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Business Case Analysis for Oversized Freight To/From Sarnia-Lambton

(Client Ref: 2015-004)

Final Report

Prepared for:

Sarnia-Lambton Economic Partnership

Sarnia-Lambton Industrial Alliance

Prepared by:

CPCS

In association with:

Anderson Haulage

Solutions for growing economies

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Cover image source: SLEP / KelGor

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Acronyms / Abbreviations

ABSA	Alberta Boilers Safety Association
AOPS	Arctic Offshore Patrol Ships
API	American Petroleum Institute
ASME	American Society of Mechanical Engineers
Bpd	Barrels per day
CAPP	Canadian Association of Petroleum Producers
CSC	Canadian Surface Combatant
CSM	Canadian Structural & Mechanical
EPC	Engineering Procurement Construction
FEED	Front End Engineering and Design
FPSOs	Floating Production, Storage and Off-loading vessels
FTE	Full-Time Equivalent
GDP	Gross Domestic Product
JV	Joint Venture
km	Kilometre
LNG	Liquefied Natural Gas
m	Metre
M	Million
mbpd	Million Barrels per Day
mmBTU	Million per British Thermal Units
MTO	Ministry of Transportation Ontario
NAFTA	North American Free Trade Agreement
NARL	North Atlantic Refining Limited
NSS	National Shipbuilding Strategy
OPG	Ontario Power Generation
PA	Pennsylvania
SC	South Carolina
SLEP	Sarnia Lambton Economic Partnership
SLIA	Sarnia Lambton Industrial Alliance
SPMT	Self-Propelled Modular Transporter
TSSA	Technical Standards & Safety Authority
UAE	United Arab Emirates
US	United States of America

Executive Summary

Sarnia-Lambton is host to a well-established cluster of fabricators who have served the needs of the local petroleum and petrochemicals sector for decades. These companies have experience with pipe fabrication, heat exchangers and pressure vessels, reactors, boilers, towers, and other specialty equipment. Much of this equipment can be large, heavy, and challenging to transport, particularly over longer distances.

Further to a slow-down in local client demand, some of the fabricators are looking at development of additional and alternative market opportunities beyond the region. Historically, sales of oversize products beyond the region has been limited, in part due to a strong local market which has kept fabricators busy, but also because of the high transportation costs of moving large pieces of equipment beyond Sarnia-Lambton.

A recent engineering study identified the preferred route for such a corridor could be established for an estimated cost of $11.4 million. The assumption is that adjustments to the existing road infrastructure and Sarnia Harbour to create a permanent oversize corridor will lower transportation costs, thereby improving the competitiveness of Sarnia-Lambton fabricators to serve other regions and reach new markets.

Based on research and consultation, this report assesses the potential impact of the proposed corridor both in terms of benefits for locally based companies who seek to import oversize loads, as well as additional sales from exports by fabricators outside of the region.

With respect to imports of oversize equipment, our research suggests that the lack of a corridor to date has not inhibited existing industries from building large-scale operations (e.g. existing refineries and petrochemicals companies). Many of the Sarnia-Lambton refineries were built decades ago, are located on the waterfront, and were able to bring in large equipment when required. Nor did consultations with local industry reveal that the oversize corridor would have a major impact in terms of leading to expansion of existing operations. However, the oversize corridor may have a positive impact in drawing industry to Sarnia-Lambton in the future, and would certainly be part of a larger sales pitch for the Sarnia-Lambton for industrial investment attraction. When making an investment decision, existence of the oversize corridor could be one consideration for companies requiring large equipment in terms of their selected location. However, it is not possible to confirm that it would be the defining factor for such an investment decision.

Our market analysis suggests that the markets with the highest level of potential will remain closely linked to the petroleum and petrochemicals sector. This includes opportunities in Atlantic Canada, and to a lesser extent the US East Coast, Mexico, and the Middle East. A number of other sectors have moderate potential, though additional market research, marketing efforts, and potential technical adaptation would be required to serve these markets. The figure below summarizes our analysis of market potential (Chapter 5), reflecting the focus of the study on opportunities that will become available as a result of the oversize corridor.

Figure ES-1: Analysis of Potential Market Opportunities

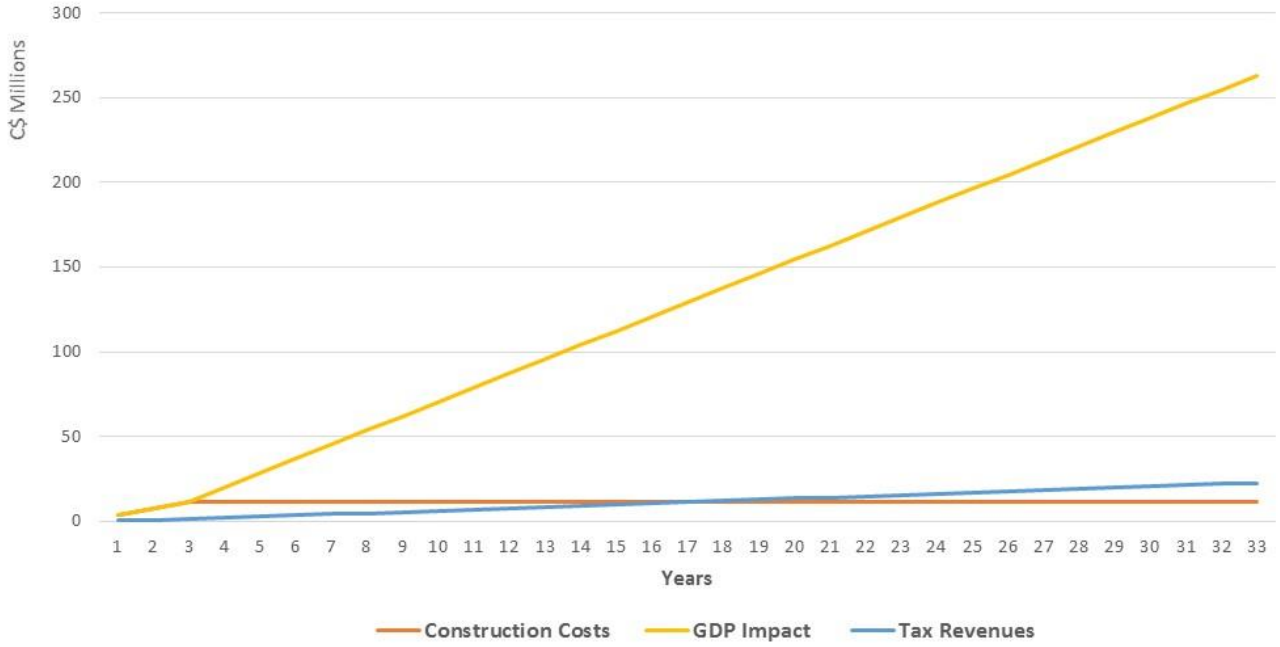
Potential Market	Strength of Opportunity
Western Canada (Alberta)	Medium
Atlantic Canada	High
US Petroleum (pipelines)	Low
US Petroleum (LNG export facilities)	Medium
Mexico (Pemex)	Medium
Cuba	Low-Medium
Middle East	Medium
West Coast LNG	Low
Biochemicals	Medium (in the long term)
Shipbuilding	Low-Medium
Water and Wastewater	Low
Power Generation	Low-Medium
Mining	Low-Medium
Food and beverage processing	Low
Pulp and Paper	Low

In terms of exports, the corridor will lower transportation costs and will enable Sarnia-Lambton fabricators to serve new markets more competitively. Based on consultations and our market analysis, we estimate the construction of the oversize corridor could result in additional potential annual sales of $9.5 million for Sarnia-Lambton fabricators. Achieving this level of additional sales would require complementary efforts by fabricators, including significant marketing to existing and new clients beyond the region.

Based on construction costs of $11.4 million, and additional annual sales of $9.5 million of products by regional fabricators, the corridor project could add $263 million to Canada's GDP (2010 dollars). This would generate an estimated 2,613 additional full time equivalent jobs (person years of employment). The project would also add approximately $21.4 million to government tax revenues (2010 dollars). These estimates reflect an aggregated impact from the construction phase and operations phase of the corridor (assuming a time period of 30 years).

The figure below illustrates the cumulative costs and benefits of the project over a 30 year period. Even using a relatively conservative estimate in terms of additional sales ($9.5 million), it is clear that investment in the corridor would more than pay for itself in the short term (GDP impact) and medium term (tax revenues).

Figure ES-2: Illustration of Cumulative Costs and Economic Impacts



Source: CPCS analysis of costs and economic impacts. Assumes three year construction timeframe with costs and benefits spread equally across three years, and no maintenance costs. Assumes corridor operating benefits start accruing in Year 4 for 30 years.

1 Introduction

Key Chapter Takeaway

Sarnia area fabricators cannot competitively serve clients beyond the region due in part to high transportation costs resulting from a lack of a dedicated oversize freight corridor to reach the waterfront. This Study assesses the anticipated economic impact (future GDP growth, tax revenues, job creation) of constructing an oversize freight corridor to improve the competitiveness of regional fabricators looking to sell products beyond the region.

1.1 Study Background

Sarnia-Lambton has a long history with the petroleum and petrochemicals industry, reaching back as far as the late 19th century, when the first oil refinery was established in Sarnia. Today, the region is host to major refineries owned by Imperial Oil, Shell, and Suncor, in addition to a number of important petro-chemical and bio-hybrid processing facilities, including NOVA Chemicals and Bio-Amber.

The presence of these major industrial players has resulted in a well-established cluster of mid-stream companies serving the engineering, construction, machining, fabrication, and maintenance requirements of these players. Of particular relevance for this study are the Sarnia-Lambton-based manufacturers and mechanical fabricators who produce, install, and service large pieces of machinery and piping required for ongoing operations and expansion. These fabricating and machining companies have extensive experience with pipe fabrication, heat exchangers and pressure vessels, reactors, boilers, towers, and other specialty equipment – much of which can be large, heavy, and challenging to transport.

The fabricators are part of a well-established supply chain, which has to date been focused almost entirely on the needs of local petroleum-based industries. Further to a slow-down in the growth of the petroleum-based industry in Sarnia-Lambton (and elsewhere globally), and with the objective of sustaining economic growth in Sarnia-Lambton, consideration has been given to development of additional and alternative market opportunities for local area fabricators. While local fabricators have some experience in exporting their products outside of the region, they are currently limited in their ability to move larger size fabricated equipment and modules that are often required in major petroleum-based industry beyond the local area, due in part to the prohibitive costs of transportation.

A number of barriers to transporting large pieces beyond the local market have been identified. A 2010 study assessing the Sarnia-Lambton manufacturing and engineering sector identified a

need to improve transportation infrastructure to allow transportation of oversize products[1]. The study identified that not all local roads are adequate to handle the size and weight requirements of large fabricated modules for transportation to the Sarnia Harbour, or to other docks located along the St. Clair River. In addition, the Sarnia Harbour facility requires upgrading to store, handle, and load larger units.

Without a corridor and shipping route that can accommodate oversize loads, local area manufacturers and fabricators are limited in their ability to bid on contracts to supply oversize products to markets in other parts of Canada and internationally. In addition, local multinational petroleum, petro-chemical, and other industrial companies may benefit from an established corridor to import large freight components for their operations.

In 2012, a preliminary engineering study was commissioned to consider a range of corridor routing options for shipping large manufactured and fabricated products to markets outside of Sarnia-Lambton, using water-based transportation[2]. The study considered a number of road routing options to reach a range of dock sites. In 2016, a further engineering study was completed identifying the requirements and costs for a single recommended route to the Sarnia Harbour (see map at Appendix A)[3]. The estimated cost for creating the oversized corridor, including road-related and port improvements, was $11.4 million.

CPCS Transcom Limited (CPCS) has been engaged to carry out this complementary study, focused on assessing the business case and economic impact of the proposed oversize corridor, in order to support any future investment decision.

1.2 Objectives and Key Questions

The primary objective of this study is to assess the business case for investing in development of a new oversize corridor, taking into consideration the anticipated benefits from the corridor for the region and province.

The study addresses the following key questions:

- What are the capabilities of Sarnia-Lambton fabricators with respect to oversize fabricated products?
- Where is the market potential greatest for Sarnia-Lambton manufacturers for oversize products?
- What would be the economic impact of an improved oversize freight transportation corridor?

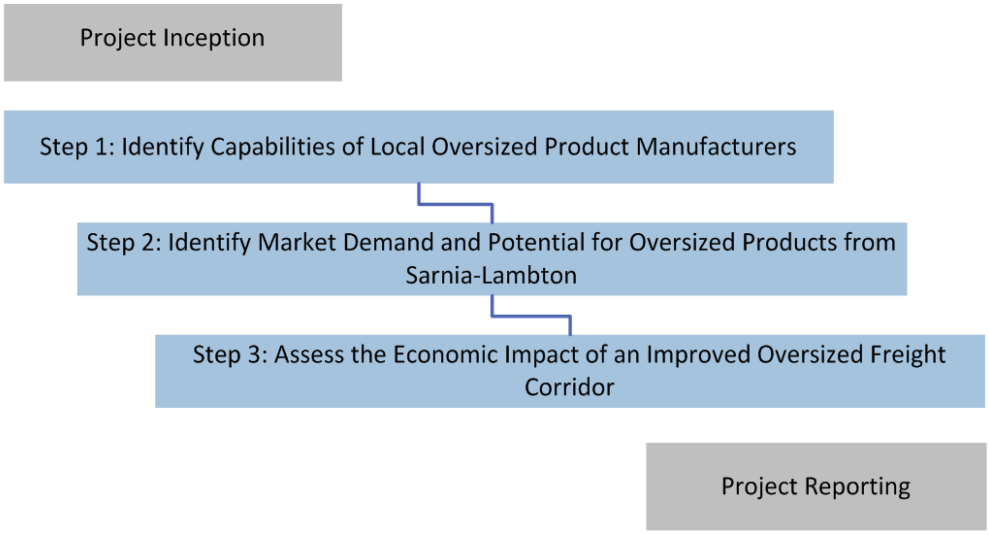
[1] Hickling Arthurs Low "Manufacturing, Machine Shop and Engineering Inventory and Capability Study: Final Report", prepared for the Sarnia-Lambton Economic Partnership, May 6, 2010.
[2] MIG Consulting Engineers "Shipping Route Assessment for Oversize Freight from Sarnia-Lambton", prepared for the Sarnia-Lambton Economic Partnership and the Sarnia Lambton Industrial Alliance, 2012.
[3] MIG Consulting Engineers "Oversize Load Corridor: Shipping Route Study", prepared for the Sarnia-Lambton Economic Partnership and the Sarnia Lambton Industrial Alliance, 2016.

The report will be used by the City of Sarnia, the County of Lambton and the Township of St. Clair to support applications for senior level government funding, and by the Sarnia Lambton Economic Partnership (SLEP) and Sarnia Lambton Industrial Alliance (SLIA) in further consideration of their support to the development of the corridor.

1.3 Methodology

The project was carried out in three broad phases as set out in Figure 1-1.

Figure 1-1: Project Structure



The study was developed using the following sources of information:

- Literature review of documents related to the movement of oversize freight (in Sarnia-Lambton and beyond) as well as reports on the Sarnia-Lambton manufacturing cluster. A list of documents reviewed is included in Appendix B.
- Desk-based research on potential markets identified by stakeholders as having the most potential for growth in exports of large fabricated units (largely online research, company websites, etc.).
- Consultations with local fabricators, industrial companies, and public sector authorities, as well as potential clients and industry experts who could shed light on opportunities outside of Sarnia-Lambton. (Consulted stakeholders are listed in Appendix C)

1.4 Limitations

The information received from local stakeholders, particularly local area fabricators, was invaluable in preparing the report. To protect the confidentiality of the information provided, we have aggregated most of the findings from consultations, with limited direct reference to individual stakeholders.

2 Oversize Product Shipping to/from Sarnia-Lambton

Key Chapter Takeaway

Moving oversize loads within and beyond Sarnia-Lambton involves extensive planning and permitting, with the level of effort and cost varying according to the size of the load. The proposed corridor connecting with the Sarnia Harbour would provide fabricators with improved and less costly access to clients via marine transportation, though there would still be restrictions to reaching some markets for very large loads where significant road transportation is still required to connect to marine port facilities.

2.1 Overview of Oversize Product Movement in Sarnia

In this chapter, we describe current approaches and limitations to moving oversize freight, within and beyond the region. This provides context for further discussions regarding imports and exports of oversize freight to/from the region.

2.1.1 Definition of an Oversize Load in Ontario

The vast majority of "oversize" products currently moved within and beyond Sarnia-Lambton are done by road transport. A truck load is typically considered oversize once it reaches size limitations beyond which permitting is required to move on Ontario roads. This would apply to a load (including truck and trailer) that meets *any* of the following criteria:

- Over 8'6" (2.6 m) wide
- Over 13' (4 m) high (most 400 series highways in Ontario have 14'6" (4.4 m) clearance)
- More than 75' (23 m) long, or
- More than 63,600 kg (140,000 lbs) gross vehicle weight

The permitting process for movement of loads meeting this criteria varies significantly depending on the size of the freight. It is relatively simple to arrange permitting for loads which are moderately beyond any of these criteria. For example, moving a small oversize backhoe (12' wide x 14' high x 82' long; 3.7 m x 4.3 m x 25 m) could be moved on a regular basis with an "annual permit". It is also possible to move loads in Ontario up to 16' (4.9 m) wide with a private escort only (as opposed to police escorts, which adds significant cost) under an "annual permit".

However, the permitting process becomes much more onerous and costly for any freight move which hits the "superload" limit, defined as any load (including transport equipment) with the following criteria:

- Over 16'4" (5 m) wide
- Over 16' (4.9 m) high[4]
- More than 150' (45.7 m) long
- More than 120,000 kg (264,000 lbs) gross weight

Figure 2-1: Repairs to Hwy 402 Bridge from Oversize Vehicle

Source: SLEP, 2015

The total load size being planned for as a maximum for the Sarnia-Lambton oversize corridor, as established in the engineering study, is 30' wide x 30' high x 150' long (9 m x 9 m x 45.7 m). This would equate to a module or equipment size of 30' wide x 26' high x 100' long (9 m x 8 m x 3.1 m).[5]

2.1.2 Oversize Shipping witin Sarnia-Lambton

The majority of fabricators within Sarnia-Lambton are located within a 10 km radius from their clients in the region, with some as close as a couple of kilometres away. There are relatively few truly oversize moves in any given year, and there is no historical or typical oversize corridor within Sarnia-Lambton. Rather, for each individual load the company arranging the transportation will consider:

- The size of the module or item being moved
- The necessary equipment to move it (for example, flatbed truck, Self-Propelled Modular Transporter (SPMT), number of axles required, etc.)
- A route which avoids bridges, where possible (over 120,000kg or 264,000 lbs)
- A route which can accommodate the swing path / turning radius of the vehicle

Once a proposed route is established, a range of public authorities are then contacted for their consent, permitting, and approvals. These include:

- Ministry of Transportation Ontario (MTO) for road permits
- Municipalities across Sarnia-Lambton
- Bell Canada
- Cable TV companies (Cogeco)

[4] Over 16' high is not a superload but does begin to incur HydroOne costs.
[5] MIG Engineering Ltd, "Oversize Load Corridor: Shipping Route Study", August 2016.

- Hydro One
- Bluewater Power
- Street traffic light management entity
- Police escorts

Once consultation with the entities above has begun, there may then be additional requirements or changes to the proposed route, for example, if construction is taking place on the proposed route at the anticipated time of the move.

Making arrangements for these permits can take anywhere from a minimum of two weeks to six months or more. The figures below illustrate the scale and complexity of oversize moves.

Figure 2-2: Oversize Product Moves in Sarnia-Lambton

Source: Kel-Gor / SLEP (images 1,3,4) and blackburnnews.com – photo by Briana Carnegie – July 17, 2015, Image 2 (Alliance)

The most significant defining factor affecting the planning (and costs) of oversize loads in Sarnia-Lambton is the height of the loads. This is because wire lifting is required. Loads with a total vehicle height under 15' to 16' (4.6 m – 4.9 m) high do not typically need wire lifting in Sarnia-Lambton, but above that height, all of the utilities listed above would likely be involved (depending on the origin and destination).

In addition, the higher the load, the more cost and risk is involved. This is because as a load gets higher it will reach increasingly more and higher voltage power utility cables, with greater implications for the community. For example, for loads of over 22' to 24' (6.7 to 7.3 m) high,

customers in the region affected by the power lines may have to have their power cut off temporarily, which requires significant planning.

The maximum size load that can currently be moved out of Sarnia-Lambton is determined by a number of factors. For example, a load 25' (7.6 m) wide is possible if it is 60-80' (18- 24 m) long. However, if the same load is 140' (43 m) long it becomes much more difficult as the turning radius and clearances at the corners increase significantly. The specific route which is feasible will always depend on the size of the load and transporter required. For example, Mammoet, a hoisting and transport company, previously quoted a move between Sarnia Harbour and one of the major oil company facilities with loaded dimensions that were 25' wide x 28' high x 235' long (7.6m W x 8.5m H x 72 m L) (including transporter) and 950,000 lbs (430 tonnes) gross weight. In this case, they would have needed to deviate from a more obvious route to negotiate the corner of Exmouth and Murphy Street. As noted above, one of the main obstacles to any move is overall height and usually the maximum height is determined by either hard overhead obstacles (building or underpass) or power transmission lines.

2.1.3 Oversize Shipping Beyond Sarnia-Lambton

Oversize products have been shipped by truck beyond the Sarnia-Lambton region, but this is limited to smaller oversize loads, due to the complexities and size limits described above.

There have also been a number of oversize moves through the Sarnia Harbour, but these are only in the order of one load in and one load out per year, over the past ten years or so. The water-based moves starting on the St. Clair River are primarily destined to locations in the Great Lakes / St. Lawrence region in Canada and the US (not overseas to any significant extent). The costs of transporting goods to the port and making arrangements for a water-based move are too high in most cases to make such a move competitive. In rare cases, the refineries have used docks at their own sites to move products in, notably when they have constructed the refineries (decades ago).

Once on the water, there are theoretically no limits to where a vessel or barge can be moved on the Great Lakes, St. Lawrence, and beyond. However, there are still some limitations with respect to water-based transportation opportunities for oversize products to certain markets.

- **Thunder Bay to Alberta:** With an oversize corridor, very large equipment could be moved to the water from Sarnia Harbour to Thunder Bay. There is ample space and technical equipment to load and unload oversize products at the port of Thunder Bay. However, moving west by road from Thunder Bay also involves road restrictions. Until you reach the designated "High Load Corridor" in Alberta[6], which accommodates loads up to 29.5' (9 m) high, movements are generally limited to about 18'6' (5.6 m) high and 18' (5.5 m) wide. Saskatchewan has greatly improved their road allowances on a selection of main roads, and

[6] The High Load Corridor in Alberta consists of designated highways which have had overhead utility lines raised to accommodate loads up to 29.5' (9 metres) high. https://www.transportation.alberta.ca/3192.htm

in some instances they can accommodate slightly larger loads than even Alberta[7]. Manitoba has not improved any of its corridors recently to handle larger loads. Manitoba also employs a slightly different bridge modelling arrangement than most of the other provinces, so determining optimum axle configurations can be challenging for superloads. Clients in the petroleum sector in Alberta more often spec their requirements for larger modules, given their access to the High Load Corridor. As a result, while Sarnia-Lambton fabricators have and continue to serve clients in the oil sands, they are somewhat limited from bidding on contracts which request much larger modules or units. The fabricators still have to contend with building only as large as the most restrictive road corridor segment.

- **Duluth to Alberta:** Shipping through the Port of Duluth, MN, is also an option to reach Western Canada. However, there are also similar load size limitations with this route as with Thunder Bay. The Port of Duluth-Superior is located inside the city, limiting the loaded dimensions to 24' (7.3m) wide and 20' (6m) high and involving utilities, which significantly increases the cost of moving the load. There are also more political risks and potential for environmental blockades when shipping through the US.
- **South along Mississippi:** Transporting oversize products down the Mississippi River into the US is restricted by height. In particular, there is an old railway bridge in Lemont, Illinois (just south-west of Chicago), which has a height restriction of 19' (5.8 m) from the water level. To address this challenge, it is possible to ballast a barge down to its lowest allowable freeboard, or to transship from a deck barge to an open hopper barge (where the load sits on the bottom of the barge as opposed to on the top).

None of the restrictions above would be alleviated by development of the proposed oversize corridor in Sarnia-Lambton.

2.1.4 Costs of Oversize Shipping in Sarnia-Lambton

Oversize loads currently moving from fabricator sites to the Sarnia Harbour incur transportation costs in the range of $15,000 to $150,000 per move depending on the size of the piece of equipment. Weight and transporter configuration will be a major contributor to the range of costs. A move with loaded dimensions 20' H x 20' W x40' L (6m H x 6m W x 12m L) and 60 tonnes could be moved for $15,000. However, if the same size load was 160 tonnes it would climb into the $30,000 range. If it was 260 tonnes it would likely climb to the $100,000 range. Increasing the height to 28' (8.5m) for the last example could push the price into the $150,000 range (in large part because of the cost for utility cables to be moved).

Some of the factors behind the high costs include the following:

- **Lack of a fixed corridor.** There is no fixed oversize corridor in the region. As such, every time a move is required, planning processes must be repeated (MTO approval, structural engineering reports for bridges, permitting, etc.) and infrastructure adjustments carried out

[7] This has been done by the Saskatchewan government to enhance their own oil-related business opportunities and for future mining opportunities in the province.

(moving hydro lines, street lights, etc.). This results in significant bureaucracy, duplication of efforts for each move, and higher costs.

- **Uncertainty of costs.** As each move is slightly different (e.g. different vehicle height) utilities therefore provide a different quote for each move. Our consultations suggested that utilities do not provide a firm, fixed quote until the move has been completed (e.g. final price could go up or down significantly). This means that fabricators must choose whether to be conservative in their bids to clients and include the higher cost estimate (and risk losing the job), or provide a bid based on the lower end of the estimate and take a risk that they will have to pay more than planned for transportation if they win the job.

2.1.5 Proposed Oversize Corridor

The proposed oversize corridor for Sarnia-Lambton is designed to provide fabricators with more efficient and less costly access to the Sarnia Harbour, to enable them to ship their products to markets beyond the region. The corridor may also be used, and have benefits for, local companies importing oversize products (as discussed in Chapter 4).

The corridor route selected is described in a report by MIG Engineering[8]. The route was determined based on the following factors:

- Ability to provide heavy shipping access to all major local facility owners and fabrication stakeholders
- Route that would minimize required upgrades and repair costs
- Route that would minimize traffic disturbances and road closures

A map of the proposed corridor can be viewed in Appendix A.

[8] MIG Engineering, "Oversize Load Corridor: Shipping Route Study", August 2016.

3 Sarnia-Lambton Fabricators and Capacities

Key Chapter Takeaway

A highly capable group of mechanical fabricators has been serving the local petroleum-based industry in Sarnia-Lambton for decades. Fabrication of oversize modules is a relatively small part of their business, which also encompasses design, installation (on-site), and ongoing maintenance.

3.1 Overview of Existing Fabrication Industry

3.1.1 Consultation with Fabricators

In August 2016, members of our team visited Sarnia-Lambton to carry out consultations with large fabricators. The objective was to gather information to start our assessment of the likely economic impact (sales revenues) from establishment of the oversize corridor. To do this, fabricators were asked to provide:

- A qualitative overview of operations, capabilities, and any limitations
- A quantitative summary of existing operations (sales) related to the production of oversize modules and equipment
- An overview of current client base and approach to serving the same, and
- A perspective on the potential benefits or downsides of establishing an oversize corridor in Sarnia-Lambton.

The stakeholder questionnaire provided to fabricators ahead of the meetings is at Appendix D.

3.1.2 Overview of Fabrication Companies

Types of Oversize Products Being Manufactured

There are half a dozen or so mechanical fabricators in Sarnia-Lambton that have the capacity to produce oversize products, the largest ones being Alliance Fabricating, Anderson-Webb, Canadian Structural & Mechanical (CSM), Chemfab, Great Lakes Fabricating, Kel-Gor, and LamSar.[9]

[9] Many other small and medium size fabricators and machinists provide support and inputs for these larger producers, but they are not producing oversize pieces.

There are other major fabricators in Sarnia-Lambton that produce structural components and assemblies, some for mechanical / electrical modules both within the region and into the US. These fabricators also produce miscellaneous metals, such as stairs, handrails, platforms, mezzanines, and miscellaneous components for industries other than Oil and Gas. They include ANJ Industrial Fabricating, Lambton Metal Service, and ProMart Industrial Products.

There is some overlap in skills and production capacity. For example, some mechanical fabricators (e.g. CSM, KelGor) have the ability for mechanical and structural work, while some companies strictly carry out structural and miscellaneous metals work (e.g. ANJ, ProMart).

The primary products produced are described below for context.

- **Mechanical modules** is the generic description given to the majority of modules required by the oil and gas and power sectors. A mechanical module is, simply put, a "unit" containing equipment (pumps, valves, compressors, vessels, etc.) and piping, instrumentation, lifting / transporting pads, and padeyes, of a prescribed size. These units are generally encompassed within a rectangular frame of structural steel members that serve for positioning / transport framing, and protection of the internal "mechanical" components. The size of modules is almost always dictated by the client and based on the available site "footprint" size.
- **Modular assemblies** are component pieces of a unit (for example, control buildings for power substations). These are often constructed in large "sub-assemblies" with all of the necessary framing to accept the designated switch panels, cable tray, etc. These "sub-assemblies" are transported to the field site where they are assembled into the final "Control Building". This process aides in transport as these units are often in remote areas. Modular assembly production is more efficient than "stick-building" on site (where many small components are assembled), however not as efficient as completed modules.
- **Pressure vessels** are containers often cylindrical in shape, designed to hold gases or liquids, at a pressure substantially different than ambient pressure. Typically they are constructed from superior materials that are substantially heavier (than those required to construct a storage vessel of the same size). Pressure vessel fabrication and testing is regulated by engineering authorities (e.g. American Society of Mechanical Engineers - ASME) and backed up by legislation (Technical Standards & Safety Authority (TSSA), Alberta Boilers Safety Association (ABSA), and others).
- **Boilers** consist of a closed vessel, in which water or other fluid is heated. These units often look like pressure vessels, cylindrical. Boilers however, have internal piping called "tubes". This makes boilers considerably heavier, and more complex to construct than a conventional pressure vessel of the same size. Boilers are also regulated by provincial authority (TSSA in Ontario), and ASME Boiler and Pressure Vessel Code (BPVC).
- **Piping modules** are units, often rectangular in shape, that primarily contain piping. For example, manifold piping modules often contain one very large pipe running the long axis of the module. Smaller diameter pipes are attached to the large pipe (perpendicular) and routed to various coordinates within the module to match site hook-up coordinates. These

smaller pipes may be used to channel the final product to different units or to inject an additive into the primary product.

- **Heat exchanger** is simply a device that transfers heat from one or more fluids. Heat exchangers in general are cylindrical in shape, made from materials such as carbon steel, or special alloys, depending on the service conditions. Heat exchangers have an outer "shell" similar to a pressure vessel, and internal "tube bundle/s".

Level of Specialization Across Fabricators

As noted above, there is overlap in production expertise and strong competition among the fabrication companies, with most of the large fabricators producing (or very able to produce) many of the products described above. That being said, the fabricators are to some extent limited by what they are certified to produce. For example, modules destined for the oil and gas sector fall under very strict regulatory scrutiny (TSSA in Ontario, ABSA in Alberta), ASME for pressure vessels, etc. Only a limited number of fabricators produce heat exchangers and pressure vessels, although the majority have the ability and technology to do so.

The level of industry knowledge, technology and equipment present in each facility varies. Generally speaking, however, the knowledge, technology and equipment in Sarnia-Lambton results in outputs that are comparable or better than the majority of industry facilities that fabricators could be competing against in the oil and gas sector. This is not to say that the upgrading or replacement of some equipment might not be required at a later date should order size and/or order type dictate. But presently, there are no obvious equipment or technological shortfalls that will impede Sarnia-Lambton fabricators when competing with other Canadian or international fabrication companies. In particular, the current level of automation and technology is not expected to affect the types of opportunities that become available as a result of any oversize corridor.

Size of Oversize Modules

There is no 'standard' size for an oversize module. The fabricators produce as large or as small a unit as their clients demand, restricted only by their ability to transport the product from their shop to the client (either fully fabricated and ready for installation, or in very large parts, to be installed on site). The only significant restrictions regarding size are related to transportation of the piece to the client site (as discussed in the previous Chapter).

Fabricators have the technical capacity and physical space to produce much larger and heavier units but they do not currently do so. As noted below, this is partly as a result of the fact that their primary market is located very nearby, where it is often more economical to ship a few moderately sized parts to the client site nearby and assemble them on-site, than to try and move a much larger final product by truck. It is also because of the limits to transporting products economically out of the region, given the costs of arranging such moves within existing road and port infrastructure restrictions.

3.1.3 Typical Business Model for Fabricators in Sarnia-Lambton

Diverse Revenue Sources

Most fabricators earn their revenues from a range of services comprising fabrication, specialised construction, installation, and ongoing support to clients (on-site). The latter is particularly relevant when there is a major "turnaround" at one or more of the refineries, where operations are temporarily shut-down for regular / scheduled maintenance and a large number of skilled workers are required on site round the clock to maintain or upgrade some of the facilities.

Overall, the fabrication of oversize modules is actually a relatively small part of the business of most fabricators in the region, with much of their product "stick built" (where a unit is built – one piece at a time – on client site).

Client Markets

The majority of production (overall) for the fabricators is destined to the local oil / petrochemicals industry. For a couple of the larger or more specialised firms, approximately 50% or more leave Sarnia-Lambton by road, though this is typically only slightly oversize, given existing road permitting requirements. For the majority of the firms, more than 80% (in some cases over 95%) of their outputs are destined to locations within Sarnia-Lambton.

Most of the fabricators interviewed are companies that have been active in the area for decades, and in some cases generations. Until recent years, they have had no need or desire to explore markets or opportunities outside Sarnia-Lambton (and some do not have the mindset to do so either). By way of exception, the majority of local fabricators have historically performed work at the Imperial Oil, Nanticoke, Ontario facility (approximately 250 km east of Sarnia), including during turnarounds. This is the result of their relationship with Imperial Oil Limited, Sarnia.

With the downturn in the oil and gas sector nationally and internationally, as well as the steady state (limited anticipated growth) among existing refineries in Sarnia-Lambton, some fabricators have begun exploring, and exploiting "offshore" markets. This effort has achieved some positive results, though limited with respect to oversize products.

Physical Capacity

Fabricators are not limited in their physical or technological capacity to make larger pieces. However, they have limited production of these units because:

- They cannot physically (and economically) move the larger units out anywhere over long distance (truck and/or water); and
- They have the option of stick-building for their local clients and shipping, say, four smaller loads on a flatbed truck to assemble them 2 km down the road, rather than building one large unit and requiring significant transportation costs and permitting time to make this an oversize move.

That being said, the utilization of "offsite assembled" modules (large modules assembled entirely at the fabricator site) has significant benefits over on-site "stick building". It allows components to be assembled, in a controlled environment, with a trained shop fabrication crew. Perhaps the biggest benefit is the potential schedule savings realized from parallel construction activities made possible by offsite fabrication. The majority of these modules may have testing performed prior to arrival on site. Once in position in the facility, they then only require "hook-up" to the adjacent components and power source (as needed).

For this reason, having an oversize corridor in Sarnia-Lambton would likely lead to benefits even for very local moves, by enabling economical transportation of more "offsite assembled" modules, relative to stick-building.

3.1.4 Summary of Fabricator Position

In summary, our consultations with fabricators in the area indicated the following:

- Fabricators are not limited in their physical space for production expansion, should the need arise. Many have recently upgraded their facilities or have the physical space to upgrade should market demand increase to the level that additional investments are required.
- Fabricators have "world class" quality outputs based on good/excellent technology combined with excellent skilled labour. The level of industry knowledge, technology, and equipment present in each facility varies, however, it is comparable with the majority of industry facilities they could be competing against. Moreover, the current level of automation and technology is not expected to affect opportunities that become available as a result of any oversize corridor.
- There is currently ample labour available to increase production of fabricated oversize products, should the market demand it. That being said, it was also recognized that there will always be peaks and troughs in work demands for Sarnia-Lambton fabricators, where labour supply is tight (e.g. when there are turnarounds at oil refineries in the region).

As assessment of potential new markets for Sarnia-Lambton fabricators to compete in, as well as an assessment of their capability to serve these markets, is included in Chapter 5.

4 Local Users of Oversize Freight

Key Chapter Takeaway

Consultation with existing Sarnia-based industries that purchase oversize freight have indicated that the development of a corridor will not trigger any expansions that are not already being planned. The consultations also indicate that the sourcing of oversize freight by these industries is unlikely to shift from local fabricators to regional or international firms due to the development of the oversize corridor. Users of oversize freight already look outside the Sarnia-Lambton for oversize specialized equipment and still select local fabricators.

Establishment of an oversize corridor may provide an incentive to new industries that require oversize products as inputs to locate in Sarnia, though it is not possible to say whether the existence of an oversize corridor would be a *defining* factor in any investment decision.

4.1 Local Users of Oversize Freight

The project team identified local industries that purchase oversize freight to define how they might use the proposed oversize corridor to import products from beyond the region, and the impacts the corridor might have on their business.

4.1.1 Approach to Consultations

Consultations with local users of oversize freight focused on the following topics:

- **Current impediments to getting oversize freight –** Define whether the lack of an oversize corridor has limited the company's ability to obtain required oversize freight. This question covered both infrastructure impediments, namely the inability for an oversize load to get to the facility, and transportation costs.
- **Impact of the oversize corridor and port enhancements –** Define whether the oversize corridor and port improvements would lead to an expansion of the company's operations in Sarnia-Lambton.
- **Oversize freight sourcing decisions –** Define whether the oversize corridor and accompanying port improvements are expected to change oversize freight sourcing. Questions on this topic helped define whether the corridor and port enhancements could lead to greater competition between local fabricators and fabricators outside Sarnia-Lambton.

4.1.2 Consultation Findings

The project team consulted with BioAmber, Imperial Oil, NOVA Chemicals, Suncor, TransAlta, Ubiquity Solar, and CF Industries to discuss impacts of the proposed oversize corridor and port expansion. The following sections provide company background and synthesize the comments received during consultations.

BioAmber

BioAmber opened its succinic acid production facility in 2015. BioAmber has not needed oversize equipment since the opening of the facility, so their ability to comment on their future use of the proposed corridor is limited.

The existing facility is a proto-type 30,000 tonne production facility. BioAmber is considering developing a larger 200,000 tonne facility, which may be located in Sarnia, Louisiana or Iowa. It was indicated by BioAmber that is too early in the process to determine if they might use the port or corridor.

Imperial Oil

Imperial Oil produces petroleum products and petrochemical products in Sarnia. Imperial Oil has no immediate plans to use the proposed oversize corridor, but is generally in support of the project. Imperial Oil has historically been able to obtain the oversize equipment as needed and does not expect the corridor and port enhancements to change the sourcing of oversize equipment in the future.

Imperial Oil has used local fabricators for their most recent projects. The company explored sourcing from outside Sarnia-Lambton, but ultimately sourced oversize equipment locally. Sourcing is driven by schedule, quality, and cost. In the last five years, the availability of local fabricators to produce the required equipment and the relatively weak Canadian dollar have also aided in competitiveness. Imperial Oil does not expect to expand operations as a result of the oversize corridor, but they would use the Sarnia Harbour if they needed to bring in oversize equipment via waterway.

Suncor

Suncor operates a refinery and ethanol plant in the Sarnia-Lambton. Suncor has their own dock that they have used to bring in oversize equipment, though not in recent years. Suncor used their dock for bringing in products for their 2005/2006 Genesis project. Since the Genesis project, Suncor has not needed to offload oversize equipment. The Suncor dock is not ideal for bringing in oversize products, but is sufficient for one-off projects. Suncor does not have any planned expansions scheduled.

Overall, the oversize corridor and port expansion only provides value to Suncor as an option for the future. Suncor voiced their support of the project as it will enable local fabricators to export their goods (and maintain a strong industry presence).

TransAlta

TransAlta operates a 500 megawatt cogeneration plant. The company does not typically import oversize products, but did so in 2000 and 2002. TransAlta is in favour of the corridor because it will enable local fabricators and encourage general economic development. TransAlta has access to an existing dock, but it is currently not set up for handling oversize equipment. Historically TransAlta has been able to get the equipment needed without an oversize corridor. They do not expect to use the oversize corridor and dock, but see it as a potential promotional option that may be valuable to future tenants of the Bluewater Energy Park.

Ubiquity Solar

Ubiquity Solar is currently in the fundraising stage to develop a solar cell manufacturing plant located at the TransAlta Bluewater Energy Park. The initial build would be a demonstration site, with final plans including a larger plant. Ubiquity Solar plans on sourcing locally, regionally and internationally driven by cost. The project is in its early stages, so there is uncertainty regarding the impediments to getting oversize equipment. Ubiquity Solar would like to use the dock on the TransAlta site as the first option for bringing in oversize equipment from outside the region, but they see the benefit of having a second option from the Sarnia Harbour. Ultimately, Ubiquity Solar sees the proposed corridor and port enhancements as a net benefit to local fabricators.

CF Industries

CF Industries does not have immediate needs for the oversize corridor and port enhancements. They do not see the corridor and port enhancements changing the sourcing of oversize equipment in the future. CF Industries generally supports the project and sees it benefitting local fabricators.

NOVA Chemicals

NOVA Chemicals produces petrochemical products. According to our consultation with NOVA Chemicals, existing infrastructure has not hindered NOVA from expanding operations in the past. The transportation costs of moving oversize equipment have not been high enough to stop expansion. The development of an oversize corridor and port enhancement could change the source of oversize goods, but NOVA believes the project will be a net benefit to local fabricators. NOVA cited non-price factors, such as knowledge of NOVA's equipment, how they do business, and the strong local labour force available to provide maintenance support, as reasons that local fabricators are competitive.

NOVA has a potential $2.5 billion project for a new polyethylene plant in Sarnia, and expansion of the existing cracker facility scheduled to start in the middle of 2017 and end by 2021. The local fabricators would very likely be engaged to work on the project, though it is unlikely that they will have enough capacity to absorb all aspects of the expansion. As such, imports from beyond the region will be required. The lead time needed for construction of the corridor may result in minimum immediate benefit to the NOVA scheduled expansion (e.g. major imports of oversize product will likely be required before the corridor is complete).

NOVA views the corridor as a net benefit to fabricators. It sees the potential increase in exports from local fabricators as a benefit to their future business. NOVA supports local exports because

it will lead to a steadier stream of business for fabricators, which in turn will aid in retention of the fabricator labour pool in Sarnia-Lambton and potentially increase local capacity. Local capacity is currently limited when a large project occurs (new build or turnarounds), requiring a company to source products and labour from outside the region. It is possible that local fabricators might be able to undertake a larger proportion of expansion projects following the growth and expansion from fulfilling export demand.

4.1.3 Summary Impact on Local Industry Users of Oversize Freight

As summary of the takeaways from consultations with industry are as follows:

- The lack of a corridor has not limited Sarnia-Lambton users of oversize equipment ability to expand operations. Additionally, those consulted suggested that the development of a corridor will not trigger expansions that are not already being planned. Users expect some transportation cost savings after the corridor is constructed and are in support of the project.
- The establishment of the corridor may have a positive impact attracting companies that require oversize inputs that are considering investment in Sarnia-Lambton. For example, TransAlta views the corridor as a potential selling point to companies looking to locate their activities at the Bluewater Energy Park. Bluewater Energy Park also offers cheaper "behind the fence" electricity pricing (without delivery charges) which would represent a significant savings to industries that locate there. Indeed, research suggests that a critical factor in assessing investment decisions in the sector also include the costs of power, which are typically much higher in Ontario (relative to competing jurisdictions)[10].
- Overall, it is not clear that the existence of an oversize corridor would be the single a defining factor in any investment decision; many other factors are at play (e.g. electricity costs). Transportation costs can in some cases be a relatively small component of a major investment project (e.g. the proposed $2.5 billion NOVA expansion project).
- The sourcing of oversize freight by local industries is unlikely to shift from local fabricators to regional or international firms due to the development of the oversize corridor and port enhancements. Multiple consultations suggested that users of oversize freight already look outside Sarnia-Lambton for oversize specialized equipment and still select local fabricators, in part due to their local knowledge and ability to provide ongoing maintenance support.
- If construction of the oversize corridor proceeds, decision makers should identify ongoing and upcoming expansion projects to ensure construction is not hindering these projects and identify opportunities for the project to eliminate impediments affecting ongoing or upcoming projects. The NOVA chemical polyethylene expansion is an example of a project that could be ongoing during the construction phase of the oversize corridor. There may be an opportunity to prioritize the removal of costly impediments affecting the NOVA project in order to maximize the benefit the corridor confers to the region.

[10] Canadian Energy Research Institute "Competitive Analysis of the Canadian Petrochemicals Sector", Study No. 160, October 2016.

5 Potential Markets for Sarnia-Lambton Fabricators

Key Chapter Takeaway

The markets with the greatest increased potential – as a result of the oversize corridor – are likely to remain the petroleum and petrochemicals sector. The opportunities will be highest for clients located near a marine port or terminal facility, where the benefits of building large modules for the oversize corridor could be maximized. Geographically, the potential appears strongest in Atlantic Canada, with moderate opportunity in the US (LNG export facilities), Western Canada, Mexico, and the Middle East. There are also opportunities in Western Canada (Alberta), though inland transportation restrictions would still prevent maximization of module or equipment size.

5.1 Approach

5.1.1 Approach to Identifying Markets

This Chapter reviews and comments on the potential markets that could be served as a result of the oversize corridor. The identification of potential opportunities for Sarnia-Lambton fabricators was based on a "market" defined by three dimensions:

- Types of oversize products fabricated in Sarnia-Lambton
- Industries currently or potentially requiring these types of oversize products
- Markets which are geographically located in areas where Sarnia-Lambton fabricators are currently able to compete or likely to be able to compete in future (once a corridor is established).

With respect to the last point above, geographical limits cover opportunities that are physically located within a reasonable distance such that Sarnia-Lambton fabricators could potentially have an advantage based on schedule, and where they are not in close proximity to much cheaper competitors (e.g. producers in India, Malaysia, China, etc.). Most of the opportunities described later in this chapter are in North America for these reasons. In addition, the clients in North America demand equipment that meets standards which Sarnia Lambton fabricators can

currently build to (e.g. ASME, API, TSSA, ABSA, etc.), which further bolsters the opportunities in this region.

The analysis also focuses on clients / projects that are either located on or very near the water, or if located inland, have access to an oversize corridor. This is because this study is focused on assessing the benefits of moving *oversize* loads through a corridor, not simply looking at any industry demanding fabricated products. To clarify, Sarnia-Lambton fabricators can already compete in markets for normal size loads; whether or not they choose to is not the focus of this study.

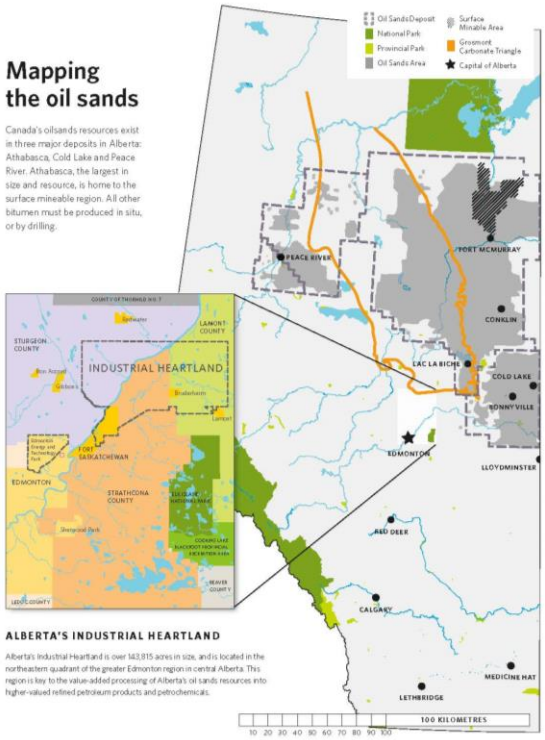
Potential markets analysed in the remainder of this chapter include:

Oil & Gas Sector	Other Sectors
• Western Canada: Inland Oil and Gas • Atlantic Canada: Oil and Gas • United States: Oil and Gas • Mexico: Oil and Gas • Cuba • Middle East • Canada West Coast: oil and LNG export	• Biochemicals • Government of Canada Shipbuilding • Water and Wastewater • Power Generation • Mining • Pulp and Paper • Food and Beverage Processing

5.2 Western Canada: Inland Oil and Gas

Canada, with 173 billion barrels of oil reserves, is the third largest oil producer in the world, following Saudi Arabia and Venezuela. About 98 percent (170 billion barrels) of Canada's oil reserves are located in Alberta, making Western Canada a critical market for fabricators in Sarnia-Lambton.[11]

Figure 5-1: Location of Alberta Oil Sands



Source: Alberta Oil Sands Industry Quarterly Update, Spring 2016

5.2.1 Current / Anticipated Sourcing Pattern for Oversize Freight

The majority of the oil reserves located in Alberta are recovered from bitumen deposits, which have higher recovery costs than traditional oil wells. These high costs, and the recent low price of oil, have slowed the expansion of the oil and gas industry in Alberta, increasing the uncertainty in estimating the size of the potential market for supplying oversize goods in the near-term. It is likely that projects currently under construction will be completed, but new projects will be deferred or cancelled (a list of oil and gas sector projects under consideration in Alberta is provided at Appendix E). An example of this slowdown in capital expenditure can be seen in the Canadian Association of Petroleum Producers' forecasting of a 62% drop in capital expenditure in 2016 ($31 billion) compared to 2014 ($81 billion).[12] Capital expenditure is not expected to recover before 2020.[13]

While there is short-term uncertainty regarding the level of future investment in the Alberta oil sands, the region still remains a good potential market for Sarnia-Lambton fabricators and should be tracked. As shown in Figure 5-2, a 2012 study of the economic impact of oil sands investment (capital expenditure on new project, maintenance, repairs, and replacement) by the Conference Board of Canada determined 27% of employment associated with providing goods and services in support of expenditures in the Alberta oil sands between 2012 and 2035 went to the producers of imported goods. Additionally, 91% of the value of these imports were

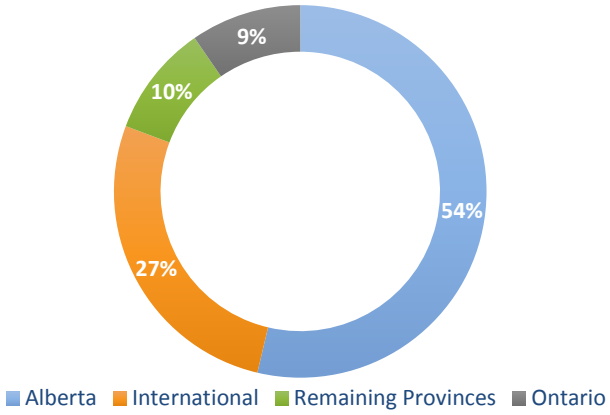
[11] http://www.albertacanada.com/files/albertacanada/AOSID_QuarterlyUpdate_Spring2016.pdf

[12] http://www.capp.ca/media/news-releases/capital-investment-in-canada-oil-and-gas-industry-down-62-per-cent-in-2-years

[13] http://www.careersinoilandgas.com/media/243763/oil_sands_outlook_online.pdf

manufactured goods, including machinery, primary metals, transportation equipment, and fabricated metal products.[14]

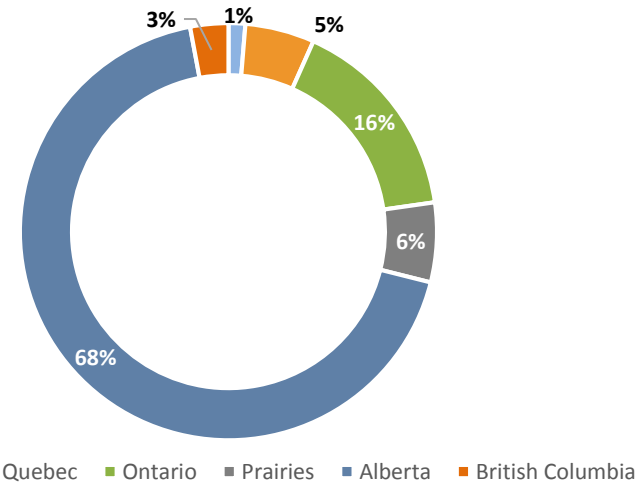
Figure 5-2: Distribution of Employment from the Supply Chain Effects of the Oil Sands



Source: CPCS Analysis of *Fuel for Thought: The Economic Benefits of Oil Sands Investment for Canada's Regions*

As shown in Figure 5-3, Ontario is the second largest Canadian recipient of employment in the fabricated metal manufacturing industry, relating specifically to projects in the Alberta oil sands.[15] Though Ontario has supplied the oil sands in the past, it does not guarantee future work. Furthermore, not all of the fabricated metal manufacturing will be oversize or of the technical nature that Sarnia-Lambton fabricators specialize in.

Figure 5-3: Proportion of Canadian Employment from the Supply Chain Effects of Fabricated Metal Products Manufacturing



Source: CPCS Analysis of *Fuel for Thought: The Economic Benefits of Oil Sands Investment for Canada's Regions*

[14] https://www.albertacanada.com/files/albertacanada/AIS_FuelforThought.pdf

[15] The fabricated metal manufacturing industry includes machine shops; metal tanks; coating, engraving, heat treating and allied activities; ornamental and architectural metal products; all other plate work; and fabricated structural products.

In addition to the potential illustrated above from oil sands projects, there is associated potential for growth in the petrochemicals sector in Alberta, thanks in part to Government support to this subsector. In particular, the Government of Alberta recently announced (February 2016) a Petrochemicals Diversification Program which will provide $500 million in royalty credits awarded to up to three new petrochemical facilities. The credits can be traded to an oil or natural gas producer, facilitating an agreement for reduced feedstock costs for the petrochemical producer in return for reduced royalty payments from the oil or natural gas producer. The focus of the program is investments in methane and propane upgrading.[16]

Sources of Oversize Freight

The government of Alberta, energy, and engineering companies estimate that 50% to 70% of equipment used in maintenance, repair, and overhaul projects is imported. A 2015 study conducted for the Canadian Transportation Act Review defined the following ports as sources of oversize modules destined for Western Canada[17]:

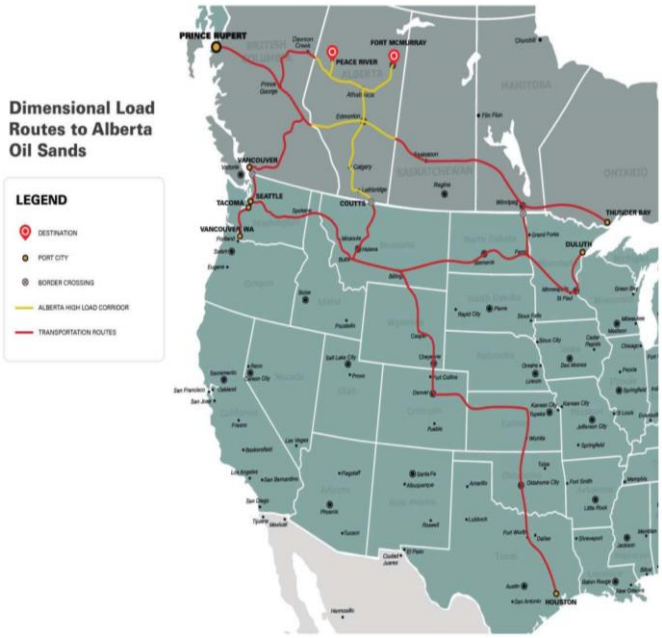
- Vancouver, British Columbia
- Prince Rupert, British Columbia
- Thunder Bay, Ontario
- Seattle, Tacoma, Washington
- Vancouver, Washington
- Houston, Texas

The Port of Houston in Texas serves as a major hub of international oversize freight destined for Western Canada. While there is not a High Load Corridor in the United States, the Great Plains states along the corridor from Texas to Alberta are less densely populated, which reduces impediments to large oversize freight. Figure 5-4 displays the location of ports of entry and the routes used to reach the Alberta Oil sands.

[16] Canadian Energy Research Institute "Competitive Analysis of the Canadian Petrochemicals Sector", Study No. 160, October 2016.

[17] Source: Van Horne Institute, PROLOG Canada, JRSB Logistics Consulting, "Over-dimensional Load – A Canadian Solution", July 2015.

Figure 5-4: Oil Sands Routes



Source: Van Horne Institute, PROLOG Canada, JRSB Logistics Consulting, "Over-dimensional Load – A Canadian Solution", July 2015.

Large oversize freight is permitted on a state-by-state and province-by-province basis. Additionally, oversize loads are limited by the corridors on which they travel. For example, Alberta has developed a High Load Corridor that can accommodate a load which is 23'8" (7m) wide and 29.5' (9m) high.[18] That said, the roads that lead to the High Load Corridor from the Great Lakes region have many more limitations (as described in Section 2.1.3).

5.2.2 Implications for Sarnia-area Fabricators

The Alberta oil sands offer considerable opportunities for companies in Sarnia-Lambton.

Fabricators in the region are more than technically capable of supplying the equipment required for operations in Alberta. Building the oversize corridor now (construction will take a few years) will ensure that Sarnia-Lambton fabricators can be ready to benefit from the rebound in the oil sector when it happens. President-elect Donald Trump also appears to strongly support approval of the Keystone XL pipeline, which could boost the oil and gas sector in Alberta.

That being said, there are still some limits to the benefits of the corridor overall. As shown in the corridor from Thunder Bay to Alberta, even if the oversize corridor is built in Sarnia-Lambton, there are restrictions on the movement of oversize loads from Thunder Bay to Western Canada. Therefore, while the proposed corridor would allow for a loaded size of 30' high and wide, such a load size could not be transported between Thunder Bay and Alberta. The difficulty with this restriction is that clients dictate the size of unit they require, which is dependent on the facility/purpose. In some cases, clients require modules larger than the above

[18] Over-dimensional Load – A Canadian Solution, 2015. The Van Horne Institute.

noted size criteria, leaving Sarnia-Lambton fabricators facing barriers even if the corridor is built. There may be scope to work with provincial governments to try and address this situation between Thunder Bay and Alberta. In particular, the Government of Ontario in its Budget 2016 committed to creating "Superload" corridors.[19] The federal government has also shown an interest in better understanding the issues associated with oversize transport in Canada; a research report on oversize loads in Canada was commissioned by the Canada Transportation Act Review committee in 2016[20].

Other challenges highlighted in previous studies in terms of accessing markets in Western Canada are a lack of local presence and engaging with oil sands firms.[21]

Relationship between Large and Small Fabrication Shops

Many of the major engineering, procurement, and construction (EPC) contractors have large fabrication shops located across Canada. For example, AECON has fabrication shops in seven cities across the country. One might ask how can the smaller shops in Sarnia-Lambton possibly compete against them?

In some cases, these large EPC contractors and the relatively smaller fabrication companies in Sarnia-Lambton will compete directly on a single job. This would typically be for a smaller order. Sometimes the Sarnia-Lambton fabricators will be able to beat the larger fabrication shops on price, given they are leaner and have lower overheads. In other cases, particularly for larger orders, the big EPC companies will ask the Sarnia-Lambton fabricators to provide them with quotes for individual components or modules, which will then be included in the larger bid (e.g. sub-contracting).

The large companies often have huge fabrication shops to assist their "internal" projects, or execute very large projects like building "super modules". They will compete if capacity and commitments allow, but it is not their primary purpose.

It is also worth noting that the Sarnia-Lambton fabricators are not only well qualified, but they are very efficient. The companies in the region have been competing against each other for years and this has contributed to their efficiency.

The level of competition and collaboration between the large and small fabrication shops is also affected by the state of the oil and gas market at any given time. When things are slow (as is currently the case), many fabrication shops will be relatively quiet and companies will be hungrier for work and do more in-house. However when the industry returns to some form of "normal", it is expected that Sarnia-Lambton's lean and efficient approach will again enable them to "punch above their weight" in terms of the contracts they could secure.

[19] Ontario Budget 2016: Jobs for Today and Tomorrow, page 19. http://www.fin.gov.on.ca/en/budget/ontariobudgets/2016/papers_all.pdf

[20] Van Horne Institute, PROLOG Canada and JRSB Consulting Ltd, "Over-dimensional Loads – a Canadian Solution", July 2015.

[21] https://www.albertacanada.com/files/albertacanada/AIS_FuelforThought.pdf

Overall, the potential size of future investment, the impacts that the corridor could have on reducing transportation costs (for the smaller oversize loads which can fit through the western corridor), and the advantageous Canadian exchange rate could position Sarnia-Lambton fabricators to be greater recipients of future projects from the Alberta oil sands. Fabricators with existing relationships are best positioned to take advantage of increased competitiveness due to the corridor.

5.3 Atlantic Canada: Oil and Gas

5.3.1 Upstream Oil and Gas

Atlantic Canada is currently home to the offshore oil and gas industry in Canada. Cumulative expenditures by the Atlantic Canadian offshore industry since 1996 total more than $39 billion. In 2014, the oil and natural gas industry paid more than $2 billion in royalties to the governments of Newfoundland and Labrador (NL) and Nova Scotia. The industry supports more than 800 supply and service companies.[22]

Newfoundland and Labrador (Upstream)

The first offshore oil wells in NL were drilled in the early 1960s, however nothing significant was found until 1979 when the Hibernia field was discovered. Many obstacles had to be overcome before first oil could be produced in 1997 when the Hibernia platform was positioned and started production. Since then, three projects have come online and each has brought opportunities for the province and Canada as a whole. The offshore projects in NL are:

- Hibernia platform gravity base offshore installation
- Two Floating Production, Storage and Off-loading vessels (FPSOs): Sea Rose and Terra Nova
- Hebron gravity base structure (under development - which is approximately 80% complete)

To date, more than 3 billion barrels of oil have been discovered offshore NL and the province estimates more than 6 billion barrels of oil are still undiscovered. In terms of natural gas, 11 trillion cubic feet of natural gas have been discovered to date, with another 60 trillion cubic feet of natural gas estimated to be undiscovered.[23]

Nova Scotia (Upstream)

Canada's first offshore project, Cohasset-Panuke, commenced oil production in 1992 and ceased production in December 1999. It produced more than 44 million barrels of crude, was a significant contributor to the Nova Scotia and Atlantic Canadian economies, and helped to build offshore oil infrastructure on Canada's East Coast.

[22] www.capp.ca and www.Atlanticcanadaoffshore.ca
[23] www.capp.ca

There are currently two producing offshore natural gas fields in Nova Scotia: the Sable Offshore Energy Project (3 platforms, North Triumph, Tibeau, and Venture) and Deep Panuke.

The province of Nova Scotia estimates there is 120 trillion cubic feet of natural gas offshore resource potential and 8 billion barrels of oil in resource potential.[24]

5.3.2 Implications for Sarnia-Lambton Fabricators in Upstream Oil and Gas

All of the above noted installations in Atlantic Canada require constant maintenance, and periodic shutdowns, for major maintenance and upgrading. Opportunities may exist prior to and during these outages for Sarnia-Lambton fabricators to construct modules, vessels, or other components for installation or use during these shutdowns.

Two major projects which may present further opportunities include:

- **West White Rose Extension – Husky Energy (NL)**. This project involves a "smaller" gravity base than the Hibernia platform, and will be the first offshore project to be constructed outside the Bull Arm fabrication facility. The facility construction is on hold until the price of oil and conditions within the industry rebound.
- **Goldboro LNG Terminal and Storage facility – Sable Energy (NS)** (see text box overleaf). We believe there are particularly good opportunities for Sarnia-Lambton fabricators to supply the Goldboro project. The facility is being developed water-side, meaning few restrictions (on the import side) in terms of the size of the products that can be shipped. This means that Sarnia-Lambton fabricators could build up to the maximum corridor size.

Generally speaking, offshore oil and gas development in and off Atlantic Canada is very young. Although these future projects are lucrative and create a huge boost to the local economy, they are few and far between (with an average time between mega-projects being 5 to 10 years.) That being said, for the foreseeable future, offshore oil and gas installations will continue to be constructed on the east coast to meet Canada's energy needs. Although there is no continuity in the construction of these platforms, they still create hundreds of excellent opportunities for qualified fabricators (mechanical and otherwise) such as those in Sarnia-Lambton.

These opportunities will become much more accessible when the oversize overweight corridor is complete and transport becomes more of a "port to port" exercise.

[24] www.capp.ca

Goldboro LNG Project

The Goldsboro liquefied natural gas (LNG) project is in development. It consists of an LNG processing facility, storage tanks and marine works, located in at the Goldsboro Industrial Park in Guysborough County, NS. The facility is adjacent to the Maritimes & Northeast Pipeline, a 1,400-kilometre transmission pipeline system built to transport natural gas between developments in Nova Scotia, Atlantic Canada and the northeastern United States. It is anticipated to produce approximately ten million metric tonnes of LNG per year and have on-site storage capacity of 690,000 cubic metres of LNG (three new Cryogenic tanks with a capacity of 230,000 Cubic Meters each). Once completed, it will be Eastern Canada's LNG export facility.

The project is being developed by Pieridae Energy (Canada) Limited, a Canadian infrastructure development company focused on LNG opportunities, at an approximate value of C$5 - $10 billion. Pieridae continues to meet major milestones for the project. Construction is expected to begin in 2017, with a workforce estimated in the 1,500 persons range during construction. Commercial operations are expected to start in 2019. There will be significant subcontractor and fabricator support requirements, including for construction of the three storage tanks, piping, and pipe racks.

CB&I UK is performing the front end engineering and design (FEED) engineering out of their office in London, England (design from the well head / platform to the beach). On completion of the terminal, storage tanks, pipe-racks, and other component pieces, the owners expect 7-13 vessel shipments per month to sail from Goldsboro.

We understand that some of the Sarnia-Lambton contractors are already aware of this opportunity.

Source: www.goldborolng.com and industry consultation

5.3.3 Downstream Oil and Gas

There are two downstream refinery complexes in Atlantic Canada:

- Irving Refining Limited, in Saint John, NB, is one of the largest refiners in Canada producing 300,000-320,000 barrels of product per day.
- North Atlantic Refining Limited (NARL), in Come by Chance, NL is a midsize refinery, producing in the range of 115,000 barrels of oil per day[25].

Both of these facilities require ongoing maintenance, equipment replacement and repair, scheduled and unscheduled turnarounds, and capital expansion and upgrades. Sarnia-Lambton fabricators are already competing in this market (e.g. they could theoretically already bid on jobs), but are not doing so to any great extent. Given their technology, workforce, and quality of product we believe that additional opportunities to serve this market competitively will arise thanks to transportation cost savings from the proposed oversize corridor. The reduction of the

[25] http://northatlantic.ca/our-company

freight cost (travelling through the city without complex load-out arrangements) as a result of the corridor will go a long way in helping them be competitive.

Refineries in Québec

There are two refineries in the province of Quebec: the Ultramar refinery in Levis and the Suncor refinery in Montreal. In theory, opening the corridor would also make Sarnia-Lambton fabricators more competitive to provide equipment to these refineries. In practice, penetrating the Quebec market is more complex than other parts of Canada. The requirements are slightly different, the Union system is more complex (with essentially one agreement covering more than a dozen building trades and others) and language barriers are a significant issue. In particular, it could be necessary to hire a bilingual supervisor for execution of installation for a fabricated piece, which would add additional cost to the project. In short, we do not believe the Quebec market would present the same opportunities as in Atlantic Canada.

5.4 United States: Oil and Gas

The recent exploitation of the Utica and Marcellus shale gas areas are a major driver of growth in the petroleum and petrochemicals sector in the US. This has implications for Sarnia-Lambton fabricators on a number of levels, both in terms of opportunities on the US North-East coast, as well as in the traditional petroleum hub of the Gulf Coast.

5.4.1 Utica and Marcellus Shale Areas

The Utica and Marcellus Shale areas are located in overlapping regions of the north-eastern US, covering large areas of Ohio, Pennsylvania, West Virginia, and New York[26]. Until the early 2000s, the areas had been known to contain natural gas but had not been extensively developed due to the great depth of the resources and the low permeability of the rock. This changed with the advent of horizontal drilling and hydraulic fracking technologies, which established the region as one of the world's largest natural gas fields under development. Production from the Marcellus and Utica shales of Pennsylvania, West Virginia, and Ohio has increased 17-fold in less than a decade, and was up to 22 billion cubic-feet/day in February 2016. Indeed, shale production out of the US in the past decade has been a major reason for the drop in natural gas prices worldwide, as a new source of production hit the markets.[27]

[26] The Utica Shale is located a few thousand feet below the Marcellus Shale.

[27] Gregory Meyer, Financial Times "US Gas: Global Market, Local Problems", September 26, 2016.

Figure 5-5: Marcellus Shale Play

JOHN SOPINSKI/THE GLOBE AND MAIL » SOURCE: U.S. ENERGY INFORMATION ADMINISTRATION

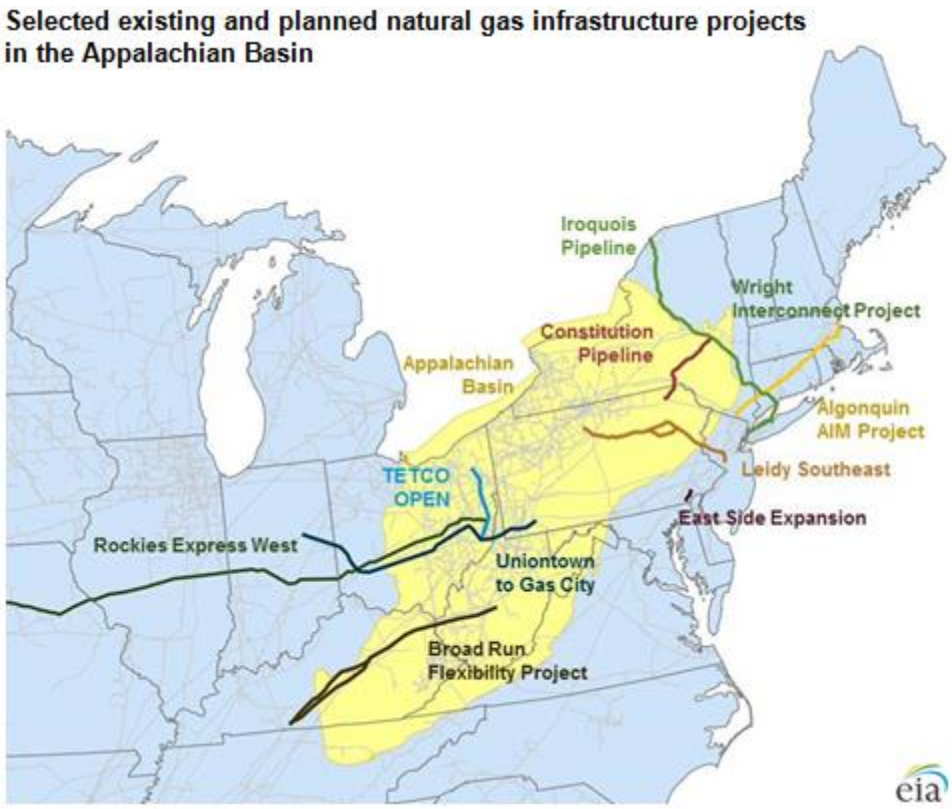
Low gas prices have slowed the natural gas fracking boom (22 rigs are drilling in Pennsylvania currently, down from 109 five year ago), though gas producers in the region are still producing huge volumes of natural gas.[28]

The growth in natural gas production has resulted in a major demand for two types of infrastructure: pipelines and LNG liquefaction.

Pipelines have historically run north to south in the US, though new natural gas pipeline projects have been proposed in recent years both down to the Gulf Coast and the US East Coast (see Figure 5-6).

[28] Gregory Meyer, Financial Times "US Gas: Global Market, Local Problems", September 26, 2016

Figure 5-6: Proposed Natural Gas Pipeline Projects



Source: http://www.oilandgas360.com/lng-update-u-s-export-terminals-and-infrastructure-in-the-works/ from EIA

New LNG (liquefaction) production and export facilities are expected to be largely concentrated on the Gulf Coast. Major LNG export terminals in development include:

- Sabine Pass LNG, Louisiana (first LNG shipment made in February 2016)
- Dominion Energy's Cove Point LNG terminal (Maryland)
- Corpus Christi LNG (Texas)
- Cameron LNG (Louisiana)
- Freeport LNG (Texas)

Some of these involve conversion of existing import terminals into export terminals.

Procurement Approach

The price of gas will have to recover for some of the proposed investment projects to move ahead, but it is expected that the natural gas boom in the US will continue for many years to come. It is difficult to say with any certainty which, and when, various pipeline and LNG export facilities will be approved and come online. In particular, there is strong resistance in the US north east to development of gas pipelines which has delayed development of additional pipelines.[29]

[29] Gregory Meyer, Financial Times "US Gas: Global Market, Local Problems", September 26, 2016

For projects that do proceed, the procurement approach for new construction is expected to follow a similar approach to existing petroleum facilities. That is, major oil and gas companies will procure EPC contractors who would then sub-contract components as required to specialised firms, including for fabrication.

5.4.2 US Gulf Coast

The Gulf of Mexico area, both onshore and offshore, is one of the most important regions for energy resources and infrastructure in the US. Gulf of Mexico federal offshore oil production accounts for 17% of total US crude oil production and federal offshore natural gas production in the Gulf accounts for 5% of total US dry production. Even more relevant for Sarnia-Lambton fabricators, over 45% of total US petroleum refining capacity is located along the Gulf coast (Texas, Louisiana, Mississippi, Alabama), as well as 51% of total US natural gas processing plant capacity.[30] All major multinational oil companies are active along the Gulf Coast, with Houston being a major petroleum and petrochemicals hub.

5.4.3 Implications for Sarnia-Lambton Fabricators

The pipeline and LNG liquefaction projects will demand the kind of equipment that Sarnia-Lambton fabricators could provide, with varying degrees of opportunity.

LNG Export Facilities North East US

For new/re-configured LNG export facilities on the US North-East coast, Sarnia-Lambton fabricators may be more competitive, given the relative proximity to Sarnia-Lambton and higher labour cost in the US North-East states (e.g. with labour rates more comparable to Canada).

US Gulf Coast

Although present circumstance within the oil and gas industry are not “booming”, the oil and gas industry in the Gulf of Mexico is always busy and relatively short on fabricator capacity. For new LNG and other facilities on the Gulf Coast, it may be difficult for Sarnia-Lambton fabricators to compete, given the abundance of a local, highly skilled labour force located nearby, which commands lower wages. While the Canadian dollar is weak, Sarnia-Lambton fabricators may see some benefits. But this is a market that would likely only be competitive on the basis of schedule (if fabrication shops in the Gulf Coast region are busier than in Sarnia-Lambton, and if fabricators can produce on a timeline that local area fabricators cannot meet).

Pipeline and Inland Work

For future pipeline projects (and other LNG-related facilities inland), Sarnia-Lambton fabricators could compete, notably through production of compression stations and pumps for pipelines. However, the size of the corridor is not likely to be a huge defining factor for this market. As the pipeline projects would mostly be located inland, the market would still be limited to sized that can fit on existing roadways (e.g. under 16’ high, or face quickly incurring additional costs). This

[30] US Energy Information Administration, “Gulf of Mexico Fact Sheet”. http://www.eia.gov/special/gulf_of_mexico/

is a market that Sarnia-Lambton fabricators can already theoretically compete in, though they would become slightly more cost competitive with the opening up of the corridor.

Shell Petrochemicals Complex - Pennsylvania

In June 2016, Shell Chemical Appalachia announced the final investment decision to build a major petrochemicals complex, comprising an ethylene cracker with a polyethylene derivatives unit, near Pittsburgh, PA on the Ohio River. The complex will use ethane from shale gas producers in the Marcellus and Utica basins to produce up to 1.6 million tonnes of polyethylene per year.

The proposed facility is about 500 km away by road from Sarnia. The project is a good opportunity for Sarnia-area fabricators as they are very likely to have the capacity to produce inputs for the facility. That being said, the type and size of modules required will have an impact on competitiveness and decisions regarding routing (road vs. water).

Any modules moving by road from Sarnia-Lambton to the new Shell facility would have to fall into the small size category (12' W x12' H x50' L; 3.6m W x 3.6 m H x 15m L) due to road restrictions along the route. Such moves would be unlikely to benefit from the oversize corridor. If larger modules were required, these could be shipped by barge from Sarnia, transit via the Illinois River to the Mississippi River, and back up the Ohio River (significantly more time involved). There is a low bridge on the Illinois River which limits loaded barge height to 19' above water, so modules would be limited to around 16' high, but they could be significantly heavier, wider, and longer than units shipped by road. The modules could alternatively be transferred to hopper style barges near Chicago to go down the river which would allow taller units. However this increases costs significantly. Generally speaking, river transport can be a challenge as there are a whole new set of conditions to meet versus simply barging on the Great Lakes.

In brief, it is hard to tell what impact the corridor would have on the competitiveness of Sarnia-Lambton fabricators for the new Shell facility. If small modules (normal size loads) are required, the competitive landscape is unchanged from the present context. If larger modules are required, the oversize corridor would have an impact on lowering transportation costs with the water option.

Source: www.shell.com; industry consultation; and Canadian Energy Research Institute "Competitive Analysis of the Canadian Petrochemicals Sector", Study No. 160, October 2016.

Figure 5-7: Module Moved by Barge on River System from Goose Creek, SC to Monaca, PA

Source: Mammoet Transport.

5.5 Mexico: Oil and Gas

Mexico is currently the 11th largest crude oil producer in the world. In 2015, it produced 2.6 million barrels per day (mbpd). In comparison, Canada produced 4.4 mbpd. Since 1938, when the Mexican government nationalised (expropriated) all oil resources and facilities from formerly private hands, the sector has been run entirely by the state-owned company Petróleos Mexicanos (Pemex). Pemex controls all oil production, refining, and sale of gasoline across the country. Infrastructure in the sector comprises 6 refineries, 9 gas processing facilities, 3 petrochemicals complexes, and a pipeline network.

Figure 5-8: Key Oil and Gas Facilities

Source: www.pemex.com (Green = Refinery, Blue = Petrochemicals, Red = Gas processing centre)

The petroleum sector is critical to the Mexican economy. Pemex has historically been very heavily taxed (close to 100% tax), with their tax revenues accounting for about one third of the federal government's total tax revenues. The company has regularly operated at a loss as a result of this arrangement, and has subsequently failed to invest adequately in maintaining and upgrading existing petroleum and petro-chemical sector infrastructure facilities, let alone carrying out additional exploration (refinery utilization rates are below the 80% level, and the country imports large volumes of gasoline from the US).[31] This suggests that there is likely decades of re-building required which includes new vessels, exchangers, towers, modules, pipe-racks, tanks, etc.

Oil production has declined steadily for the past decade or so, from a high of 3.8 mbpd in 2004 to 2.6 mbpd in 2015. Proven oil reserves have also declined over time (in contrast to the US and

[31] OPEC World Oil Outlook 2015, p. 315.

Canada, for example), though recent discoveries of offshore oil and gas have renewed hope in the sector.

The energy sector in Mexico is undergoing major reforms, and Pemex is being re-structured. In 2014, the government signed into law energy reforms which ended Pemex's 75-year monopoly on oil and gas activities. The legislation enables some private sector participation in the oil and gas sector, including opening up the market for competitive tender by foreign firms for offshore exploration contracts (with production-sharing contracts).[32] The reforms were done in an effort to increase investment in oil and gas exploration, and addresses the need for major overhaul of how the sector is managed in order to encourage the upgrading of existing refinery and other processing facilities across the country.

As part of the energy sector reform, Pemex is in the process of implementing a major "fuel quality" project, which involves US$2.8 billion investment in increasing production of lower sulfur diesel at five of Mexico's refineries. Contracts awarded in recent years associated with this fuel quality project include:[33]

- Técnicas Reunidas EPC contract (US$500 million) for commissioning of three new refining units at the Lazaro Cardenas refinery
- ICA Fluor Daniel (US$737 million) for the Francisco Madero refinery
- Samsung Engineering Co. Ltd. (US$359 million) for the Antonio Amor refinery
- Foster Wheeler USA Corp. (US$584 million) for the Antonio Dovalí Jaime refinery
- ICA-Fluor Joint Venture for modernization and expansion of Miguel Hidalgo refinery in Tula.

All of these projects are multi-year undertakings, and a number are still in the early stages. There are additional refinery upgrade projects in various stages of planning, some of which are on hold for the time being, pending an increase in the price of oil.

Overall, the energy sector reforms have improved the outlook for the Mexican oil and gas sector, and should significantly increase the number of opportunities for foreign companies to become involved in the oil and gas sector across the country.

Based on consultation, following decades of under-investment, there is a major lack of any local capacity for fabrication of modules and other technical equipment required for the sector, and the market is ripe for entrants from outside of Mexico.

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[32] HART ENERGY E & P "Mexico: Land of Bidding Opportunity", May 1, 2015. http://www.epmag.com/mexico-land-bidding-opportunity-792711#p=full

[33] Oil & Gas Journal, "Pemex advances diesel program at Mexican refineries", September 15, 2014. http://www.ogj.com/articles/2014/09/pemex-advances-diesel-program-at-mexican-refineries.html, and Oil & Gas Journal, "Pemex lets contract for Tula refinery upgrade", November 13, 2015. http://www.ogj.com/articles/2015/11/pemex-lets-contract-for-tula-refinery-upgrade.html

5.5.1 Current / Anticipated Sourcing Pattern for Oversize Freight

Experience to date suggests that the procurement model used for Greenfield and upgrading investments in the petroleum sector will be similar to approaches used globally. Large EPC companies (Empresas ICA,[34] Fluor,[35] Foster Wheeler, Samsung Engineering, etc.) are being engaged by Pemex to carry out work in the sector. These companies then subcontract various components to specialised sub-contractors, including for fabrication.

Consultation suggests that an absolutely critical factor to securing any contracts or sub-contracts in Mexico (relative to Canada and the US) is establishment of local relationships. This does not necessarily mean that a Sarnia-Lambton fabricator needs to establish a shop in Mexico, but rather that use of a local, well-connected agent is essential to become known to the right companies and players.

5.5.2 Implications for Sarnia-Lambton Fabricators

There appears to be a significant demand for the types of products manufactured by Sarnia-Lambton companies in Mexico, though it is not possible to determine what proportion of future project needs will relate to oversize products specifically. Importantly, we understand there is very limited local fabrication capacity for supplying high-end products, most of which will therefore need to be sourced externally. This suggests that there is a large opportunity for Sarnia-Lambton fabricators, particularly taking into consideration some existing trade advantages between Canada and Mexico:

- Canada is part of NAFTA and would benefit from some of its advantages, including the right to bring Canadian-made equipment, materials, and services into the country tariff-free, as well as access to dispute resolution mechanisms.[36] Of course, these benefits extend to US competitors as well. It is also worth noting that the future of NAFTA under President Trump is unclear, though one could assume that trade relations between Canada and Mexico would remain strong.
- The relatively low Canadian dollar exchange rate makes nearby US fabricator products relatively more expensive.

There are risks to doing business in Mexico. Public sector corruption is a challenge. The country ranks 95th out of 168 countries globally in the Transparency International "Corruption

[34] Empresas ICA, S.A.B. de C.V. is Mexico's largest infrastructure company. ICA carries out large-scale civil and industrial construction projects and operates a portfolio of long-term assets, including airports, toll roads, water systems, and real estate. Founded in 1947, ICA is listed on the Mexican and New York Stock exchanges. www.ica.com.mx

[35] Fluor Corporation (NYSE:FLR) is a global engineering and construction firm that designs and builds complex infrastructure projects, including engineering, procurement, fabrication, construction, maintenance, and project management. For more than a century, Fluor has served clients in the energy, chemicals, government, industrial, infrastructure, mining, and power market sectors. www.fluor.com

[36] C. Sands and J. Barnett, "The Mexican Energy Opportunity for the Reluctant Amigo", Energy Magazine, Issue 2, 2016. www.energymag.ca

Perceptions Index", which ranks countries on perception of public sector corruption.[37] Security can also be a concern. There are options to address these risks, including Export Development Canada (EDC) Insurance that can also be used to mitigate financial risk when doing business with companies in countries such as Mexico.

Overall, we believe there is an opportunity worth exploring to supply fabricated pieces to major EPC contractors active in the country, without a major need for investment or physical presence in the country. What is critical, as noted above, is investment in developing the necessary relationships with locally-based agents and companies active in the sector to market the capacities of local area fabricators.[38] Developing such relationships will take time, and if Sarnia-Lambton fabricators wish to serve this market (for oversize products or otherwise), development of these relationships should start now (e.g. even before physical development of any oversize corridor).

5.6 Cuba: Oil and Gas

Over the course of our consultations, the potential for demand for fabricated products in the Cuban oil and gas sector was also mentioned. Cuba's current crude oil and associated natural gas production from onshore and shallow water coastal reservoirs is approximately 50,000 bpd of liquids and 20,000 bpd oil equivalent of natural gas.[39] The country is increasingly interested in offshore exploration, mostly across the Cuban shelf, located along the Northern region of the country.[40]

Cuba Petróleo Union (CUPET) is the state-owned oil company responsible for the country's oil and gas sector, including refining and distribution of petroleum products. A number of international companies are active in the country, including Canada's Sherritt International which produced about 20,000 barrels of oil per day in 2014 (the country's largest independent energy producer[41]).[42] CUPET is working on increasing their refining capacity and reworking currently suspended wells.

In November 2014, Cuba's Ministry of Foreign Trade and Investment announced 246 development projects for which it was seeking US$8 billion in foreign investment. Among the portfolio of projects, 86 are in the petroleum sector. The Government has specifically stated

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[37] Transportation International, 2015. www.transparency.org

[38] Pemex has an on-line supplier registration process, known as Pemex PASS, which may be one angle to starting to do business in the country (www.pemex.com/en/procurement/supplier_relationships/Paginas/pemex-pass.aspx). However, it would be insufficient and development of additional relationships would be required.

[39] US Geological Survey, "Recent Trends in Cuba's Mining and Petroleum Industries", April 2015.

[40] http://www.cubabusinessreport.com/interview-with-felix-chevalier-on-the-recent-houston-trade-mission-to-havana/ and http://www.usnews.com/news/articles/2016-03-21/obama-castro-call-for-trade-embargo-on-cuba-to-be-lifted

[41] US Geological Survey, "Recent Trends in Cuba's Mining and Petroleum Industries", April 2015.

[42] Cuba Business Report "The Oil and Gas Industry in Cuba", March 13, 2016. http://www.cubabusinessreport.com/the-oil-and-gas-industry-in-cuba/

that Cuba will remain a state-driven economy dominated by large public-sector owned companies and that most foreign ventures will retain a majority Cuban ownership. In the energy sector specifically, the country is offering joint ventures in petroleum extraction from onshore and offshore blocks, but has also reported that it hopes to increase the share of electricity produced by renewable sources (hydro, wind, solar) from 4% in 2014 to 24% by 2030.[43]

As of 2015, deep-water drilling by such foreign companies as Repsol S.A. of Spain and JSC Zarubezhneft of Russia has resulted in no discovery of commercial quantities of oil or gas.

5.6.1 Potential for Sarnia-Lambton Area Fabricators

In principle, there is an abundance of opportunity for further development of the oil and gas sector in Cuba, though it is difficult to determine the extent of the opportunity for Sarnia-Lambton fabricators at this stage. There are still risks to doing business in Cuba as it is a very different environment to most open market economies worldwide, with public-sector ownership (or majority ownership) still prevalent and a tightly controlled labour market. It is not clear what this relationship would mean for Sarnia-Lambton in terms of influence on procurement decisions, bearing in mind that Sarnia-Lambton fabricators would likely be subcontractors to larger engineering firms for any upgrading or new investment work. In principle, Canadian fabrication firms – relative to their US competitors in the Gulf Coast – would likely have a major advantage serving this market, at least until the US trade embargo is removed.[44]

Again, marketing efforts targeted at developing relationships on the ground would be critical to this success.

5.7 Middle East: Oil and Gas

Countries in the Middle East lead global production of petroleum products. Saudi Arabia is currently the world's largest single oil producer, with other low-cost producers in the region including Kuwait, the United Arab Emirates (UAE), Iraq, and Iran. While the Middle East has long dominated the world market for crude oil exports, the region has not until recently started to build up a significant refinery system. Some of the crude that is produced in the Middle East is shipped to refineries in Asia, Europe, and the US before being sold back to the Middle East in the form of gasoline, jet fuel, and petrochemicals products.[45]

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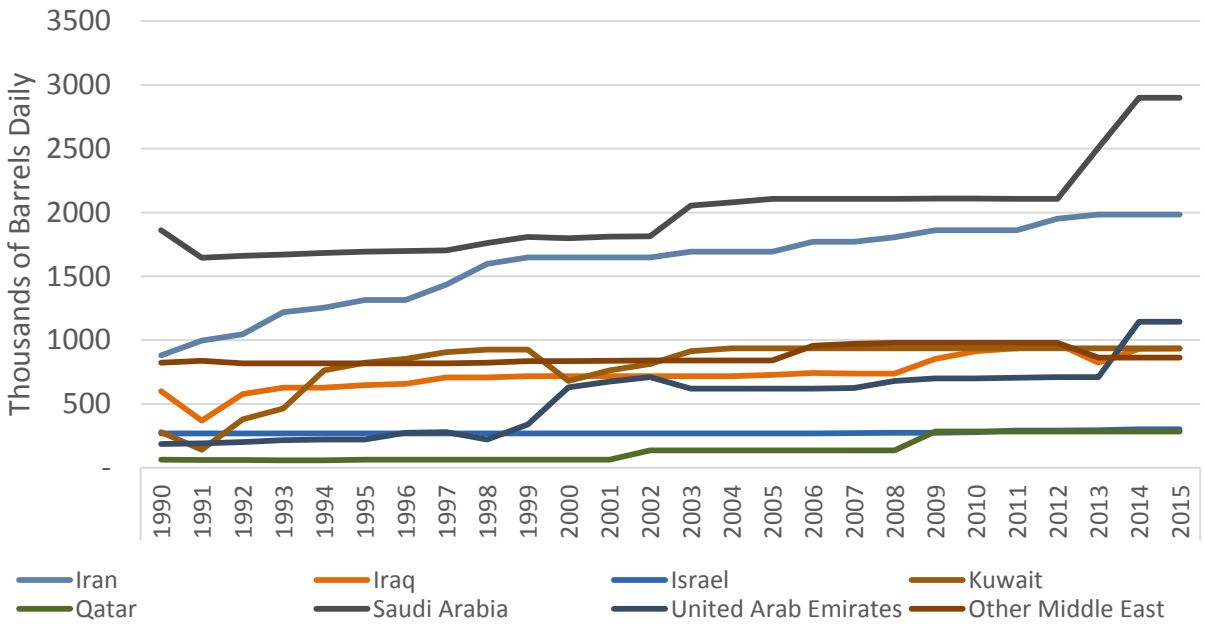
[43] US Geological Survey, "Recent Trends in Cuba's Mining and Petroleum Industries", April 2015.

[44] On January 15, 2015, the U.S. Departments of Commerce and the Treasury published regulatory amendments to the Cuba sanctions (U.S. Department of the Treasury, 2015) in accordance with President Obama's December 2014 policy announcement (The White House, 2014). These measures made changes in the implementation of the embargo but did not lift the embargo. Most transactions involving Cuba, including private and public investment in mineral production, continue to be prohibited. Source: US Geological Survey, "Recent Trends in Cuba's Mining and Petroleum Industries", April 2015.

[45] Wall Street Journal, "Middle East Refinery Expansion Plans Hit Snags", August 3, 2015. http://www.wsj.com/articles/middle-east-refinery-expansion-plans-hit-snags-1438591860

In recent years, countries in the region – led by Saudi Arabia and the UAE – are making concerted efforts to change this reality by investing in development of refinery systems, thereby offering greater opportunities for value adding at home and reducing the need for imports. Middle Eastern refining capacity increased from 6.5 million barrels/day in 2000 to 9.4 million barrels/day in 2015 (Figure 5-9). To put this in perspective, in 2015, countries in the Middle East accounted for 32% of oil production globally, but still only accounted for only 9.6% of refining capacity worldwide[46].

Figure 5-9: Middle East Oil Refining Capacities



Source: CPCS analysis of BP Statistical Review of World Energy 2016. "Oil Refinery Capacities".

While there are always fluctuations in the petroleum and petrochemicals sector (alongside the price of crude oil), the World Oil Outlook 2015 forecasts that more refining capacity will be added in the Middle East than any other region of the world between 2015 and 2020. A few of the projects in development are listed below.[47]

- Saudi Arabia is developing a new 400,000 bpd refinery complex "Jazan Industrial City" (start-up anticipated in in 2018) as well as expanding the Petro Rabigh refinery/petrochemicals complex.
- UAE is developing a 200,000 bpd refinery in Fujairah on Gulf of Oman, and is upgrading their Jebel Ali condensate refinery.

[46] BP Statistical Review of World Energy 2016

[47] OPEC World Oil Outlook 2015, October 2015. http://www.opec.org/opec_web/static_files_project/media/downloads/publications/WOO%202015.pdf

- Kuwait plans to build the Middle East's largest refinery (Al-Zour) at 615,000 bpd (commissioning unlikely before 2019), and is adding refining capacity at two of its existing facilities (Mina Abdullah and Mina Al-Ahmadi).

The projects above are examples of the types of mega projects that may provide opportunities for fabricators in the Sarnia-Lambton region.

5.7.1 Current / Anticipated Sourcing Pattern for Oversize Freight

Many of the petroleum refineries in the Middle East are owned by state-owned companies. Based on a review of previous refinery upgrade and greenfield projects, contracts for engineering and construction of large projects have been awarded to multi-national EPC companies including: SK Engineering & Construction, Samsung Engineering, Daewoo Engineering & Construction, CB&I, Saipem (Snamprogetti), Technip, and Foster-Wheeler, to name a few.[48]

Sarnia-Lambton fabricators could be sub-contractors to these types of companies.

5.7.2 Implications for Sarnia Area Fabricators

There is a large and ongoing demand for the types of metal and mechanical fabricated products made in Sarnia-Lambton in the Middle East. The question, however, is whether Sarnia-Lambton based fabricators are competitive enough to tap into this market. Three factors are notable in this respect.

Transportation Logistics

Our consultations suggested that clients in the Middle East retain responsibility for arranging the logistics and transportation from the fabricator site to the job site. This is in contrast to local and regional moves in North America, which typically remain the responsibility of the supplier. To date, we are aware of only one fabricator from Sarnia-Lambton who has successfully supplied products to the Middle East, and these were not oversize products, meaning that arranging transportation was not complex or costly (relative to oversize products). It is not possible to confirm, but one could assume that arranging transportation for an oversize load in Sarnia-Lambton would be more complex for an outside agent, than for a local fabricator, given their limited knowledge of the local context, transporters, etc. This could be viewed as an added obstacle and cost, relative to competitors with fabrication shops that provide easier (cheaper) access to water. This would of course be alleviated somewhat with the introduction of a permanent oversize corridor, which could be used as a "marketing tool" to entice potential clients to consider Sarnia-Lambton.

Sarnia-Lambton fabricators could also potentially make arrangement of transportation part of their offer to Middle East clients, should such clients be open to this approach.

[48] Arabianoilandgas.com, "The 25 Biggest Refineries in the Middle East".

Relative Proximity to Asian Fabricators

The Middle East is physically closer to extremely large fabrication shops in Asia (China, Korea, Malaysia, India) that have economies of scale beyond the realm of anything possible in Sarnia-Lambton (see Figure 5-10). This places Sarnia-Lambton fabricators at a disadvantage in terms of physical distance and time required to reach client site from the fabrication shop. Considering the cheaper cost of production in Asia due to lower labour rates and economies of scale, Sarnia-Lambton fabricators may face some disadvantages, though they could still potentially compete on the basis of quality and schedule (e.g. if the Asian shops are very busy, while Sarnia-Lambton fabricators are not).

Figure 5-10: Daewoo Fabrication Yard, Korea

Source: dsmeoffshore.com

Importance of Local Presence

In North America, much of the procurement for metal fabricated pieces for petroleum sector projects is carried out through a competitive tender based on a list of approved global suppliers. This approach is much less common in the Middle East, where having a local presence (or at least visibility through a local agent) is critical to developing personal relationships for securing contracts. Without this type of presence, it can be challenging to secure business to any significant extent. Though existing relationships with global EPC contractors may help, significant efforts would still be required to develop any substantial awareness of Sarnia-Lambton fabricators in the region (e.g. for more than one-off, occasional sales).

The factors above suggest that the Middle East is a very large market opportunity (made even larger by the lifting of sanctions against Iran in 2016). Securing even a small portion of anticipated work in future could keep Sarnia-Lambton fabricators very busy. That being said,

Sarnia-Lambton fabricators will need to devote significant efforts to developing this market (relative to other opportunities). It will take time to build relationships with some of the key players in the region, and to illustrate the quality of product which is available from Sarnia-Lambton companies.

5.8 Canada West Coast: Oil and Gas Export

A large number of export-related oil and LNG projects are under consideration on the West Coast of Canada, all of which would require inputs that Sarnia-Lambton fabricators could theoretically manufacture. The largest of these include:

- **Pacific North West LNG Project**: an LNG export terminal in Prince Rupert connected by pipeline to BC's northeast, owned by Malaysian-state owned firm Petronas.
- **Northern Gateway Pipeline Project**: two parallel 1,176 km pipelines connecting Bruderheim, AB and Kitimat, BC, one flowing west with crude oil, and one flowing east with condensate. The projects would require ten pump stations powered by electric pumps, in addition to infrastructure at a Kitimat Marine terminal with two tanker berths and a tank farm.[49]
- **Pacific Trail Pipeline:** A 470km natural gas pipeline from Summit Lake, BC to Kitimat, with an investment decision linked to the associated **Kitimat LNG Project,** natural gas liquefaction plant and marine export terminal. The Kitimat LNG Project EPC contract was awarded in 2014 to a JV of Fluor Canada and JGC Corp of Japan.
- **TransCanada Pipeline:** A 700 km pipeline, from Montney region near Dawson Creek, BC to Kitimat, which is linked with the **LNG Canada** project, a natural gas liquefaction plant and marine export terminal in Kitimat. Per an agreement from 2014, this plant would be built by CFSW LNG Constructors (a partnership of Chiyoda, Foster Wheeler, SAIPEM, and WorleyParsons).
- **Kitimat Clean Refinery:** Kitimat Clean Ltd has proposed to build a heavy oil refinery near Kitimat. It would be one of the ten largest refineries in the world, capable of processing 400,000 bpd of bitumen from the oil sands into gasoline, jet fuel, and diesel fuel, primarily for export.
- **Pacific Future Energy:** This project involves construction of a refinery to process a form of bitumen transported by rail from Alberta to an industrial area called Dubose Flats (halfway between Terrace and Kitimat). The refinery would have an input capacity of 200,000 bpd of "NEATBIT" a processed form of bitumen the consistency of peanut butter which requires rail transportation.[50]

[49] http://www.kitimat.ca/EN/main/business/invest-in-kitimat/major-projects.html

[50] Because NEATBIT has very small amounts of diluent, unlike other forms of oil transported by rail or pipeline, it has very low flammability, and as a result is exempt from the Transport Canada *Transportation of Dangerous Goods Regulations* ((Part 1, 1.33).

All of these are multi-year, multi-billion dollar projects. All of the projects have been in development for years, and it is too early to say which of the projects will proceed, if any, particularly given the slump in oil and natural gas prices over the past five years or so. The price of LNG has fallen from $18.17 million per British thermal units (mmBTU) in 2012 to $5.75 per mmBtu currently. Most recently (September 2016), the federal government announced its conditional approval of the Pacific NorthWest LNG project, though with 190 legally binding conditions.[51]

5.8.1 Current / Anticipated Sourcing Pattern for Oversize Freight

The procurement approach for these major petroleum-sector projects is expected to be similar to other projects in the sector. The sponsors of the project (oil majors) engage large EPC contractors to manage the work. In turn, Sarnia-Lambton fabricators could potentially supply components to these EPC contractors under sub-contract.

5.8.2 Implications for Sarnia Area Fabricators

A number of the projects taking place in northern BC consist of marine export terminals, which have virtually no load-size restrictions relative to other petroleum sector facilities in-land.

This is a positive for Sarnia-Lambton, insofar as once a large module or piece of equipment is loaded at the Sarnia Harbour, it could be shipped entirely by water through the St. Lawrence Seaway, Panama Canal, and up the West Coast to northern BC.[52] However, it is also a positive for very large fabricators located in Asia, who would be competitive in terms of production costs. Shipping times from Asia to the North Coast of BC are also about half the time as a move from Sarnia-Lambton. For example, shipping from China and South Korea to the port of Prince Rupert takes approximately 8 – 12 days of sailing time assuming a direct service.[53] In contrast, shipping from Sarnia to Prince Rupert would likely take more like 16 – 20 days via the Panama Canal.

Some companies have already indicated that sourcing will be directed immediately to Asian fabricators. For example, the Pacific Future Energy refinery Project Description Summary states outright that "the Project is planning for the purchase of [100 to 150] pre-built Refinery modules from Asia […] each with dimensions ranging from 40 – 50 m in length, 35 – 47 m in width, and 17 – 27 m in height […and] estimated to weigh between 2,5000 and 5,000 metric tonnes."[54] This approach suggests that Sarnia-Lambton fabricators will not be in a strong position to supply the West Coast.

Overall, the opportunity to supply major projects under consideration in BC are not obvious. The projects are still likely years away from commencing construction, though the EPC

[51] CBC News "Federal government approves liquefied natural gas project on BC coast with 190 conditions", September 27, 2016. http://www.cbc.ca/news/politics/pacific-northwest-lng-project-1.3780758

[52] Shipping by rail would be an alternative (to Prince Rupert, with CN), but this would not be feasible for oversize loads.

[53] http://www.maerskline.com/~/media/maersk-line/Countries/int/Routenet/pdfs/2m-east-west-network-2015/2016/6_ASIA%20TO%20NORTH%20AMERICA_V19.pdf

[54] Pacific Future Energy Refinery, Project Description Summary, June 2016. http://pacificfutureenergy.com/wp-content/uploads/2016/06/SuperfinalSUMMARY.pdf

contractors have already been identified in the anticipation of project progression. In short, while there is little risk to Sarnia-Lambton fabricators from marketing themselves to the future EPC contractors that have already been announced, the opportunities where Sarnia-Lambton fabricators can compete may be limited to higher value products where Sarnia's quality and potential schedule advantage (if they are less busy than shops in the US and Asia) could come into play.[55]

Overall, in the current market, it is unlikely that Sarnia-Lambton fabricators could compete on the West Coast, as fabrication activity worldwide is slower than normal and there would be significant competition.

5.9 BioChemicals

Biochemical facilities and bio-commodities may present a good opportunity for Sarnia-Lambton fabricators. This sector includes plants manufacturing cellulose fibres, butanediols, ethanol from grain and other plants, and other bio-fuels. Biobased feedstocks for both energy use and basic chemicals are increasingly being developed (alongside greater use of natural gas) as replacements for traditional crude-based feedstocks and this trend is expected to continue over time.

The new BioAmber facility in Sarnia – producing succinic acid from sugar feedstocks from corm – is an example of this type of industry. Suncor also operates an ethanol plant in Sarnia-Lambton currently.

The biochemical sector (and bio-economy generally speaking) are growing sectors in Canada. Of note, provincial and federal government agencies are turning to the sector as it holds potential for new manufacturing opportunities. In particular, in Ontario, the provincial government is looking to the bio-economy as a means to shift reliance away from the historically important automotive manufacturing sector to the bio-chemicals sector. The sector would also benefit from access to agricultural inputs from the important growing regions of Southern Ontario.[56]

The biochemical sector is very new. Other than ethanol production, there are relatively few biochemical facilities in North America, with BioAmber being one such facility.[57] We are not aware of any new biochemical facilities being developed in Ontario, though BioAmber intends to develop a larger facility in future (its existing facility is a 30,000 tonne production prototype; the larger facility will be 200,000 tonne production). The company has not decided whether this will be in Sarnia-Lambton or another area.

There is some overlap in the types of equipment in demand for the sector and the capacity of Sarnia-Lambton fabricators. In particular, the majority of biochemical facilities require the use of fermenters (fermentation tanks), which could be produced by the fabricators. We

[55] For the avoidance of doubt, in the case of smaller size (normal loads), shipping by rail to the West Coast, and then truck or barge to the client site, would be quicker than marine shipping through the panama canal.

[56] Invest in Ontario, "Chemical and Biochemical" background: http://www.investinontario.com/chemical-and-biochemical#extensive-infrastructure

[57] Other examples include DuPont Tate & Lyle Biochemicals (Loudon, Tennessee) and Natureworks (Blair, Nebraska).

understand that some of the biochemicals produced in North America are used in food products. When this is the case, the equipment must be developed to food grade standards. We do not believe this would be a significant investment requirement for Sarnia-Lambton fabricators (in terms of meeting equipment standard requirements), though it would require market research to understand how these standards could be achieved.

Overall, the extent of the opportunities which would become available as a result of the oversize corridor is not known, given the early stage of development of the sector. On one hand, Sarnia-Lambton fabricators have the technical capacity to supply equipment to this sector (pending confirmation that food grade standards could be achieved in some cases). On the other hand, given the very early stage of market development it is not possible to confirm the level of demand for oversize pieces specifically or whether future production facilities will be located near water to benefit from an oversize corridor. Certainly, in the case of BioAmber potentially expanding in Sarnia-Lambton, the local area fabricators would have a good opportunity to supply this market.

Sarnia-Lambton fabricators should monitor this market to gain a better understanding of the types of equipment that will be required (food grade or otherwise), and whether these are for oversize products.

5.10 Government of Canada Shipbuilding

The National Shipbuilding Strategy (NSS) was introduced in 2010 and seeks to support the Canadian marine industry by providing long-term certainty to Canadian shipbuilders. With this certainty, shipbuilders can develop, modernize and invest in the facilities, skills and expertise needed for building modern vessels.

After the development of the NSS, the Canadian government selected two shipyards to rebuild the Royal Canadian Navy and the Canadian Coast Guard fleet. The selected shipyards are Seaspan's Vancouver Shipyards for non-combat vessels and Irving Shipbuilding in Halifax for combat vessels. Contracts will span a 20 to 30 year period. Seaspan and Irving have invested $500 million in their shipyards to develop the capacity, facilities, and processes to undertake shipbuilding projects.

The NSS has three components: 1) Construction of large vessels, 2) Construction of small vessels, and 3) Vessel repair, refit and maintenance (RRM).

Large Vessel Construction

The large vessel program is further split into the following combat and non-combat vessels:[58]

- Combat Vessels – Arctic Offshore Patrol Ships (AOPS) and Canadian Surface Combatant (CSC).

[58] http://www.tpsgc-pwgsc.gc.ca/app-acq/amd-dp/mer-sea/sncn-nss/rapport-report-20151231-3-eng.html#a1

  - AOPS – Six vessels built in Halifax for approximately $3.5 billion. The AOPS are under construction, with the first vessel set for delivery in 2018.
  - CSC – Up to 15 vessels built in Halifax. The budget was originally over $26 billion, but is now under review. Contracts to build CSC are expected to be awarded in 2021.

- Non-combat vessels – Offshore Fisheries Science Vessels, Offshore Oceanographic Science Vessel, Joint Support Ships and Polar Icebreaker.
  - Offshore Fisheries Science Vessels – Three vessels built in Vancouver for approximately $687 million. Construction underway with first vessel to be delivered in 2017.
  - Offshore Oceanographic Science Vessel – One vessel built in Vancouver. The budget is under review. The build contract is expected to be awarded in 2017 and delivery is expected in 2018-2019.
  - Joint Support Ships – Two vessels built in Vancouver, originally budgeted $2.3 billion, but the budget is under review. The build contract is expected to be awarded in 2017 and delivery of the first vessel is expected in 2020.
  - Polar Icebreaker – One vessel built in Vancouver, originally $800 million, but the budget is under review. The build contract is expected to be awarded in 2018 and delivery is expected in 2021.

Small Vessel Construction

Small vessel construction and repair is competed on a project-by-project basis. The Seaspan and Irving shipyards engaged in large vessel construction are not eligible for small vessel contracts. The amount budgeted in 2010 for Small Vessel Construction was $2 billion spent over 30 years. From February 2012 through the end of 2015, $162 million has been contracted under small vessel construction, of which Ontario received $63 million.

Vessel Repair, Refit and Maintenance

RRM is competed through publically announced requests for proposals. The budget identified in 2010 for RRM was $500-600 million annually. From February 2012 through the end of 2015, the RRM program has contracted $400 million, of which Ontario received $66 million.

5.10.1 Current / Anticipated Sourcing Pattern for Oversize Freight

Based on initial estimates, approximately $30 billion will be spent in the construction of CSC and AOPS vessels at the Irving shipbuilding facility in Halifax. The approach to building the AOPS and likely the CSC is to modularize construction as much as possible, which would provide opportunities for Sarnia-Lambton fabricators.

The AOPS vessels are already under construction and existing supplier relationships have been established, making it difficult for Sarnia-Lambton fabricators to provide fabricated goods on these contracts. However, the CSC vessels are in the initial stages of identifying the design of the CSC and are likely years away from engaging suppliers. Another benefit is that the multi-year shipbuilding program could provide modular requirements for a number of years to come.

Irving Shipbuilding has internal fabricators and there are established suppliers in this space. Therefore Sarnia-Lambton fabricators would have to become known and demonstrate value to secure work in this area. The recommendation from Irving Shipbuilding is to register with Irving's supplier registry, which will be used to issue requests for proposals for AOPS vessels and will possibly be used for CSC vessels. Irving Shipbuilding noted that the AOPS suppliers would be notified if a separate database were developed for CSC vessels. Irving Shipbuilding notes the following considerations when selecting a potential supplier: [59]

- Capability to provide the required materials
- An established position in the market
- Provide Canadian manufactured content for Canada
- Provide a great value for Canada
- Robust quality assurance, ISO or equivalent controls
- Security clearances including Controlled Goods and Canadian Industrial Securities Directorate
- Workers compensation board registrations
- Appropriate insurances

5.10.2 Implications for Sarnia Area Fabricators

Overall, there is potential for Sarnia-Lambton fabricators to provide modules for the future CSC vessels, particularly given the preference for Canadian context. However, there is uncertainty about the timing and the exact needs for these ships. Additionally, the requirement for some projects to require a security clearance, competition from internal Irving fabricators, and existence of firms already producing oversize equipment in the shipbuilding industry limit the potential opportunity for Sarnia-Lambton fabricators.

5.11 Water and Wastewater

This sector comprises water and wastewater retrieval/distribution systems (pipes/sewers) as well as the facilities where water and wastewater are treated.

Generally speaking, the technology required by the sector is much less sophisticated than what the Sarnia-Lambton fabricators are able to produce and excel at producing. Most water distribution systems in Canada are based on plastic, as opposed to metal, piping. The technology at water treatment facilities uses significant amounts of concrete/concrete basins as part of the filtration process, in addition to metal storage tanks, pipes and pumps. However, the level and standard of technology required is generally lower (for most equipment) than in the oil and gas sector, in part due to the different risks involved in handling petroleum and petrochemicals versus water/sewage. For example, while a lot of atmospheric tanks (not

[59] http://irvingshipbuilding.com/irving-shipbuilding-suppliers-supplier-faqs.aspx

pressurised) are used in a water treatment plant, there are no pressure vessels to speak of. The types of metal pieces used in water and waste water treatment do not require ASME or other similar standards.

5.11.1 Procurement Approach

Water and wastewater treatment is controlled at the municipal level across Canada. Unlike the private petroleum sector, when minor or major works are required municipalities are required to carry out a public procurement exercise with an open tender process, notably through the national public tenders system MERX[60] (procurement notices will also often be included on regional and municipal government websites).

For a specific small technical job, it would be possible for smaller firms to directly compete and supply a piece of equipment to a water or wastewater treatment facility through a public procurement exercise. For larger jobs such as construction of new wastewater treatment plant, the municipality would typically look to contract with a larger engineering firm (e.g. Veolia) who may then be subcontracting to external firms for specific components of work.

5.11.2 Implications for Sarnia

The water and wastewater treatment sector does not appear to offer significant potential for future business for Sarnia-Lambton mechanical fabricators, given that most work involves technology which is less sophisticated than what Sarnia-Lambton fabricators produce. It would not make commercial sense to pursue these markets if other more lucrative opportunities are available where Sarnia-Lambton fabricators have a competitive advantage given their specialised skills and equipment.

That being said, the technology in the water treatment sector is undergoing change to increase the level of sophistication. This includes a gradual move away from simple filtration processes in huge basins of water to the use of high-rate technologies which involve mixers, railing, and module components with a smaller footprint than typical water treatment plants. This may be an area for further exploration.

Beyond mechanical fabrication, there may be opportunities for structural steel components at the water filtration plant, such as towers and tanks. The extent of this market would be based on individual water and wastewater treatment facilities in development.

5.12 Power Generation

Power plants make use of both mechanical fabrication and structural fabrication. Thermal power plants (e.g. coal, gas) make use of boilers, tubes, turbines, and cooling towers. Nuclear power stations also use heat exchangers. Hydroelectric projects require less mechanical fabrication, but do require extensive structural fabrication.

[60] www.merx.com

Province of Ontario

The province of Ontario (through Ontario Power Generation) currently produces power through the following systems:

- Two thermal biomass plants at Atikokan and Thunder Bay. Both the Atikokan Generation and Thunder Bay Generating Stations were converted from coal to biomass and recommissioned in September 2014 and February 2015, respectively[61]. Sarnia-Lambton fabricators did supply equipment to the Thunder Bay conversion.
- One dual-fuel oil and natural gas plant in Lennox.
- Two nuclear power plants owned and operate by OPGs: Pickering and Darlington. OPG also owns two nuclear generating stations on Lake Huron that are leased to and operated by Bruce Power (a private company).
- 65 hydroelectric stations and 240 dams.

We are aware of only two major projects underway in Ontario that may require significant inputs from fabricators in Sarnia-Lambton.

The Darlington power plant is undergoing a major refurbishment, which will commence in October 2016. The EPC contract was awarded to a JV of AECON and SNC Lavalin in 2011. Planning, design, and training working is now complete. Refurbishment is expected to start in October 2016, with four units to be refurbished and project completion in 2023. Cost of the refurbishment project is $12.8 billion.[62]

Bruce Power announced in early 2016 a long-term refurbishment program ($13 billion) on six of its units that will commence in 2020.

Other Provinces

Conversion of power plants from coal to natural gas or biomass would likely present some opportunities for Sarnia-Lambton fabricators. As noted above, Ontario has now converted all of its coal-fired power plants. Saskatchewan, Nova Scotia, and New Brunswick all have coal-fired power plants, with no intention to convert the plants based on our research.[63] Alberta has 18 coal power stations and the province has announced plans to phase them out by 2030. Two-

[61] There are no longer any coal-fired power stations in Ontario.

[62] www.opg.com.

[63] Saskatchewan does not have plans to phase out coal (and may be going down the carbon capture route instead). Nova Scotia has eight coal-powered plants and an agreement with the Federal government to keep them open (e.g. no plans for change). New Brunswick has one coal-powered plant, with no plans for closure. Sources: https://www.thestar.com/opinion/commentary/2016/09/08/alberta-the-new-coal-burning-canary-steward.html and http://www.cbc.ca/news/business/canadian-coal-by-the-numbers-1.3408568.

thirds of the power from these is planned to be replaced with renewable sources, with one-third replaced by natural gas.[64]

5.12.1 Procurement Approach

The Darlington nuclear unit refurbishment is scheduled to commence shortly, and we understand that major contractors have already been selected.[65] Given the length of the refurbishment program (up to 2023), there may still be opportunities for fabrication and other sub-contracts.

The Bruce Power refurbishment program is at an earlier stage of development, and there would likely be more opportunities for exploring sub-contracting opportunities at this stage, relative to the Darlington refurbishment.

5.12.2 Implications for Sarnia Area Companies

We understand that nuclear power plant work is broken into two sections, with different implications for Sarnia-Lambton fabricators.

The first type is process piping inside the Nuclear Cell, which must be fabricated under extremely stringent Quality Assurance standards with contractors that do speciality work under what is called an "N" stamp, which is different from the ASME qualification which is called a "U" stamp. Companies with this "N" certification include Aecon, ES Fox, etc. We do not believe any of the fabricators in Sarnia-Lambton currently have this certification.

The work outside of the Nuclear Cell falls under the "U" stamp work, or at a minimum under the TSSA. All of the mechanical contractors in Sarnia-Lambton carry the TSSA certification, though only three have the "U" stamp as far as we know (Alliance Fabricating, Canadian Structural & Mechanical, and Kel-Gor). There is a reasonable amount of work in the ASME position, however, this work is typically done by the contractors that also have the "N" stamp.

Consultations suggest that while attaining the "N" stamp for some of the larger fabricators would be attainable, the investment does not appear to have been warranted to date. The initial costs of obtaining this certification are in the order of $100,000, and would require new market entry efforts for Sarnia-Lambton fabricators to prove themselves in the nuclear power business.

Beyond the nuclear power plants, there are always general structural manufacturing requirements at power plants. However, the competition in this market is quite high.

Finally, as noted above, Alberta appears to be the province with the most opportunity for power plant conversion to natural gas. As noted previously, opportunities for Sarnia-Lambton fabricators would therefore still be limited to equipment that can move within the road / rail

[64] http://www.alberta.ca/climate-coal-electricity.aspx

[65] See partners here: http://www.opg.com/generating-power/nuclear/stations/darlington-nuclear/darlington-refurbishment/Pages/our-people.aspx

transportation load size limits. The oversize corridor would lower transportation costs for slightly oversize loads, but would not make a difference for very large loads.

5.13 Mining

Mining is a huge industry in Canada with over 375,000 persons working in mining and mineral processing across the country.[66] During industry consultations and research, few "significant" opportunities were uncovered for Sarnia-Lambton fabricators.

There are two somewhat distinct markets in the mining sector which have different opportunities for Sarnia-Lambton fabricators: these can be loosely broken into mine site/heavy handling and processing.

At the mine site, most of what would be considered "typical" equipment for extraction of raw materials (e.g. conveyors, hoppers, etc.) can be built by fabricators that carry significantly less certification than the Sarnia-Lambton mechanical fabricators, if any certification at all. This type of work includes "Carbon Steel work", the type of structural/mechanical work that almost any fabricator could produce. Some of this work is a little more complex, and will require some structural and mechanical engineering to accomplish (for example: ore conveyors and ship loaders). Some of the large ship loaders can carry 200 metric tonnes of ore plus their own weight and they articulate. The conveyors can carry a good deal more than that and are often quite high. While engineering is required, the fabrication though not simple, requires a lower level of certification and standard (if any) relative to the mechanical fabrication that Sarnia-Lambton fabricators can supply. There is a large number of such fabricators that can supply this market, and they have a lower cost overhead. This would therefore impact the Sarnia-Lambton fabricators ability to compete on that sort of equipment, as they have to produce their fabricated products to a more demanding standard (with associated cost overheads).

There may, however, be opportunities for the fabricators that can produce structural steel components to supply equipment to mine sites on a case by case basis in this steel work area. There is, however, significant competition for this market. For the corridor to make a difference in competitiveness, the mine or location of demand for equipment (e.g. ship loaders) would need to be located by the water, or on an oversize corridor, which is not likely in the case of the mine (mine location is based on resource location, not convenience of transportation).

In contrast, Sarnia-Lambton mechanical fabricators could potentially supply equipment required as part of the processing (smelting/refining) activities for mining projects, many of which are located on the water to receive the heavy inputs required for processing. For example, in order to process ore from their Voisey's Bay mine in Newfoundland, Vale constructed: a Hydromet plant in Argentia (a process that uses water based chemicals to recover metals from minerals); a concentrator in Voisey's Bay, Labrador; a refinery in Long Harbor; and a port facility at Long Harbor. This project is currently in operation, with some construction activities continuing alongside production.

[66] Mining Association of Canada

In the smelting/refining (e.g. precious metals) area of a mining operation you will find the chemical refining systems, the storage of chemicals, mixers, piping, separation vessels, etc. This process often requires that the "containers" (tanks, vessels) have to be of a suitable alloy and a quality that can withstand the harsh chemicals used in the process. They will likely also require that they be fabricated to an accepted standard (i.e. ASME, API, etc.) and are more suited to the Sarnia-Lambton fabricators technology and capabilities than other more basic mine equipment. This is the area where the Sarnia-Lambton fabricators could do well, in particular because the competition is limited.

These fabricated components would likely be large enough to require the use of an oversize overweight corridor to transport them from the fabricators facility to the Sarnia Harbour.

Going forward, the mining industry could be tracked, in particular for new smelters or refining facilities being constructed, bearing in mind that such projects are few and far between. Smelters are very costly to build and are built sporadically to cater to multiple sources of inputs from a range of different mine locations across the world (e.g. a new smelter is not required for each new mine).

We are not aware of any new smelter or ore refining capacity projects in development in North America currently. This does not appear to be a “low hanging” fruit market for Sarnia-Lambton mechanical fabricators to exploit in the short-term.

5.14 Other Sectors

There are other industrial sectors that require the use of boilers, tanks, piping, and modules.

Pulp and Paper Sector

Our consultations did not indicate that this sector presents strong opportunities for Sarnia-Lambton fabricators. The technical standards required in this industry are less stringent than in the oil and gas sector, due to the relatively lower level of risk involved. This means that the market is open to more fabrication shops that do not have to maintain the same accreditations and work to the higher standard codes that the Sarnia-Lambton fabricators must keep for the oil and gas sector work (e.g. fabricating to ASME standards, traceability requirements, etc.).

Sarnia-Lambton fabricators face costs associated with working to these standards, including paperwork and the use of unionised labour, which contribute to increasing their overheads and making them relatively costly compared to basic fabrication shops.

While the shops in Sarnia-Lambton could theoretically “dumb down” to serve the pulp and paper market, and other sectors that require structural steel or modular equipment where standards are lower, this would not make commercial sense. The oil and gas sector will continue to be the major driver for the Sarnia-Lambton fabricators and they will always need to maintain high standards to keep this clientele. Furthermore, there are many more basic fabrication shops in the market that can manufacture products for the non-oil and gas sector, meaning Sarnia-Lambton fabricators would face even stiffer competition for relatively lower-margin work.

Food and Beverage Processing

Based on consultations, we do not believe that opening of an oversize corridor would create significant additional opportunities in the food processing industry.

On one hand, Sarnia-Lambton fabricators have the technical skills and engineering expertise to supply this sector with some of the higher-end equipment that is required in food processing plants.[67] Of note, some of the companies already work with speciality stainless steels that are used across much of the food processing industry. Consultations also suggest that there is a shortage of locally-made, higher-end processing equipment, with some companies looking to Europe for the best technology. On the other hand, there are different regulatory standards for food and beverage processing equipment and we are not aware that any of the Sarnia-Lambton fabricators have such certifications in place. Research would need to be carried out to better understand what level of effort would be required to achieve these standards.

Even more importantly, however, the requirements for food processing equipment (generally speaking) are not for oversize equipment. This suggests that the oversize corridor in and of itself would not open up significant new opportunities for support to the food processing sector that do not already exist. Rather, consideration would need to be given to the certifications required to supply this sector generally (for normal size loads) and whether this would present a strong market for the fabricators to consider.

5.15 Summary of Opportunities

Overall, our assessment of the market can be summarised as follows:

- **Stay focused on petroleum and petrochemicals.** Sarnia-Lambton fabricators have significant experience catering to the oil and gas sector. This is a large and lucrative market (when times are good), which requires the technical skills and certifications that Sarnia-Lambton fabricators possess. Opportunities to expand sales to upstream and downstream petroleum sector companies within Canada, the US, and globally appears to offer the greatest potential for the region, should a corridor be developed.

  Look to the water. Generally, the 30’ x 30’ corridor in Sarnia-Lambton is really opening up markets where the load is traveling from Sarnia-Lambton to a port destination or close to a port. With the possible exceptions where you can access the Alberta High Load Corridor or something similar, all loads will contend the same restrictions as currently. The corridor is therefore expected to make a primary difference in competitiveness for loads that are oversize and currently not able to move at a reasonable cost within the physical limitations of road or rail corridors. The relevant markets where new opportunities will be available are therefore likely to be those where client has direct access to the water (e.g. a smelter), as opposed to inland (e.g. a mine). Figure 5-11 presents a summary of the potential for Sarnia-Lambton fabricators to supply these markets.

[67] Food processing also requires some more basic equipment, which could be supplied by non-specialized fabricators and which would not be an attractive market for Sarnia are fabricators.

Figure 5-11: Analysis of Potential Market Opportunities

Potential Market	Strength of Opportunity	Comments
Petroleum / Petrochemicals		
Western Canada (Alberta)	Medium	• Market is large (notably once sector conditions improve) • Companies consistently require large equipment • Opportunities will become available due to lower transport costs, but there are still size restrictions west of Thunder Bay / Duluth so full benefits of oversize loads will be limited
Atlantic Canada	High	• Water-side opportunities where load size can be maximized • Goldboro LNG (immediate opportunity) • West White Rose Expansion (when price of oil improves)
US Petroleum (pipelines)	Low	• Most pipelines will be inland (far from water), thus limiting much of the comparative advantage fabricators could have as a result of the corridor.
US Petroleum (LNG export facilities)	Medium	• Water-side transportation • US Gulf Coast fabricators typically cheaper (lower labour cost), but could be beat on schedule if shops are busy. • Competitiveness also depends on value of C$
Mexico (Pemex)	Medium	• Very large market with immediate needs • Currently underserved (limited local capacity) • C$ favourable (relative to US Gulf Coast fabricators) • Risks in terms of security • Establishing personal relationships / presence critical
Cuba	Low-Medium	• Similar opportunities to Mexico (sector in need of investment) • Strong Canadian-Cuban relationship (relative to US-Cuba) • Risks associated with government ownership / tightly controlled labour market • Establishing personal relationships / presence critical
Middle East	Medium	• Water-side opportunities • Plenty of opportunity (very large market) • Some cost challenge in terms of competing with international (Asian) suppliers • Establishing personal relationships / presence critical
West Coast LNG	Low	• Market size unknown as many approvals still required • Difficult for Sarnia fabricators shops to compete on price with closer, Asian suppliers

Potential Market	Strength of Opportunity	Comments
Other Sectors		
Biochemicals	Medium (in the long term)	• Some overlap in technology with petrochemicals (e.g. tanks) • Growing bio-based sector in North America, though still very new with limited immediate and clear opportunities • May require different certification for food-grade biochemicals • Demand for oversize equipment cannot be confirmed
Shipbuilding	Low-Medium	• Unknown market / unknown to client • Preference for Canadian content (positive) • Barriers to entry (security clearance)
Water and Wastewater	Low	• Limited, diverse, one-off opportunities • Public tendering with lots of competition • Sector generally requires lower-tech standards that those Sarnia fabricators can attain (and must maintain at a cost)
Power Generation	Low-Medium	• Nuclear may present opportunities for Sarnia-Lambton fabricators but added certifications are required in some cases ("U" stamp) and Sarnia-Lambton fabricators not well known in the sector • Alberta planning major conversion from coal power plants to alternative fuels, though size limitations would still exist for equipment transportation • All power plants present opportunities for structural, though competition is high
Mining	Low-Medium	• Mechanical fabrication needed in the processing / refining sector, but such opportunities (new smelters) are few and far between • Structural fabrication opportunities on a case by case basis (mine sites not on water cannot harness benefits of corridor)
Food and beverage processing	Low	• For higher-end equipment, there is demand for Canadian suppliers, but regulatory standards require different certification • For lower-tech equipment, there is an abundance of fabricators available to provide this equipment at a cheaper cost than Sarnia-Lambton • Industry does not typically require oversize equipment, and processing facilities not usually close to water access
Pulp and Paper	Low	• Sector generally requires lower-tech standards that those Sarnia-Lambton fabricators can produce (and must maintain at a cost) • Multiple suppliers already available to meet market need

6 Actions to Harness Benefits from Oversize Corridor

Key Chapter Takeaways

Having a permanent, oversize corridor will open up opportunities for Sarnia-Lambton fabricators and enable them to be more price competitive. However, harnessing the benefits of the corridor will rest as much on marketing efforts by the regional fabricators as it will on being able to be price competitive.

Consultations did not indicate that investment in additional technological / automation at the fabrication shops would influence the overall benefits of the corridor. Further investment may be beneficial as market potential becomes clearer.

The extent of benefits which may arise from the corridor will also be influenced by external factors beyond the control of fabricators, most notably, the price of oil and value of the Canadian dollar.

The previous chapter outlined a number of potential market opportunities for Sarnia-Lambton fabricators to consider, should an oversize corridor be established. In this chapter we outline the factors that will impact the ability of Sarnia-Lambton manufacturers to be competitive in these markets, as well as the actions required to increase the anticipated economic benefits of the corridor.

6.1 Competitiveness Considerations

Clients consider three overarching factors when making a purchasing decision: quality, schedule, and price. In the subsections below, we describe the current status of Sarnia-Lambton fabricators with respect to each components.

The majority of existing clients for Sarnia-Lambton fabricators are still in the petroleum and petrochemicals sector. We anticipate this is likely to remain the case for the majority (though not all) potential future markets. The analysis which follows is thus primarily focused on the oil and gas sector, unless noted otherwise.

6.1.1 Quality

Given the long life of oil refineries and other petrochemicals facilities, and the high opportunity cost involved in turnarounds, clients look for very high quality in the goods they are purchasing. This encompasses both the physical product being provided, as well as access to skilled labourers to install the product and provide ongoing maintenance. The same could be said for

other sectors where major capital investments are being made (biochemical, mining smelter, etc.).

Sarnia-Lambton fabricators produce quality products to high standards. They have the technical capacity to produce world-class quality modules and other units, with support from a pool of highly skilled tradespeople. We do not believe quality is a reason for lack of ability to serve existing and new petroleum and petrochemicals markets that would be more accessible with an oversize corridor.

For entry into new sectors (e.g. biochemicals, power generation), fabricators would need to ensure they meet the certification standards associated with the sector, which would require additional market research and potentially investment.

6.1.2 Schedule

Schedule refers to the ability of fabricators to produce outputs within a timeframe that meets the window of installation at a client site. The overall schedule is a factor of both **fabrication time** (based on availability of raw materials, equipment and labour) and **transportation time** (to move product from the shop floor to the client site).

While oil companies typically schedule their major projects and refinery turnarounds with at least a year of notice, schedules can sometimes change and a new piece may be required within a shorter timeframe. Of note, oil companies always want to limit the duration of any "turnaround" to as few days as possible, given a shut-down of any of their oil producing facilities can literally cost them millions of dollars a day. Sarnia-Lambton will continue to have a major schedule advantage in terms of serving the local oil and gas companies in Sarnia-Lambton, relative to other fabrication shops outside of the region.

For clients located beyond Sarnia-Lambton, establishing a permanent oversize corridor could be expected to lower the time required to plan and undertake transportation to the port. This, however, would be time savings in the order of days or weeks, not months. The corridor is therefore not expected to materially affect the overall schedule (and competitiveness) for a move by water beyond the region.

A much more critical factor regarding overall schedule is how busy competing fabrication shops are relative to local area fabricators. During busy times, skilled labourers are often at maximum capacity and this can affect the ability to produce new units within the required timeframes (most clients provide at least a few months to a couple of year of notice of their requirements).

Sarnia-Lambton fabricators compete with fabricators located near major petroleum-based industry hubs in Alberta and Gulf Coast / Southern US (among others internationally). Even in quiet times (for Sarnia-Lambton), fabricators in these other markets often operate at capacity and are busy relative to Sarnia-Lambton fabricators. They are sometimes not able to meet tight timelines (even with a year or more of notice). As a result, Sarnia-Lambton fabricators may be able to – when they themselves are not busy with work – compete on schedule for markets outside of the region, even where there are equally capable fabricators located within closer proximity to the client. Based on our consultations, the limits of the "schedule benefit" appear

to be primarily limited to clients located within Canada (Alberta), the US Great Lakes area and Atlantic Canada.

Overall, however, we do not anticipate the corridor would have a major impact on schedule considerations or significantly increase the competitiveness of Sarnia-Lambton fabricators (relative to quality and price).

6.1.3 Price

The final price is typically the most heavily weighted factor in any purchasing decision. The price to the client for a fabricated unit can be loosely broken down into four cost categories: raw materials, labour costs, transportation costs, and profit margin.

i) Raw Materials

Fabricators require a range of materials and component pieces for their manufacturing, including steel, alloy steels, tubes, pipe, valves, pumps, structural members, etc. Consultations suggested these materials and component pieces accounted for (very roughly) 10% of total project cost. Based on our knowledge of the sector, Sarnia-Lambton fabricators do not have any particular advantage or disadvantage with respect to the cost of these inputs, which are often determined on a global scale based on commodity prices. As such, the cost of raw materials / parts does not appear to play a significant role in whether or not Sarnia-Lambton fabricators are competitive relative to their peers outside of the region. We do not anticipate that the corridor would change this situation.

ii) Labour Costs

Labour costs make up the largest part of any fabrication business in Sarnia-Lambton, as skilled, unionised labour is required. Consultations in Sarnia-Lambton indicated that labour costs make up between 50% - 60% of the total landed price of their products to clients, with a typical skilled worker costing approximately $65/hour. In busy times (turnarounds), this can increase to $100/hour or more, where overtime is required.

While these labour costs are comparable (or slightly lower), than labour costs in Alberta for similar work, they are among the highest in the world in terms of the companies competing for international business. Consultations suggested labour rates in some Asian markets (China, India, Malaysia) are in the $5 - $15/hour range for similar work, though quality is not always as high. In the US market, rates are also typically lower. Of note, while some states in the US use unionised labour, a number of southern states are “Right to Work” states, where employees have the right to work without being required or compelled to join a union. This can keep labour costs very low (in the US$20 - $25/range).

Of course, hourly labour costs cannot be directly compared across countries without also considering labour productivity. While labour costs in Sarnia-Lambton are higher, efficiency of labour is also high; with good technology more can be done per hour of labour. Climate and shop conditions also make a difference. For instance, welding inches per hour (a productivity metric) in a climate controlled shop in Sarnia-Lambton would be higher than outside in February

in Northern Alberta or July in Louisiana. Finally, the amount of work being carried out in each market affect labour efficiency. A consistently high demand for workers in Alberta, for example, has typically meant employees can command a higher wage in that province. Labour shortages have meant that less experienced and less productive staff are sometimes hired, driving down efficiency.[68]

In terms of sales within Sarnia-Lambton, the relatively high labour costs of local area fabricators does not appear to have disadvantaged the fabricators (relative to their competitors outside the region), given their advantages with respect to schedule, the high quality of their products, and the benefits that clients gain from working with nearby fabricators that can manufacture, install, and service their facilities on an ongoing basis.

In terms of sales beyond the region, this high cost of labour could result in a significantly higher production cost, particularly with respect to Asian suppliers. This invariably affects competitiveness, *all else being equal*, but we do not believe it would prohibit Sarnia-Lambton fabricators from competing outside of the region given their productivity and quality.

Overall, the corridor will not alter labour costs. Fabricators have very little control on these labour costs, though when warranted (e.g. once a potential market is proven) there is always opportunity to invest in automation should the economics of such a decision make sense.

iii) Transportation Costs

The oversize corridor would have a significant impact on lowering the transportation costs associated with moving oversize products from fabricator facilities to clients (both locally and beyond the region via the port).

As noted in Chapter 2, these costs range from anywhere between $15,000 to $150,000 or more, depending on the size of the equipment being moved. With the establishment of an oversize corridor, costs would be lowered considerably. The cost of arranging for infrastructure adjustments would virtually disappear, as the movement of utility lines accounts for the largest portion of the transportation costs (though traffic lights would still need to be moved, and a police escort required in some cases). The process of streamlining applications for oversize loads could presumably also take place if authorities know that the corridor is already engineered to carry these loads.

The extent to which this permanent change would affect the competitiveness of fabricators would vary for each move and would depend on the proportion of total landed price which is made up by local transportation costs (which in turn will depend on the value of the module). Very roughly speaking, mechanical fabricated pieces and other pieces range in price anywhere from $100,000 - $1 million, meaning that transportation costs could have a very significant, or minimal, impact on total landed price.

[68] Canadian Energy Research Institute "Competitive Analysis of the Canadian Petrochemicals Sector", Study No. 160, October 2016.

iv) Profit Margin

The final component of any price to a client is the profit margin for the fabricator. This will always vary based on the given market context, depending on supply and demand. The Sarnia-Lambton fabricators, and the owner clients, have enjoyed a long history together, through many oil industry cycles. They have remained viable and competitive with each other and in some cases outside the region. This would lead one to believe that the local fabricators profit margins are set at a "tolerable" level.

Outside the region, Sarnia-Lambton fabricators may need to consider accepting lower profit margins in order to break into and provide themselves in new markets to new clients. This would require a long term perspective of diversification. This would naturally be considered on a case by case basis for each fabricator.

In summary, the corridor's primary impact on competitiveness would be to lower transportation costs. As explained previously, the ultimate impact will vary depending on the size of the load and value of the product.

6.2 Investment and Improvement Needs

6.2.1 Physical and Technology Investments

Based on our consultations and knowledge of the competencies of Sarnia-Lambton fabricators, there are no major physical investments needed for these fabricators to be able to compete with their peers. Most of the companies have good technology, excellent skilled labour, and plenty of space either already developed or that could be very easily developed for increased business activity (e.g. they have the land already in their ownership).

This is not to say that investments in upgraded technology and automation would not be beneficial generally, including to lower labour requirements and associated costs. However, the investment in such technology would likely only be warranted with an expanded order book. Put differently, lack of technology or other physical investments are not expected to a binding constraint to the competitiveness of Sarnia-Lambton fabricators should the corridor be built.

6.2.2 Marketing Efforts

Having a permanent, oversize corridor will open up opportunities for Sarnia-Lambton fabricators and enable them to be more price competitive. However, harnessing the benefits of the corridor will rest as much on marketing efforts by the regional fabricators as it will on being able to be more price competitive.

The corridor will not generate sales by itself; significant marketing to develop new relationships will generate sales. Some of the markets described in this report could already be attractive to Sarnia-Lambton fabricators (for normal size loads), but they are not being considered by all fabricators. Moreover, existence of the corridor could become a sales point both for oversize and normal loads, insofar as it might create a more efficient process/system for movement by truck for all load sizes.

The Sarnia-Lambton fabricators already have some advantages that will help them win business outside of Sarnia-Lambton. The companies are already known and contracted by Exxon Mobil, Shell, Suncor, Nova, CF Industries and other global players. In some cases, the fabricators already have sight of upcoming Request for Quotation (RFQs) and Requests for Proposals (RFPs) from these types of companies. The companies have also performed work for major EPC contractors such as Horton CB&I, Kellog Brown and Root (KBR) Aecon, and Jacob's. These are among the largest oil and gas contractors in the world. Many have global procurement systems that allow contractors to view potential projects required around the world. Fabricators interested in bidding on more opportunities (e.g. getting more sight of RFQs) could also reach out to procurement managers to promote themselves further if the corridor is approved.

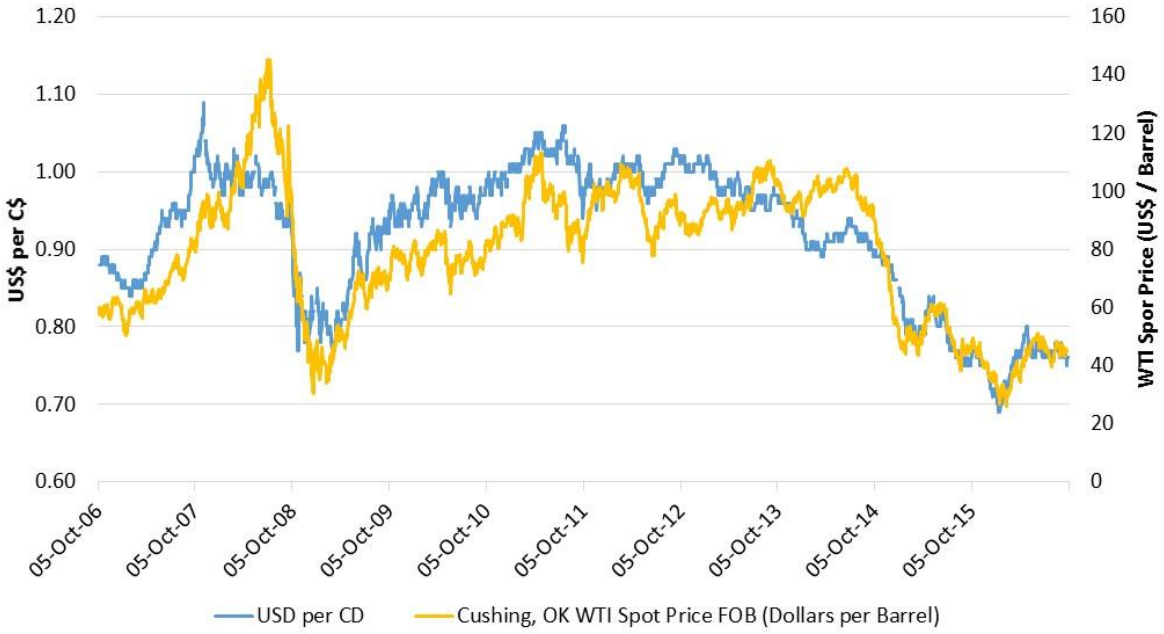
Market research, and marketing efforts where warranted, will also be required in new industries that are currently not being served to any great extent (nuclear power generation, bio-chemicals, etc.).

6.2.3 Other Factors

A number of other factors will influence the impact of the oversize corridor in terms of increased sales beyond the region.

- **Exchange rate fluctuations.** For the time being, the Canadian dollar is very weak (see Figure 6-1). This provides Sarnia-Lambton fabricators with a slight advantage in terms of price relative to their US counterparts. The time to start looking for new markets is now – while the low Canadian dollar provides a competitive advantage.
- **Pick up in the oil and gas sector.** The oil and gas sector is in a major slump, as reflected in the low price of oil (see Figure 6-1). When the sector picks up, not only will this mean more opportunity for projects beyond Sarnia-Lambton (e.g. shelved projects), but it will also likely mean more activity within Sarnia-Lambton. The benefits of the corridor will be highest if Sarnia-Lambton fabricators continue to look outside the region when the sector improves, even if they are busy with local business. This would require taking a longer-term view of market development. As can be seen from the figure, however, the price of oil and the value of the Canadian dollar typically follow the same pattern, so when business picks up, the Canadian dollar also increases in value.

Figure 6-1: Exchange Rate and Crude Oil Prices, 2006 – 2016



- **Support from public authorities.** The benefits of the corridor will be enhanced in terms of time and associated cost savings if public sector authorities involved in approving oversize load moves through the city and Sarnia Harbour are willing to use a 'fast track' approach to permitting such moves. For example, removing requirements for additional engineering studies for oversize loads for each move, as long as the load follows the oversize corridor route.

Speed of corridor development. NOVA Chemicals is considering building a new petrochemicals facility in Sarnia-Lambton. We understand that they could start moving in large modules in the next couple years, which is before any proposed corridor could be built (e.g. pending approval of funding and distribution, as well as construction activities). To the extent that the corridor could be built sooner rather than later, this may provide added benefits for NOVA Chemicals (and they could even be approached to support the cost of such a corridor).

7 Economic Impact Analysis

Key Chapter Takeaway

Assuming construction costs of $11.4 million, and additional annual fabricated product sales of $9.5 million, the Sarnia-Lambton oversize freight corridor project would add approximately $263 million to Canada's GDP (2010 dollars) over a period that includes a three year construction phase and 30 years of operation. The project would result in an estimated 2,613 additional full time equivalent jobs (person years of employment), and would add approximately $21.4 million to government tax revenues (2010 dollars).

7.1 Introduction and Approach

This chapter estimates the economic impact of the proposed oversize Sarnia-Lambton freight corridor in terms of:

- Gross Domestic Product (GDP)[69]
- Employment
- Government tax revenues

Simulation using an input-output model (a model that replicates the inter-industry relationships in the economy) is the method used to estimate the economic impact. The simulation is carried out by deliberately altering or "shocking" the level of a particular variable (or variables) in order to change them from their status quo, and then observing the effects on the remaining variables in the model, in particular GDP, employment, and tax revenues.

The key drivers resulting in the economic impacts are: (i) the construction activity involved in building the improved corridor as measured by its capital costs; and (ii) the anticipated increase in revenues for local area fabrication companies who would increase their production and sales of oversize equipment as a result of having access to an improved corridor.[70] We were not able to quantify any impacts for future increases in inbound shipments, as we could not identify any immediate such shipments.

7.1.1 Construction Costs of Improved Corridor

Construction costs of the improved corridor are provided in the engineering analysis commissioned for the project and shown in MIG Consulting Engineers, "Oversize Load Corridor

[69] GDP is a measure of the value of all the goods and services produced by an economy.

[70] In some infrastructure projects, economic impact analysis would also include an assessment of the impact of "operating costs" for a new asset. In the case of the oversize corridor in Sarnia, we expect such ongoing operating (maintenance) costs to be minimal and have not included them.

Shipping Route Study" (Revision Date: August 4, 2016). Figure 7-1 presents a summary of the estimated construction costs. The total costs are estimated as $11.4 million. Based on conversation with the City of Sarnia, the time to complete the corridor may be estimated as three years (assuming no fast-tracking).

As may be seen, the largest element of the construction cost ($4.0 million) is due to the necessary improvements at the Sarnia Harbour. Other major elements are the civil and structural work involving improvements to bridges, culverts, and road upgrades ($2.5 million) and the electrical work to relocate wires, cables, poles, transformers, traffic signals, and lights ($2.4 million) to ensure uninterrupted passage of oversize loads and their transport vehicles.

The engineering study also includes in the total for the project an amount of $2.6 million to account for Contingency (20 percent) and Escalation (10 percent). In Figure 7-1 we have spread this proportionately among the three main construction cost elements.

Figure 7-1: Sarnia-Lambton Oversize Freight Road Corridor Construction Cost Summary

Item	Description	Construction Cost ($)	Contingency and Escalation ($)
1	Port of Sarnia Harbour and Dock	3,959,063	1,187,719
2	Road Infrastructure (Civil, Structural and Misc.)	2,472,782	741,835
3	Road Infrastructure (Electrical)	2,360,794	708,238
	Sub-Total	8,792,639	2,637,792
	Total for Construction, Incl. Contingency and Escalation	**$11,430,431**	

Source: Cost summary in MIG Consulting Engineers, Oversize Load Corridor Shipping Route Study Revision B (August 4, 2016)

7.1.2 Anticipated Increase in Sales from Oversize Corridor

Based on our industry consultations with fabricators, combined our assessment of potential market opportunities, we estimate that the oversize corridor could result in additional sales of $9.5 million per year in fabricated equipment (mechanical and structural fabrication). This estimate reflects the competitive environment faced by fabricators regionally and globally.

7.2 Economic Impact Methodology

To estimate the economic impact of the Sarnia-Lambton oversize freight road corridor we used the Statistics Canada Interprovincial Input-Output (I-O) model.[71] The model, through its representation of the inter-industry relationships in the economy, allows for the estimation of the direct, indirect and induced impacts of a project. In carrying out the exercise we worked closely with Statistics Canada's Industry Accounts Division which maintains the model, makes available the service of running the model, and advises on its use. Use of the model is made available by Statistics Canada on a cost recovery basis and is common practice by project proponents in Canada.

[71] Statistics Canada. Input-Output Model Simulations (Interprovincial Model). Product main page at http://www5.statcan.gc.ca/olc-cel/olc.action?lang=en&ObjId=15F0009X&ObjType=2

7.2.1 The Input-Output Model

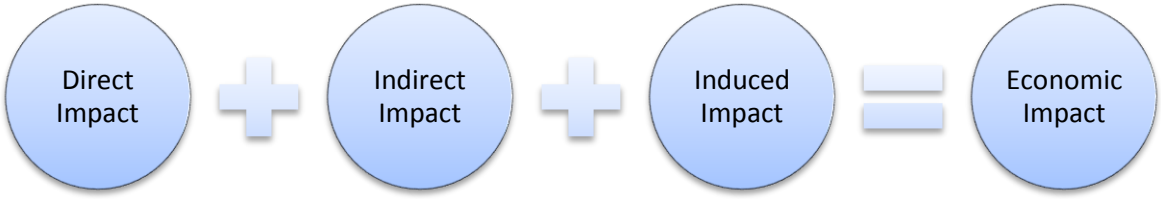
Industry inputs and outputs in the I-O model cover every industry in the economy and must, of course, be expressed in a common measurement unit. They are therefore expressed in value (dollars), and not volume, terms. The current model is based on 2010 values for industry inputs and outputs. This means that the impacts estimated using the model will reflect the 2010 inter-industry structure and relative prices in the economy.

Modeling inter-industry relationships requires a system for classifying industries and commodities. As described by Statistics Canada,[72] the industry classification in the model is designed to accommodate business establishment-based data, the building blocks of the I-O system. The commodity classification used is designed specifically for the I-O system and is intended to provide concordance between a variety of commodity classification systems employed throughout the Canadian statistical system. Consistent classification of commodities is crucial in the construction and balancing of I-O tables. For example, a commodity must be coded consistently whether it be as part of manufacturing output, as an item being transported, as an export or import, or as a purchase by a final consumer.

7.2.2 Standard Economic Impact Assessment

The analysis takes the standard approach of estimating three categories of impacts: direct, indirect, and induced. Also in keeping with standard practice, the sum of these is referred to as the economic impact of the project, as illustrated in Figure 7-2.

Figure 7-2: Components of Economic Impact



As defined by Statistics Canada, **direct impact** in general measures the initial requirements for an extra dollar's worth of output of a given industry. **Indirect impact** measures the changes due to inter-industry purchases in response to the new demands of the directly affected industries. This includes all the chain reaction of outputs up the production stream since each of the products purchased will require, in turn, the production of various inputs. **Induced impact** measures the changes in the production of goods and services in response to consumer expenditures induced by households' incomes generated by the production of the direct and indirect requirements.

[72] Statistics Canada. A User Guide to the Canadian System of National Accounts, Chapter 3, Input-Output. http://www.statcan.gc.ca/nea-cen/pub/guide/chap3-eng.htm.

In the results presented below, impacts are presented for Ontario, the province where the project is occurring, and for all of Canada. Impacts are reported in terms of additional GDP, full-time equivalent (FTE) jobs – the same as person-years of employment – and tax revenues. Regarding tax impacts, these are taxes on products and production; the model does not include income taxes.

7.2.3 Interpreting the Results

Every project has a life cycle including both a construction phase and an operations phase. For the present analysis, I-O model simulations have been carried out to estimate the economic impacts of both phases, i.e. construction and operations. However, it is important to recognize that the results of the two phases cannot simply be added together to arrive at the total impact over the project life cycle.

When the model is shocked by an amount accounting for the cost of construction or expansion of a facility, the model estimates the economic impact. In reality, however, such activity occurs over a number of years and what the model estimates is, in effect, the cumulative impact of the construction phase. In contrast, when the model is shocked by an amount representative of annual activity in the operations phase, the result given by the model corresponds to the economic impact for a single year. To arrive at the cumulative impact of the operations phase, the results given by the model would have to be multiplied by the number of years the facility would be in operation.[73] In section 7.3.2 below, we summarize the operations phase impacts on both an annual and cumulative basis.

7.3 Economic Impact of Oversize Freight Road Corridor

This section summarizes the estimated economic impact of the Sarnia-Lambton oversize freight corridor project. Results are indicated first for the construction and operations phases of the project, respectively. Following this, we provide an indication of the impact on a cumulative basis, combining the results for the construction and operations phases.

7.3.1 Construction Phase Impact

In order to estimate the economic impact of the construction phase it has been necessary to assign the engineering construction cost estimates shown above to the appropriate I-O model industry categories. Figure 7-3 shows this assignment.

[73] Calculating the cumulative impact in this manner does not, of course, take into account the "time value of money," as would be the case in a financial or economic cost-benefit evaluation where future cash flows are discounted to their present values.

Figure 7-3: Road Corridor Construction Cost Classified for Economic Impact Analysis

Engineering Description	$ Thousands			I-O Model Industry	
	Construction Cost	Contingency and Escalation	Total	Code	Title
Port of Sarnia Harbour and Dock	3,959	1,188	5,147	BS23C100	Transportation engineering construction
Road Infrastructure (Civil, Structural and Misc.)	2,473	742	3,215	BS23C100	Transportation engineering construction
Road Infrastructure (Electrical)	2,361	708	3,069	BS23C300	Electric power engineering construction
Total	**8,793**	**2,638**	**11,430**		

As may be inferred from Figure 7-3, carrying out the model simulation to estimate the economic impact of the construction phase has involved shocking two industries, the transportation engineering construction industry where the shock value amounts to $8.4 million, and the electric power engineering construction industry where the shock value amounts to $3.1 million, with these adding up to the total engineering cost estimate of $11.4 million.

Using the above costs to "shock" the I-O model, Figure 7-4 summarizes the economic impact results for the construction phase of the Sarnia-Lambton oversize freight road corridor project. Not surprisingly, almost all of the impact occurs in Ontario.

Figure 7-4: Sarnia-Lambton Oversize Freight Corridor Construction Phase Economic Impact

Effect	GDP at Basic Prices ($ thousands)		FTE Jobs Created (number)	
	Ontario	Canada	Ontario	Canada
Direct Impact	4,736	4,736	58	58
Indirect Impact	3,450	4,267	34	40
Induced Impact	2,202	2,722	20	25
Total Economic Impact	10,388	11,725	112	123

Source: Statistics Canada Interprovincial Input-Output Model simulation

In total (adding the direct, indirect, and induced impacts together), the construction of the road corridor is estimated to lead to an increase in GDP of approximately $11.7 million in Canada as a whole, of which $10.4 million occurs in Ontario and $1.3 million occurs in the rest of Canada. We note that the GDP impact in Figure 7-4 is measured at "basic prices" (i.e. it excludes taxes on products) and is the incremental value added associated with the estimated job creation. The FTE jobs created during the construction phase are estimated as 123 in Canada, of which 112 would occur in Ontario.

Not shown in Figure 7-4 are the tax implications. In total, the construction of the Sarnia-Lambton oversize freight road corridor is estimated by the I-O model to lead to an increase in governments' tax revenue (not including income taxes) of approximately $1.2 million in Canada as a whole, of which approximately $1.0 million would accrue in Ontario.

7.3.2 Operations Phase Impact (Additional Sales)

It is our understanding that, once it is constructed, any work activity associated with maintaining the new corridor will be relatively insignificant and we have not included such activity in the economic impact analysis.

The economic impact in the operations phase therefore derives from the additional production and sales of oversize fabricated equipment that access to the corridor would make possible. Based on our consultations with members of the industry, this is estimated to be $9.5 million per year. Also, this represents the delivered value of the equipment, i.e. it includes the costs of production as well as the costs of transportation and handling to deliver the products to their final markets. We estimate that of the $9.5 million per year, 80 percent would be exported to markets outside of Ontario and 20 percent would be destined for customers within Ontario.

To estimate the economic impact of the additional production and sales of oversize fabricated equipment we must, as with the construction phase economic impact analysis, identify the appropriate I-O model variables to be shocked. Based again on our consultations and knowledge of the fabricator sector in Sarnia-Lambton, it is estimated that of the $9.5 million in annual production and sales, 80 percent would fall under "Boiler, tank, and shipping container manufacturing" (industry BS332400). This includes boilers, heat exchangers, pressure vessels and the like, equipment manufactured by the majority of the fabricators consulted. The remaining 20 percent would fall under "Architectural and structural metals manufacturing" (Industry BS332300). This would include structural steel framing, stands, platforms, stairs, handrails, etc.

Figure 7-5 shows the estimated economic impacts resulting from the additional production and sales of fabricated equipment made possible by the oversize freight corridor. In total, there would be an annual impact on GDP of $8.4 million for Canada as a whole, of which $7.3 million would occur in Ontario. The annual FTE jobs created are estimated as 83 in Canada, of which 73 would accrue in Ontario.

Figure 7-5 also shows the cumulative impact of the additional production and sales assuming operation of the road corridor over a period of 30 years. The cumulative impact would amount to additional GDP of $251 million for Canada, of which $220 million would occur in Ontario. The corresponding additional FTE jobs would amount to 2.5 million for Canada, of which 2.2 million would occur in Ontario.

Figure 7-5: Sarnia-Lambton Oversize Freight Corridor Operations Phase Economic Impact (Annual and 30-Year Cumulative)

	GDP ($ thousands)		FTE Jobs Created (number)	
Effect	Ontario	Canada	Ontario	Canada
Direct Impact	3,861	3,861	39	39
Indirect Impact	1,822	2,463	19	24
Induced Impact	1,656	2,058	15	20
Total Economic Impact	**7,339**	**8,382**	**73**	**83**
Total Over 30 years	**220,170**	**251,460**	**2,190**	**2,490**

Source: Statistics Canada Interprovincial Input-Output Model simulation

Although not shown in Figure 7-5, the additional production and sales of fabricated equipment enabled by the oversize freight corridor would also result in increased tax revenues for governments. For Canada as a whole, the annual tax revenues generated from this activity are estimated by the I-O model to total $0.7 million (not including income taxes), of which approximately $0.6 million would accrue in Ontario.

7.3.3 Summary of Economic Impact

Figure 7-6 presents a summary of the project's economic impact on the Canadian economy. Focusing on the cumulative impacts, the results indicate that the project would add approximately $263 million to Canada's GDP (2010 dollars) over a period that includes a three year construction phase and 30 years of operation. The resulting additional full time equivalent jobs, or person years of employment, would be approximately 2,613. The project would also add approximately $21.4 million[74] to governments' tax revenues (2010 dollars).

Figure 7-6: Summary of Sarnia-Lambton Oversize Freight Road Corridor Economic Impact (1)

Construction Phase Impact (2)	
Total construction cost (including contingency and escalation)	$11.4 million
GDP impact	$11.7 million
Jobs impact	123
Tax impact	$ 1.2 million
Annual Operations Phase Impacts (3)	
Annual production/sales of oversize equipment enabled by corridor	$9.5 million
Annual GDP impact	$8.4 million
Annual jobs impact	83
Annual tax impact	$ 0.7 million
Cumulative Impacts (4)	
GDP impact	$ 263 million
Jobs impact	2,613
Tax impact	$ 21.4 million

(1) Impacts shown are for Canada, and are the total of direct, indirect and induced effects. Jobs impacts are full-time equivalent full year jobs and thus equal to person-years of employment. Tax impacts include taxes on production and on products but not on incomes. Dollar figures are 2010 values reflecting the current version of Statistics Canada's Interprovincial Input-Output (I-O) Model. All figures are nominal values.

(2) Construction costs and impacts are totals relating to the entire construction period (3 years).

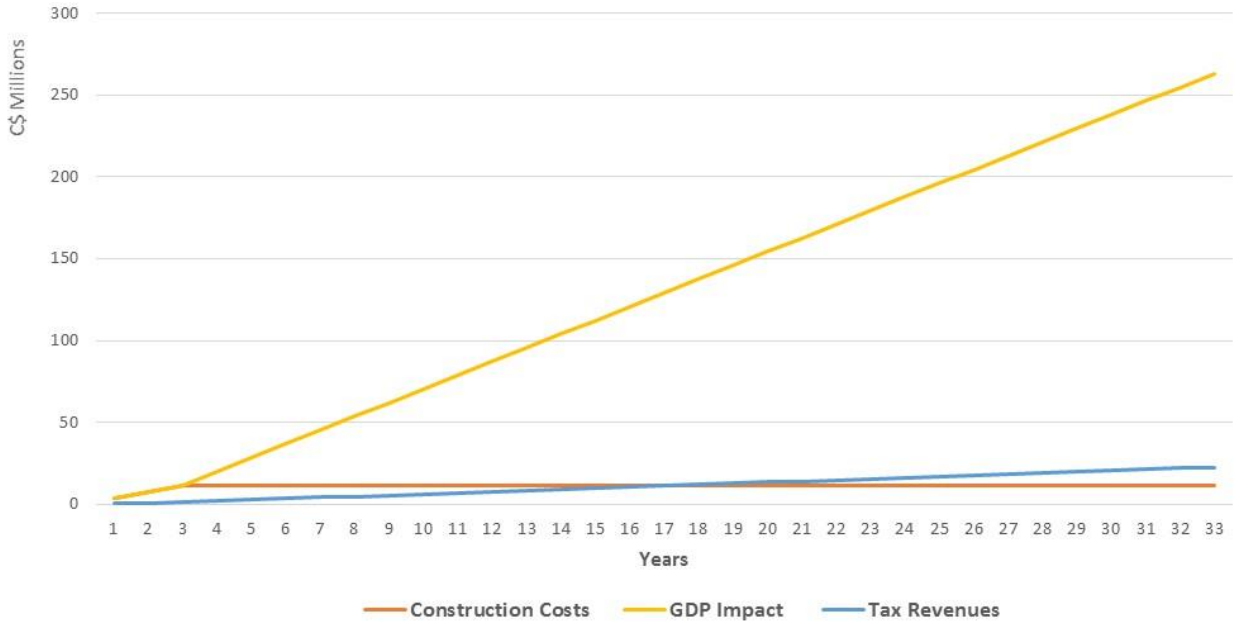
(3) Production/sales of equipment and impacts relate to a single year in the operating life of the corridor.

(4) Cumulative impacts are the sum of the impacts for the construction phase and for 30 years of operation of the corridor. All figures are nominal values.

[74] $21.4 million results from using figures as actually generated by the model and not the rounded figures reported above.

Figure 7-7 below illustrates the cumulative costs and benefits of the project over a 30 year period. Even using a relatively conservative estimate in terms of additional sales ($9.5 million), it is clear that investment in the corridor would more than pay for itself in the short term (GDP impact) and medium term (tax revenues).

Figure 7-7: Illustration of Cumulative Costs and Economic Impacts



Source: CPCS analysis of costs and economic impacts. Assumes three year construction timeframe with costs and benefits spread equally across three years, and no maintenance costs. Assumes corridor operating benefits start accruing in Year 4 for 30 years.

7.4 Additional Economic Benefits (Qualitative Benefits)

7.4.1 Further Benefits of the Corridor

The economic impacts quantified above are limited to impacts from construction activities and sales of additional fabricated products destined beyond the region. There would be a number of additional benefits to the corridor, as listed below. These have not been quantified, either because the benefits are very small and/or are not quantifiable.

- **Benefits for local moves:** While not the focus of the study, the construction of an oversize corridor could also be expected to improve the economics (lower transportation costs) of moving oversize pieces of equipment from local fabrications to existing clients within the region. This could result in cost savings to clients and/or increased profitability for the local area fabricators.
- **Future cost savings:** If the corridor is not built, costs will continue to be incurred for each and every oversize product move destined both within and beyond the region. As such, construction of the corridor will result in future cost savings as a result of no longer having to alter infrastructure repeatedly for oversize moves. This would benefit both local moves

(from fabricators to client sites) as well as moves from fabricator facilities to the port for movement beyond the region.

- **Lowering health and safety risks:** Related to the point above, establishing a permanent corridor will remove significant health and safety risks associated with moving hydro and other utility lines. Every time a hydro one employee must lift a hydro line, there are health risks involved which must be taken into consideration. These risks would be reduced or eliminated if the corridor is established.
- **Marketing tool for future investors in Sarnia-Lambton:** We were not able to quantify the potential benefits that may arise for future importers of oversize freight who could locate themselves in Sarnia-Lambton, given this future market is unknown. However, one could assume that in the coming decades, the corridor will serve as a benefit to at least one or more companies who require the use of an oversize freight corridor and who would not otherwise have considered Sarnia-Lambton.

8 Conclusions

8.1 Summary of Findings

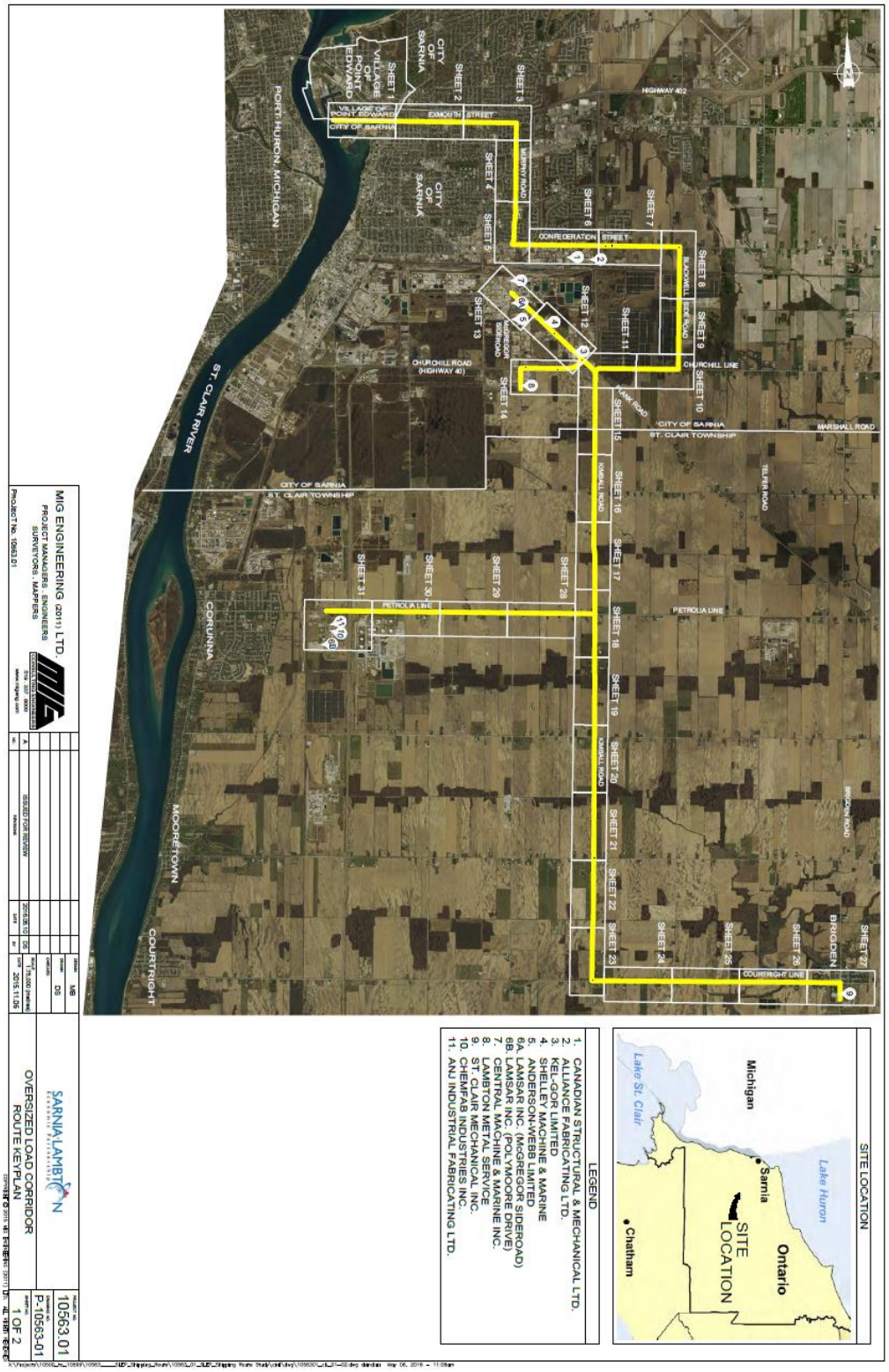
Establishing an oversize corridor to enable less costly transportation of oversize products to existing and new clients in markets outside of Sarnia-Lambton would improve the ability of local fabricators to develop and compete in these markets. The impact in terms of additional sales will be highest for large, lower value pieces of equipment, where the difference in transportation cost has the greatest impact on total landed price.

The markets with the highest potential appear to be in the petroleum and petrochemicals sector, as well as opportunities where clients are located directly on the water front and equipment could be built to the maximum load size permitted through the corridor. Petroleum sector opportunities in Atlantic Canada appear to hold the highest potential, followed by the US East Coast, Mexico and the Middle East.

Based on consultations and assessment of potential markets, we estimate that an additional $9.5 million in annual sales could be generated as a result of the corridor. To realise the full benefits of the oversize corridor, however, Sarnia-Lambton fabricators will have to carry out marketing to existing and more geographically diverse clients in the petroleum and petrochemicals sector. They will also need to undertake market research to better assess opportunities in other sectors that may require the types of equipment that Sarnia-Lambton fabricators do, or could, produce.

Assuming construction costs of $11.4 million, and additional sales of $9.5 million per year (for 30 years), the corridor is expected to generate cumulative economic impacts which could add approximately $263 million to Canada's GDP (2010 dollars). The project could generate 2,613 full time equivalent jobs (or person years of employment), and could generate approximately $21.4 million in government tax revenues. Investment in the corridor would more than pay for itself in the short term (GDP impact) and medium term (tax revenues).

Appendix A: Corridor Map



Appendix B: Literature Reviewed

- Canadian Energy Research Institute "Competitive Analysis of the Canadian Petrochemicals Sector", Study No. 160, October 2016.
- Canadian Manufacturers & Exporters, "Manufacturing Supply Chains in Alberta's Oil Sands", October 2014
- Canadian Manufacturers & Exporters, "Oil Sands Manufacturing", November 2013
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- HAL Innovation Policy Economics, "Manufacturing, Machine Shop and Engineering Inventory and Capability Study", Sarnia-Lambton Economic Partnership, May 6, 2010
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- MIG Consulting Engineers "Oversize Load Corridor: Shipping Route Study", prepared for the Sarnia-Lambton Economic Partnership and the Sarnia Lambton Industrial Alliance, 2016.
- MIG Engineering, "Shipping Route Assessment for Oversize Freight from Sarnia-Lambton", for Sarnia-Lambton Economic Partnership, 2012
- Oil & Gas Journal, "Pemex advances diesel program at Mexican refineries", September 15, 2014
- Oil & Gas Journal, "Pemex lets contract for Tula refinery upgrade", November 13, 2015
- Organization of the Petroleum Exporting Countries, "2015 World Oil Outlook", October 2015
- Pacific Future Energy Refinery, Project Description Summary, June 2016
- The Conference Board of Canada, "Fuel for Thought: The Economic Benefits of Oil Sands Investment for Canada's Regions", 2012
- The Economist, "Canada's internal trade, The great provincial obstacle course", July 23 2016
- The Van Horne Institute, PROLOG Canada Inc., JRSB Logistics Consulting Ltd, "Over-dimensional Loads- a Canadian Solution", July 2015
- U.S. Geological Survey, "Recent Trends in Cuba's Mining and Petroleum Industries", April 2015
- U.S. Department of Commerce, International Trade Administration, Industry & Analysis, "2016 Top Markets Report Upstream Oil and Gas Equipment", May 2016
- Wall Street Journal, "Middle East Refinery Expansion Plans Hit Snags", August 3, 2015

Appendix C: Stakeholders Consulted

- Alliance Fabricating Limited
- Anderson-Webb
- ANJ Industrial Fabricators
- BioAmber
- Bioindustrial Innovation Canada
- Bluewater Power
- Canadian Structural & Mechanical
- CF Industries
- CH2M Engineering (water and wastewater specialist)
- Chemfab
- City of Sarnia
- Food and Beverage Ontario
- Former naval maritime surface and sub-surface officer (with expertise on ship construction and procurement)
- Great Lakes Fabricating
- Imperial Oil
- Irving Shipbuilding
- Kel-Gor
- LamSar
- Macrotek
- Mammoet Transportation
- Marilyn Gladu (MP for Sarnia)
- NOVA Chemicals
- Ontario Ministry of Economic Development and Growth (Project Lead – Energy Connections)
- Port of Sarnia
- Promart
- Suncor
- Toolrite Engineering
- TransAlta
- Ubiquity Solar

Appendix D: Fabricator Survey

Study Background

The Region of Sarnia-Lambton is considering the development of an enhanced oversize/overweight (OSOW) freight road-port corridor in the City of Sarnia. The anticipated corridor would facilitate increased movement of large industrial fabricated steel modules and equipment to and from local industries, lower transportation costs for exporters and importers of such freight, and enhance trade in OSOW products.

CPCS Transcom (CPCS) has been engaged by the Sarnia Lambton Economic Partnership (SLEP) and the Sarnia-Lambton Industrial Alliance (SLIA) to assess the benefits, including economic impacts, of the proposed OSOW project, notably from increased ability for regional fabricators to compete in new markets.

Company-level Information provided in interviews will be held strictly in confidence. Analysis of information in our report to SLEP/SLIA will reflect an aggregated perspective for the entire Sarnia-Lambton region.

Qualitative production overview: Please describe your operations, as related to oversize products.

1. Do you ship OSOW assemblies? What specific type(s) (e.g. mechanical modules, modular assemblies, pressure vessels, piping modules, storage tanks, boilers, heat exchanges, etc.)?
2. Is there a standard assembly size or range of sizes for your assemblies? (e.g. 15 x 15, 20 x 20, etc.)
3. Are there other modular assemblies that you have the capacity to fabricate which you ARE NOT currently fabricating (e.g. upstream oil & gas, power sector modules, mining modules)?

Quantitative production overview: Please describe the approximate scale of your operations.[75]

4. What is the approximate revenue from each type of module (price per ton per type of assembly – mechanical, vessels, piping, structural, etc.)?
5. Approximately how many tons of each type of module do you produce each year? And how does this break down between local sales within the Sarnia-Lambton region, versus sales outside the region?
6. What are your current employment levels (skilled, unskilled) related to fabrication of oversize overweight assemblies?

[75] Information on sales and employment will be aggregated across all companies and used to assess the quantitative benefits of an expanded corridor in the region (e.g. current sales and employment relative to potential future sales and employment).

Current market overview: Please describe your current client base and approach to supplying them.

7. Which downstream industries are you currently supplying with your OSOW products?
8. Where are these downstream clients located and how do you transport OSOW loads to these clients?
9. Who are your key competitors (other fabricators) outside the Sarnia-Lambton region?

Transportation and other costs. Please provide an overview of costs/barriers for OSOW product movement.

10. What are the approximate costs to transport oversize loads to your current clients (cost per ton of module for a range of load types, distance to client, etc.)? What is the approximate transport cost as a percent of total landed cost (price to your client) for the modules you supply?
11. Do you experience administrative or regulatory difficulties or delays in obtaining permits required for your transportation of OSOW loads?

Potential Markets with Enhanced Corridor. Please describe the qualitative and quantitative benefits you anticipate from the proposed oversize freight corridor.

12. Which specific downstream industries and markets do you see as having the greatest potential for your sales of OSOW products *as a result of the enhanced corridor* (in Canada, US, overseas)?
13. To what extent have transportation costs been a significant issue prohibiting you from servicing these industries? What other factors (other than costs and efficiency of transportation) might affect your ability to compete in these markets (e.g. labour costs, technology usage, etc.)?
14. For the different OSOW products that you fabricate, what do you estimate is the potential additional sales (in $ value terms) that would result from having access to an enhanced OSOW freight corridor? How would this likely break down as between increased shipments to existing markets and new shipments to currently unserved markets)?
15. Considering any additional production of OSOW products that would result from access to an enhanced freight corridor, what, if any, investments or improvements in fabrication do you feel would be necessary to better serve existing and/or new markets?
16. Considering the additional production of OSOW products that would result from access to an enhanced freight corridor, what impact would this have on your employment levels (skilled and unskilled)? Would you anticipate difficulties in securing the required additional labour from the existing local labour force?

Appendix E: Alberta Oil and Gas Projects

Alberta Major Projects

The timing and size of expansions in Alberta's oil and gas sector is uncertain due to the relatively low price of oil.

Industry groups such as the Canadian Association of Petroleum Producers (CAPP) suggest that projects under construction will continue, but projects that have been approved but have not yet begun construction are expected to be delayed. Given the time needed to secure funding and to construct the oversize corridor, a short term delay in Alberta projects could allow Sarnia fabricators to access these markets in the future using the oversize corridor. As noted, fabricators should leverage existing relationships and will need to market their services to expand their presence in the Alberta oil and gas sector.

As a resource to guide future marketing, in conjunction with economic development and industry organizations, the tables in this section are included to provide a sense of upcoming opportunities. The information provided in these tables was sourced from the Alberta Government's Major Projects Database, which lists private and public sector projects by sector over $5 million. Sectors include:

- Industrial
- Infrastructure
- Institutional
- Mixed-Use
- Oil and Gas
- Pipelines
- Power
- Residential
- Retail
- Tourism/Recreational

Oil Sands Project

The table below presents oil sands projects, noting the name of the project, municipality, type of oil sands project, cost, project stage, and schedule when available. For further information on these projects, the project name hyperlinks to an overview of the project. Additionally, the Alberta government produces a quarterly report titled *Alberta Oil Sands Industry Quarterly Update*, which provides regularly updated details on the status of oil sands projects (announced, in application, approved, under construction, on-hold, suspended, or cancelled). Additionally, the *Alberta Oil Sands Industry Quarterly Update* is organized by region and company, providing information needed to strategically target companies based on location, project status, or existing relationship.

Oil Sands Projects

Project Name	Municipality	Project Type	Cost	Project Stage	Schedule
BlackGold Oil Sands Project Phase 2	Wood Buffalo	In Situ	$540.0M	Proposed	-
Great Divide SAGD Expansion Phase 1	Wood Buffalo	In Situ	$600.0M	Proposed	-
Lewis SAGD Oil Sands Project	Wood Buffalo	In Situ	$65.0M	Proposed	-
May River Bitumen Project Phase 1	Wood Buffalo	In Situ	$250.0M	Proposed	-
Silvertip Oil Sands Facility Phases 1 and 2	Wood Buffalo	In Situ	$100.0M	Proposed	-
Tamarack Bitumen Project Phase 1	Wood Buffalo	In Situ	$1.4B	Proposed	-
Thickwood SAGD Oil Sands Project	Wood Buffalo	In Situ	$420.0M	Proposed	-
Equinox Oil Sands Mine	Wood Buffalo	Mining	$5.8B	Proposed	-
West Ells' Oil Sands Project Phases 1 and 2	Wood Buffalo	In Situ	$525.0M	Proposed	2012 - 2015
Germain Commercial Demonstration Project Phase 2	Athabasca County	In Situ	$1.1B	Proposed	2013 - 2015
Blackrod SAGD Oil Sands Project Phase 1	Lac la Biche County	In Situ	$802.0M	Proposed	2014 - 2016
Hoole Grand Rapids SAGD Project Phase 1	Opportunity No. 17	In Situ	$452.0M	Proposed	2014 - 2016
Muskwa SAGD Oil Sands Project	Opportunity No. 17	In Situ	$800.0M	Proposed	2014 - 2017
Pelican Lake Grand Rapids SAGD Oil Sands Project	Opportunity No. 17	In Situ	$2.0B	Proposed	2014 - 2017
Audet Lands Oil Sands Facility	Wood Buffalo	In Situ	$550.0M	Proposed	2015 - 2016
Dunkirk Project	Opportunity No. 17	In Situ	$123.0M	Proposed	2015 - 2016
Rigel Oil Sands Project	Wood Buffalo	In Situ	$390.0M	Proposed	2015 - 2017
Saleski Oil Sands Pilot Project Expansion	Opportunity No. 17	In Situ	$520.0M	Proposed	2015 - 2017
Saleski Thermal Oil Sands Project	Opportunity No. 17	In Situ	$300.0M	Proposed	2015 - 2017
Christina Lake SAGD Project Phase 3	Wood Buffalo	In Situ	$500.0M	Proposed	2016 - 2018
Pike Oil Sands Project	Lac la Biche County	In Situ	$3.8B	Proposed	2016 - 2018
Sepiko Kesik (Saleski East) Oil Sands Project	Opportunity No. 17	In Situ	$70.0M	Proposed	2016 - 2018
Aspen Oil Sands Project	Wood Buffalo	In Situ	$7.0B	Proposed	2016 - 2020
Birchwood SAGD Oil Sands Project	Wood Buffalo	In Situ	$510.0M	Proposed	2017 - 2018
Taiga Oil Sands Project	Bonnyville No. 87	In Situ	$1.6B	Proposed	2017 - 2018
Cold Lake Oil Sands Project (Midzaghe Project)	Cold Lake	In Situ	$2.0B	Proposed	2019 - 2022
Frontier Oil Sands Mine	Wood Buffalo	Mining	$20.0B	Proposed	2019 - 2026

Walleye SAGD Oil Sands Project	Bonnyville No. 87	In Situ	$450.0M	Proposed	Commencing 2017
Algar Lake Oil Sands Project Phase 2	Wood Buffalo	In Situ	$185.0M	Proposed	Commencing 2018
Grouse In Situ Oil Sands Project	Lac la Biche County	In Situ	$1.5B	Proposed	Commencing 2018
Voyageur South Mine	Wood Buffalo	Mining	$4.4B	Proposed	Commencing 2018
Ells North Oil Sands Facility Phases 1 and 2	Wood Buffalo	In Situ	$100.0M	Proposed	Commencing 2019
Christina Lake Thermal Expansion Project	Lac la Biche County	In Situ	$2.7B	Under Construction	2012 - 2017
Foster Creek Oil Sands Project	Bonnyville	In Situ	$2.0B	Under Construction	2012 - 2017
Horizon Oil Sands Project Phase 2 and 3	Wood Buffalo	Mining	$2.1B	Under Construction	2012 - 2017
Hangingstone SAGD Commercial Production Project	Wood Buffalo	In Situ	$774.0M	Under Construction	2013 - 2016
Narrows Lake In Situ Oil Sands Project	Wood Buffalo	In Situ	$1.6B	Under Construction	2013 - 2017
Fort Hills Oil Sands Mine	Wood Buffalo	Mining	$13.5B	Under Construction	2013 - 2017
Dover Commercial Project Phase 1	Wood Buffalo	In Situ	$2.5B	Under Construction	2014 - 2017
Telephone Lake SAGD Project Phase 1	Wood Buffalo	In Situ	$1.0B	Under Construction	2014 - 2018
Kirby North Phase 1 Oil Sands Project	Lac la Biche County	In Situ	$1.4B	Under Construction	2015 - 2016

Source: Alberta Government Major Projects Database

Gas Projects

The following gas sector projects include processing, storage and expansion projects, among others. The project name hyperlinks to an overview of the project.

Gas Projects

Project Name	Municipality	Cost	Project Stage	Schedule
Greenview Sour Gas Plant	Greenview No. 16	$50.0M	Proposed	-
LNG Production Plant and other facilities	Sturgeon County	$4.0B	Proposed	-
Turner Valley Gas Plant Renovations	Turner Valley	$23.5M	Proposed	-
LNG Liquification Plant	Edmonton	$45.0M	Proposed	2014 - 2016
Redwater RFS 3 Fractionator	Redwater	$460.0M	Proposed	Commencing 2017
Sasol Natural Gas to Liquid Refinery	Strathcona County	$12.5B	Proposed	Commencing 2017
Simonette Gas Plant Modifications	Yellowhead County	$90.0M	Under Construction	2014 - 2015
Keyera NGL Expansion	Fort Saskatchewan	$220.0M	Under Construction	2015 - 2016

Source: Alberta Government Major Projects Database

Distribution and Storage Projects

The figure below displays oil and gas sector storage and distribution facilities. The project name hyperlinks to an overview of the project.

Distribution and Storage Projects

Project Name	Municipality	Cost	Project Stage	Schedule
Condensate tanks at Edmonton Terminal	Edmonton	$90.0M	Proposed	-
Hydrocarbon Storage Cavern	Redwater	$65.0M	Proposed	-
Sturgeon Refinery Terminal	Fort Saskatchewan	$180.0M	Proposed	-
Sunday Creek Terminal Expansion	Wood Buffalo	$200.0M	Proposed	-
Terminal Expansion	Edmonton	$100.0M	Proposed	2014 - 2015
Edmonton Terminal Expansion Project Phase 2	Strathcona County	$112.0M	Proposed	2015 - 2017
Strathcona Salt Cavern Storage Project	Strathcona County	$200.0M	Proposed	2015 - 2017
Cheecham Terminal Expansion	Wood Buffalo	$300.0M	Under Construction	-
Edmonton Terminal South Expansion	Strathcona County	$260.0M	Under Construction	2013 - 2015
Baseline Terminal	Strathcona County	$672.0M	Under Construction	2015 - 2017
Northern Courier Tank Terminal	Wood Buffalo	$50.0M	Under Construction	2015 - 2017
Canadian Diluent Hub Phase 1	Strathcona County	$250.0M	Under Construction	2016 - 2017

Source: Alberta Government Major Projects Database

Upgrader and Other Projects

The figure below displays other proposed oil and gas projects, not classified above. The project name hyperlinks to an overview of the project.

Other Oil and Gas Project

Project Name	Municipality	Cost	Project Stage	Schedule
Chemical Looping Steam Generator Pilot Plant	Wood Buffalo	$62.0M	Proposed	
Hi-Q Pilot Plant	Strathcona County	$50.0M	Proposed	
Centrifuge Plant for Mature Fine Tailings	Wood Buffalo	$1.9B	Under Construction	2012 - 2015
North West Bitumen Refinery Phase 1	Redwater	$8.5B	Under Construction	2013 - 2017
Frac Sand Transfer Facility near Peers	Yellowhead County	$20.0M	Under Construction	2015 - 2016

Source: Alberta Government Major Projects Database