions required for this investment are in place.

C. ECONOMIES OF SCALE FROM MULTIPLE UPGRADERS ARE A KEY FACTOR IN ATTRACTING DOWNSTREAM VALUE-ADDED INVESTMENT

The second component of the economic potential for new investments in energy-related industries in the Edmonton region is what is described as downstream value-added activities. Downstream, in this case, refers to economic activities related to products or by-products of the bitumen upgrading process in region. They are value-added because they are widely considered to have a high economic value; unlike the “upstream” upgrading and, especially, mining activities, the downstream activities bring highly skilled, higher income employment to the region.

The Alberta government’s Hydrocarbon Upgrading Task Force (HUTF) was formed in 2004 as industry–government group to “explore synergies [and] other competitive opportunities with the refining and petrochemical industries.” According to the Alberta Energy website, among the things the task force has been considering is integration “opportunities for feedstocks, petrochemicals, fertilizers, syngas and electricity with bitumen upgrading and refining in Alberta ... [and] best practices [of] successful integrated hydrocarbon clusters in various jurisdictions around the world to identify competitive gaps for Alberta.”

Based on the HUTF reports and other work on the subject, potential downstream value-added activities have been considered in three categories. The Edmonton region has the potential to attract each of them. They are the additional refining of finished products, the use of byproduct gases from upgrading, and the use of heavy products from upgrading. Each category is described below.

Of critical importance from an economic perspective is that the latter two categories, which rely on byproduct gases and heavy products from bitumen upgrading, are made possible in part by the economies of scale of multiple upgraders in relatively close proximity. While the economics of investment in these other activities also relies on many other factors (and there is a wide range of opinion here), the volume of products

and by-products associated with multiple upgraders is a key potential advantage for the Edmonton region.

1. Additional Refining of Finished Products

Using the new supplies of synthetic crude (or existing conventional crude sources), Alberta could add additional refining capacity for finished products, such as gasoline for shipment to North American (and possibly offshore) markets. In recent years, the Alberta Government has expressed a keen interest in attracting additional refining capacity to the Province, which would in all likelihood be located in the Edmonton region.

There is arguably a demand for additional refining capacity in the North American market. Among the many factors influencing where this capacity could be provided is the access to the pipeline transportation system. Most of pipeline capacity out of Alberta is currently used for crude oil and there are significant limitations on the ability of a pipeline primarily used for crude to also be used for finished product, largely due to sulphur contamination from the crude into the finished products. The existing finished product pipeline to Manitoba does have additional capacity. This existing capacity is relatively close to the U.S. finished product distribution system in Minnesota to which it could, conceivably, be connected.

It is very important to note that finished product refining is not specifically associated with oil sands, upgrading or synthetic crude. The additional capacity could be constructed today based on conventional crude feedstock. The fact that it has not occurred already suggests that the economic conditions are not yet in place to realise this value-added downstream activity. Indeed, the economic conditions that would encourage this value-added investment are likely to be the very same conditions that are needed to assure that the upgrader proposals in the Edmonton region are realised.

2. Use of the Byproduct Gases from Upgrading

The upgrading process produces byproduct gases which are typically burned off because the quantity produced by a single upgrader is not sufficient to warrant the economic reuse of the gases for other purposes. The multiple upgrader facilities currently being proposed in the northeastern part of the Edmonton region may provide the economies of scale to make capture and reuse economic. If the byproduct gases from all of the upgraders were captured and centralised, they could potentially be economically processed into other products for a range of purposes.

In Alberta's case, the most attractive reuse of byproduct gases may be the production of olefins, which can then be used as petrochemical feedstock for current plants such as

Dow in Fort Saskatchewan and Nova in Joffre. This is particularly attractive for Alberta because it could help maintain this existing petrochemical plant infrastructure. Many existing plants depend on natural gas for feedstock. As gas supplies are expected to become more limited in the future and, as a result, more expensive, there is a threat to the industries in Alberta relying on inexpensive gas. In part related to the current price and the potential future availability of feedstock, the Dow plant in Fort Saskatchewan is already reducing some of its operations and laying off employees. Similarly, the Celanese plant in Edmonton will be closing and is reportedly moving production to China where feedstock is available readily and inexpensively.¹

The possibility of the reuse of what would otherwise be a waste product to maintain and enhance Alberta's petrochemical industries should be further explored and pursued as part of the development of the upgrader capacity in the Edmonton region and northeastern Alberta.

3. Use of the Heavy Products from the Upgrading Process

The upgrading process produces a significant amount of heavy products as byproduct and waste product (much of which is the tarry and waxy substances that make bitumen so viscous). These heavy products have traditionally comprised about 25% of bitumen feedstock. However, current proposals for the new upgraders indicate that much smaller amounts of the heavy products, about 20% and, in one case, even as low as 15%, will result.

Even with more efficient production of synthetic crude and reduced byproduct and waste product, the multiple upgraders proposed in the Edmonton region would still produce a very large quantity of heavy products. The economies of scale associated with this large quantity create the potential to be a waste product of synthetic crude production for a variety of purposes. Costly reprocessing may become economic because the feedstock is essentially a low cost waste product that is available in large quantities.

¹ Historically, the value of natural gas has been tied to the ability to transport it to market. Alberta's ability to export natural gas by pipe for residential and industrial use in the North American market has maximized price and sales potential, particularly under the generally higher prices of recent years along with increased export capacity provided by the Alliance pipeline. Petrochemical industries in Alberta are competing with areas with lower value natural gas supplies, particularly the inexpensive "stranded" supplies (stranded supplies are in areas not easily connected by pipe to major markets). Stranded supplies are the basis of petrochemical industries in places such as Trinidad, Libya and Qatar. This global natural gas industry is now rapidly changing as a result liquified natural gas (LNG) technologies which increasingly allow price competitive transport. The very notion of stranded natural gas may soon be ending. This shift may have significant long-term implications for Alberta's petrochemical potential. In the near term, however, Alberta's petrochemical industries will still be competing globally with areas where the available natural gas supplies provide lower cost feedstock.

There is a wide range of uses for these heavy products. For the purpose of this review and as an input to economic scenarios for the long-term development of the Edmonton region, the following assumption about the potential reuse of the heavy products has been made:

- a. About one-third of the heavy product could be converted to energy through co-generation to provide power for the operation of upgrader and related plants, hydrogen production, water and wastewater operations, carbon dioxide capture and other related purposes.
- b. About one-third of the heavy products could be directed to fertilizer production. Hydrogen production is the key intermediary for the fertilizer products (linking this use of the heavy products for fertilizer with the use for power production to produce hydrogen). Available hydrogen allows, among other things, the production of synthetic gas from the heavy products. Leaving the chemistry aside, our understanding is that synthetic gas along with waste carbon dioxide and carbon monoxide can be used for the production of the major base products for fertilizer which are ammonia, urea and ammonium nitrate.

North America is understood to currently be short of production capacity for fertilizer. Offshore production for import to North America is based on the availability of inexpensive natural gas. With technology rapidly increasing the ability to ship gas as LNG, the availability of inexpensive “stranded” gas reserves is diminishing.

Like the by-product gases above, the opportunity here is to make expensive production processes economically viable through the use of inexpensive feedstock in what is otherwise a waste product.

- c. The remaining one-third of heavy products could be used for synthetic gas production (through a process known as partial oxidation, which requires oxygen as an input). The synthetic gas, in turn, can be used for a range of purposes including:
 - Production of additional hydrogen beyond the needs of Edmonton region upgraders. This could be sold, for example, to Fort McMurray area upgraders that will all be in need of hydrogen.
 - Diesel fuel production.
 - Methanol production from synthetic gas which can either be used for MTBE or, preferably, converted to olefins for use as a replacement feedstock for

polyethylene or polypropylene production at Dow Fort Saskatchewan or Nova Joffre.

- Other petrochemicals.

Overall, there are many possible downstream value-added investments that can result from the significant investment associated with the oil sands extraction and upgrading. As with the investments in the upgraders themselves, attracting this downstream investment in a globally competitive market requires a suitable investment climate in Alberta and the Edmonton region.

D. UTILITIES AND INFRASTRUCTURE COULD MAKE EDMONTON REGION MORE ATTRACTIVE TO UPGRADERS AND RELATED PETROCHEMICAL ACTIVITIES

A key part of creating an attractive and competitive investment location for the upgraders and the potential downstream value-added investments is to provide the utilities and infrastructure required to operate the upgraders and related petrochemical plants.

Municipal governments in the Edmonton region, together with the Province and the private sector, can play an important role in this respect. Municipal involvement falls into two categories. The first is with the utilities which direct necessary products and services to the plants. The second is with the broader infrastructure and services that support businesses and residents of the region.

1. A Range of Utility Functions Could Increase the Competitiveness of the Edmonton Region for Upgrader and Related Investment

Attractiveness for investment can be increased through the provision of infrastructure and services that support the upgraders and other petrochemical facilities. There is a number of advantages to providing utilities and support services:

- Potential economies of scale are associated with the provision of services to a number of upgraders and related petrochemical plants.
- Reduced direct capital investment is required by the firms building the upgraders, relative to offshore locations, because each plant does not have to build its own supporting utilities.

- Permitting oil companies to focus only on their core business (rather than having to manage, for example, their own wastewater treatment) is attractive to investment.
- Reliability of services can be enhanced both by the increased scale of operation and the ability of single operators to maximize the skills and technology applied.
- Significant environmental benefits could be realised both through efficiency and, with economies of scale, by permitting activities to occur using the best available environmental technologies.

There are additional significant benefits to providing some key municipal support services to the upgraders and related plants collectively. Because the oil industry is highly competitive and often secretive, the oil companies are unlikely to collaborate to create an integrated utility network for the plants, despite the potential advantages. It is in the coordination and possible direct provision of some utility services that municipal governments or companies like EPCOR can play an important role.

Among the services best suited to be provided by third parties as utilities to the upgraders and related plants are the following:

a. Water Supply

Large scale plants, like the Shell Scotford and BA Energy upgraders, often provide their own water supplies rather than purchase water from municipalities. A collective private or municipal water utility for plants in the northeastern part of the Edmonton region could facilitate investment by removing this function from the plant thereby allowing more effective management of scarce water resources and making better use of regulations on water supply.

In addition, the potential to use recycled water supply from plant wastewater or urban wastewater could be enhanced and facilitated. Petro-Canada's upgrading facility recently completed at its Strathcona refinery uses treated wastewater from the City of Edmonton's Gold Bar plant as its industrial water source, rather than the City returning the wastewater to the North Saskatchewan River and Petro-Canada undertaking its own independent water taking from the river. This is just the type of creativity and innovation, both financial and environmental, that is needed to support the upgraders and related investments in the Edmonton region.

b. Wastewater Treatment

Like water supply, wastewater treatment has advantages in facilitating investment and better managing resources. In particular, collective wastewater management would allow the use of the best and most innovative technologies for the treatment and reuse of wastewater. This could be a significant environmental benefit to the Province, the Edmonton region and the North Saskatchewan watershed.

c. Hydrogen Production

Upgraders, as well as other petrochemical processes, require significant amounts of hydrogen. The production of hydrogen is energy consumptive and the process is less reliable than the production of other industrial gases (such as pure oxygen). Realising the advantages of scale including reliability of supply of this key product would likely be very attractive for upgrader investors if it were provided on a collective utility basis.

It has been reported in the media that Luscar Coal and Air Products are both considering investments in this area. This is potentially a competitive advantage for the Edmonton region that could be enhanced by the involvement of municipal and Provincial authorities.

d. Power Cogeneration

Large quantities of coke (which can also be used for hydrogen production) and other combustible products and byproducts of bitumen upgrading and other petrochemical processes present the opportunity for cogeneration of electrical power. Upgraders require a large reliable supply of power, the provision of which could be enhanced by collective cogeneration. Like other aspects of upgrading and petrochemical processes, anywhere that waste or low value products can be used to provide higher value production, such as electricity, is an economic advantage to the upgrader investors and the Edmonton region.

e. Carbon Dioxide Capture

Upgrading processes produce significant amounts of carbon dioxide as a byproduct. Increased concerns over greenhouse gases and climate change have focused attention on the capture of carbon dioxide from industrial processes. While the capture may be undertaken strictly for sequestering the carbon dioxide, there is also interest in the potential economic reuse of the product.

The Alberta government and the private sector are about to undertake a pilot project to capture carbon dioxide from an Edmonton region refinery and inject it into conventional oil fields to enhance secondary extraction of conventional resources and sequester some of the carbon dioxide in the process.

If this proves economic, there are enormous potential advantages for the environment and for both the conventional and oil-sands-based energy sectors.

2. Traditional Infrastructure Is Also Important for Attracting Energy Investment

In addition to the specialised utility functions described above, major industrial operations such as the upgraders and related petrochemical industries require a high level of service in more traditional municipal infrastructure. The key infrastructure for these operations is transportation in all of its forms:

- The rail system in the northeastern part of the Edmonton region will likely require improvements to permit the level of service necessary for ongoing operations.
- Road access is critical for both plant construction and the delivery of goods and labour during operation. Specialised road services are also important, including dangerous goods routes and over-size vehicle routes.
- Airport services are important for the specialised labour needed for both construction and operation. The distance of the Edmonton airport from most of the projects means good road access also becomes a critical component of the air transportation system.

E. SERVICE AND SUPPORT FUNCTIONS ARE AN IMPORTANT COMPONENT OF THE ECONOMIC BENEFITS OF UPGRADER INVESTMENT

To properly understand the needs of the upgraders and the energy industry and to prepare information for use in the fiscal analyses being undertaken for the Edmonton region, other service and support functions need to be recognized. Refineries and downstream petrochemical plants require significant off-site support for ongoing operations, particularly with respect to maintenance and repair.

A large number of professionals and skilled tradesmen are required during the maintenance shut-downs that occur every 1½ to 2 years. The increased number of facilities will allow more of this specialised employment to be permanently stationed in Alberta. This in itself will encourage further investment.

For upgraders, infrastructure and downstream activities, service and support is expected to amount to approximately 40% of the total employment in the plants. This is an important consideration when assessing the economic and employment impacts of these operations.

Service and support functions can for the most part be provided by the private sector. Thus, there is no municipal role in this area beyond a general responsibility to ensure a high quality of life that will attract a skilled and mobile labour force and the investment that employs it.

F. EX-ALBERTA UPGRADING IS THE LARGEST THREAT TO THE EDMONTON REGIONS ECONOMIC FUTURE

The greatest threat to the Edmonton region's economic future is likely to be the export of dilute bitumen for upgrading elsewhere. The exporting of bitumen means that the Province and the region not only miss out on the economic benefits of upgrading but also lose the downstream value-added investment and its related service and support economy.

This threat is imminent. Imperial oil is already exporting significant quantities of bitumen to refineries in Minnesota and Illinois and Encana has recently proposed to start exports to the same area. Shell also recently announced that it is considering adding upgrading capacity to existing refinery complex in Sarnia, Ontario. The Shell proposal would make use of the exiting Trans-Canada Pipeline system.

New pipelines could spell a greater risk of exported bitumen. Enbridge's Gateway proposal could be used to export bitumen off-shore, likely in Asia. If overseas export proves to be economic, there is a very significant threat to the economic future of the Edmonton region as it competes for upgraders and downstream value-added industries.

The table below gives estimates of how much bitumen could be exported based on new pipeline projects which may be specifically proposed for this purpose. However, dilute bitumen can also be shipped through the existing crude oil pipeline system. At the same time, additional pipeline projects will be required to ship increased synthetic crude (and possibility other products) should the proposed upgraders be built.

Because of the multiple purpose potential of these lines, the figures in the table below cannot be used to forecast bitumen export. Rather, they provide a guideline to the potential quantity of such exports in the near term.

Table 6		
Potential for Ex-Alberta Upgrading Capacity: Existing and Proposed Pipeline Projects (in 000s of barrels per day)		
Enbridge Gateway	400 diluted bitumen, 150 inbound diluent line 450 bpd bitumen based on 150 inbound diluent at 25% dilution, only about 2/3 of the total can be shipped out by gateway	450
Enbridge Southern Lights	180 inbound diluent, assumed to provide for 540 outbound bitumen by a 25% dilution ration ratio	540
Two competing Gulf of Mexico proposals: Enbridge and Altex	Enbridge total 400, assumed to be 300 bitumen and 100 diluent	300
	Altex ultimate of 750 assumed to be 560 bitumen and 190 diluent (using lower diluent ratio technology)	560
Total		1,290 to 1,550

Note: Existing off-shore upgrading by Exxon-Mobil using natural gas liquids as diluent is assumed to be replaced by the naphtha diluent in the Southern Lights project, so the bitumen would be included in the 300,000 bpd associated with Southern Lights in the table.

III ECONOMIC SCENARIOS BASED ON ABILITY OF REGION TO ATTRACT DOWNSTREAM VALUE ADDED INVESTMENT

To gain a better understanding of the potential risks and growth of the Edmonton region's economy an economic outlook for the region has been prepared. The outlook combines the potential upgrader and related investments described in the previous chapter with a range of government action and economic competition. Three economic scenarios have been defined. Each scenario generates population growth forecasts and the second scenario, "Achieving Current Proposals", underpins the fiscal impact analysis of the region and its municipalities described in the companion technical report.

The components of the economic scenarios, described in detail in the previous chapter, each carry their own risks for Alberta and the Edmonton region. As an introduction to the consideration of the economic scenarios, Table 7 summarises the key components of the investment outlook — upgraders, downstream value-added, utilities and support, and ex-Alberta upgrading — and the key risks associated with each of these components. The range of investment embodied in the economic scenarios are, in large part, based on the degree to which the risks either limit investment or can be mitigated through policy or other economic instruments.

The three economic scenarios are:

Scenario 1: Do Nothing

Scenario 2: Achieving Current Proposals

Scenario 3: Attracting Downstream Investment

Each scenario is described in detail in this chapter. The chapter is itself divided into three sections. The first section describes the economic and governmental basis for each scenario. In the second section, the timing and amount of upgrader and related investment components are described. The specific capital and investment and employment figures required as an input for the municipal fiscal analysis are provided in the third section.

Table 7		
Components of Oil-Sands-Based Economic Outlook		
Components	Role and Scale	Risks
Upgraders	<ul style="list-style-type: none"> Over half the under construction and proposed upgrading capacity in Alberta is in Edmonton region For Edmonton region this represents an addition of about 1.3 million bpd capacity with a direct capital investment in the range of \$25 billion 	<ul style="list-style-type: none"> Requires an attractive investment climate, including infrastructure, utilities and support services that the region will be challenged to meet Labour availability, construction cost, infrastructure and quality of life factors may put competitiveness at risk
Downstream Value Added	<ul style="list-style-type: none"> Potential to use upgrading products and by-products for value-added investment in the petrochemical and related industries 	<ul style="list-style-type: none"> Requires highly attractive investment climate which requires coordinated efforts by all governments and the private sector to deliver
Utility and Services Support for Upgraders	<ul style="list-style-type: none"> Attraction and support of proposed upgraders enhanced by coordinated utilities and infrastructure and the broader services required by major facilities Water, wastewater and electricity, at minimum, but collective co-generation, hydrogen production and CO₂ sequestration may be advantageous 	<ul style="list-style-type: none"> Requires municipal and Provincial government coordination and cooperation Private sector role could be compromised by absence of public encouragement and cooperation
Ex-Alberta Upgrading	<ul style="list-style-type: none"> Current pipeline proposals could export up to 1.5 million bpd of bitumen for upgrading elsewhere 	<ul style="list-style-type: none"> Places upgrader investments at risk “Value-added” potential is exported — leaves Albertans as just “miners” of the resources

A. LEVEL OF DEVELOPMENT IN EACH ECONOMIC SCENARIO BASED ON OPPORTUNITIES AND RISKS IN THE REGION

Each of the three economic scenarios prepared for the region is described in Table 8 overleaf. For each scenario the following is summarized:

- Purpose of the Scenario — describes why it is important, for the purposes of this review, to test the different levels of economic growth which may occur.
- Actions or Events Associated with Scenario — describes the government actions or events that might lead to achieving the scenario, with a focus on infrastructure and government policy in the Edmonton region.

- Results of Actions or Events — summarizes the results of each scenario.

These text descriptions of the scenarios are applied to development expectations in the following tables.

There are three key components to consider when developing the broadly-based definitions of the economic scenarios into more specific forecasts of development in the oil sands related energy sector in the Edmonton region. As above, this information is provided in tabular form so that the reader can understand the relationships between the three scenarios. Table 9 provides the following more specific descriptions of the economic scenarios:

- Upgrading capacity is described in specific terms of the amount in bpd of capacity.
- Downstream value added investment is defined with reference to achieving the high level of downstream value-added investment associated with Scenario 3.
- Amount and type of supporting infrastructure and utilities is directly associated with operation of the upgraders.

The specific timing, capacity and location of the upgrader investment (to which the rest of the analysis in this chapter and in the fiscal analysis is tied) is provided in Table 10 for the entire Province of Alberta and in Table 11 for the Edmonton region.

Table 8			
Basis for the Economic Scenarios			
	Scenario 1 Do Nothing	Scenario 2 Achieving Current Proposals	Scenario 3 Attracting Downstream Investment
Purpose of the Scenario	Scenario 1's purpose is to test the potential low end of economic growth to understand economic and fiscal risks if proposed development does not occur due to inaction to attract investment or other external factors.	Scenario 2's purpose is to test a reasonable mid-range for potential economic growth in the Edmonton region if actions are taken to assure the region is attractive to upgrader investment.	Scenario 3's purpose is to test the potential high end of economic growth if conditions are in place to attract downstream value-added activities in addition to all of the proposed upgraders.
Actions or Events Associated with Scenario	<p>The “Do Nothing” scenario includes governments doing little to encourage upgrader investment and, in particular, not delivering the regional infrastructure and utilities needed to attract upgraders in time to support key investment decisions.</p> <p>This low scenario could also arise for many other reasons. These could include technical, transportation, labour or infrastructure problems which significantly increase capital cost or create delays, reducing returns on investment below threshold levels. Reduced returns and cancellations could also result from lower than planned oil prices.</p>	<p>“Achieving Current Proposals” assumes that supporting infrastructure and utilities are sufficient to assure these proposals are completed but that only <i>limited</i> additional downstream investments are attracted.</p> <p>Achieving this mid-range scenario will require government involvement and regional coordination to ensure that the infrastructure and utilities are provided appropriately and in a timely fashion.</p>	<p>Attracting the significant downstream value-added investment is no less than establishing a major globally-competitive petrochemical complex in the Edmonton region.</p> <p>Achieving this level of investment will require carefully planned, financed and delivered infrastructure and utilities and policies at all levels of government (and goals in the private sector) directed at achieving this major economic objective.</p>
Results of Actions or Events:	<p>A number of upgrader projects are cancelled, significantly delayed or scaled down.</p> <p>Increased ex-Alberta upgrading occurs or some decreased extraction.</p> <p>Little or no downstream value-added investment occurs.</p>	<p>Currently proposed upgraders in Edmonton region are completed within 20 years (a small delay on the proposals 15 years).</p> <p>A limited amount of downstream value-added investment is attracted to the Edmonton region.</p>	<p>Currently proposed upgraders in Edmonton region completed as currently proposed by 2021 and with continued construction of additional extraction and upgrading capacity beyond 2021.</p> <p>Significant downstream value-added investments in refining and petrochemicals and industries related to waste and co-generation are attracted.</p>

Table 9			
Energy Industry Components of the Economic Scenarios			
	Scenario 1 Do Nothing	Scenario 2 Achieving Current Proposals	Scenario 3 Attracting Downstream Investment
Upgrading	Upgrading assumptions for Alberta for Scenario 1 are based on completing projects currently under construction plus a small amount of the proposed capacity, equivalent to under construction plus one phase of one of the proposed Edmonton region projects, by 2016. Between 2016 and 2026 a total 230,000 bpd capacity would be added, equivalent to about 2 or 3 phases of either Edmonton region or Fort McMurray area proposals.	Scenario 2 upgrading assumptions for Alberta are based on completion of projects currently under construction, plus 75% of the capacity of all firmly proposed extraction and upgrader projects by 2016. The full capacity of all proposals is reached by 2026.	Scenario 3 upgrading assumptions for Alberta are based on completion of projects currently under construction plus all firmly proposed capacity by 2021, approximately on schedule with the proposals. Between 2016 and 2026, additional capacity is assumed to be added. The 310,000 bpd in the five years is equivalent to one major upgrader project.
Capacity and Value in the Edmonton Region	Edmonton region upgrading capacity in 2026: 1,900,000 bpd Value of upgrader investment in the Edmonton region (under construction and proposed) by 2026: \$10.5 billion	Edmonton region upgrading capacity in 2026: 3,265,000 bpd Value of upgrader investment in the Edmonton region (under construction and proposed) by 2026: \$24.3 billion	Edmonton region upgrading capacity in 2026: 3,575,000 bpd Value of upgrader investment in the Edmonton region (under construction and proposed) by 2026: \$30.2 billion
Downstream Value-Added Activities	Values and economic effects are assumed to be 10% of the Scenario 3 downstream activities — this is the same as Scenario 2 (25% of Scenario 3), factored down to the proportion of Edmonton region upgrading capacity in Scenario 1.	Values and economic effects are assumed to be 25% of Scenario 3 downstream activities.	Completion of investments in downstream activities totalling approximately \$8 billion
Support Activities and Infrastructure:	Insufficient capacity completed in the Edmonton Region to gain the economies of scale or warrant coordination of the support infrastructure and utilities — what is built will still, of course, require its water, wastewater and electricity services from some source.	Completion of the support infrastructure for the upgraders, through coordinated utility provision where possible and continued high level of transportation service.	Completion of all of the utility functions described in the previous chapter and possibly additional utility functions such as other more specialised industrial gases.

Table 10						
Alberta Upgrading Capacity: Scenarios 1, 2 and 3 (in 000s of barrels per day bitumen capacity)						
Status	2006	2011	2016	2021	2026	Ultimate
Timing and Capacity from Proposals	870	1,738	2,530	3,265	3,265	3,265
Scenario 1: Do Nothing	870	1,550	1,670	1,780	1,900	3,265
Scenario 2: Achieving Current Proposals	870	1,680	2,280	2,770	3,265	n/a
Scenario 3: Attracting Downstream Investment	870	1,738	2,530	3,265	3,575	n/a

Table 11						
Edmonton Region Upgrading Capacity: Scenarios 1, 2 and 3 (in 000s of barrels per day bitumen capacity)						
Status	2006	2011	2016	2021	2026	Ultimate
Timing and Capacity from Proposals	870	740	990	1,450	1,450	1,450
Scenario 1: Do Nothing	170	550	590	660	720	1,450
Scenario 2: Achieving Current Proposals	170	680	870	1,160	1,450	n/a
Scenario 3: Attracting Downstream Investment	870	740	990	1,450	1,760	n/a

B. INPUTS TO THE FISCAL ANALYSIS: CAPITAL INVESTMENT, EMPLOYMENT AND LOCATION

Having established the economic scenarios, further analysis is necessary to provide inputs to the municipal fiscal impact analysis described in the Fiscal Report. For this analysis two sets of data are required: capital forecasts and employment forecasts. In both cases a geographic distribution of growth among Edmonton region municipalities is required.

Specific capital expenditure forecasts are required for the upgrader investment, utilities and supporting infrastructure and downstream value-added investments. These capital

investment forecasts are used to prepare part of the assessment forecast and, ultimately, the municipal tax revenue stream.

The investment figures below for infrastructure are the private sector infrastructure associated with the upgraders and downstream investments. This part of the analysis does not include the pure municipal infrastructure that would also be required. This municipal infrastructure, especially at the higher end of the economic scenario range would be a very large investment. As noted elsewhere in our work, achieving the higher end of the scenarios including the value-added investments requires a major co-ordinated economic development effort including these substantial municipal infrastructure investments. While not directly addressed in this section, the value of the municipal infrastructure investment are incorporated into the municipal fiscal analysis in the companion report.

An employment forecast has been prepared for the upgraders, utilities and supporting infrastructure and the downstream value-added investments as well as the service and support employment for these industries. In addition, the significant amount of construction employment is also incorporated into the forecasts.

The employment forecasts are required as an input to the overall employment forecasts provided in Chapter V of this report. The employment outlook is used as part of the preparation of the assessment forecast for the municipalities in the Edmonton region and is used as part of the determination of the forecast municipal expenditures in each municipality.

1. Amount and Distribution of Capital Investments

For the capital investment forecasts the key assumptions are as follows:

- Value of capital investment for the upgraders is assumed to be \$1.9 billion per 100,000 bpd capacity (applied to the capacities in Table 11). This is approximately the average cost of the Edmonton region upgrader proposals where a price has been published. These costs do not account for the recent rapid construction price escalations anticipated for these projects. However, for the purposes of the fiscal analysis, it is appropriate to be using stable 2005–2006 cost levels to determine assessment, since the rest of the assessment base in the analysis will be based on 2005 current values.

- Utility and support infrastructure is based on an estimated additional capital investment of \$280 million per 100,000 bpd capacity. This represents about a 15% additional investment beyond the upgraders' direct costs. This is a reasonable estimate as it considers cost estimates for such facilities as electrical cogeneration plants and carbon dioxide sequestration facilities. For some of the other utility-type investments that would be assessed for property tax purposes (discussed in the previous chapter), the costs are assumed to be incorporated in the upgrader capital cost estimates. The \$280 million per 100,000 bpd is used for Economic Scenarios 2 and 3, while Scenario 1 uses 25% of this level.
- Downstream value-added investment for Scenario 3 is based on a total of \$500 million in capital investment per 100,000 bpd upgrader capacity. This incorporates three components: a 300,000 bpd refinery (\$5 to \$6 billion); a major petrochemical complex in the \$6.5 billion range, half of which would be in the Edmonton region; and another downstream facility (such as methanol, ammonia or "export" hydrogen plant), assumed to be at the same level of investment in the Edmonton region as the petrochemical complex at just over \$3 billion. The total of just over \$12 billion in such investments is equivalent to the \$500 million per 100,000 bpd capacity for Scenario 3. Scenario 1 assumes investment at 10% of this level and Scenario 2 at 75% of this level.
- The assumed geographic distribution of the upgrader investments is shown in Table 12. The distribution is based on the location of the proposals described earlier in this report. It should be noted that even if one or the other scenarios is correct in actual total upgrader capacity, the actual projects built may not be identical to the ones proposed and may therefore occur in different locations.

		Table 12				
Geographic Distribution of Upgrader Capacity Within the Edmonton Region		(in 000s bpd capacity)				
Scenario and Location		2006	2011	2016	2021	2026
1	Strathcona County	170	520	550	550	560
	Sturgeon County	0	30	40	110	160
	Fort Saskatchewan	0	0	0	0	0
	Edmonton	0	0	0	0	0
	Leduc County	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>
	Total Edmonton Region	170	550	590	660	720
2	Strathcona County	170	520	660	680	700
	Sturgeon County	0	160	210	480	750
	Fort Saskatchewan	0	0	0	0	0
	Edmonton	0	0	0	0	0
	Leduc County	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>
	Total Edmonton Region	170	680	870	1,160	1,450
3	Strathcona County	170	520	700	700	700
	Sturgeon County	0	220	290	750	1,060
	Fort Saskatchewan	0	0	0	0	0
	Edmonton	0	0	0	0	0
	Leduc County	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>
	Total Edmonton Region	170	740	990	1,450	1,760

- The assumed geographic distribution of the utility and support infrastructure and the downstream investments is shown in Table 13. These investments are assumed to be more widely distributed than the upgraders themselves, since the support and downstream activities will in some measure be building onto the existing developed industrial base in the Edmonton region and can locate in a wider range of locations.

Table 13	
Geographic Distribution of Utility and Support and Downstream Value-Added Investments	
Strathcona County	30%
Sturgeon County	20%
Fort Saskatchewan	10%
Edmonton	40%
Leduc County	<u>0%</u>
Total Edmonton Region	100%

2. Amount and Distribution of Employment

For the employment related to the capital investment forecasts the key assumptions are as follows:

- Upgrader construction employment is 4,600 person years per 100,000 bpd upgrader capacity plus 300 permanent operating employees per 100,000 bpd capacity once completed. These estimates are based on the averages of the employment suggested in the various background reports associated with the upgrader project announcements or approval applications. The construction employment associated with the investments is annualised over the 20 year forecast period to ensure comparability between the two types of employment.
- Both construction and ongoing operating employment for the utility and support infrastructure and downstream value-added investments is estimated to have the same relationship to value as the employment for the upgrader investments.
- In addition, service and support employment is estimated to be 40% of the permanent employment for the upgraders and the downstream value-added investments and 20% of the permanent employment for the utilities and support infrastructure. These estimates follow industry standards for energy industry employment.
- The geographic distribution of employment follows the distribution of investment shown above. The service and support employment associated with the investments is more widely distributed since much of it will result from expansions to existing businesses. For this reason Leduc County (mainly in the Nisku Business Park) would be expected to attract a significant amount of this employment, despite none of the direct investment being anticipated there. The service and support employment distribution is shown in Table 14.

Geographic Distribution of Service and Support Employment to the Energy-Related Investments	
Strathcona County	20%
Sturgeon County	10%
Fort Saskatchewan	5%
Edmonton	40%
Leduc County	<u>25%</u>
Total Edmonton Region	100%

3. Forecast Energy-Related Investment and Employment by Area

The above investment and employment outlooks and distributions generate capital investments and employment forecasts for each of the three economic scenarios. The following are displayed in Tables 15 and 16.

Scenario and Location		2006	2011	2016	2021	2026
1	Strathcona County	\$ 3,230	\$ 9,980	\$ 10,510	\$ 10,540	\$ 10,800
	Sturgeon County	\$ 0	\$ 720	\$ 900	\$ 2,260	\$ 3,270
	Fort Saskatchewan	\$ 0	\$ 50	\$ 50	\$ 60	\$ 70
	Edmonton	\$ 0	\$ 180	\$ 200	\$ 230	\$ 270
	Leduc County	—\$ 0	—\$ 0	—\$ 0	—\$ 0	—\$ 0
	Total Edmonton Region	\$ 3,230	\$ 10,930	11,680	\$ 13,080	\$ 14,400
2	Strathcona County	\$ 3,230	\$ 10,850	\$ 13,810	\$ 14,810	\$ 15,820
	Sturgeon County	\$ 0	\$ 3,810	\$ 4,980	\$ 10,450	\$ 15,930
	Fort Saskatchewan	\$ 0	\$ 340	\$ 460	\$ 650	\$ 840
	Edmonton	\$ 0	\$ 1,340	\$ 1,830	\$ 2,590	\$ 3,350
	Leduc County	—\$ 0	—\$ 0	—\$ 0	—\$ 0	—\$ 0
	Total Edmonton Region	\$ 3,230	\$ 16,340	\$ 21,070	\$ 28,500	\$ 35,930
3	Strathcona County	\$ 3,230	\$ 11,170	\$ 15,200	\$ 16,300	\$ 17,020
	Sturgeon County	\$ 0	\$ 5,070	\$ 6,690	\$ 16,250	\$ 22,620
	Fort Saskatchewan	\$ 0	\$ 440	\$ 640	\$ 1,000	\$ 1,240
	Edmonton	\$ 0	\$ 1,770	\$ 2,540	\$ 3,990	\$ 4,960
	Leduc County	—\$ 0	—\$ 0	—\$ 0	—\$ 0	—\$ 0
	Total Edmonton Region	\$ 3,230	\$ 18,450	25,070	\$ 37,530	\$ 45,840

Table 16						
Geographic Distribution of Employment in Upgraders and Related Industries in the Edmonton Region						
Scenario and Location		2006–11	2011	2016	2021	2026
1	Strathcona County	1,290	2,480	2,570	2,590	2,650
	Sturgeon County	430	610	650	870	1,040
	Fort Saskatchewan	10	50	50	60	60
	Edmonton	80	340	360	400	440
	Leduc County	<u>50</u>	<u>170</u>	<u>180</u>	<u>200</u>	<u>230</u>
	Total Edmonton Region	1,870	3,650	3,820	4,125	4,420
2	Strathcona County	1,530	3,230	3,750	4,000	4,240
	Sturgeon County	1,890	2,770	2,990	3,890	4,800
	Fort Saskatchewan	10	200	230	290	340
	Edmonton	80	1,010	1,200	1,490	1,790
	Leduc County	<u>50</u>	<u>250</u>	<u>320</u>	<u>430</u>	<u>540</u>
	Total Edmonton Region	3,600	8,960	8,480	10,100	11,720
3	Strathcona County	1,530	3,390	4,110	4,410	4,640
	Sturgeon County	2,540	3,720	4,020	5,590	6,660
	Fort Saskatchewan	10	270	320	410	480
	Edmonton	80	1,300	1,580	2,070	2,460
	Leduc County	<u>50</u>	<u>280</u>	<u>380</u>	<u>540</u>	<u>690</u>
	Total Edmonton Region	4,210	8,960	10,400	13,020	14,920

C. SCENARIOS CAN BE SUMMARISED BY IDENTIFYING THE ROLE GOVERNMENTS WILL PLAY IN THE OVERALL LEVEL OF INVESTMENT

Table 17, below, summarizes the three economic scenarios. The purpose of this summary is to link the scenarios and associated investment levels with the government action or role in achieving each scenario.

Table 17				
Scenarios of Investment and Government Role in Edmonton Region Upgrader and Petrochemical Industries				
Scenario	Description	Municipal and Regional Role	Senior Government Role	Upgrader and Related Investment (\$billion, 2006–26)
1 Do Nothing	Most projects cancelled or significantly delayed	Status quo	Uncertain and unclear commitment	\$ 14.4
2 Achieving Current Proposals	All current proposals completed by 2026	Regional planning, coordination and investment in infrastructure	Provincial and Federal coordination and investment	\$ 35.9
3 Attracting Downstream Value Added	Addition of significant downstream investment	Aggressive coordinated plan to establish a major petrochemical cluster		\$ 45.8

IV BROADER ECONOMIC IMPACT ANALYSIS OF THE UPGRADER AND ASSOCIATED INVESTMENTS

The previous chapter provided details of the economic scenarios and the input information required for the municipal fiscal impact analysis. This chapter provides a broader analysis of the economic impact of upgrader and related investments on the Alberta and Canadian economy. The impact of such investment is described in this chapter in terms of gross domestic product (GDP) and of person-years of employment. This broad analysis is not used as a direct input to the other analysis undertaken in this report and the Fiscal Report. However, it provides a “check” on both the other economic impact work as well as the population and employment forecasts. In the latter case, using a broad approach helps to establish a relationship between economic growth and population growth in the Edmonton region.

The broad economic impact analysis is prepared using Statistics Canada’s input-output model. This econometric model uses economic multipliers to assess to the total effect on the economy of a specific shock or event. In this case the shock or event is the capital investment in the energy sector in the Edmonton region.

Economic multipliers typically measure three types of impacts: direct, indirect and induced. Direct impacts are impacts arising from industries that are expanding production to satisfy increased demand generated by investment. Indirect impacts measure the activity of suppliers that purchase goods and services directly from these industries. The direct and indirect effects are clearly traceable and can be attributed to the initial investment.

Induced impacts refer to changes in the economic activity of households that receive wages from the capital investment (i.e. the economic shock). Induced impacts are not, in our view, appropriate to model for our current purpose as they are too far removed from the investment being analysed.

Tables 18 and 19 on the following pages provide the results of the analysis in terms of the effects on GDP and on employment generated for each of the years 2016 and 2026 under each of the three economic scenarios.

Table 18				
Summary Economic Impact Analysis to 2016				
		1 Do Nothing	2 Achieving Current Proposals	3 Attracting Downstream Value Added
Economic Input				
Edmonton Area Upgrader and Related Capital Investment (\$ millions)	Total	\$ 11,600	\$ 21,000	\$ 24,900
	Annualised	\$ 1,200	\$ 2,100	\$ 2,500
Canadian Economic Output in GDP				
Total Canadian GDP (\$ millions)	Alberta Direct	\$ 3,900	\$ 7,000	\$ 8,300
	Alberta Indirect	\$ 4,200	\$ 7,500	\$ 8,900
	Other Provinces	\$ 900	\$ 1,800	\$ 2,100
	Total	\$ 9,000	\$ 16,300	\$ 19,400
	Annualised	\$ 900	\$ 1,600	\$ 1,900
Canadian Employment				
Total Canadian Employment (in person-years)	Alberta Direct	50,000	89,000	106,000
	Alberta Indirect	52,000	94,000	111,000
	Other Provinces	13,000	24,000	28,000
	Total	114,000	207,000	246,000
	Annualised	11,000	21,000	25,000

Table 19				
Summary Economic Impact Analysis to 2026				
		1 Do Nothing	2 Achieving Current Proposals	3 Attracting Downstream Value Added
Economic Input				
Edmonton Area Upgrader and Related Capital Investment (\$ millions)	Total	\$ 14,400	\$ 35,900	\$ 45,800
	Annualised	\$ 700	\$ 1,800	\$ 2,300
Canadian Economic Output in GDP				
Total Canadian GDP (\$ millions)	Alberta Direct	\$ 4,800	\$ 11,900	\$ 15,200
	Alberta Indirect	\$ 5,100	\$ 12,800	\$ 16,300
	Other Provinces	\$ 1,200	\$ 3,000	\$ 3,800
	Total	\$ 11,100	\$ 27,700	\$ 35,300
	Annualised	\$ 600	\$ 1,400	\$ 1,800
Canadian Employment				
Total Canadian Employment (in person-years)	Alberta Direct	61,000	152,000	194,000
	Alberta Indirect	64,000	160,000	204,000
	Other Provinces	16,000	41,000	52,000
	Total	141,000	353,000	450,000
	Annualised	7,000	18,000	23,000

V RANGE OF REGIONAL POPULATION AND EMPLOYMENT GROWTH ASSOCIATED WITH THE ECONOMIC SCENARIOS

Population and employment forecasts have been prepared under each of the three economic scenarios for all the municipalities within the Edmonton CMA. The forecasts are required for two reasons. First, they serve as a measure of the anticipated effects of the economic scenarios on growth in the Edmonton region. Second, they are used as inputs to the municipal fiscal impact analysis: levels of population and employment growth are central to the calculation of future municipal costs and revenues as well as long-term infrastructure needs.

The forecasting approach has made use of some secondary sources, particularly for the distribution of population and employment growth within the CMA. The approach used is sufficient for the purposes of the fiscal impact analysis of the growing Edmonton region. However, we caution against using the forecasts as precise forecasts for other purposes, without first carefully reviewing local conditions, infrastructure, and development proposals in each of the municipalities.

This chapter describes the method used to prepare the forecasts for the Edmonton CMA, the key factors influencing the results, and the CMA-wide results themselves. It also outlines the method used for the distribute population and employment within the Edmonton CMA and the forecasts by municipality that result.

A. OTHER NON-ENERGY RELATED ECONOMIC ACTIVITIES ARE PART OF THE OVERALL ECONOMIC OUTLOOK IN THE GROWTH FORECAST

The first four chapters of this report have been focussed on the energy industry and, particularly, on the oil-sands-related upgraders and associated industries. While these industries are generating much of the current and forecast growth in the Edmonton region, the area does have a diverse economic base with other generators of growth and prosperity. The forecasts of population and employment embody an outlook for the entire economy of the Edmonton region.

In the broader resource sectors, conventional oil and gas, coal, forestry and other mining are very significant industries in Alberta now and in the future. The Edmonton region remains the primary support and service centre for these industries in Alberta as well for parts of northern Saskatchewan and B.C. and the Northwest Territories — as it has long been described, the Edmonton region remains Canada’s gateway to the north.

While not likely to be a major engine economic *growth*, agriculture and food industries are a key part of the historic economic base of the province and region and remain a large and important industry. Like the resource sector, the Edmonton region provides support services to agriculture and food for large parts of the province.

As the Edmonton region has become a larger, more diverse metropolitan area non-resource-based economic activity has also grown and will continue to do so. Of particular importance has been, and will continue to be, learning, research and commercial innovation in a variety of sciences, but particularly in the medical sciences. This success has been achieved, in part, through significant strategic public investment in the University of Alberta Hospitals and the large number of associated medical institutions. Similarly, more recent investment in other sciences including the new Centre for Nanotechnology may prove equally successful and continue to broaden the regional economic base.

The anticipated growth in all economic activities is incorporated into the economic outlook and the specific population and employment forecasts described in the rest of this chapter. While the three scenarios are specifically tied to expectations for the oil-sands-based industries, most of the factors that will influence the prospects for most other economic activity. If, for example, labour shortages affect the upgrader investments, such shortages will also become limiting factors for many other economic sectors. Likewise, the need for coordinated, efficient and timely delivery of infrastructure affects all parts of the economy. And, anything which affects the overall quality of life in the Edmonton region, for better or worse, will be felt across all economic sectors.

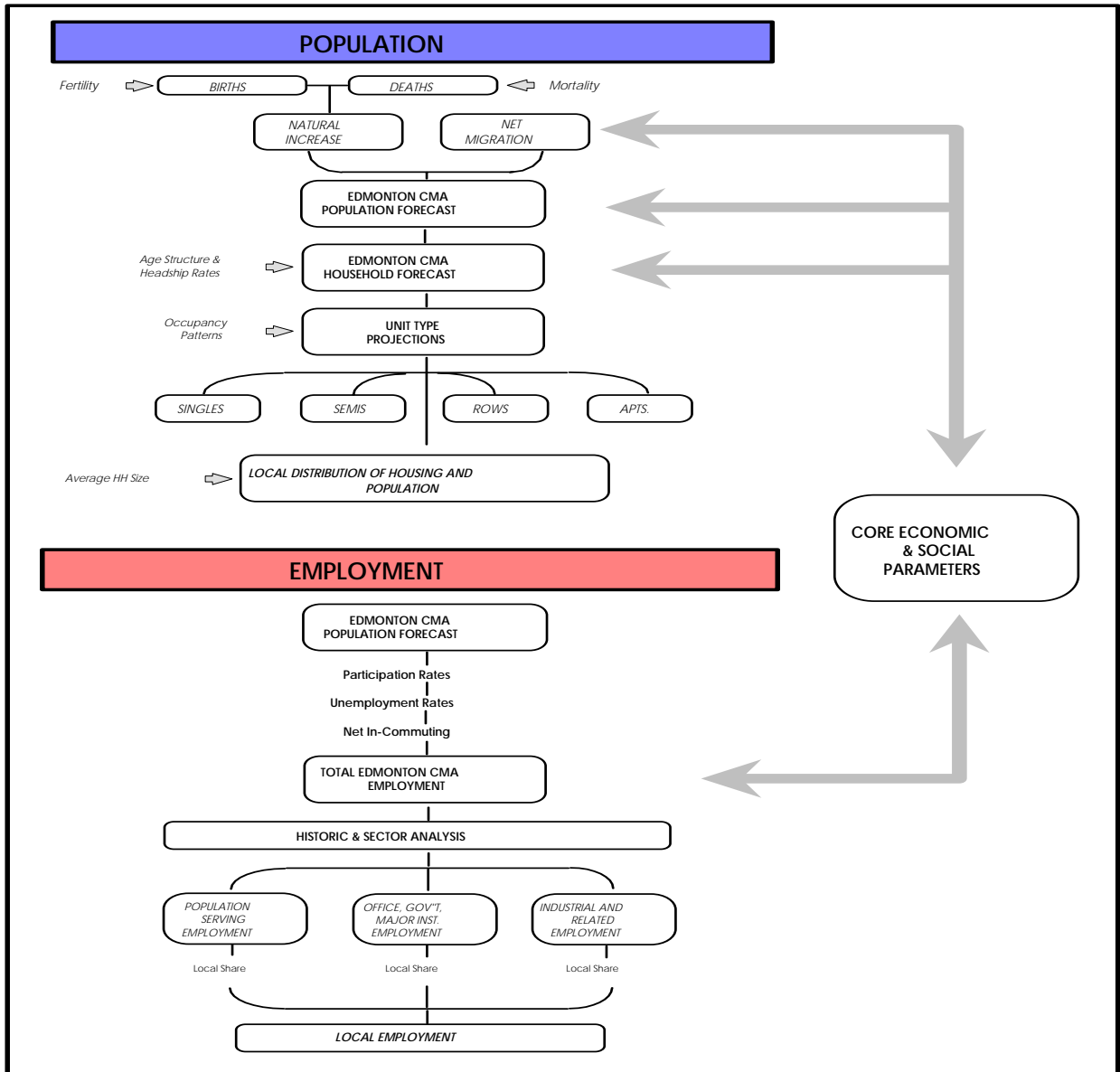
For the purposes of preparing the forecasts, the outlook for the energy-based industries and the factors that will influence outcomes in this sector become, in large measure, the outlook and influencing factors for the broader economy.

B. BASIS FOR POPULATION AND EMPLOYMENT GROWTH OUTLOOK INCORPORATES BOTH DEMOGRAPHIC AND ECONOMIC FACTORS

1. Forecast Method for the CMA Uses a Standard Cohort-Survival Model

The chart below graphically illustrates the method used to prepare the forecasts for the Edmonton CMA and the approach used to distribute the population and employment within the CMA.

EDMONTON CMA FORECAST METHOD



The general approach to the forecast is an iterative one by which “core economic and social parameters” provide a basis for the forecast and where the numerous assumptions *and* results within the technical forecast model (shown on the left side of the chart) are defined and reviewed within the context of the core parameters. For the purpose of these forecasts, the primary parameters are the economic scenarios and their underlying bases.

Technically, the Edmonton CMA population uses a standard cohort-survival model which, broadly, takes the population by age and sex in five year age groups and forecasts forward by aging each group five years, deducting deaths in each age group and adding net migrants in each age group. Births are then added to provide the 0 to 4 years age group. Fertility rates, mortality rates and migration are the key assumptions for the CMA population forecasts.

The household and housing forecasts are based on age-specific household formation rates and age-specific housing occupancy patterns by type (single, semi, row and apartment). These determine a forecast of total households, average household size and housing growth by unit type.

CMA-wide employment is calculated from the population forecast by applying age-specific labour force participation rates to determine a total labour force. Unemployment rates are applied to the labour force to determine employed labour force. Finally, net commuting is added to determine total employment in the CMA. Note that employment is total employment by place of work, that is the number of jobs in the CMA not the number of people living within the CMA who have jobs. For a large metropolitan area the distinction between place of work and place of residence is not large. However, in smaller jurisdictions it can be very significant.

It is important at this stage of the employment forecast to understand the iterative approach to the forecast. Essentially, the economic scenarios generate a level of employment growth in the region which itself generates population forecasts.

2. Demographic Factors Influencing the Population Forecast

There are two key factors that influence population growth: natural increase (births less deaths) and migration. The fertility and mortality rate assumptions are based on the following:

- The total fertility rate in the Edmonton CMA is about 1.7 (this is the number of live births expected for each woman in her life at the current rate). This is consistent with the national average and is kept constant throughout the forecast. There are expected to be no major shifts in either direction to the largely stable national or local fertility rates. The number of births will vary over time in accordance with the number of women in child-bearing age, hence the “baby boom

echo” experienced through the late 1980s and the 1990s as the baby boomers moved through child-bearing years.

- Mortality rates are forecast to continue their slow steady decline. This has been seen for many decades and results from continued improvements in public health and medical treatment.

Despite declining mortality *rates*, the absolute number of deaths will increase over time because the overall population is larger and because the large baby boom population will be entering older age groups. Unlike much of the rest of Canada, however, in the Edmonton CMA, the number of births will still far outweigh deaths throughout the forecast. This is because Edmonton has and will continue to have a much younger population profile than Canada as whole. The phenomenon of an aging population, widely discussed in the media and elsewhere in recent years, is certainly occurring nationally. However, the continued high level of economic growth that is attracting large numbers of young-adult migrants has given Alberta and the Edmonton CMA a much younger population profile than much of the rest of Canada. As a result, most of the widely discussed social and economic effects and associated public investments related to an aging population will affect Alberta and the Edmonton region, just to a lesser extent than in most of the rest of Canada.

3. Economic Growth Generates Migration

While the natural increase is almost entirely unaffected by the different economic scenarios being considered for the Edmonton CMA, the population growth attributable to migration is closely related to the economic conditions and is therefore highly variable.

The basis of the assumptions about migration are described below and are shown historically in Table 20:

- International migration includes immigrants, emigrants, returning emigrants, Canadians temporarily abroad and changes in the number of non-permanent residents. This is the relatively stable component of the Edmonton CMA migration. Most of the growth through net international migration is immigration. This fluctuates between about 4,000 and 6,000 annually resulting in, after the other components are included, a net international migration in the range of 2,000 to 4,000 annually. Because of the nature of the individual decisions involved, international migration tends to be affected by perceived long-term economic opportunities.
- Net inter-provincial migration, comprised of migration exchanges with other provinces, is the most volatile component of migration. It is more often based on

shorter-term economic prospects both in Alberta and the Edmonton CMA as well as those in the places of origin of the migrants. For example, in the late 1990s and the early part of this decade B.C., Alberta and Ontario all had buoyant economies and were competing for inter-provincial migrants. The combination of a slowing Ontario economy in the last couple of years with the booming Alberta economy has allowed Alberta's inter-provincial migration to reach record levels in 2006.

- Net intra-provincial migration is partly related to the relative near-term economic prospects between, for example, Edmonton and Calgary, but is also largely related to other social and lifestyle choices. In Alberta, like most other provinces there continues to be a significant movement of younger people from rural areas into the major centres. This is in part compensated by out-migration to smaller cities by some of the middle aged population. While the amount of net intra-provincial migration varies over time, it is generally a smaller component of growth than the other types of migration.

Average Annual Edmonton CMA Historic Migration by Source				
	Net Annual International	Net Annual Inter-Provincial	Net Annual Intra-Provincial	Net Annual Migration
1981–86	4,300	(2,600)	(600)	1,100
1986–91	4,600	(4,200)	500	900
1991–96	3,500	(3,300)	(2,200)	(2,000)
1996–01	2,000	5,200	700	7,900
2001–04	3,900	3,000	900	7,700

Source: Statistics Canada, Annual Demographic Statistics

The migration levels are directly influenced by the economic scenarios. Forecast migration levels are based on the scenarios defined in the previous chapters and the level of total projected CMA employment growth expected under the economic conditions implied by the scenarios. The historic and forecast migration for the Edmonton CMA under the three scenarios is shown in Table 21. Note that the current estimate for net migration for the entire 2001–06 period is much higher than the data for 2001–04 in Table 20. This is because of extremely high rates of inter-provincial in-migration to Alberta in the last two years of the five-year Census period. Indeed more recent data now suggest that the migration in 2006 may have been higher again than the high rates of 2004 and 2005.

This increase is suggested in the migration forecast for 2006–11 where the absolute migration and the migration rate are forecast to increase over 2001–06 levels in the mid-range Scenario 2. Even beyond 2011 the migration range in the Scenario 2 forecast to

remain stable at 1.1%, but as the region grows, the stable rate does mean higher absolute levels of migration.

In relation to the economic scenarios, this higher absolute population growth later in the forecast period is the result of the Edmonton region having a larger economic base but also continuing to grow significantly as a result of continued energy investments (in Scenarios 2 and 3). Serving the expanding base, plus providing for the economic growth increment means an accelerating labour demand through the period, as long as new major energy-related investments continue. The acceleration is particularly marked in Scenario 3, where the value-added downstream investments create more significant economic growth.

	Scenario 1 Do Nothing		Scenario 2 Achieving Current Proposals		Scenario 3 Attracting Downstream Value Added	
	Annual Migration	Annual Migration Rate	Annual Migration	Annual Migration Rate	Annual Migration	Annual Migration Rate
1981–86	1,100	0.2%	1,100	0.2%	1,100	0.2%
1986–91	900	0.1%	900	0.1%	900	0.1%
1991–96	(2,000)	-0.2%	(2,000)	-0.2%	(2,000)	-0.2%
1996–01	7,900	0.9%	7,900	0.9%	7,900	0.9%
2001–06	8,800	0.9%	8,800	0.9%	8,800	0.9%
2006–11	6,800	0.7%	10,700	1.0%	13,000	1.3%
2011–16	5,400	0.5%	12,000	1.1%	17,500	1.6%
2016–21	4,900	0.4%	13,700	1.1%	20,400	1.6%
2021–26	4,600	0.4%	14,300	1.1%	21,800	1.6%

Note: Total CMA population is provided in “Total Population” which includes a Census under-coverage factor of 2.4% in 2001.

4. Metropolitan Results

The population, household and employment forecasts that are generated using the model and the economic, demographic and social assumptions described earlier, are shown in Tables 22, 23 and 24.

Range of Edmonton CMA Population Forecasts Under Three Economic Scenarios						
	Scenario 1 Do Nothing		Scenario 2 Achieving Current Proposals		Scenario 3 Attracting Downstream Value Added	
	Population 000s	Annual Growth Rate	Population 000s	Annual Growth Rate	Population 000s	Annual Growth Rate
1981	750	—	750	—	750	—
1986	800	1.2 %	800	1.2 %	800	1.2 %
1991	850	1.4 %	850	1.4 %	850	1.4 %
1996	880	0.5 %	880	0.5 %	880	0.5 %
2001	960	1.7 %	960	1.7 %	960	1.7 %
2006	1,040	1.5%	1,040	1.6%	1,040	1.6%
2011	1,100	1.2%	1,120	1.6%	1,130	1.8%
2016	1,160	1.0%	1,210	1.6%	1,250	2.0%
2021	1,210	0.9%	1,310	1.6%	1,390	2.1%
2026	1,260	0.8%	1,410	1.5%	1,530	2.0%

Note: Total CMA population is provided in "Total Population" which includes a Census under-coverage factor of 2.4% in 2001.

Range of Edmonton CMA Household Forecasts Under Three Economic Scenarios						
	Scenario 1 Do Nothing		Scenario 2 Achieving Current Proposals		Scenario 3 Attracting Downstream Value Added	
	Households 000s	Annual Growth Rate	Households 000s	Annual Growth Rate	Households 000s	Annual Growth Rate
1991	310	—	310	—	310	—
1996	320	0.9 %	320	0.9 %	320	0.9 %
2001	360	2.2 %	360	2.2 %	360	2.2 %
2006	420	3.2%	420	3.2%	420	3.2%
2011	450	1.5%	460	1.8%	460	2.0%
2016	470	1.1%	500	1.7%	510	2.1%
2021	500	0.9%	540	1.6%	560	2.0%
2026	520	0.8%	580	1.5%	620	2.0%

	Scenario 1 Do Nothing		Scenario 2 Achieving Current Proposals		Scenario 3 Attracting Downstream Value Added	
	Employment 000s	Annual Growth Rate	Employment 000s	Annual Growth Rate	Employment 000s	Annual Growth Rate
1981	400	—	400	—	400	—
1986	380	- 0.9 %	380	- 0.9 %	380	- 0.9 %
1991	420	2.0 %	420	2.0 %	420	2.0 %
1996	440	0.6 %	440	0.6 %	440	0.6 %
2001	500	2.7 %	500	2.7 %	500	2.7 %
2006	560	2.3%	560	2.3%	560	2.3%
2011	590	1.0%	600	1.4%	610	2.3%
2016	600	0.3%	630	1.0%	650	1.5%
2021	600	0.2%	660	1.0%	710	1.6%
2026	610	0.2%	700	1.2%	770	1.7%

Note: Historic employment is estimated based on the employment growth rates shown for the CMA in the Statistics Canada's Monthly Labour Force Survey.

C. DISTRIBUTION OF GROWTH WITHIN THE EDMONTON REGION

The total population, households and employment for the Edmonton CMA is determined through a range of external broader economic factors. The distribution of that growth, save for some industrial development, is largely determined by local planning decisions. Because our current work in the Edmonton region is neither intended to be a growth management strategy nor to be a reconsideration of existing development and infrastructure plans in the region, we have largely relied on current information about development.

1. Population and Household Distribution within the Edmonton Region

The distribution of population is primarily based on the growth shares used in the 2004 forecast work prepared by Applications Management Consulting Ltd. for the City of Edmonton and by Alberta Transportation for the purposes of transportation planning in the Edmonton region. These are sound and recent forecasts that do not need to be comprehensively revisited for the purposes of this analysis. That said, some minor

adjustments to growth shares were made where recent changes to development activity or anticipated development patterns were known. For example, up until recently the Town of Redwater had experienced severe land constraints and was, quite reasonably, allocated little growth in the Applications' 2004 forecasts. In the Hemson forecasts the growth allocation for Redwater has been adjusted upward to reflect recent boundary expansions and development activities.

While the forecasts rely largely on growth shares established in existing sources, the shares are applied to Hemson's three economic scenarios. The resulting population forecasts therefore differ from many of the existing published materials on population growth depending on the scenario.

For the distribution of growth in the forecasts, there is a key assumption about the relationship between the economic scenarios and the population distribution: the Edmonton CMA is being treated as a single labour market. This means that regardless of the scenario and the corresponding amount of upgrader and related development in the northeastern part of the region it is assumed that the *proportion* of population growth attributed to each part of the region will not change. This means that construction and operation employees will be drawn from across the region (and beyond), but these workers would not, in response to taking these jobs, choose to move to a new residential location within the CMA.

The population distributions under each economic scenario are shown in Tables 25, 26 and 27.

The household forecast and growth in households is largely dependant on the population forecast, since most of the population is accommodated in households. Patterns of household growth do vary somewhat from the patterns of population growth because of changes in average household size over time. However, these changes are not significant over the forecast period. The household distributions under each economic scenario are shown in Tables 28, 29 and 30.

2. 2006 Population Estimates Prepared to Be Suitable for Use in the Financial Analysis and Are Slightly Lower than Current Expectations for the 2006 Census Results

The 2006 population estimates for the Edmonton CMA and all of the Edmonton region communities are based on 2001 Census data as updated by available Statistics Canada information at the CMA level and housing construction data at the local level. In late 2006, the most recent CMA level migration data available were current to mid-2005 and housing data were available to mid-2006. The large number of communities in the Edmonton region meant the need for a standardised 2006 estimation method for each municipality. This resulted in an estimated 2006 CMA population of 1,010,000 (Census definition excluding Census undercoverage) and the City of Edmonton population

estimated at about 715,000. Information from Edmonton's municipal census in 2005 and provincial level migration data to mid-2006 both suggest that growth may have been somewhat more rapid in the last year (2005–06) of the Census period and that the population estimates for 2006 for the CMA and the City of Edmonton may be slightly low.

As inputs to the Edmonton region fiscal analysis, the City population figures should not be estimated by a different method than surrounding communities to assure a fair and consistent approach within the fiscal analysis. Also, the basis of the fiscal analysis is 2006 municipal budgets which were prepared based on 2005 data and 2005 expectations of growth for 2006. The rapid acceleration in growth in 2006 was not anticipated by those budget documents, so increased assessment or expenditure associated with the accelerated growth would not have been captured. Maintaining a sound basis for fiscal analysis requires the approach to 2006 population estimated used here, even if the results are little lower than expectations today.

Census populations for 2006 will be released in March of 2007, providing an updated consistent set of region-wide base data for future analyses. There is no anticipation that the differences between current estimates and the forthcoming actual 2006 figures would be sufficient to have any significant affect on the longer-term growth outlook under any of the scenarios.

Table 25						
Population Forecast - Scenario 1: Do Nothing						
	2001	2006	2011	2016	2021	2026
Edmonton	666,100	713,600	753,200	785,900	815,200	842,700
St Albert	53,100	58,400	63,500	68,500	73,500	77,700
Sturgeon County	18,100	19,300	20,200	21,200	22,100	22,700
Morinville	6,500	7,000	7,300	7,700	8,100	8,300
Gibbons	2,700	2,900	3,100	3,300	3,500	3,700
Redwater	2,200	2,300	2,400	2,600	2,700	2,800
Bon Accord	1,500	1,600	1,700	1,800	1,800	1,900
Legal	1,100	1,100	1,200	1,200	1,300	1,300
Alexander First Nation	800	900	1,000	1,100	1,200	1,200
Strathcona County	72,000	79,200	86,100	92,900	99,700	105,400
Fort Saskatchewan	13,100	14,200	15,400	16,600	17,800	18,700
Bruderheim	1,200	1,300	1,300	1,400	1,500	1,500
Leduc City	15,000	16,300	17,400	18,600	19,700	20,500
Leduc County	12,700	13,500	14,200	15,000	15,700	16,200
Beaumont	7,000	7,700	8,400	9,000	9,700	10,300
Devon	5,000	5,400	5,800	6,100	6,500	6,800
Calmar	1,900	2,100	2,200	2,300	2,500	2,600
Thorsby	800	800	900	900	900	1,000
Warburg	600	600	600	600	700	700
New Sarepta	400	400	400	500	500	500
Parkland County	27,400	29,700	31,500	33,400	35,200	36,600
Spruce Grove	16,000	17,300	18,600	20,000	21,300	22,300
Stony Plain	9,600	10,500	11,600	12,600	13,600	14,400
Enoch Cree Nation	1,100	1,200	1,300	1,400	1,500	1,600
Wabamum IR	1,000	1,100	1,200	1,200	1,300	1,400
Wabamum	600	600	600	700	700	700
Total Region - Minus City of Edmonton	271,300	295,400	317,900	340,600	362,800	380,700
Total Population	938,100	1,009,800	1,071,800	1,127,200	1,178,700	1,224,100
Growth	-	71,700	62,000	55,400	51,600	45,400

Note: The population distribution shown in this chart is Census population excluding Census undercoverage, which in 2001 was about 2.4% of the total population. The Census definition is used to allow comparison to the household and employment forecasts, which are also Census based, as well the existing Applications forecasts prepared in 2004.

Table 26						
Population Forecast - Scenario 2: Achieving Current Proposals						
	2001	2006	2011	2016	2021	2026
Edmonton	666,100	713,600	765,000	817,800	874,000	934,700
St Albert	53,100	58,400	65,000	73,100	82,800	92,000
Sturgeon County	18,100	19,300	20,400	22,000	23,700	25,100
Morinville	6,500	7,000	7,400	8,100	8,800	9,300
Gibbons	2,700	2,900	3,200	3,500	3,900	4,300
Redwater	2,200	2,300	2,500	2,700	2,900	3,100
Bon Accord	1,500	1,600	1,700	1,800	1,900	2,000
Legal	1,100	1,100	1,200	1,300	1,300	1,400
Alexander First Nation	800	900	1,000	1,200	1,300	1,500
Strathcona County	72,000	79,200	88,100	99,200	112,200	124,800
Fort Saskatchewan	13,100	14,200	15,700	17,700	19,900	21,900
Bruderheim	1,200	1,300	1,300	1,500	1,600	1,700
Leduc City	15,000	16,300	17,700	19,600	21,700	23,700
Leduc County	12,700	13,500	14,400	15,600	17,000	18,100
Beaumont	7,000	7,700	8,600	9,700	10,900	12,100
Devon	5,000	5,400	5,900	6,500	7,200	7,800
Calmar	1,900	2,100	2,200	2,500	2,800	3,000
Thorsby	800	800	900	900	1,000	1,100
Warburg	600	600	600	700	700	700
New Sarepta	400	400	400	500	500	500
Parkland County	27,400	29,700	32,100	35,100	38,600	41,700
Spruce Grove	16,000	17,300	19,000	21,200	23,700	25,900
Stony Plain	9,600	10,500	11,900	13,500	15,400	17,200
Enoch Cree Nation	1,100	1,200	1,300	1,500	1,700	1,900
Wabamum IR	1,000	1,100	1,200	1,300	1,400	1,600
Wabamum	600	600	600	700	700	700
Total Region - Minus City of Edmonton	271,300	295,400	324,600	361,300	403,800	443,400
Total Population	938,100	1,009,800	1,090,300	1,179,800	1,278,600	1,378,900
Growth	-	71,700	80,500	89,500	98,700	100,300

Note: The population distribution shown in this chart is Census population excluding Census undercoverage, which in 2001 was about 2.4% of the total population. The Census definition is used to allow comparison to the household and employment forecasts, which are also Census based, as well the existing Applications forecasts prepared in 2004.

Table 27						
Population Forecast - Scenario 3: Attracting Downstream Investment						
	2001	2006	2011	2016	2021	2026
Edmonton	666,100	713,600	772,200	841,400	918,100	1,004,600
St Albert	53,100	58,400	65,900	76,600	89,700	103,000
Sturgeon County	18,100	19,300	20,600	22,700	25,000	27,000
Morinville	6,500	7,000	7,500	8,300	9,300	10,100
Gibbons	2,700	2,900	3,200	3,700	4,200	4,800
Redwater	2,200	2,300	2,500	2,800	3,100	3,400
Bon Accord	1,500	1,600	1,700	1,900	2,000	2,200
Legal	1,100	1,100	1,200	1,300	1,400	1,500
Alexander First Nation	800	900	1,000	1,200	1,400	1,600
Strathcona County	72,000	79,200	89,400	103,900	121,700	139,600
Fort Saskatchewan	13,100	14,200	16,000	18,500	21,600	24,400
Bruderheim	1,200	1,300	1,400	1,500	1,700	1,800
Leduc City	15,000	-	-	-	-	-
Leduc County	12,700	13,500	14,600	16,200	18,000	19,500
Beaumont	7,000	7,700	8,700	10,100	11,800	13,600
Devon	5,000	5,400	5,900	6,700	7,700	8,600
Calmar	1,900	2,100	2,300	2,600	2,900	3,300
Thorsby	800	800	900	1,000	1,100	1,100
Warburg	600	600	600	700	700	800
New Sarepta	400	400	400	500	500	600
Parkland County	27,400	29,700	32,400	36,400	41,100	45,600
Spruce Grove	16,000	17,300	19,300	22,100	25,500	28,700
Stony Plain	9,600	10,500	12,000	14,200	16,800	19,400
Enoch Cree Nation	1,100	1,200	1,400	1,600	1,900	2,100
Wabamum IR	1,000	1,100	1,200	1,400	1,500	1,700
Wabamum	600	600	700	700	700	800
Total Region - Minus City of Edmonton	271,300	295,400	328,700	376,800	434,900	491,200
Total Population	938,100	1,009,800	1,101,600	1,218,900	1,353,700	1,496,600
Growth	-	71,700	91,800	117,300	134,800	142,800

Note: The population distribution shown in this chart is Census population excluding Census undercoverage, which in 2001 was about 2.4% of the total population. The Census definition is used to allow comparison to the household and employment forecasts, which are also Census based, as well the existing Applications forecasts prepared in 2004.

Table 28						
Household Forecast - Scenario 1: Do Nothing						
	2001	2006	2011	2016	2021	2026
Edmonton	265,300	309,700	331,100	348,000	361,100	373,600
St Albert	18,100	21,700	23,900	25,900	27,900	29,500
Sturgeon County	5,600	6,500	6,900	7,200	7,500	7,800
Morinville	2,000	2,400	2,500	2,700	2,800	2,900
Gibbons	900	1,100	1,200	1,300	1,300	1,400
Redwater	800	900	1,000	1,100	1,100	1,200
Bon Accord	500	600	600	600	700	700
Legal	400	400	400	500	500	500
Alexander First Nation	200	200	200	300	300	300
Strathcona County	23,900	28,600	31,500	34,300	36,800	38,900
Fort Saskatchewan	4,700	5,500	6,000	6,600	7,000	7,400
Bruderheim	400	500	500	500	600	600
Leduc City	5,400	6,300	6,900	7,400	7,800	8,200
Leduc County	4,400	5,100	5,400	5,700	6,000	6,200
Beaumont	2,100	2,500	2,700	2,900	3,200	3,300
Devon	1,700	2,100	2,200	2,400	2,500	2,700
Calmar	700	800	900	900	1,000	1,000
Thorsby	300	400	400	400	400	400
Warburg	200	200	200	300	300	300
New Sarepta	100	200	200	200	200	200
Parkland County	9,300	10,900	11,700	12,500	13,200	13,800
Spruce Grove	5,500	6,500	7,000	7,600	8,100	8,500
Stony Plain	3,300	4,000	4,400	4,800	5,200	5,600
Enoch Cree Nation	200	300	300	300	400	400
Wabamum IR	200	200	200	300	300	300
Wabamum	200	300	300	300	300	300
Total Region - Minus City of Edmonton	91,000	107,900	117,600	126,900	135,300	142,100
Total Households	356,300	417,700	448,800	474,900	496,400	515,700
Growth	-	61,400	31,100	26,100	21,500	19,200

Table 29						
Household Forecast - Scenario 2: Achieving Current Proposals						
	2001	2006	2011	2016	2021	2026
Edmonton	265,300	309,700	335,900	360,900	385,200	411,700
St Albert	18,100	21,700	24,400	27,600	31,200	34,700
Sturgeon County	5,600	6,500	6,900	7,500	8,100	8,600
Morinville	2,000	2,400	2,500	2,800	3,000	3,200
Gibbons	900	1,100	1,200	1,300	1,500	1,600
Redwater	800	900	1,000	1,100	1,200	1,300
Bon Accord	500	600	600	700	700	700
Legal	400	400	400	500	500	500
Alexander First Nation	200	200	200	300	300	400
Strathcona County	23,900	28,600	32,200	36,500	41,200	45,800
Fort Saskatchewan	4,700	5,500	6,200	7,000	7,800	8,600
Bruderheim	400	500	500	600	600	600
Leduc City	5,400	6,300	7,000	7,700	8,600	9,300
Leduc County	4,400	5,100	5,500	6,000	6,500	6,900
Beaumont	2,100	2,500	2,800	3,100	3,500	3,900
Devon	1,700	2,100	2,300	2,500	2,800	3,000
Calmar	700	800	900	1,000	1,100	1,200
Thorsby	300	400	400	400	500	500
Warburg	200	200	200	300	300	300
New Sarepta	100	200	200	200	200	200
Parkland County	9,300	10,900	11,900	13,100	14,400	15,600
Spruce Grove	5,500	6,500	7,200	8,000	9,000	9,800
Stony Plain	3,300	4,000	4,500	5,200	5,900	6,600
Enoch Cree Nation	200	300	300	400	400	500
Wabamum IR	200	200	200	300	300	300
Wabamum	200	300	300	300	300	300
Total Region - Minus City of Edmonton	91,000	107,900	120,000	134,200	149,900	164,400
Total Households	356,300	417,700	455,800	495,200	535,100	576,100
Growth	-	61,400	38,200	39,300	39,900	41,000

Table 30						
Household Forecast - Scenario 3: Attracting Downstream Investment						
	2001	2006	2011	2016	2021	2026
Edmonton	265,300	309,700	338,800	370,600	403,600	441,100
St Albert	18,100	21,700	24,700	28,900	33,700	38,700
Sturgeon County	5,600	6,500	7,000	7,700	8,500	9,200
Morinville	2,000	2,400	2,600	2,900	3,200	3,400
Gibbons	900	1,100	1,200	1,400	1,600	1,800
Redwater	800	900	1,000	1,100	1,300	1,400
Bon Accord	500	600	600	700	700	800
Legal	400	400	400	500	500	600
Alexander First Nation	200	200	300	300	300	400
Strathcona County	23,900	28,600	32,700	38,100	44,600	51,100
Fort Saskatchewan	4,700	5,500	6,300	7,300	8,500	9,600
Bruderheim	400	500	500	600	600	700
Leduc City	5,400	6,300	7,100	8,000	9,200	10,200
Leduc County	4,400	5,100	5,500	6,200	6,800	7,400
Beaumont	2,100	2,500	2,800	3,300	3,800	4,400
Devon	1,700	2,100	2,300	2,600	3,000	3,300
Calmar	700	800	900	1,000	1,100	1,300
Thorsby	300	400	400	400	500	500
Warburg	200	200	200	300	300	300
New Sarepta	100	200	200	200	200	200
Parkland County	9,300	10,900	12,000	13,600	15,300	17,000
Spruce Grove	5,500	6,500	7,300	8,400	9,600	10,800
Stony Plain	3,300	4,000	4,600	5,400	6,400	7,400
Enoch Cree Nation	200	300	300	400	400	500
Wabamum IR	200	200	200	300	300	400
Wabamum	200	300	300	300	300	300
Total Region - Minus City of Edmonton	91,000	107,900	121,400	139,700	161,000	181,600
Total Households	356,300	417,700	460,100	510,300	564,600	622,700
Growth	-	61,400	42,500	50,100	54,300	58,100

3. Employment Forecast Based on Three Categories of Employment

The employment forecast for each community is directly tied to the economic scenarios being tested and are therefore based on Henson's own approach and assumptions about employment growth. The employment forecast accounts for three categories of employment:

- Office and service employment, which refers primarily to activity concentrated in large office buildings or major institutions. In general it is located in the central city and it includes financial services, the provincial government, professional services, and cultural industries. This category is forecast based on each municipality maintaining its 2001 share of this type of employment. As the City of Edmonton's shares of regional growth gradually decline, it is assumed that office and service employment will remain concentrated in the central city.
- Population-related employment are those services which are dependant on population including retail, education, municipal government, and local health care, as well as work-at-home employment. The growth in this type of employment is tied directly to the forecast shares of population growth.
- The third category, industrial-type employment, is more complicated in the way it is affected by the economic scenarios, and is therefore further sub-categorised as:
 - The small amount of primary employment (farming and mining) in the region. This is kept constant at the 2001 level for the entire CMA and for each community as it is unlikely to see significant change.
 - The upgrader and related employment, which is distributed according to the employment forecasts for each of the three economic scenarios provided at the end Chapter III of this report.
 - Finally, the remainder of the industrial-type employment in the CMA, which is distributed to municipalities at a constant 2001 share of employment. Industrial employment growth over the next 20 years that is not directly related to the upgrader investments will occur as expansions and additions to the existing industrial base.

The employment forecasts under each economic scenario are shown in Tables 31, 32 and 33.

Table 31						
Employment Forecast - Scenario 1: Do Nothing						
	2001	2006	2011	2016	2021	2026
Edmonton	388,600	432,200	451,700	455,900	458,100	462,000
St Albert	16,900	19,400	21,000	22,000	22,900	23,800
Sturgeon County	7,700	9,200	9,800	10,000	10,400	10,700
Morinville	2,200	2,400	2,600	2,600	2,700	2,700
Gibbons	700	800	900	900	900	1,000
Redwater	1,100	1,200	1,300	1,300	1,300	1,300
Bon Accord	300	300	400	400	400	400
Legal	500	500	500	500	500	500
Strathcona County	28,300	33,600	37,200	38,400	39,400	40,500
Fort Saskatchewan	7,700	8,800	9,300	9,400	9,500	9,600
Bruderheim	300	400	400	400	400	400
Leduc City	7,100	8,000	8,400	8,600	8,700	8,900
Leduc County	14,400	16,400	17,200	17,100	16,800	16,800
Beaumont	1,500	1,800	2,000	2,200	2,300	2,400
Devon	1,700	1,900	2,100	2,100	2,200	2,300
Calmar	600	700	800	800	800	800
Thorsby	600	600	700	700	600	600
Warburg	400	400	400	400	400	400
New Sarepta	200	200	200	200	200	200
Parkland County	8,300	9,500	10,100	10,400	10,600	10,800
Spruce Grove	6,700	7,600	8,000	8,200	8,400	8,500
Stony Plain	1,500	1,900	2,200	2,300	2,500	2,600
Wabamum	300	300	300	300	300	300
Total Region - Minus City of Edmonton	109,000	126,000	135,600	139,300	142,400	145,700
Total Employment	497,700	558,200	587,400	595,300	600,500	607,700
Growth	-	60,500	29,100	7,900	5,300	7,100

Employment Forecast - Scenario 2: Achieving Current Proposals							Table 32
	2001	2006	2011	2016	2021	2026	
Edmonton	388,600	430,900	458,500	477,600	499,400	525,600	
St Albert	16,900	19,400	21,500	23,500	25,800	28,200	
Sturgeon County	7,700	10,600	12,100	12,800	14,300	15,900	
Morinville	2,200	2,400	2,600	2,800	2,900	3,100	
Gibbons	700	800	900	1,000	1,000	1,100	
Redwater	1,100	1,200	1,300	1,400	1,400	1,500	
Bon Accord	300	300	400	400	400	500	
Legal	500	500	500	500	600	600	
Strathcona County	28,300	33,700	38,500	41,800	45,200	48,900	
Fort Saskatchewan	7,700	8,800	9,600	10,100	10,700	11,400	
Bruderheim	300	400	400	400	400	500	
Leduc City	7,100	8,000	8,500	9,000	9,600	10,200	
Leduc County	14,400	16,300	17,400	17,900	18,600	19,400	
Beaumont	1,500	1,800	2,100	2,300	2,600	2,900	
Devon	1,700	1,900	2,100	2,300	2,400	2,600	
Calmar	600	700	800	800	900	1,000	
Thorsby	600	600	700	700	700	700	
Warburg	400	400	400	500	500	500	
New Sarepta	200	200	200	200	200	200	
Parkland County	8,300	9,500	10,300	11,000	11,800	12,700	
Spruce Grove	6,700	7,500	8,100	8,600	9,200	9,800	
Stony Plain	1,500	1,900	2,200	2,600	3,000	3,400	
Wabamum	300	300	300	300	400	400	
Total Region - Minus City of Edmonton	109,000	127,300	141,100	151,100	162,700	175,600	
Total Employment	497,700	558,200	599,500	628,600	662,100	701,200	
Growth	-	60,500	41,300	29,100	33,500	39,100	

Table 33						
Employment Forecast - Scenario 3: Attracting Downstream Investment						
	2001	2006	2011	2016	2021	2026
Edmonton	388,600	430,400	462,900	494,200	531,300	575,400
St Albert	16,900	19,300	21,800	24,700	28,000	31,700
Sturgeon County	7,700	11,200	13,200	14,300	16,900	19,000
Morinville	2,200	2,400	2,600	2,900	3,100	3,400
Gibbons	700	800	900	1,000	1,100	1,300
Redwater	1,100	1,200	1,300	1,400	1,500	1,600
Bon Accord	300	300	400	400	500	500
Legal	500	500	500	600	600	600
Strathcona County	28,300	33,700	39,200	44,100	49,200	54,900
Fort Saskatchewan	7,700	8,800	9,800	10,600	11,600	12,800
Bruderheim	300	400	400	400	500	500
Leduc City	7,100	7,900	8,600	9,400	10,200	11,200
Leduc County	14,400	16,300	17,600	18,600	19,900	21,500
Beaumont	1,500	1,800	2,100	2,500	2,900	3,400
Devon	1,700	1,900	2,100	2,400	2,600	2,900
Calmar	600	700	800	900	1,000	1,100
Thorsby	600	600	700	700	800	800
Warburg	400	400	500	500	500	500
New Sarepta	200	200	200	200	200	200
Parkland County	8,300	9,400	10,400	11,500	12,800	14,200
Spruce Grove	6,700	7,500	8,200	9,000	9,800	10,800
Stony Plain	1,500	1,900	2,300	2,800	3,300	3,900
Wabamum	300	300	300	400	400	400
Total Region - Minus City of Edmonton	109,000	127,800	144,000	159,000	177,300	197,400
Total Employment	497,700	558,200	606,900	653,300	708,600	772,800
Growth	-	60,500	48,700	46,400	55,300	64,200

VI CONCLUSION

In addition to the descriptive information provided in earlier sections, this report provides key inputs to the broader review being undertaken of the Edmonton region.

In this regard, the report provides key input information to the fiscal analysis of Edmonton region municipalities in the companion Technical Report. Based on the results of the analysis described in this growth report, the fiscal analysis is recommended to be undertaken based on Scenario 2, which is a mid-range scenario. This is appropriate for the fiscal analysis as this scenario is based on implementing the overall recommendations of the project, especially concerning planning and financing and delivering infrastructure in the Edmonton region. It cannot be over-emphasized, however, that Scenario 2, while mid-range, cannot be accepted as the most likely outcome, as actions are required from all three levels of government to generate the Scenario 2 outcomes. In the absence of concerted government action, Scenario 1 is the more likely outcome.

In addition, there are some key conclusions to be drawn from this report that are important foundations for the overall conclusions of the assignment:

- There is significant potential for investment in the Edmonton region arising directly from the proposed upgraders in northeast part of the region, plus the additional potential for downstream value-added investment in related petrochemical industries.
- The upgraders and related investment are not certain to occur as Alberta and the Edmonton region face labour shortages and escalating costs and as the ease of shipping bitumen to other areas in North America or overseas increases.
- To ensure that the proposed investments occur and to attract additional downstream value-added investment, Alberta and the Edmonton region need to establish and maintain an attractive investment climate in the face of global competition for these investments.
- A critical part of maintaining an attractive investment climate lies with the timely and efficient delivery of necessary support infrastructure for the upgraders and related industries. This infrastructure includes private and municipal services. The

delivery of the infrastructure requires coordinated planning and investment by the Edmonton region and the Province of Alberta.

- Another critical part of maintaining an attractive investment climate is less direct but equally important and that is the maintenance of a high quality of life in the region. Quality of life is important for existing residents of the region, but in the competition for labour, the region has to offer both economic opportunity and an attractive quality of life for prospective new residents. Municipalities are the chief delivery agents for the regional quality of life through infrastructure and municipal services.
- The upgrader investments, should they occur, as well as the other sectors of the regional economy, will generate rapid population and employment growth creating additional infrastructure and service demands. As demonstrated in the accompanying fiscal analysis a major challenge for the region is in the distribution of the growth and investments. Most of the investment (and therefore assessment growth) will be highly concentrated in a few communities in the region. However, the rapid population growth and associated service demands are widely dispersed across the region. This distribution of growth could create significant imbalances in the region which are explored further in the fiscal analysis and will need to be addressed in a coordinated region-wide way.

APPENDIX A: SELECT BIBLIOGRAPHY

ENERGY INDUSTRY

National Energy Board. Canada's Oil Sands: Opportunities and Challenges to 2015 – An Update. June 2006.

T. J. McCann and Associates Ltd. et al. Petrochemicals From Oil Sands. July 2002.

Nexen Inc. and OPTI Canada Inc. Long Lake South SAGD Project: Proposed Development Plan. April 2006.

National Energy Board. Short-Term Outlook for Canadian Crude Oil to 2006. September 2005.

Laureshen, C. J. et al. "Adding value to Alberta's oil sands." Journal of Canadian Petroleum Technology, Volume 45, No. 8, August 2006.

Alberta Department of Energy. Alberta's Oil Sands 2004. December 2005.

Shell Canada Limited. Shell Canada – The Scotford Upgrader.

Purvin & Gertz Inc. Summary – Bitumen to Refined Products and Petrochemicals Presentation. April 28, 2004.

Oil & Gas Network. Oil Sands. August 2006.

Gee, Gordon et al. Canadian Oil Sands Sector. RBC Capital Markets Report. October 4, 2006.

Alberta Economic Development. Oil Sands Industry Update. December 2005.

Canadian Energy Research Institute. Economic Impacts of Alberta's Oil Sands. Volume I. Study No. 10. October 2005.

Canadian Association of Petroleum Producers. Canadian Crude Oil Production and Supply Forecast 2006 – 2020. May 2006.

Cambridge Energy Research Associates. "World oil & liquids production capacity to grow significantly through at least 2015: CERA Update." August 8, 2006 Press Release.

Gateway Pipeline Inc. Preliminary Information Package: Enbridge Gateway Project. October 2005.

Canadian Association of Petroleum Producers. Canadian Crude Oil Production and Supply Forecast 2006 – 2020. May 2006.

Woynillowicz, Dan et al. Oil Sands Fever: The Environmental Implications of Canada's Oil Sands Rush. November 2005.

Petro Canada. Public Disclosure Document: Proposed Sturgeon Upgrader.

BA Energy. Public Disclosure Document: The Alberta Heartland Upgrader for Oil Sands Bitumen. December 2003.

Northern Lights. Public Disclosure Document: Northern Lights Oil Sands Upgrader Project. March 2006.

North West Upgrading Inc. North West Upgrader Project. January 30, 2006.

Alberta Economic Development. Oil Sands Industry Update. December 2005.

Alberta Chamber of Resources. Oil Sands Technology Roadmap: Unlocking the Potential. January 30, 2004.

Canadian Association of Petroleum Producers. The Canadian Oil Sands: Opportunities and Challenges. February 2006.

Shell Canada Limited. Application for Approval of the Scotford Upgrader Expansion Project. Volume 1: Project Description. April 2005.

Strathcona County Economic Update 2006. Alberta's Long-range Outlook: "Oil's Well."

Suncor Energy Inc. Voyageur Project: Voyageur Upgrader Project Application. March 2005.

Canada West Foundation. Treasure in the Sand: An Overview of Alberta's Oil Sands Resources. April 2005.

Griffiths, Mary et al. Troubled Waters, Troubling Trends: Technology and Policy Options to Reduce Water Use in Oil and Oil Sands Development in Alberta. May 2006.

Gateway Pipeline Inc. Enbridge Gateway Project: Preliminary Information Package. October 2005.

Alberta Energy and Utilities Board. Alberta's Energy Reserves 2005 and Supply/Demand Outlook 2006 – 2015. May 2006.

Canadian Association of Petroleum Producers. Canadian Crude Oil Production and Supply Forecast 2006 – 2020. May 2006.

Timilsina, Govinda R. et al. Canadian Energy Research Institute: Economic Impacts of Alberta's Oil Sands. October 2005.

Nichols Applied Management. Manufacturing Opportunities Related to In Situ Sands Industry Expansion. May 2003.

The Pembina Institute. Albertans' Perceptions of Oil Sands Development Poll.

Canadian Association of Petroleum Producers. Alberta's Oil and Natural Gas Industry.

Canadian Association of Petroleum Producers. Oil Sands Economic Impacts Across Canada – CERI Report. September 2005.

TD Bank Financial Group. The Calgary-Edmonton Corridor: Take Action Now to Ensure Tiger's Roar Doesn't Fade. April 22, 2003.

Athabasca Regional Issues Working Group (RIWG). Wood Buffalo Business Case 2005 March 2005.

GROWTH MANAGEMENT

Relevant municipal development plans or related planning documents of all municipal governments in the Edmonton region.

City of Edmonton. Plan Edmonton: Edmonton's Municipal Development Plan. Schedule A of Bylaw No. 11777, as Amended. 1998.

Stantec Consulting Ltd. Alberta Capital Region Long Range Transportation Plan. Appendix: Transportation Implementation Priorities 2007 – 2016. September 21, 2006.

Application Management Consulting Ltd. Population and Employment Forecasts: 2003 to 2030 – Edmonton Region. December 2003.

Applications Management Consulting Ltd. Working Paper – Municipal Population Allocation: Edmonton Region Population & Employment Forecast Allocation Study. May 2004.

Applications Management Consulting Ltd. City of Edmonton. Population & Employment Forecasts: 2003 – 2030. Technical Report. August 2005.

Applications Management Consulting Ltd. City of Edmonton: Population & Employment Forecasts: 2003 – 2030. Summary Report. May 2005.

Applications Management Consulting Ltd. Edmonton Region Population & Employment Forecast Allocation Study: Municipal Population Allocation Working Paper. May 2004.

Applications Management Consulting Ltd. City of Edmonton and Edmonton Region Population Forecasts 2001 – 2030. Working Paper. February 2004.

Applications Management Consulting Ltd. Population & Employment Forecasts: 2003 – 2030. Edmonton Region. Summary Report. December 2005.

Slack, Enid et al. Large Cities Under Stress: Challenges and Opportunities. March 3, 2006.

PRESS REPORTS

Brethour, Patrick. “Sizzle turns to fizzle as Alberta’s growth cools” in *The Globe and Mail*, October 6, 2006.

Ebner, David. “Petrocan delays oil sands project decision” in *The Globe and Mail*, October 4, 2006.

“Alberta, Ottawa team up to fund oil-sands highway” in *The Globe and Mail*. August 30, 2006.

Stevenson, James. “Is Alberta’s energy bubble likely to burst – again?” in *The Globe and Mail*. August 06, 2006.

Gregg, Allan. “The true West, strong and free” in *The Walrus*. September 2006.

Jaremko, Gordon. "Economic upgrades: Sleepy Redwater has just received a multibillion-dollar wake-up call from oilsands developers lined up to build facilities there" in *The Edmonton Journal*. March 10, 2006.

Cross, Philip and Bowlby, Geoff. "The Alberta economic juggernaut: The boom on the rose" in *Canadian Economic Observer*. September 2006.

Kamalick, Joe. "Insight: Oil at \$100/bbl, so what?" August 4, 2006.

Ebner, Dave. "Edwards sees threat to oil sands projects" in *The Globe and Mail*. September 22, 2006.

"Dow Chemical to shut down Ontario, Alberta facilities" in *The Globe and Mail*. August 31, 2006.

Haavardsrud, Paul. "Suncor silent on rising costs" in *The Calgary Herald*. August 4, 2006.

Harding, Jon. "Refining Alberta" in *Financial Post*. March 13, 2006.

"Study: The Alberta economic juggernaut" in *The Daily*. September 14, 2006.

Ebner, David. "EnCana teams up with ConocoPhillips in oil patch" in *The Globe and Mail*. October 5, 2006.

Brethour, Patrick. "Oil industry to study CO₂ potential" in *The Globe and Mail*. July 28, 2006.

Cattaneo, Claudia. "Alberta needs outside capacity: Economy can't handle any more than it already has" in *The National Post*. August 29, 2006.

Monchuk, Judy. "In Focus: Petro Canada. Refinery project's costs escalate" in *The Toronto Star*.

Mayor Stephen Mandel. "Cities Need to Work Together to Get the Most Out of the Boom."

McKeen, Scott. "Time for St. Albert mayor to get off fence" in *The Edmonton Journal*. November 10, 2006.

Polczer, Shaun. "Canada's first new refinery since 1980s studied" in *The Calgary Herald*. November 24, 2006.

Schmidt, Lisa. "Bitumen inventory blowout sale" in *The Calgary Herald*. November 17, 2006.

Jaremko, Gordon. "Landowners cry foul over their deal for upgrader site" in *The Edmonton Journal*. November 9, 2006.

HEMSON CONSULTING

About Hemson Consulting

Hemson Consulting is a consulting firm with a combination of planning, economic and financial expertise, and a wealth of experience in municipal governance and urban policy. While its practice is largely based in Ontario, the firm undertakes assignments for clients throughout Canada, ranging from large urban agglomerations to smaller cities, regional and county governments, and smaller rural towns and townships. Hemson has established a strong reputation for communicating complex concepts to audiences ranging from technical and academic groups to litigation hearings, political forums and public arenas.

Study Contributors

The assignment involved the entire firm, the following being the main contributors:

Russell Mathew, Partner

Project Manager - Economics, Demography and Planning

Craig Binning, Partner

Project Manager - Fiscal Impact Analysis

Ray Simpson, Partner

Overall Project Direction and Advisor

John Hughes, Partner

Project Advisor on Tax Policy and Assessment

Stefan Krzeczunowicz, Consultant

Research and Writing

Contact Details

30 St. Patrick Street, Suite 1000

Toronto, ON, M5T 3A3

T: 416-593-5090

F: 416-595-7144

www.hemson.com