



# Greater Edmonton Area Bitumen Upgrader Supply Chain Report

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## Table of contents

Executive Summary.....	4
Background.....	10
Phase 1 of the GEA Bitumen Upgrader Supply Chain Study.....	14
Project Methodology.....	17
Data Review .....	18
Colt Engineering Data Review.....	18
Public Data Review: capacity and competitiveness.....	18
EEDC and AEII Data.....	19
Alberta’s Metal Products Fabrication & Machinery Industries.....	20
Growth and Investment in Industry Sectors.....	20
Role of Imports and Exports in Metal Products and Machinery.....	21
Stakeholder Interviews .....	25
Key Messages from Stakeholder Interviews.....	25
Opportunities .....	26
Import Substitution.....	26
Maintenance and Environmental Services .....	29
Challenges.....	30
Structural Steel .....	30
Pressure Vessels .....	32
Strategic prioritization of opportunities .....	33
Key Forecast Risks .....	34
Economic Development Strategies .....	36
Supporting Collaboration in Manufacturing.....	37

## Table of Figures

Figure 1	Western Canada Crude Oil Supply Forecast. ....	11
Figure 2	Alberta Pipelines for SCO and Bitumen. ....	12
Figure 3	Cost Breakdowns from Phase 1 of Study.....	15
Figure 4	List of Greater Edmonton Area Upgrader Projects.....	16
Figure 5	Growth of Alberta Metal Products and Machinery Manufacturing.....	20
Figure 6	Annual Capital Investment in Machinery and Equipment in the Private Sector. ....	21
Figure 7	Exports and Imports of Fabricated Metal Products and Machinery .....	22
Figure 8	Key Financial Estimates –Metal Products and Machinery Manufacturing. ....	23
Figure 9	Expected Sourcing of Oil Sands and Upgrader Inputs by Market.....	24
Figure 10	Alberta Shipments of Valves Pumps and Compressors .....	27
Figure 11	Alberta - Imports and Exports of Metal Valves.....	27
Figure 12	Alberta Imports and Exports of Pumps and Compressors.....	28
Figure 13	Alberta Shipments of Plate Work and Fabricated Structural Products. ....	31
Figure 14	Non-Residential Construction in Alberta .....	32
Figure 15	Capacity Utilization in Metal Fabrication and Machinery Manufacturing .....	34
Figure 16	Labour Shortages by Month, Alberta 2006-2007.....	35

## EXECUTIVE SUMMARY

With a number of bitumen upgrader projects announced and under consideration for the Greater Edmonton Area (GEA), Edmonton Economic Development Corporation (EEDC) and Alberta Employment, Immigration and Industry (AEII) commissioned a study to identify the equipment and services needs that these very large investments will have and their potential impact on the regional economy. For the first phase of this study, EEDC and AEII commissioned Colt Engineering Corporation to prepare high level estimates of the quantity counts for major equipment and bulk materials required to construct the upgrader projects planned for the region. At the time of the study, in March 2007, Colt Engineering identified the main projects that had been announced or were likely to proceed in the GEA and used these projects to quantify the equipment and service requirements. Colt estimated the total capital costs at between \$40 and \$70 billion and their report identified major components and bulk equipment requirements of between \$18.8 and \$32.9 billion for the period 2008 – 2015.

In the Phase 2 of this study, QGI Consulting has been retained by EEDC and AEII to expand the work done in Phase 1 and use the information developed by Colt and additional research to identify the industry sectors involved in supporting the upgrading industry. The consultant will then develop an assessment of these sectors' capability to handle the expected growth in the industry. The specific deliverables of the project include:

- Identification of the gaps in equipment and service capabilities/capacity to support the upgrader development in Alberta.
- Identification of the challenges and issues with growing the equipment manufacturing and service sectors in the GEA.
- Strategic recommendations on improving the capability of GEA firms and Alberta firms outside the GEA to supply product/equipment and services to the GEA upgrader projects. Identification of industry sectors that should be targets for industry development, formation and attraction.

Following a review of the Colt Engineering report and investigation of publicly available data on the output and capacity of the relevant sub-sectors of the Alberta economy, QGI identified and interviewed 25 representatives of engineering, manufacturing, project construction and procurement and government stakeholders to obtain their views on the capacity of Alberta industry to support the GEA upgrader projects.

A dominant theme that emerged in the interview process is that the major equipment types and services identified in the Colt Engineering Phase I study are presently being sourced

internationally and that this is expected to continue in the future. As a result, Alberta firms' participation in these projects will be based on their ability to compete within global supply chains.

Over the last several years, Alberta based companies have obtained a market share of 36% of the Alberta fabricated metal products market and 22% of the Alberta machinery market. If Alberta companies can retain these recent historical market shares, then of the \$18.8 to \$32.9 billion worth of equipment and components that Colt determined would be required for the upgrader projects assessed, approximately \$6.0 to \$10.5 billion of this amount would be provided directly by Alberta based companies.

#### Import Substitution Opportunities

Pumps, compressors and valves were all areas where study participants indicated that there would be increased opportunity for Alberta companies to participate in the bitumen upgrader projects.

Increased participation by Alberta and other Canadian companies in these sub-sectors could create significant value for domestic companies. Based on the Colt Engineering study, a total of \$3.8 - \$6.6 billion will be required for these categories during the construction phase alone. This total comprises:

- Pumps \$ 2.8 - \$ 4.9 billion
- Compressors \$ 0.4 - \$ 0.7 billion
- Valves \$ 0.6 - \$ 1.0 billion

While procurement professionals in the Engineering industry have not indicated that they intend to purchase a significant volume of pumps, compressors and valves for the upgrader projects from Alberta suppliers, Alberta firms have a well-established presence in the province and a proven record in exports. These factors should create significant opportunity for Alberta based firms to increase their participation in these segments in the future.

#### Maintenance and Environmental Services

Annual spending on capital maintenance for the equipment required for the upgrader plants will be from \$376 to \$658 million per year over the 30 year life of these facilities. The total expenditure on capital maintenance of this equipment will be equivalent to 60% of the invested capital or approximately 20% on a net present value basis for a total of \$3.5 - \$6.2 billion in

current dollars.<sup>1</sup> A number of stakeholder representatives identified maintenance of the upgrader projects as an important future opportunity for Alberta firms. In addition, given the number of new operating processes and environments being utilized in these upgrader plants, some stakeholders believe that the maintenance requirements for these plants may be understated and that the opportunity may be somewhat larger than the estimates provided, which are based on experience with more mature technologies and processes.

Further, several stakeholders emphasized the value and emerging importance of the market for environmental technologies and services. While these services were not evaluated directly by Colt Engineering and there is no clear way to assess their potential value, stakeholders clearly believe that additional capability that is not present in the local Alberta marketplace will be required in coming years.

All new upgrading projects require an extensive Environmental Impact Assessment (EIA). Applications for regulatory approvals from the Alberta Energy and Utilities Board (EUB) and from Alberta Environment will require in-depth assessment of each project's potential impact upon; groundwater, streams and rivers, land clearing impacts, release of air emissions, and the handling of by-products. While the GEA upgrader projects are located outside the densely populated metropolitan Edmonton area they are in close proximity to a number of smaller towns such as Fort Saskatchewan, Gibbons, Bon Accord and Redwater. In addition, adjacent land use at many of the sites is working agricultural land.

The rapid industrial growth in the region will undoubtedly result in increasing demand for companies to implement best practices and adopt more advanced technologies. In addition, the industry is looking to develop integrated eco-industrial clusters to optimize environmental management practices that will also improve operational efficiencies. Opportunities are expected for firms with experience in the completion of EIA's, in on-going monitoring and in mitigation management for environmentally sensitive processes.

### Challenges

The two notable supply chain challenges that were generally accepted by most study participants were in the provision of structural steel and pressure vessels. The total demand for structural steel for the identified upgrader projects is expected to be between \$800 million and \$1.4 billion

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<sup>1</sup> The Net Present Value (NPV) calculation discounts the future cash stream spent on capital maintenance over the 30-year life of the project to make the future cash flows directly comparable to the upfront spending on capital. Using a 10% discount rate for the calculation yields an NPV value of 19% of invested capital being spent on capital maintenance, assuming an annual requirement for 2% of invested capital.

over the six to seven year construction horizon considered in the report. The increase in demand required for the upgrader projects equates to an estimated increase of from 8% – 15% in output from the structural steel industry in Alberta. Given the industry's growth of over 250% over the last five years it seems likely that they will be able to meet the growth challenge created by the new upgrader projects with supplemental volumes provided by other Canadian and international suppliers.

For pressure vessels Alberta manufacturers would be expected to obtain approximately 70% of the estimated \$814 million worth of vessel construction forecast. While there may be some opportunity for new entrants in this field, most stakeholders believe that given Alberta industry's current capabilities and infrastructure additional new entrants may face significant challenges. For example, companies will experience difficulty obtaining access to sufficient skilled labour - particularly welders and shop floor and production supervisors. Given Canadian fabricators established presence in this market, it may be more feasible for existing Canadian fabricators outside Alberta to increase their participation in this market in partnership with Alberta fabricators in order to alleviate some of the anticipated constraints on supply.

#### *Economic Development Strategies*

There are three primary strategic approaches that EEDC, the Government of Alberta and its partners could undertake to foster productivity growth within the Alberta economy:

- Awareness (information, education and communication)
- Assessment (benchmarking and productivity enhancement tools and services )
- Policy and regulatory environment conducive for productivity and innovation

These general approaches must be pursued jointly with industry and in collaboration with all levels of government, academic institutions, associations, and related agencies. New strategies, structures, systems and process efficiencies create new value and foster productivity within Alberta firms which allows them to compete globally and become part of global supply chain networks.

The strategies currently being pursued by EEDC, AEII and other public stakeholders in the areas of labour strategy, productivity improvements and supply chain partnering should be continued and focused specifically upon the opportunities identified in targeted markets for products and services such as those identified through this study. These initiatives and programs include:

- Labour strategy:
  - The 10 year Workforce Strategy for Alberta's Manufacturing Industry – a program to Inform, Attract, Develop and Retain the productive workforce that is needed by Alberta Manufacturers.
- Productivity enhancement
  - Support for LEAN manufacturing initiatives and training
  - Support for training and development in advanced technologies through centres such as the Northern Alberta Institute of Technology's Centre for Manufacturing Solutions
  - Support for the re-establishment of the Weldco-Beales Chair and program in Welding Engineering at the University of Alberta
- Supply Chain Partnering
  - Continued support for and facilitation of the National and Regional Buyer Seller Forums as well as specific targeted forums in order to increase opportunities for partnership development
  - Encourage major project owners, proponents and their procurement specialists to develop regional supply chain strategies through mentoring and partnering local firms with best in class manufacturers either locally, or through international supply chain partnerships.

#### Supporting Collaboration in Manufacturing

Alberta has a significant presence in the manufacturing sectors required to support oil sands and upgrader project development. However, Alberta firms' presence in certain sub-segments is still developing and many components are sourced outside the region in spite of the presence of regional firms in those sectors. In order to encourage the development of the metal products manufacturing cluster in the GEA and the rest of Alberta, new activities which promote the awareness of the value of supply chain collaboration amongst Engineering, Construction and Manufacturing firms as well as project owners and educational and research institutions – should be encouraged.

One of the lead initiatives in this area is the National Buyer/Seller Forum, a joint initiative between government, the Canadian Manufacturers and Exporters and industry that works to connect oil sands and oil sands-related buyers with potential suppliers from across Canada. Now in its eighth year, the Forum has welcomed thousands of participants and been the foundation for numerous

manufacturing projects. The next Forum will be held March 25-27, 2008 in Edmonton, Alberta; for further information, visit [www.nationalbuyersellerforum.ca](http://www.nationalbuyersellerforum.ca).

Another example of best practices in industry cluster development for small and medium enterprises (SME's) in manufacturing is the Doyle Center for Manufacturing Technology in Pittsburgh, PA. Founded in 2003, the Center is a federally funded, non-profit organization established to help small and medium-sized manufacturing enterprises successfully develop and actively participate in global supply chains. Currently, the Center provides Network Centric Manufacturing<sup>SM</sup> solutions for U.S. based manufacturing enterprises and their customers using state-of-the-art business and engineering processes, technology, best practices and training to improve supply chain value, quality and responsiveness to market demand.

A similar concept focused on the needs of the petroleum and petrochemical industries should be considered for Alberta. Such an organization might include participation from organizations such as: Alberta Research Council, the Faculties of Engineering at the Universities of Alberta and Calgary, the Northern Alberta Institute of Technology (NAIT) and the key firms in engineering, procurement and oil sands and upgrader project development. A Centre for Manufacturing Innovation with a particular focus on the needs of the oil and gas and petrochemical industries could provide the forum for active supply chain collaboration and innovation in Alberta.

The actual structure and strategic objectives of such a Centre would need to be determined by the stakeholders themselves. However, the foundations of such a collaborative organization already exist in the groups named earlier. In particular, the NAIT Shell Centre for Manufacturing Solutions may be able to provide the core requirements of such a collaborative effort. This centre, which was originally focused on software solutions for the oil and gas industry is developing a broader capability in a number of manufacturing processes. However, a networking approach which includes such groups as the NSERC Construction Industry Research Chair and the Weldco-Beales Chair in Welding Engineering at the University of Alberta would broaden the collaborative network. These latter groups, along with the Alberta Research Council would extend the NAIT Shell Centre's capabilities beyond workforce training and development to include access to advanced research.

The role of government agencies such as AEII and EEDC should be to facilitate the discovery of mechanisms to create such collaborative networks and organizations through both the established programs mentioned earlier in this section, as well as through fostering discussion and investigation of best practice examples such as the Doyle Centre and other international examples of successful supply chain and regional cluster collaboration.

## BACKGROUND

Alberta is in the midst of the greatest industrial expansion in its 102-year history. The primary driver of this economic growth has been the development of the province's vast oil sands resources located in northern Alberta. Since 1967, Alberta's oil sands have been commercially developed but it has only been in the last 5 to 10 years that international interest significantly peaked when several oil publications and government agencies around the world began to recognize the long-term supply opportunity from this resource.

The petroleum resource in Alberta's oil sands exists as bitumen, which is a semi-solid hydrocarbon compound mixed with other materials including minerals, sand and clay, as well as water. The extraction processes used to recover the bitumen include both mining and in situ<sup>2</sup> projects. Mining technology uses conventional truck and shovel operations where the oil sands are dug up and sent through a hot water separation process to separate the bitumen from the other matter. For the majority of the oil sands in Alberta, in situ technologies are required since the deposits are buried too deep for the use of mining technologies. Most in situ projects require the use of steam to assist in producing the bitumen from the deeper deposits. Hot steam is injected into the bitumen deposit where it loosens the bitumen and allows it to be recovered using conventional drilling technology. Two of the most common technologies used in thermal in situ processes today are the Steam Assisted Gravity Drainage (SAGD) and the Cyclic Steam Stimulation (CSS). The raw bitumen which is recovered from oil sands can then be further upgraded into a lighter crude oil referred to as synthetic crude oil (SCO). Both diluted bitumen and SCO are then shipped to commercial refineries to produce higher value products.

The Government of Alberta through the Department of Employment, Immigration and Industry (AEII) maintains an inventory of major construction projects (over \$5 million)<sup>3</sup>, which are underway or have been publicly announced by industry. As of September 2007, projects related to oil sands amounted to \$148.8 billion and of these approximately \$70 billion are related to bitumen upgrading projects.<sup>4</sup>

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<sup>2</sup> "In situ" is Latin for, in place. This refers to the fact that bitumen is separated from the oil sands within the deposit rather than being mined and separated at the surface.

<sup>3</sup> The Alberta inventory of major construction projects is available on the Internet at: [www.alberta-canada.com/statpub/albertaConstructionProjects](http://www.alberta-canada.com/statpub/albertaConstructionProjects)

<sup>4</sup> This includes recently announced or extended projects such as the \$22 Billion Shell Scotford SU2 project and Statoil Canada's \$7.2 Billion Strathcona County upgrader project.

Current raw bitumen production from oil sands is approximately 1.25 million barrels per day and this figure is projected to grow to over 3 million barrels per day by 2020. The illustration below shows the forecast growth in total marketable crude oil for Western Canada.

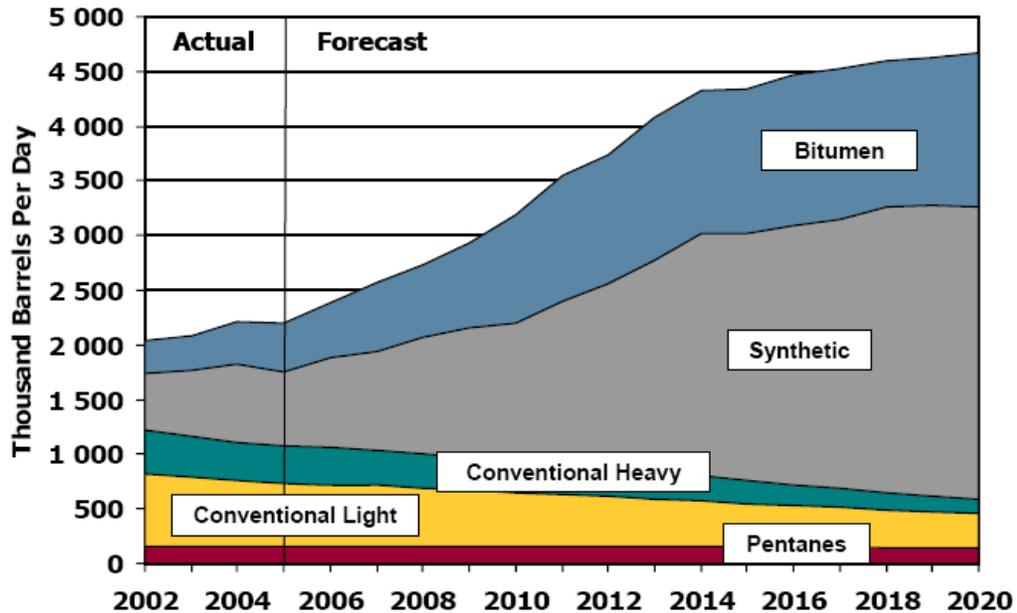


Figure 1 Western Canada Crude Oil Supply Forecast.<sup>5</sup>

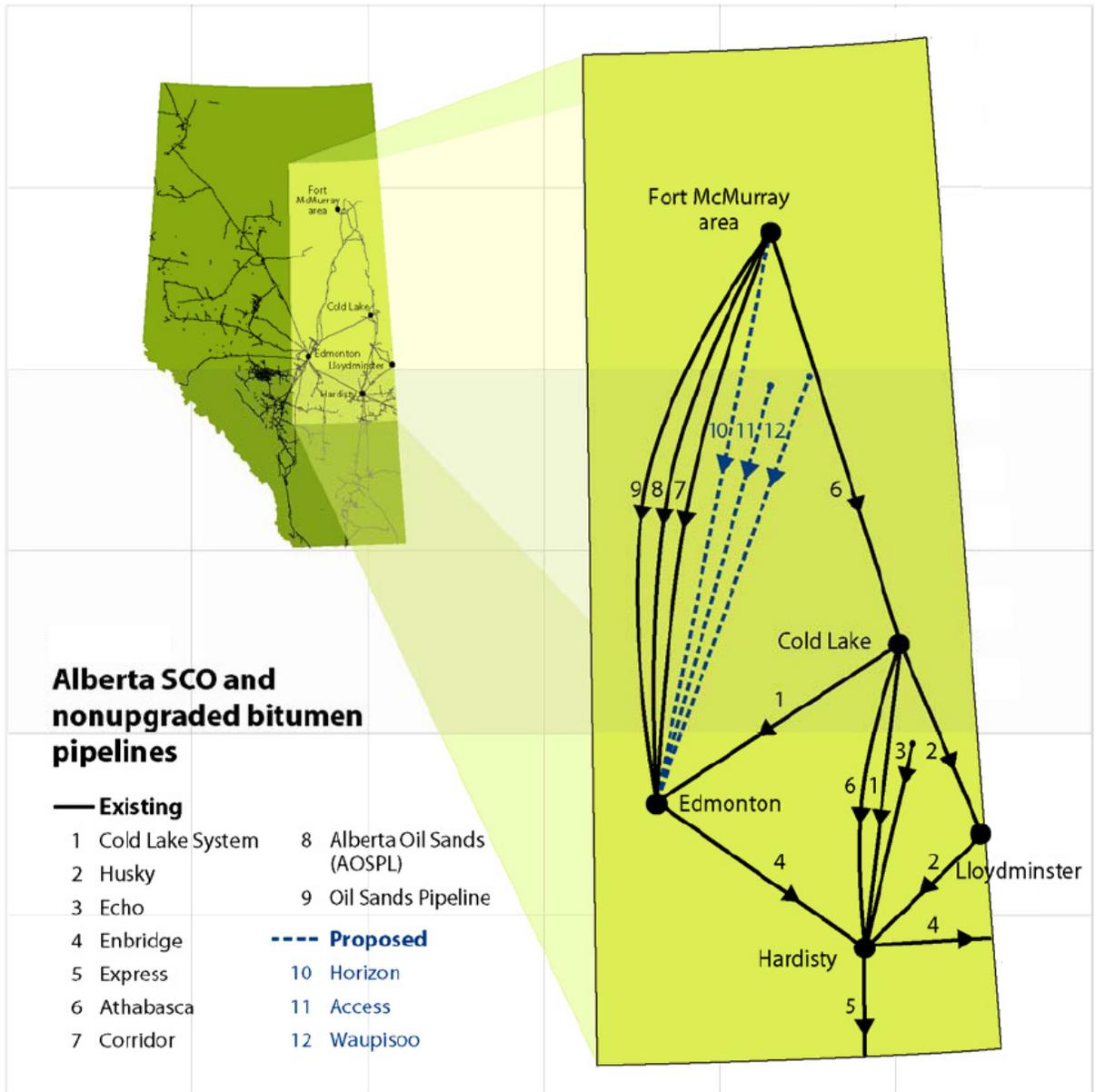
As is reflected in the graph above, SCO production is forecasted to grow rapidly as new and expanded bitumen upgrader projects come on stream. At present, regional upgrading capacity is over 800 thousand barrels per day at the four large bitumen upgrader facilities owned by: Suncor, Syncrude, and Shell in Alberta and the Husky upgrader located in Saskatchewan. The forecast of total upgrading capacity in Alberta by 2020 is expected to reach over 3 million barrels per day.

Most of Alberta's bitumen production is located in the Athabasca deposit in Northeastern Alberta where the original oil sands mining plants operated by Syncrude and Suncor are integrated with upgrading facilities located next to their production sites. The Shell upgrader is located downstream from its production site in the Greater Edmonton Area (GEA), where the majority of new upgrading projects are being proposed. In order to move the bitumen from the production site to the GEA facilities for further processing, it must first be diluted with lighter hydrocarbons such as natural gas condensates to enable it to be transported by pipelines. The GEA has the necessary infrastructure required to support the upgrader projects as this is also the location where Alberta's refining and petrochemical industry exists. Constructing these operations in

<sup>5</sup> Reproduced from *Canadian Crude Oil Production and Supply Forecast 2006 – 2020* Canadian Association of Petroleum Producers.

close proximity to one another allows for the integration of projects to enhance operations through increased synergies and reduced environmental footprint. As shown in the following figure, the GEA is at a key junction for pipelines bringing SCO and diluted bitumen (referred to as bitumen blend) to the refinery and bitumen upgrader complexes that exist now and are being planned for the region.

Figure 2 Alberta Pipelines for SCO and Bitumen.<sup>6</sup>



<sup>6</sup> Map reproduced from *Alberta's Energy Reserves 2006 and Supply/Demand Outlook 2007-2016*. ST98-2007, Alberta Energy and Utilities Board. June 2007

The GEA is a major service and transportation centre for the oil and gas industry in North America with excellent road and transportation services including access to the main line services of both of Canada's transcontinental railways. In addition, the GEA provides a significant regional market for SCO as it is home to three petroleum refineries with a total capacity of approximately 430 thousand barrels per day. In 2006, conventional crude provided 45% of Alberta's refinery feedstock while the balance was a combination of bitumen blend and SCO crudes. The GEA is also located to provide excellent access to the continental USA for a variety of crude oil and refined products through the North American pipeline network.

## **PHASE 1 OF THE GEA BITUMEN UPGRADER SUPPLY CHAIN STUDY**

With a number of bitumen upgrader projects announced and under consideration for the GEA, Edmonton Economic Development Corporation (EEDC) and Alberta Employment, Immigration and Industry (AEII) commissioned a study to identify the equipment and services needs that these very large investments will have and their potential impact on the regional economy. For the first phase of this study, EEDC and AEII commissioned Colt Engineering Corporation to prepare high level estimates of the quantity counts for major equipment and bulk materials required to construct the upgrader projects planned for the region.

Based on information provided by the project proponents regarding the different process technologies to be used in each of the projects and with their considerable experience in bitumen upgrading and refining engineering, Colt identified the major equipment types required for the projects. Colt's analysis divided the types of process units used in bitumen upgraders into two major categories: processing units and offsites and utilities. Processing units are directly involved in the processing of bitumen and offsites and utilities are the processes, equipment and facilities that support the processing units. For the projects under review, Colt estimated the total capital costs at between \$40 and \$70 billion. Using information about the specific process, plus information from the proponents on the time lines associated with each project's construction, Colt identified the major classes of equipment required, the sub-groups of equipment within each class and the number of each type of unit required for each project individually and for all the projects combined. Colt also estimated a range of capital costs for each major class of equipment. These estimates were based on factors, which assigned the cost for a major class of equipment based on the typical percentage that each major class represented of the total capital cost of similar facilities.

Figure 3 Cost Breakdowns from Phase 1 of Study.<sup>7</sup>

<b>Equipment</b>	<b>Cost Range \$ Millions</b>	<b>NAICS Group</b>
Heaters & Heat Exchangers	\$2,800 - \$4,900	Fabricated Metal Products
Vessels Pressure vessels and tanks	2,800 - 4,900	Fabricated Metal Products
Pumps	2,800 - 4,900	Machinery
Compressors	400- 700	Machinery
Mechanical Equipment	400- 700	Machinery
<b>Bulks</b>		
Structural Steel	\$ 800 - \$1,400	Fabricated Metal Products
Piping	5,200 - 9,100	Fabricated Metal Products
Electrical	2,000 - 3,500	Other
Instruments and Controls (including valves)	800 - 1,400	Fabricated Metal Products and other
Insulation / Paint	801 - 1,400	Other
<b>Total</b>	<b>\$18,800 - \$32,900</b>	

Using these factors, Colt's analysis resulted in estimates for major component and bulk products as shown in figure 3. The supply costs for the major components and bulk equipment were estimated to be between \$18.8 and \$32.9 billion for the period from 2008-2015. Furthermore, based on industry experience with facilities of this type, Colt estimated that annual operating and maintenance costs would be 2-3% total capital expenditures and sustaining capital would be 2% annually over the 30-50 year expected life of the facilities.

Each of the major categories has been assigned against the primary North American Industry Classification System (NAICS) group within which most items in the grouping fall. This application to NAICS groups has been done so that the Phase 1 data prepared by Colt can be assessed using Statistics Canada trade, industry, investment and production data which is classified using NAICS codes. As can be seen from Figure 4 above, most of the major

<sup>7</sup> Colt Engineering Corporation. March 2007. North American Industrial Classification (NAICS) groups assigned by QGI Consulting.

equipment and components fall within the Fabricated Metal Products (NAICS 332) and Machinery Manufacturing (NAICS 333) groups.

The table below outlines the projects under development for the GEA.

Figure 4 List of Greater Edmonton Area Upgrader Projects.<sup>8</sup>

Name	Status	Capacity	Date on-line
Petro-Canada Refinery	Under construction	135,000 bpd	2008
Shell Scotford Expansion #1	Under construction	135,000 bpd	2012
BA Energy	Under construction	162,000 bpd	Phase #1 – 54,000 (2009) Phase #2 – 54,000 (2011) Phase #3 – 54,000 (2013)
Northwest Energy Upgrader	Regulatory approval received in August 2007	231,000 bpd	Phase #1 – 77,000 (2010) Phase #2 – 77,000 (2012) Phase #3 – 77,000 (2015)
Synenco Northern Lights Upgrader	Regulatory application filed but put on hold	100,000 bpd	N/A
Sturgeon Fort Hills Upgrader Partners – (PetroCanada, UTS, Teck Cominco)	Regulatory application filed	340,000 bpd	Phase #1 – 165,000 (2011) Phase #2 – 105,000 (2015) Phase #3 – 70,000 (date unknown)
Shell Scotford Upgrader #2	Regulatory application filed	400,000 bpd	Phase #1 – 100,000 (2009 – 2012) Phase #2 – 100,000 (2012-2015) Phase #3 – 100,000 (2015-2018) Phase #4 - 100,000 (2018 – 2021)
StatoilHydro Upgrader  Formerly North American Oil Sands	Regulatory application filed	250,000 bpd	Phase #1 – 70,000 (2011) Phase #2 – 180,000 (2014)
Total E&P Upgrader	Regulatory application filed	245,000 bpd	Phase #1 – 175,000 (2013-2014) Phase #2 – 75,000 (2015-2017)

<sup>8</sup> Strathcona County Economic Development. December, 2007. The Greater Edmonton Area upgrader projects will be located in Alberta's Industrial Heartland.

In the Phase 2 of this study, QGI Consulting has been retained by EEDC and AEII to expand the work done in Phase 1 and use the information developed by Colt and additional research to identify the industry sectors involved in supporting the upgrading industry. The consultant will then develop an assessment of these sectors' capability to handle the expected growth in the industry.

The specific deliverables of the project include:

- Identification of the gaps in equipment and service capabilities/capacity to support the upgrader development in Alberta.
- Identification of the challenges and issues with growing the equipment manufacturing and service sectors in the GEA.
- Strategic recommendations on improving the capability of GEA firms and Alberta firms outside the GEA to supply product/equipment and services to the GEA upgrader projects. Identification of industry sectors that should be targets for industry expansion, formation, retention and attraction.

## **PROJECT METHODOLOGY**

Following discussion with the project sponsors regarding the goals and priorities for Phase 2 of the Bitumen Upgrader Supply Chain Report, QGI chose to pursue this study in four steps.

- Step 1 Data review
- Step 2 Stakeholder interviews
- Step 3 Supply chain gap and opportunity assessment
- Step 4 Maximizing opportunities from bitumen upgrader investments

The purpose of the first step was to assess the data from the Colt Engineering study and to obtain any data available from the project sponsors that would allow for development of the Alberta companies database. In addition, during this step, a review would take place of public data on the capacity and utilization levels of the relevant sub-sectors of Alberta's economy that will be the major suppliers to the upgrader projects.

In step 2, QGI interviewed manufacturing and engineering firms as well as government representatives to better understand key supply chain and investment attraction issues relevant to the study. This information allowed for a focus, during step 3, on the key supply chain gaps and opportunities identified in the stakeholder interviews and using information developed during

the data review, permitted the targeting of key areas where gaps can and should be addressed through industry development, formation, attraction and other government initiatives. In step 4, recommendations are made on the economic development initiatives that will allow Albertans to maximize the benefits of investments in bitumen upgraders.

## **DATA REVIEW**

### **Colt Engineering Data Review**

QGI representatives met with the lead consultants from Colt Engineering to review the work done in Phase 1. Colt provided QGI with a detailed database that was developed by Colt to support their Phase 1 study. This database included estimates of both equipment requirements for each of the projects assessed by Colt as well as a range of cost estimates for individual equipment and bulk supply components. The database also included the estimated timelines for purchase of key equipment and bulk requirements, as was summarized in the Phase I report. Colt also provided insight on supply chain issues associated with the components and bulk equipment required for the upgrader projects. From this information, QGI developed a template that identified which types of equipment and supplies were available from Albertan and other Canadian sources, versus which were primarily provided by imported products. This general information provided a starting point for discussions with the industry and government stakeholders who participated in the next phase of the project.

### **Public Data Review: capacity and competitiveness**

Public data on industry sector financial performance and competitiveness is gathered on a regular basis through a number of means by Statistics Canada. QGI reviewed with Statistics Canada the availability of data that would allow for as precise as possible an evaluation of the output and capacity of the relevant manufacturing sub-sectors of the Canadian and Alberta economies that provide support to the oil and gas sector. QGI was able to obtain excellent trade, output and investment data by industry sub-sector for all of Canada. However, for the province of Alberta data on industry capacity as measured by either capital flows or capacity utilization were not broadly available at the sub-sector level by province. This data is gathered at a provincial level but is restricted to national industry sector analysis due to confidentiality and accuracy considerations at the provincial sub-sector level.

As a result, QGI's analysis of the overall capacity of manufacturing industry sub-sectors within Alberta will be limited to a review of high level capacity utilization statistics at the national level as well as information that can be inferred from sub-sector output and trade data as well as information provided directly by stakeholders through the interview process.

### **EEDC and AEII Data**

In order to develop a database of Alberta companies that might be expected to be involved in providing equipment and services to the upgrader construction projects, QGI reviewed potential data sources with both EEDC and AEII representatives. Following investigation of a number of options, QGI obtained access to the AlbertaFirst.com<sup>9</sup> database of companies and developed the list of companies based upon a sort of the database based upon North American Industrial Classification (NAICS) codes.

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<sup>9</sup> AlbertaFirst.com is a provincial, municipal and industry partnership dedicated to the promotion of business and community development in Alberta. The organization gathers information directly from businesses in Alberta as well as from the databases of member organizations and institutions. This information is made available through an Internet based system to individuals and members for economic development initiatives.

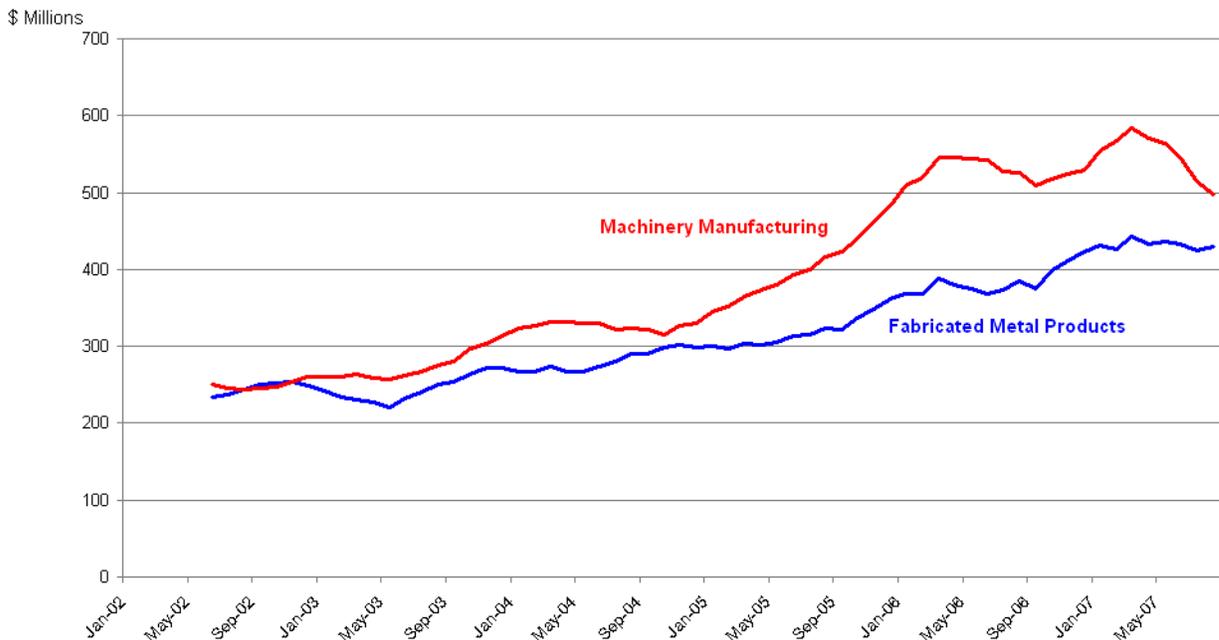
## ALBERTA'S METAL PRODUCTS FABRICATION & MACHINERY INDUSTRIES

Industry stakeholder interviews indicated that Alberta manufacturers were important suppliers in a number of key areas that will be of importance to the oil sands upgrader projects. The following analysis provides a high level quantitative assessment of the role of Alberta, other Canadian and foreign fabricators and machinery manufacturers. This analysis will focus on the Fabricated Metal Products and Machinery sectors, with some sub-sector analysis of specific groups. These two major sectors account for the majority of the equipment and components identified by Colt Engineering in Phase I of the study.

### Growth and Investment in Industry Sectors

Alberta's metal products and machinery industry has shown remarkable growth over the past five years in response to increasing demand for products and services in the oil and gas sectors as well as other industrial and commercial sectors. The following graph indicates that both sectors have doubled in output over the past five years when measured on the basis of the value of shipments.

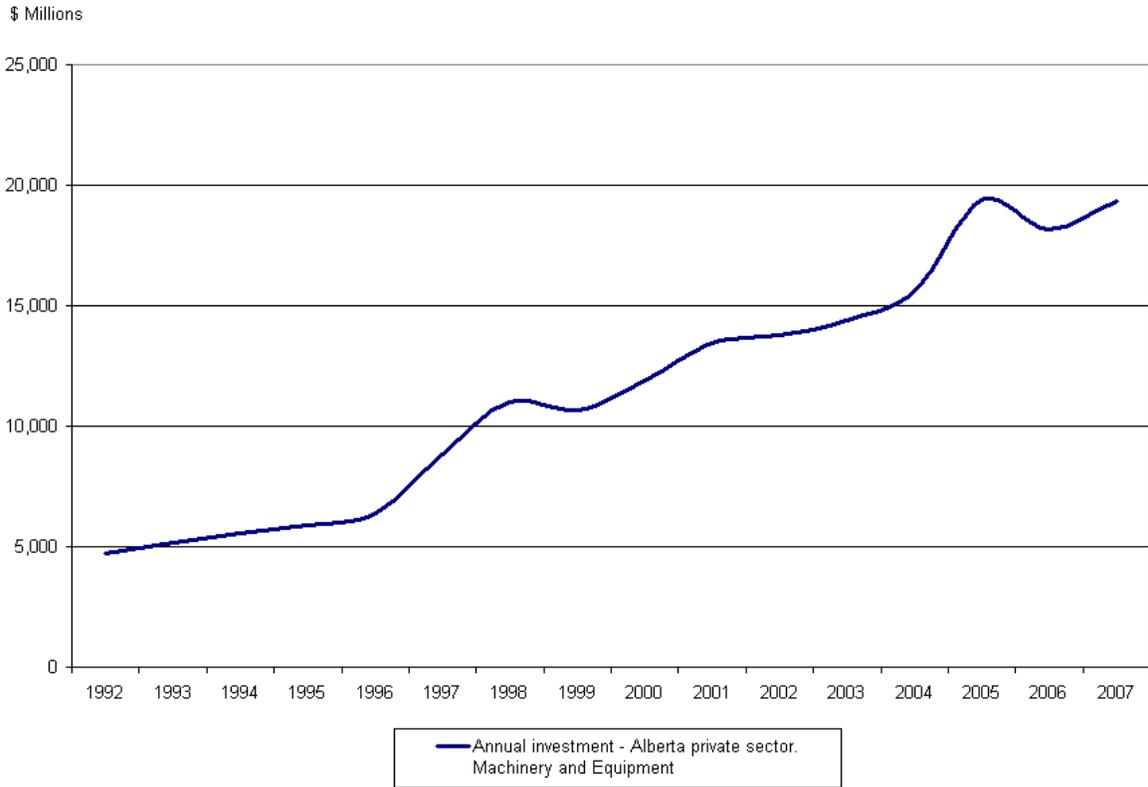
Figure 5 Growth of Alberta Metal Products and Machinery Manufacturing.<sup>10</sup>



<sup>10</sup> Source: Statistics Canada. Six month rolling average of the value of monthly shipments from Alberta based companies.

This growth of output has been supported through tremendous capital investment in machinery and equipment in these sectors in Alberta. While data on investment in these two sub-sectors is not available, the following graph which shows investment in machinery and equipment in the private sector in Alberta provides a good indication of investment trends in these sub-sectors which dominate the manufacturing industry overall in the Province.

Figure 6 Annual Capital Investment in Machinery and Equipment in the Private Sector.<sup>11</sup>



Over the 15 year period covered by the previous graph Alberta’s annual capital investment in machinery and equipment in the private sector increased from by almost 400%. On a national basis, Alberta’s share of total capital investment in this area rose from 12% of total Canadian investment to 21% of the national total by 2007.

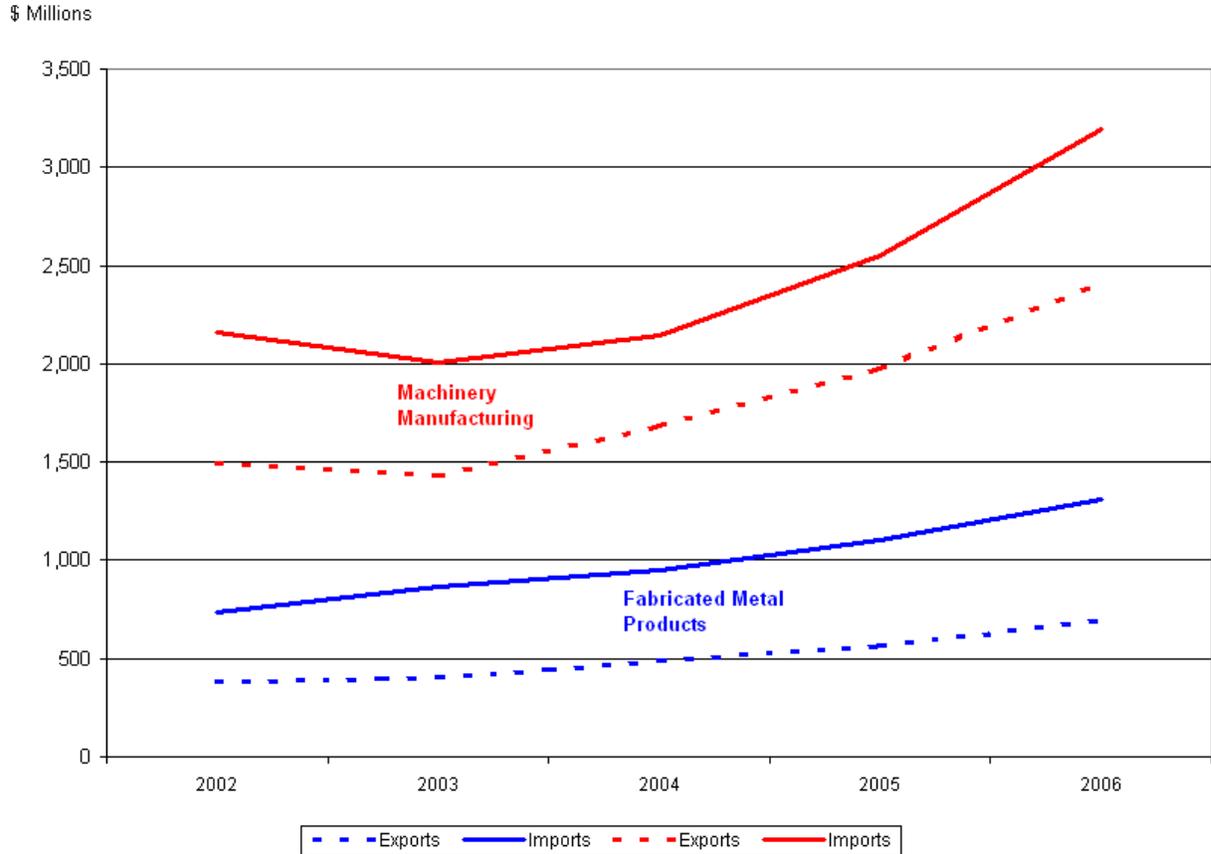
**Role of Imports and Exports in Metal Products and Machinery**

While investment and output in the machinery and manufacturing sectors in Alberta has been impressive, equally impressive has been Alberta manufacturers’ export performance. The following graph displays the growth of exports and imports of the two key sub-sectors and

<sup>11</sup> Statistics Canada.

illustrates that while import growth has slightly outpaced export growth over the last five years, export growth has been impressive as well. This success in exports of fabricated metal products and machinery is contrary to common perceptions of the Alberta industry. Recent past history suggests that Alberta's metal products industry is well positioned to compete internationally in some key market segments.

Figure 7 Exports and Imports of Fabricated Metal Products and Machinery<sup>12</sup>



In order to estimate the expected direct impact of the proposed upgrader projects on the metal products and machinery sectors in Alberta, a wide range of trade and production data for the sectors was reviewed including interprovincial trade data. This data provides estimates of both the total size of the markets under consideration in Alberta based on past and current economic activity, and shows the role of Alberta production, interprovincial trade and international trade in the industries examined. The following table provides a summary of this analysis.

<sup>12</sup> Statistics Canada.

Figure 8 Key Financial Estimates –Metal Products and Machinery Manufacturing.<sup>13</sup>

	<b>Fabricated Metal Products</b> \$ billions	<b>Machinery</b> \$ billions
Alberta 2006 Production	\$4.74	\$6.42
Alberta 2006 demand (est.)	\$8.03	\$13.45
Interprovincial imports (est.)	22%	7%
International imports (est.)	42%	70%
Alberta fabricators and manufacturers share of Alberta demand (est.)	36%	22%

The data in figure 8 show that the total market for metal products and machinery in Alberta was approximately \$21.5 billion in 2006 with Alberta firms supplying an estimated \$2.9 billion worth of fabricated metal products and \$3.0 billion worth of machinery for a total of \$5.9 billion in these two sectors. Using the data developed by Colt for Phase I of this study and applying the estimates developed above for Alberta firms' share of these markets, it is estimated that of the \$18.8 to \$32.9 billion worth of equipment and components that Colt determined would be required for the 9 upgrader projects assessed, approximately \$6.0 to \$10.5 billion of this amount would be provided directly by Alberta based companies. These estimates assume that Alberta companies obtain their recent historical market share of 36% of fabricated metal products and 22% of machinery.

However, as part of this study, QGI consulting asked a small number of experts involved in major oil and gas project construction in Alberta where they expected key inputs to the oil sands and upgrader plants to be sourced from. While only four of the individuals contacted were able to provide a detailed breakdown of sourcing by market and key input, these individuals, who are directly involved in decisions affecting project planning and supply chain management, suggested that the distribution of supply by market would be approximately as is shown in the following table.

<sup>13</sup> Statistics Canada and QGI Consulting

Figure 9

Expected Sourcing of Oil Sands and Upgrader Inputs by Market

<b><u>Key Inputs</u></b>	<b>Alberta Supply %</b>	<b>Other Canada Supply %</b>	<b>US Supply %</b>	<b>Offshore Supply %</b>	<b>Total Supply %</b>
<b>Heat Exchangers</b>	15	20	50	15	100%
<b>Pressure Vessels</b>	70	15	2.5	12.5	100%
<b>Pumps &amp; Compressors</b>	-	2.5	55	42.5	100%
<b>Valves</b>	-	-	50	50	100%
<b>Structural Steel</b>	60	10	20	10	100%
<b>Piping (Pipe Spools)</b>	75	15	10	-	100%
<b>Instruments &amp; Controls</b>	-	50	50	-	100%

It is important to note that these estimates reflect the current intentions of the supply chain experts consulted for this study. These individuals based their estimates upon recent experience and their personal expectations regarding future market conditions. In some cases these estimates may represent departures from historic market shares for Alberta and other suppliers. For example, over the past five years, Alberta fabricators share of the pressure vessel market has exceeded 80 percent according to data on pressure vessel registrations provided by the Alberta Boiler Safety Association. This contrasts with the average of 70% Alberta supply anticipated in future by the stakeholders contacted for this study. There are a number of possible reasons for this discrepancy and the actual market shares achieved in future by Alberta suppliers of components and services will be determined by competitive factors.

When the values in figure 9 are applied against the total requirements for these key inputs as determined by Colt in Phase 1, the Alberta firms expected share of these inputs amounts to approximately \$6.8 to \$11.9 billion which is very similar to the values calculated earlier (\$6.0 to \$10.5 billion) which are based on historical trade and production statistics.

## STAKEHOLDER INTERVIEWS

A broad range of organizations participated in the stakeholder interview process. QGI Consulting interviewed 25 individuals from Alberta organizations whose expertise ranged from manufacturing to engineering to procurement. Individuals from the sponsoring organizations within AEII and EEDC also provided their direct input to the project. The following table provides a summary of the stakeholder interview participants.

<b><i>Type of Organization</i></b>	Engineering and Procurement	Manufacturing	Government	Project Construction
<b><i>Interviews Completed</i></b>	7	12	3	3

### **Key Messages from Stakeholder Interviews**

The purpose of the stakeholder interviews was to determine what individuals involved in supporting Alberta's oil sands development believed were the key limits to the capacity of Alberta industry to support oil sands expansion – particularly with respect to the upgrader projects identified in Phase 1 of this study. The individuals in the private sector organizations selected for the interviews all had direct experience

either as suppliers of products or services or as procurement or engineering services providers. Within the manufacturers; producers of products such as: pressure vessels, valves, orifice plates, pipe spools and structural steel participated in the study. In addition, custom fabricators from the machine shop sector also provided input.

***The major equipment types and services are sourced internationally. Alberta firms' participation in these projects will be based on their ability to compete within global supply chains.***

A dominant theme that emerged in the interview process is that the major equipment types and services identified in the Colt Phase I study are presently being sourced internationally and that this is expected to continue in the future. As a result, Alberta firms' participation in these projects will be based on their ability to compete within global supply chains.

Currently, there are no critical shortages of products, equipment or services that study participants believe cannot be supplied from local or international sources. While the fabrication of large pressure vessels and structural steel were identified as possible challenges in upgrader project development, it was expected that Alberta-based suppliers of these products would be

able to expand their production to avoid becoming a major constraint on project development.<sup>14</sup> Some stakeholders believe that limited capability to supply these components may extend the current construction timelines beyond those that are currently projected by one to five years.

## **OPPORTUNITIES**

### **Import Substitution**

Pumps, valves, and compressors were all areas where study participants indicated that there would be increased opportunity for Alberta companies to participate in the bitumen upgrader projects. These areas represent significant opportunities as Alberta companies are already well established in these sectors. The challenge for Alberta companies will be to remain cost competitive with foreign suppliers in the face of rising costs for labour, energy and materials due to the strong domestic economy in Canada and due to Canada's very strong currency.

Increased participation by Alberta and other Canadian companies in these sub-sectors could create significant value for domestic companies. Based on the Colt study, a total of \$3.8 - \$6.6 billion will be required for these categories during the construction phase alone. This total is comprised of:

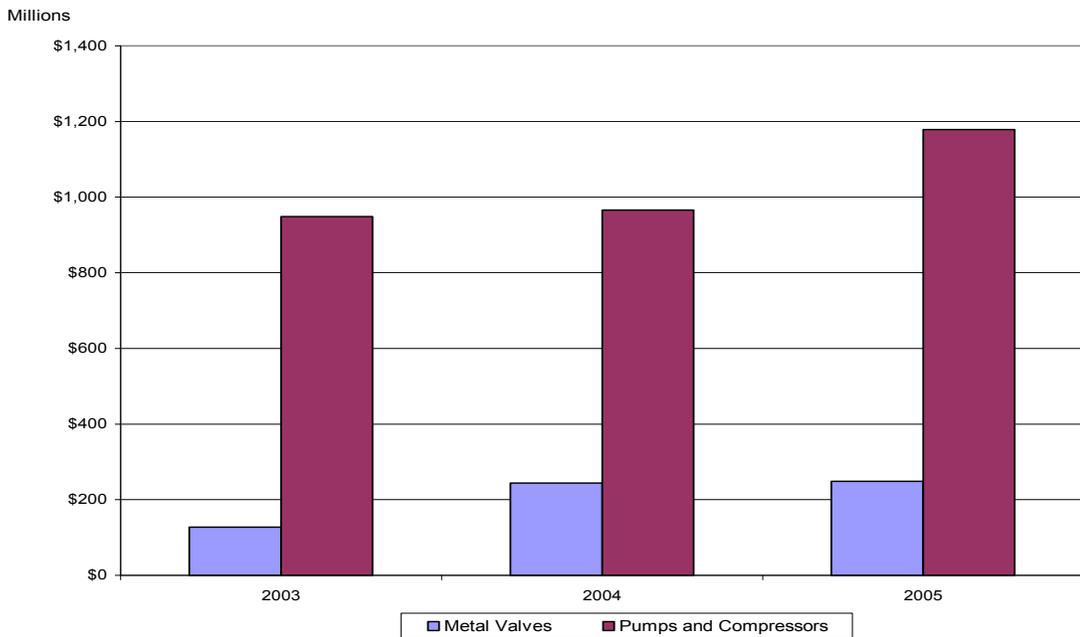
- Pumps                                 \$ 2.8 - \$ 4.9 billion
- Compressors                         \$ 0.4 - \$ 0.7 billion
- Valves                                 \$ 0.6 - \$ 1.0 billion

These three areas represent a significant opportunity for Alberta based suppliers as the vast majority of these inputs are now and in the future are expected to be sourced from foreign suppliers. However, Alberta based firms already have a significant presence in these markets and Alberta firms annual shipments of these three components exceeded \$1.4 billion in 2005 and would be estimated at as much as \$1.7 billion in 2006.

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<sup>14</sup> Vessels over 14 feet in diameter or over 100 tonnes are fabricated within Alberta due to transportation restrictions on roads and railways from tidewater to Alberta.

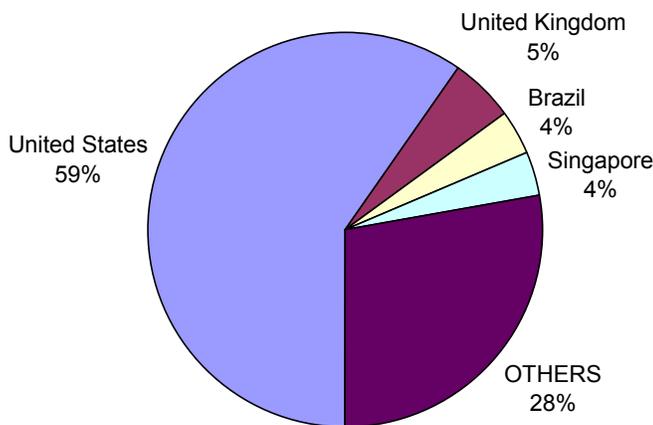
Figure 10 Alberta Shipments of Valves Pumps and Compressors<sup>15</sup>



Based on the expected spending on these components, the potential value to Alberta businesses of the construction spending on these items for the GEA bitumen upgraders is equivalent to approximately 2 to 4 times the current annual production of pumps and compressors now produced in Alberta and approximately 1.8 to 3 times the current annual provincial production of valves. While these sectors in Alberta are not presently viewed by procurement specialists as primary sources for the upgrader plants, these are established industries in Alberta with a significant export capability.

Figure 11 Alberta - Imports and Exports of Metal Valves<sup>16</sup>

**Exports of Valves from Alberta**

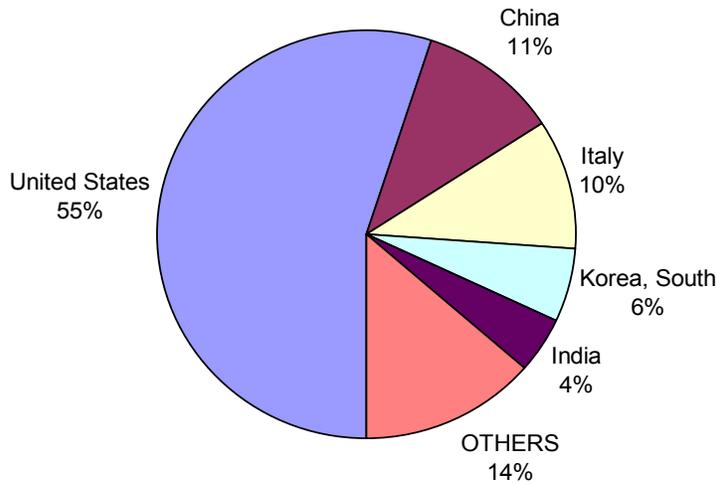


Total exports of metal valves, which were fabricated in Alberta, had a value of \$224 million in 2006 with the United States being the major destination market. Not coincidentally, the United States is also the major source of imports of valves to Alberta. The total value of imports was \$581 million in 2006.

<sup>15</sup> Statistics Canada

<sup>16</sup> Statistics Canada. 2006 data

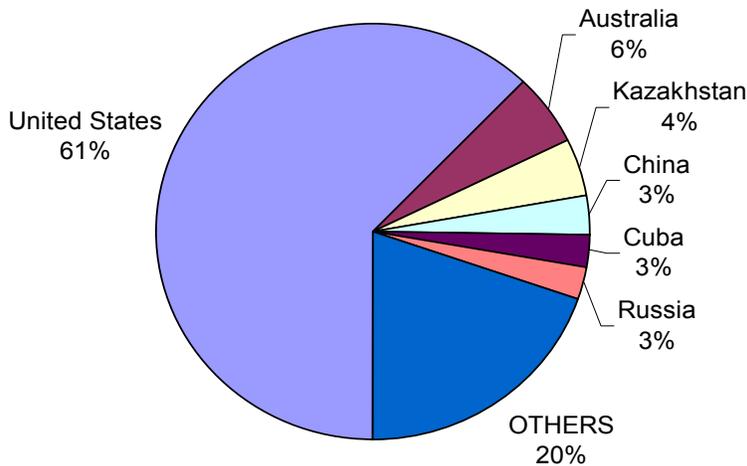
**Imports of Valves to Alberta**



Alberta manufacturers therefore have an established presence in export markets, which provides some evidence of their ability to be globally competitive in this segment. This may allow Alberta fabricators, either on their own or in partnership with existing foreign suppliers of metal valves, to increase their participation in the domestic Alberta market – particularly in the large upgrader construction market.

Figure 12 Alberta Imports and Exports of Pumps and Compressors.<sup>17</sup>

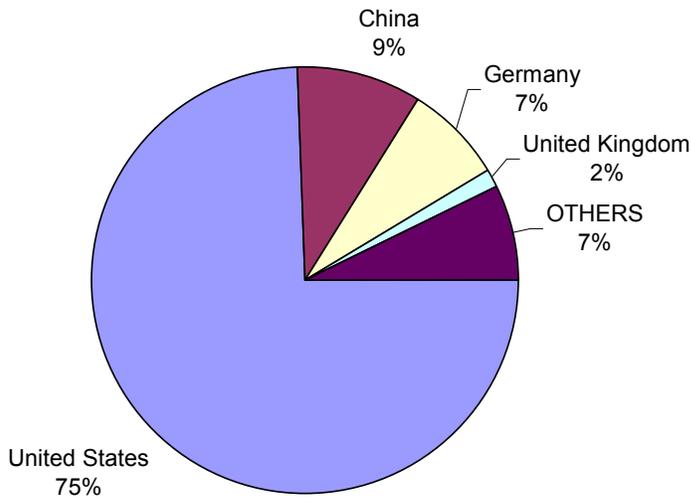
**Exports Pumps and Compressors - Alberta**



Total exports of pumps and compressors that were manufactured in Alberta had a value of \$459 million in 2006. As with metal valves, the major export market was the United States - making up 61% of total exports.

<sup>17</sup> Statistics Canada. 2006 data

### Imports Pumps and Compressors - Alberta



Imports of pumps and compressors totaled \$427 million in 2006. While procurement professionals in the Engineering industry have not indicated that they intend to purchase a significant volume of pumps and compressors for the upgrader projects from Alberta suppliers, Alberta firms have a well-established presence in the province and a proven record in exports.

These factors should create significant opportunity for Alberta based firms to increase their participation in these segments in the future.

### **Maintenance and Environmental Services**

Based on Colt's high level estimate of ongoing sustaining capital investment equivalent of 2% of initial capital, the annual spending on capital maintenance for the equipment required for the upgrader plants will be from \$376 to \$658 million per year over the 30 year life of these facilities. The total expenditure on capital maintenance of this equipment will be equivalent to 60% of the invested capital or approximately 20% on a net present value basis for a total of \$3.5 - \$6.2 billion in current dollars.<sup>18</sup> A number of stakeholder representatives identified maintenance of the upgrader projects as an important future opportunity for Alberta firms. In addition, given the number of new operating processes and environments being utilized in these upgrader plants, some stakeholders believe that the maintenance requirements for these plants may be understated and that the opportunity may be somewhat larger than the estimates provided, which are based on experience with more mature technologies and processes.

Several stakeholders also emphasized the value and emerging importance of the market for environmental technologies and services. While these services were not evaluated directly by Colt Engineering and there is no clear way to assess their potential value, stakeholders clearly

<sup>18</sup> The Net Present Value (NPV) calculation discounts the future cash stream spent on capital maintenance over the 30-year life of the project to make the future cash flows directly comparable to the upfront spending on capital. Using a 10% discount rate for the calculation yields an NPV value of 19% of invested capital being spent on capital maintenance, assuming an annual requirement for 2 % of invested capital.

believe that additional capability that is not present in the local Alberta marketplace will be required in coming years.

All new projects require an extensive Environmental Impact Assessment (EIA). Applications for regulatory approvals from the Alberta Energy and Utilities Board (EUB) and from Alberta Environment will require in-depth assessment of each project's potential impact upon; groundwater, streams and rivers, land clearing impacts, release of air emissions, and the handling of by-products. While the GEA upgrader projects are located outside the densely populated metropolitan Edmonton area they are in close proximity to a number of smaller towns such as Fort Saskatchewan, Gibbons, Bon Accord and Redwater. In addition, adjacent land use at many of the sites is working agricultural land. With the growth of industrial demand for water resources in particular, plants are exploring the use of treated wastewater from the Alberta Capital Region Wastewater Commission as process water for the facilities.

The rapid industrial growth in the region will undoubtedly result in increasing demand for companies to implement best practices and adopt more advanced technologies. In addition, the industry is looking to develop integrated eco-industrial clusters to optimize environmental management practices that will also improve operational efficiencies. Opportunities are expected for firms with experience in the completion of EIA's, in on-going monitoring and in mitigation management for environmentally sensitive processes.

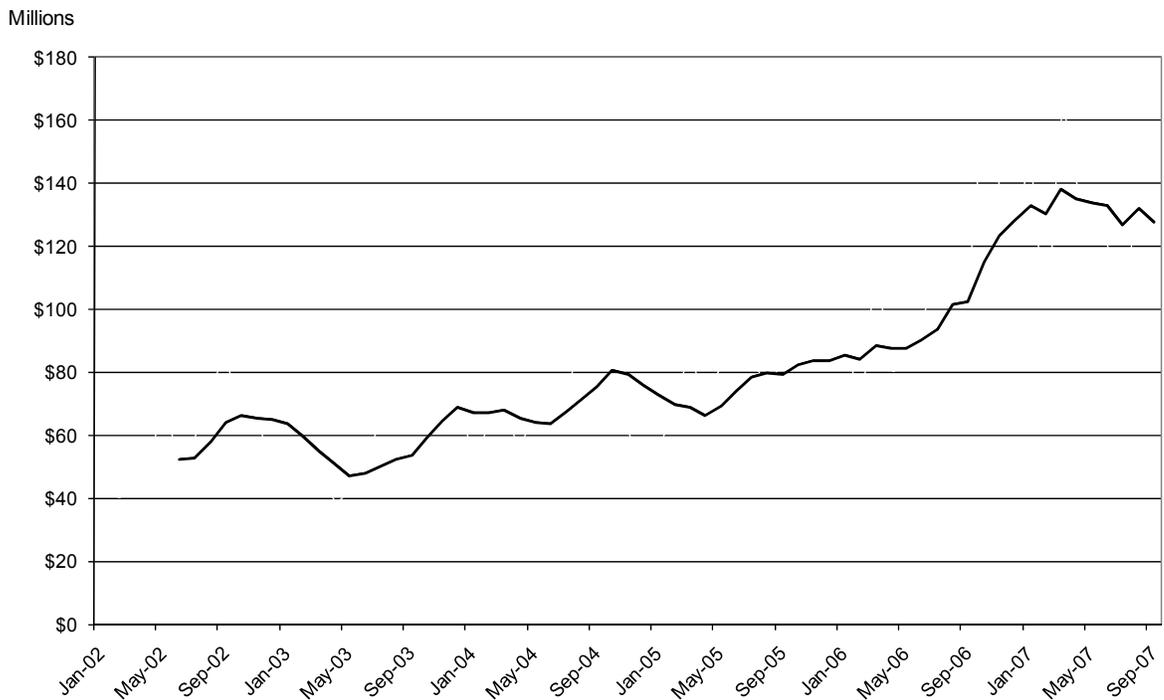
## **CHALLENGES**

### **Structural Steel**

The two areas where study participants identified challenges in the region's capabilities were in the provision of structural steel and pressure vessels. Based on the Colt Engineering study the total demand for structural steel for the identified upgrader projects is expected to be between \$800 and \$1.4 billion over the six to seven year construction horizon considered in the report. While this demand is more heavily loaded towards the later years of the construction period according to the Colt data, the average incremental monthly demand for structural steel would be approximately \$11 to \$19 million on a financial basis.

This area is dominated by one major regional supplier and by a small number of domestic and international firms. As shown by the following graph, this area of Alberta's economy has grown explosively over the past five years as both public and private investments in infrastructure have spurred Alberta's construction boom.

Figure 13 Alberta Shipments of Plate Work and Fabricated Structural Products. <sup>19</sup>

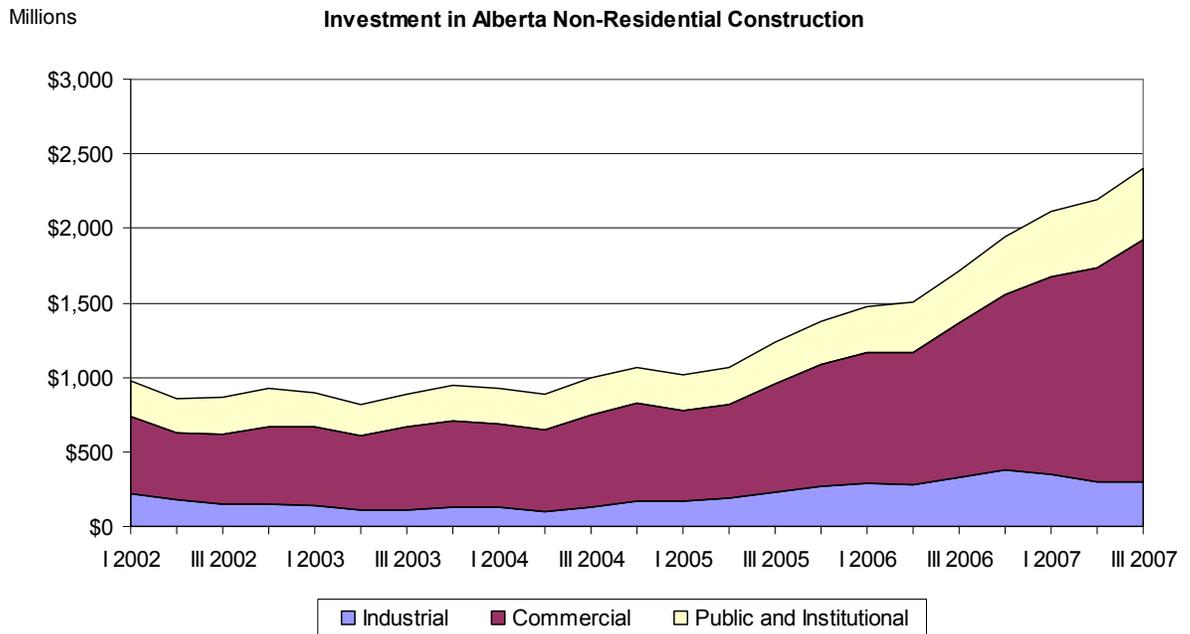


Many stakeholders indicated that firms in this business are currently working at capacity and that this may be an area of constraint as construction demands increase for upgrader projects in coming years. However, firms directly involved in this industry suggested that there was room for some increase in capacity within their organizations through increased productivity within their firms and through improved planning and coordination of projects with project developers.

The increase in demand required for the upgrader projects equates to an estimated increase of from 8% – 15% in output from the structural steel industry in Alberta, based upon the Statistics Canada data cited above. Given the industry's growth of over 250% over the last five years it seems likely that they will be able to meet the growth challenge created by the new upgrader projects with supplemental volumes provided by other Canadian and international suppliers. However, the demand for structural steel will not be driven solely by the upgrader projects nor by the oil and gas industry alone. Investments in infrastructure in Alberta in the public and private sectors generally will also create increased demands for structural steel.

<sup>19</sup> Statistics Canada. Graph displays 6 month moving average of monthly shipments.

Figure 14 Non-Residential Construction in Alberta<sup>20</sup>



The graph above shows clearly that demand for structural steel is likely to be more strongly affected by demand for non-residential construction in the commercial and public sectors than it is by the industrial sector. These competing demands are likely to place continuing pressure on the structural steel industry and may create demands for even greater investments by sector participants to increase capacity.

### **Pressure Vessels**

Pressure vessel fabrication was the other area identified as a possible constraint upon upgrader project construction. The detailed Colt assessment indicated that the upgrader plants would require approximately 2900 different pressure vessels of various types with an approximate value of \$1.16 billion.

Based on the data provided earlier, Alberta manufacturers would be expected to obtain approximately 70% of this total opportunity or \$814 million worth of business over the construction period. While there may be some opportunity for new entrants in this field, most stakeholders believed that given Alberta industry's current capabilities and infrastructure, additional new entrants may face significant challenges in obtaining access to sufficient skilled labour, particularly welders and shop floor and production supervisors, to allow them to be

<sup>20</sup> Statistics Canada.

successful. Given Canadian fabricators established presence in this market, it may be more feasible for existing Canadian fabricators to increase their participation in this market, in partnership with Alberta fabricators, in order to alleviate some of the anticipated constraints on supply. While the industry in Alberta is made up of approximately 20 firms, this number is too low to allow Statistics Canada to provide detailed data on production, market size and investment for reasons of confidentiality and accuracy.

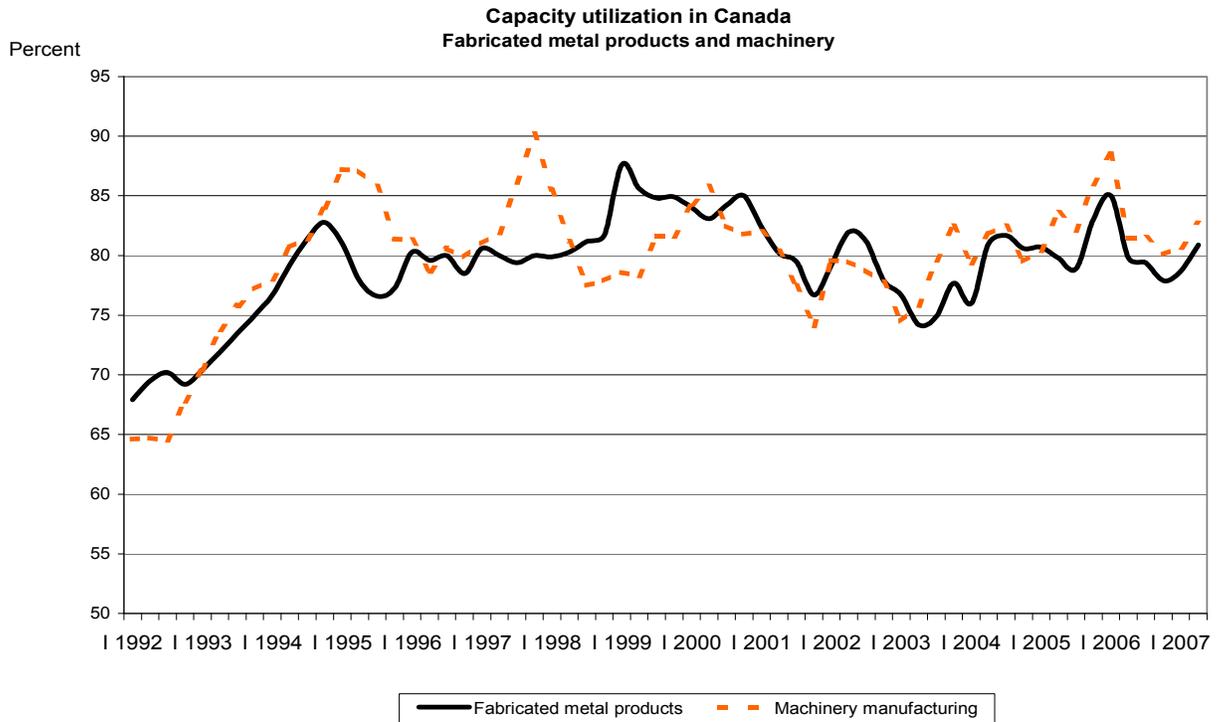
## **STRATEGIC PRIORITIZATION OF OPPORTUNITIES**

From an industry sector perspective opportunities have been identified in:

- Pumps and Compressors
- Metal Valves
- Maintenance
- Environmental Technologies

While trade statistics demonstrate that Alberta firms are able to compete in certain manufacturing sectors on an international basis, the realities of Alberta's geographic position - distant from tidewater and from major steel production facilities - places certain practical limitations on most investments in manufacturing in Alberta. For the commodity type products that make up the majority of the equipment and service needs of Alberta's bitumen upgrader plants, investments made in Alberta to serve these plants will be directed initially towards a domestic Alberta market. Therefore, economic development initiatives should focus on expanding the capacity of Alberta and Canadian firms to replace some of the growing share of these markets served by imported products. Capacity utilization levels are reported to be high in Alberta in the key metal fabrication and manufacturing sectors. However, based on Statistics Canada data, capacity utilization levels in Canada as a whole are at levels that should allow some initial import substitution to be won by Canadian firms. This will be particularly true if current efforts to build collaborative relationships between project owners, Alberta manufacturers and fabricators and non-Alberta companies develop as hoped. Initiatives of industry and government agencies such as the National Buyer-Seller forum and the various regional supply chain partnering forums and meetings are excellent examples of initiatives that can assist in obtaining a greater share of the bitumen upgrader construction and maintenance markets for both Alberta firms and for other Canadian firms.

Figure 15 Capacity Utilization in Metal Fabrication and Machinery Manufacturing<sup>21</sup>



**Key Forecast Risks**

The capital investment projections for bitumen upgrader projects are based on the public investment plans of the project proponents. These plans are in turn based upon currently forecast prices for bitumen and crude oil as well as upon expectations regarding the construction costs. All of these factors are subject to forecasts risks. The key areas of risk are in the availability and cost of important inputs to the projects – particularly labour.

The most important constraint on growth in Alberta is a general shortage of skilled labour. Alberta’s current unemployment rate is approaching an historic low of near 4%.

At present, the labour situation in the province remains very tight with shortages being experienced in a number of trades. The graph shown below is developed from data collected by

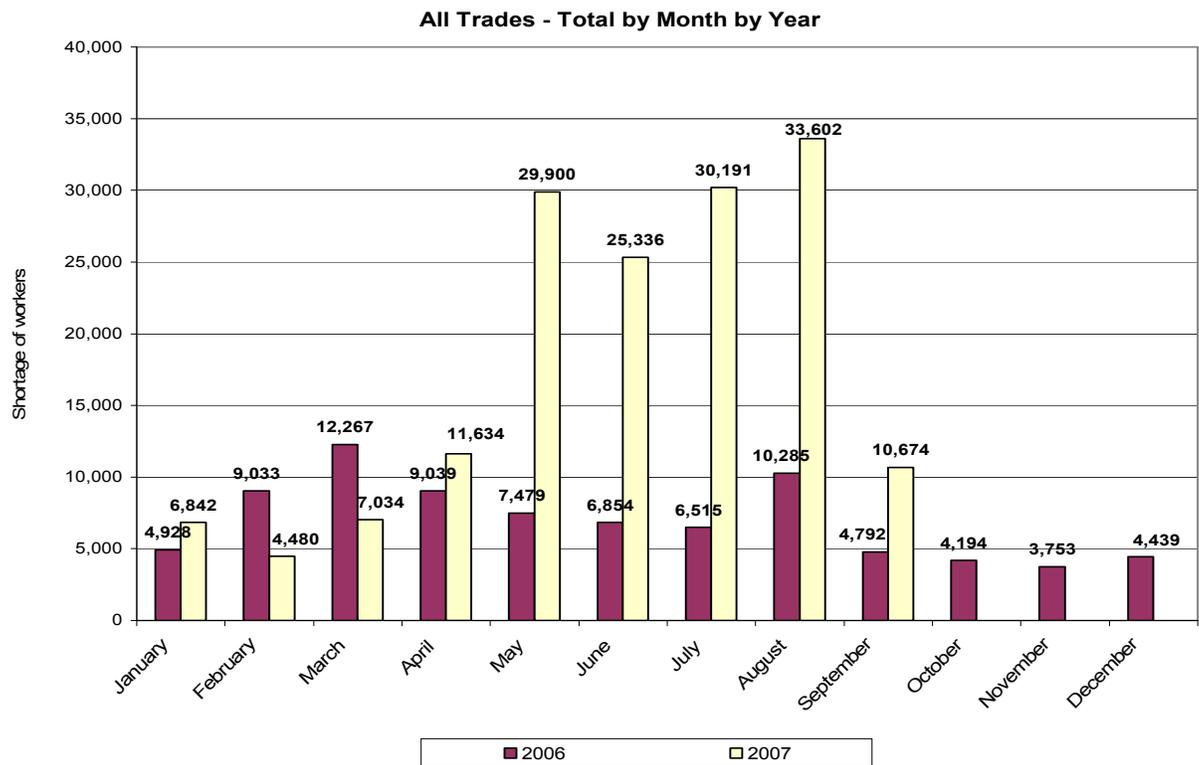
<sup>21</sup> Statistics Canada.

Jacobs Industrial Services Ltd.<sup>22</sup> The graph shows the average monthly shortages of supply compared to demand in Alberta for the following trades;

- Boilermakers
- Carpenters
- Electricians
- Insulators
- Ironworkers
- Labourers
- Pipefitters

This data is compiled through Jacobs' direct contact with the individual unions involved.

Figure 16 Labour Shortages by Month, Alberta 2006-2007.



While some forecasts suggest an easing of labour shortages, the Jacob's International experience through 2007 has been that significant shortages continue. Most stakeholders now accept that while a number of private sector and government strategies to address labour constraints are having a positive effect, the current tight labour market is likely to have the effect

<sup>22</sup> Jacobs is an international company whose Edmonton offices provide consulting, engineering, and construction services for clients in oil and gas, infrastructure, mining and materials management and other industries.

of lengthening the construction period for major projects beyond the time frames that have been published for a number of projects – including the bitumen upgrader projects.

In addition, commodity prices and exchange rates can have significant effects on project economics. While oil prices are currently well above the rates contemplated when the major bitumen upgrader projects were initially planned, a sudden unforeseen drop in prices could affect proponents willingness to invest. The current high value of the Canadian dollar is likely to make the achievement of historic market shares for Alberta metal fabrication and machinery manufacturers difficult to achieve. While the high Canadian currency values make imported supplies less costly, this is more than offset by the increased competitiveness of foreign suppliers created by a rising Canadian dollar.

## **ECONOMIC DEVELOPMENT STRATEGIES**

There are three primary strategic approaches that EEDC, the Government of Alberta and its partners could undertake to foster productivity growth within the Alberta economy:

- Awareness (information, education and communication)
- Assessment (benchmarking and productivity enhancement tools and services )
- Policy and regulatory environment conducive for productivity and innovation

These general approaches must be pursued jointly with industry and in collaboration with all levels of government, academic institutions, associations, and related agencies. New strategies, structures, systems and process efficiencies create new value and foster productivity within Alberta firms which allows them to compete globally and become part of global supply chain networks.

The strategies currently being pursued by EEDC, AEII and other public stakeholders in the areas of Labour strategy, productivity improvements and supply chain partnering should be continued and focused specifically upon the opportunities identified in targeted markets for products and services such as those identified through this study

These initiatives and programs include:

- Labour strategy:
  - The 10 year *Workforce Strategy for Alberta's Manufacturing Industry* – a program to Inform, Attract, Develop and Retain the productive workforce that is needed by Alberta Manufacturers.
- Productivity enhancement

- Support for LEAN manufacturing initiatives and training
- Support for training and development in advanced technologies through centres such as the Northern Alberta Institute of Technology's Centre for Manufacturing solutions
- Support for the re-establishment of the Weldco-Beales Chair and program in Welding Engineering and the University of Alberta
- Supply Chain Partnering
  - Continued support for and facilitation of the National and Regional Buyer Seller Forums as well as specific targeted forums in order to increase opportunities for partnership development
  - Encourage major project owners, proponents and their procurement specialists to develop regional supply chain strategies through mentoring and partnering local firms with best in class manufacturers either locally, or through international supply chain partnerships.

### **Supporting Collaboration in Manufacturing**

As this study shows, Alberta has a significant presence in the manufacturing sectors required to support oil sands and upgrader project development. However, Alberta firms' presence in certain sub-segments is still developing and many components are sourced outside the region in spite of the presence of regional firms in those sectors. In order to encourage the development of the metal products manufacturing cluster in the GEA and the rest of Alberta, new activities which promote the awareness of the value of supply chain collaboration amongst Engineering, Construction and Manufacturing firms as well as project owners and educational and research institutions – should be encouraged.

As was demonstrated in the stakeholder interviews and in the data on sourcing of upgrader equipment and components; Alberta firms compete in an international market for the supply of goods and services to the major Alberta projects. To increase their competitiveness, regional firms must seek advantages that go beyond direct input cost advantages. As a developing business cluster, many firms in the Alberta manufacturing industry are only recently beginning to discover the benefits of supply chain collaboration. In mature clusters, it has become clear through research that competitive advantage is not created only by the flow of goods, services or capital throughout the world. These resources can move with few impediments and become available to all market entrants. However, social capital, such as personal networks result in business innovations that tend to stay in one place.

Being part of a cluster gives all firms better access to suppliers, employees, and information about markets, technology and competition. This can accelerate innovation and lead to geographically based competitive advantage which is rooted in the networks and clusters themselves.

One of the lead initiatives in this area is the National Buyer/Seller Forum, a joint initiative between government, the Canadian Manufacturers and Exporters and industry that works to connect oil sands and oil sands-related buyers with potential suppliers from across Canada. Now in its eighth year, the Forum has welcomed thousands of participants and been the foundation for numerous manufacturing projects. The next Forum will be held March 25-27, 2008 in Edmonton, Alberta; for further information, visit [www.nationalbuyersellerforum.ca](http://www.nationalbuyersellerforum.ca).

Another example of an organization that fosters supply chain collaboration is the Doyle Center for Manufacturing Technology in Pittsburgh Pennsylvania. Founded in 2003, the Center is a federally funded, non-profit organization established to help small and medium-sized manufacturing enterprises successfully develop and actively participate in global supply chains. Currently, the Center provides Network Centric Manufacturing<sup>SM</sup> solutions for U.S. based manufacturing enterprises and their customers using state-of-the-art business and engineering processes, technology, best practices and training to improve supply chain value, quality and responsiveness to market demand.

A similar concept focused on the needs of the petroleum and petrochemical industries should be considered for Alberta. Such an organization might include participation from organizations such as: Alberta Research Council, the Faculties of Engineering at the Universities of Alberta and Calgary, the Northern Alberta Institute of Technology (NAIT) and the key firms in engineering, procurement and oil sands and upgrader project development. A Centre for Manufacturing Innovation with a particular focus on the needs of the oil and gas and petrochemical industries could provide the forum for active supply chain collaboration and innovation in Alberta. This could foster the personal networks and collaborative environments that are needed for mature industry clusters to develop.

The actual structure and strategic objectives of such a Centre would need to be determined by the stakeholders themselves. However, the foundations of such a collaborative organization already exist in the groups named earlier. In particular, the NAIT Shell Centre for Manufacturing Solutions may be able to provide the core requirements of such a collaborative effort. This centre, which was originally focused on software solutions for the oil and gas industry is developing a broader capability in a number of manufacturing processes. However, a networking

approach which includes such groups as the NSERC Construction Industry Research Chair and the Weldco-Beales Chairs in Welding Engineering at the University of Alberta would broaden the collaborative network. These latter groups, along with the Alberta Research Council would extend the NAIT Shell Centre's capabilities beyond workforce training and development to include access to advanced research.

The role of government agencies such as AEII and EEDC should be to facilitate the discovery of mechanisms to create such collaborative networks and organizations through both the established programs mentioned earlier in this section, as well as through fostering discussion and investigation of best practice examples such as the Doyle Center and other international examples of successful supply chain and regional cluster collaboration.<sup>23</sup>

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<sup>23</sup> References on Supply Chain and Cluster Collaboration  
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