ECO RESSOURCES CONSULTANTS

National Renewable Diesel Initiative Infrastructure Project

Milestone 4- Final Report

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Executive Summary

In 2006, the Canadian government proposed Regulations under the Canadian Environmental Protection Act that, amongst other requirements, would mandate the requirement for an average of two percent renewable content in the diesel and heating oil pool by 2012 upon successful demonstration. In April 2010, the federal government indicated that no fixed timeline would now be associated with the two percent regulation and that "this requirement would only be brought into force once the technical feasibility of renewable diesel fuel use under a range of Canadian conditions has been demonstrated" (Environment Canada, 2010).

In this context, the Canadian government requires a study that addresses the necessary infrastructure, capital and other costs and time frame required for the implementation of a 2% national renewable diesel mandate across Canada under the conditions prescribed by the proposed Regulations. The principal objective of this project is to assess these issues. More specifically, this mandate involves the following tasks: assessment of the existing blending, storage and distribution infrastructure for renewable content in diesel and heating oil in place on January 1st 2010; assessment of what infrastructure remains to be installed in order for regulated parties to comply with the regulations, as well as the estimated costs and lead times of these new investments; estimation of incremental renewable diesel (biodiesel, hydrotreated vegetable oil (HVO), etc.) and kerosene requirements to meet fuel specifications, based on projected regional blending schedules; and an evaluation of the industry's ability to ensure that distillate pools with biocontent can be kept separate from those without.

The results of these Tasks were obtained by carrying out a literature review and also through extensive consultation with industry proponents. The majority of the large petroleum producers in Canada agreed to participate in this study. In order to preserve the confidentiality of the commercially sensitive information provided by the petroleum producers, for the purposes of this report the results have been aggregated by region. The region defined as "West" includes British Columbia, Alberta, Saskatchewan and Manitoba. There is a central region that includes only the province of Ontario and is therefore referred to simply as "Ontario" throughout the text. The region defined as "East" includes Quebec and the Atlantic provinces.

Existing and necessary additional infrastructure for the storage, blending and distribution of renewable content in diesel and heating oil and their lead times

Biofuel distribution in Canada is not achieved by the same means as fossil fuels; infrastructure must be modified for the transportation and distribution of first generation biofuels. Since the biodiesel industry is still at an embryonic phase and its development is fast, the best practices are not always used for the different distribution activities: transportation is currently done mostly by truck or rail, storage is primarily done by petroleum producers, especially for pure biodiesel for which there are no primary terminals, and blending is done largely through splash blending due to lack of infrastructure. Quebec is an exception with 65% to 75% of the blending is done by in-line injection directly at terminals.

Below we provide a description of the existing and additional necessary renewable diesel infrastructure that could realistically be put in place by a series of milestone dates. First we present the infrastructure that is already in place and then we describe the projects that are currently underway and their estimated completion dates. Finally, we describe the new projects that are awaiting regulatory certainty to be started

and the estimated length of time required for these infrastructure additions/modifications. It should be noted that in most cases, new infrastructure will only be made operational during the Spring or Summer. This is to avoid beginning operations during the winter months, which can be more problematic due to cloud point issues. Therefore, if regulatory certainty is attained in December and a project takes a year to complete, it will still not be made operational until at least April of the following year. This important point should be taken into account when analysing lead times for new infrastructure.

The lead times for the upgrade of a terminal or refinery site are approximately one to three years. Longer lead times are usually associated with larger investments, such as truck, rail and/or marine receipt facilities. Permitting and planning are typically the most time-intensive steps in the process, totaling 9 to 18 months. The planning stage is the most unpredictable at this point, as many respondents are waiting for regulatory certainty to begin their planning in earnest. Respondents noted that accelerating lead times in order to meet a mandated regulatory start date, although possible in some cases, can lead to significant cost overruns due to plans and permitting being rushed. The lead times for sales site (commercial and retail) upgrades are very short, three to six months, since the types of modifications are minor (tank cleaning, new filters, inspections).

Existing infrastructure as of January 2010

Investments in new renewable diesel infrastructure have been made at two refineries in the West: at the Consumer's Co-op Refineries Ltd. (CCRL) refinery in Regina, Saskatchewan and the Chevron refinery-terminal in Burnaby, British Columbia. In addition, ten terminals had received modifications or upgrades to accommodate biodiesel. Seven out of the ten terminals are located in the West and are operated by Imperial Oil, Shell and Suncor. The investments in the West were made in order to meet provincial regulations in Manitoba and British Columbia and in anticipation of regulations in Alberta and Saskatchewan. Three of the ten upgraded terminals are located in the East, are operated by Norcan and Canterm (under the ownership of Olco) in Montreal and Québec City, and are not due to any federal or provincial regulations.

All of the investments have been related to the storage and blending of biodiesel, at the refinery or terminal, such as the installation of new B100 receipt tanks and/or modification of existing tanks (cleaning, treating and installation of filters, usually one tank per site), temperature control equipment (heating and insulation), blending equipment (in-line or at the rack), modification of blending electronics and billing systems and customer education. Three sites received truck offload facilities and two sites received rail and marine offload facilities, respectively.

A total of approximately 200 sales sites (commercial and retail) had already been upgraded in order to accommodate biodiesel blends. The majority of these sites are in the East, due to Quebec already having a market for biodiesel blends, and are operated by independents. The remaining sites are in the West (no sites in Ontario). The investments in the West were put in place in order to meet the provincial regulations, whereas those in the East were not.

Projects currently underway

New infrastructure projects that are currently underway are described below and listed according to their expected completion dates. In order to preserve the confidentiality of the data provided by the respondents, refinery and terminal infrastructure additions are described together. It should be noted that all projects that are currently underway are located in the West and have been put in place in order to meet existing provincial regulations.

January 2011- It is predicted that three refinery and/or terminal upgrades in the West only could be put in place by January 2011 (although it should be noted that actual biodiesel blending would not likely occur before early April, due to cold temperatures). These infrastructure additions include truck receipt facilities for biodiesel at two sites, rail receipt facilities at one site, new tanks and lines with heating, facilities for rack blending directly into truck and rail, as well as in-line blending facilities.

June 2011- By this date, it is estimated that in addition to the infrastructure described above, additional infrastructure at one refinery/terminal could be operational. This site upgrade would include heated storage tanks and a heated in-line blending system, as well as truck offload facilities.

December 2011- No additional infrastructure is anticipated for this date.

June 2012- One additional site infrastructure upgrade could be completed by this date. It will include heated storage tanks and a heated in-line blending system, as well as truck offload facilities.

Approximately 230 additional sales sites have been upgraded to accommodate biodiesel blends since January 2010.

Projects awaiting regulatory certainty

The majority of new infrastructure projects that would be put in place in order to meet the proposed federal regulations are awaiting regulatory certainty to be put into action. These projects are described below and listed by their estimated required lead times from regulatory certainty. In order to preserve the confidentiality of the data provided by the respondents, refinery and terminal infrastructure additions are described together.

6 months- None of the planned additional infrastructure could be in place by this time.

12 months- One proposed project in the East could be completed by this time. The project involves the installation of heated storage tanks and a heated in-line blending system at a refinery or terminal site.

18 months- No additional planned infrastructure modifications could be in place by this time.

24 months- It is estimated that the majority (10 sites) of large-scale infrastructure additions could be in place by this time. In addition to the one site in the East completed at 12 months, it is expected that two refinery and/or terminal sites could be upgraded in the West, four in Ontario and three in the East. One site will invest in pipeline testing and pipeline protocol changes in order to possibly transport B5 by pipeline. Two sites will receive marine receipt and piping facilities, one site will receive rail receipt facilities and three sites will receive truck receipt facilities Three sites will receive rack blending facilities and one site will

receive equipment for batch blending of ultra low-sulfur kerosene (ULSK) with seasonal diesel. Most sites will also include heated tanks and lines as well as upgrades to blending electronics.

30+ months- For this date, in addition to the infrastructure put in place by 24 months, it is estimated that the remaining six sites comprised of one refinery and/or terminal site upgrade would be completed in the West, two in Ontario and three in the East. All six sites will receive rail receipt facilities and five will also receive truck receipt facilities. Five sites will install rack blending equipment; two will install in-line blending equipment. All sites will either install new tanks and/or clean existing tanks, as well as tank and line heating systems.

It is estimated that approximately 1500 additional sales sites (commercial and retail) will need to be converted in order to meet the federal regulations.

Biodiesel and kerosene requirements

The situation in the West is unique because of existing provincial mandates. The marginal volumes of biodiesel being blended in order to meet the proposed federal requirements are relatively low (notably because the regional producers/blenders in the West would already be meeting the proposed federal requirement via their blending for provincial regulations). National refiner/marketers operating in this region will choose to blend in high concentrations (B5) only during the warmer months, mostly April to September, in order to help them meet their national 2% average. Therefore kerosene is required only during the season transition months of March, April, May and August, September, October.

The situation is quite different in Ontario and the East. Since there are no existing or planned provincial regulations for renewable content in diesel/heating oil in these regions, the volumes of biodiesel that will need to be blended in order to meet the federal mandate will be higher. Due to the regional nature of their operations, regional producers/blenders will have less flexibility in terms of where and when they blend with biodiesel. Therefore, in this region, there are significant volumes of biodiesel that will be blended during the winter months, which requires large volumes of kerosene. Nevertheless, in all regions blenders will seek to minimize biodiesel blending during the colder months.

Costs of infrastructure additions/upgrades and additional kerosene

The costs for the upgrade of one refinery or terminal site range from $0.5 million to $16.3 million, the average being around $7.5 million. The costs depend largely on the extent of the infrastructure additions. Sites that require marine and/or rail offloading infrastructure for biodiesel had the highest costs, usually in the $7 million to $16 million range. Truck offloading equipment, new tanks, equipment for heating and in-line or blending at the rack are all also significant expenses, ranging from $1 million to $7 million.

Table 1 presents the total infrastructure additions and their costs, by region:

TABLE 1 - NUMBER OF REFINERY AND/OR TERMINAL SITES RECEIVING NEW INFRASTRUCTURE ADDITIONS AND/OR UPGRADES AND THEIR COSTS

	Existing investments		Additional investments		Total	
	Number of sites	Total cost ($ million)	Number of sites	Total cost ($ million)	Number of sites	Total cost ($ million)
West	9	20.0	8	48.3	17	68.3
Ontario	0	n/a	6	42.6	6	42.6
East	3	1.7	7	68.0	10	69.7
Total Canada	12	21.7	21	158.9	33	180.6

The cost of upgrading a retail site is very low, from $400 - $2000 on average. However, the number of retail sites that are expected to be upgraded is high, approximately 1500. Based on estimates from the respondents, it is expected that a total of $1.8 million will need to be spent on upgrading retail sites across the country in order to sell biodiesel blends due to the proposed federal regulations.

Table 2 presents the marginal annual costs of blending with kerosene in order to meet cloud point requirements. For the purposes of this calculation we have used a price differential of 4.9 CAN cents/litre between kerosene and conventional diesel. This is based on the average historic differential in wholesale prices for kerosene and No.2 distillate during winter months (October to March) for the last three years (2007 – 2010) (EIA, 2010). The table is based on projected 2013 demand for diesel in Canada as it can be assumed that all blending infrastructure would be in place at that time.

TABLE 2 – ANNUAL COSTS OF ADDITIONAL KEROSENE

	Provincial mandates only		Federal mandate only		Total	
	Volume* (m^3)	Cost (million $)	Volume* (m^3)	Cost (million $)	Volume* (m^3)	Cost (million $)
West	123,865	6.07	55,704	2.73	179,570	8.80
Ontario + East	10,723	0.53	472,277	23.14	483,000	23.67
Total Canada	134,588	6.59	527,981	25.87	662,569	32.47

*Based on 2013 demand.

In some cases producers and blenders will be using HVO instead of biodiesel in order to meet the federal and provincial requirements (primarily because HVO has superior cold flow properties). This is mainly due to the fact that in some regions, companies will have to blend biocontent during the winter months to adhere to provincial regualtions especially in BC, for the 5% provincial regulation. The use of HVO would also result in savings in avoided ULSK purchases as well as by reducing the need for specialized infrastructure to store and blend it.

However, HVO is currently very expensive relative to biodiesel. The price differential will vary according to changes in feedstock prices but is currently in the range of about 0.3 – 0.4 $/L. Therefore, for the provincial regulations only in the West, it is expected that about $18 - $21 million will be spent annually on HVO, based on 2013 demand (no HVO is intended to be used in Ontario and the East in the absence of federal

regulations). The incremental annual costs of HVO for the federal regulations only is expected to be approximately $9 - $12 million in the West and $1.8 - $2.4 million in Ontario and the East. A significant portion of these costs are related to transportation, since for the moment and in the near future the product is only available in Singapore and Europe. It should be noted that some respondents indicated that they are considering plans to install facilities to produce this product themselves.

1. Introduction

1.1 Background

Since 1980, the Government of Canada has supported alternative transportation fuel development. The Government of Canada has been very active in the area of research and development on technologies for renewable fuel production and use. In 2006, the Canadian government proposed Regulations under the Canadian Environmental Protection Act that required average renewable fuels content for the Canadian conventional fuels. The key elements of the approach as indicated in the Notice of Intent, published December 30, 2006, included (Canada Gazette, 2006):

- The requirement for an average of five percent renewable content based on the volume of gasoline that a company produces or imports for use in Canada commencing in September 2010;

- The requirement for an average of two percent renewable content in the diesel and heating oil pool by 2012 upon successful demonstration of renewable diesel fuel use under a range of Canadian conditions;

- A credit and trading system such that a company would have an option of obtaining credits from others rather than actually having renewable content in its fuel.

On 26 June 2008, Bill C-33, an Act to amend the Canadian Environmental Protection Act (1999), was passed by the Standing Senate Committee on Energy, the Environment and Natural Resources, facilitating the implementation of regulations that can address the key elements of renewable content in fuels and reduce greenhouse gas (GHG) emissions.

In April 2010, the federal government indicated that no fixed timeline would now be associated with the two percent regulation and that "this requirement would only be brought into force once the technical feasibility of renewable diesel fuel use under a range of Canadian conditions has been demonstrated" (Environment Canada, 2010).

In this context, the Canadian government requires a study that addresses the necessary infrastructure, capital and other costs and time frame required for the implementation of a 2% national renewable diesel mandate across Canada under the conditions prescribed by the proposed Regulations. The principal objective of this project is to assess these issues.

More specifically, this mandate involves six tasks:

1) Assessment of physical blending, storage and distribution infrastructure for renewable content in diesel and heating oil in place on January 1st 2010;

2) Assessment of what infrastructure remains to be installed in order for regulated parties to comply with the regulations;

3) Estimation of incremental kerosene/ultra low-sulfur kerosene (ULSK) and biodiesel requirements to meet fuel specifications, based on projected regional blending schedules;

4) Estimation of the lead time required to plan, permit, build and commission the infrastructure necessary to comply with the federal regulations, including refinery, terminal, retail and transportation infrastructure;

5) Estimation of the incremental costs of additional infrastructure and ULSK necessary to meet the federal regulation;

6) Evaluation of the industry's ability to ensure that distillate pools with biocontent can be kept separate from those without.

The results of these Tasks were obtained by carrying out a literature review and also through extensive consultation with industry proponents. We provided fuel producers and importers with a questionnaire to complete (included in Appendix A) and obtained clarifications when necessary. The majority of large petroleum producers have agreed to participate in this study, with the understanding that any sensitive commercial information be protected.

In order to preserve the confidentiality of the commercially sensitive information provided by the petroleum producers, for the purposes of this report we will be presenting results aggregated by region. The region defined as "West" includes British Columbia, Alberta, Saskatchewan and Manitoba. There is a central region that includes only the province of Ontario and will therefore be referred to simply as "Ontario" throughout the text. The region defined as "East" includes Quebec and the Atlantic provinces.

1.2 Existing demand for biodiesel

Infrastructure for handling and blending biodiesel currently exists across the country, in the absence of a federal regulation, for a number of reasons. In the Western region, provincial regulations currently exist in both British Columbia (5%) and Manitoba (2%). Alberta has officially mandated its own 2% biodiesel regulation, to take effect next year, and Saskatchewan has indicated that it will do the same (although it has not yet been formally mandated).

In Ontario and Quebec, some biodiesel is being blending in the absence of provincial or federal regulations. This is due to some demonstration initiatives taking place with public transportation and government service vehicles in a number of jurisdictions. In Quebec in particular, this has allowed Norcan and Olco, who are already in the business of providing boutique products, to get into the business of selling biodiesel blends. There have also been some initiatives in Quebec to incent agricultural producers to use biodiesel blends for their equipment, given that using these fuels supports their industry. Relative to the volumes being blended in the West for provincial regulations, however, the volumes blended in Ontario and the East remain small.

2. Existing and anticipated additional infrastructure for the storage, blending and distribution of renewable content in diesel and heating oil

This section provides a description of the existing infrastructure for the production of renewable diesel blends, as of January 1st, 2010, as well as the necessary anticipated additional infrastructure that would be required in the context of a 2% federal requirement for renewable content in diesel and heating oil.

Regarding anticipated new infrastructure, it should be noted that certain stakeholders have not yet fully planned what new infrastructure investments they would make in order to conform to the proposed federal requirements. Some are waiting for a definitive signal from the federal government before they begin this planning process. In addition, those estimates that were provided by stakeholders are by definition preliminary and subject to change. Therefore, the results presented regarding anticipated new infrastructure should be regarded as neither a complete nor a definitive portrait of future investments.

2.1 Refineries

There are presently 19 refineries[1] in Canada. The most recent refinery was built in 1984, but since then the constant increase in demand has required investments to upgrade efficiency and reduce costs. Refineries have also made investments to comply with product specifications and environmental regulations.

Although Canada is the world's 7th largest oil producer, its crude oil imports account for more than half of the input to domestic refineries (NRCan, 2008),mainly because the cost of transporting oil from western Canada to eastern Canada is higher than the cost of importing crude oil. Also, not all refineries in eastern Canada are well equipped to use bitumen-based crude oil. Consequently, Atlantic Canada and Quebec choose to import crude oil from Europe, OPEC countries and the north-eastern United States because they have access to those markets by the major waterways. More recently, a number of these refineries have started to use some of the offshore Newfoundland and Labrador production as feedstock.

In general, western refineries supply petroleum product demand from Vancouver to Thunder Bay; Ontario refineries supply Sault Ste. Marie, northern Ontario and the area surround the GTA; Quebec refineries supply the St. Lawrence River corridor from Toronto to the Gaspé Peninsula. Finally, Atlantic refineries generally supply local demand as well as the Arctic and Hudson Bay regions and export significant product to the United States.

The downstream petroleum industry can be divided into three regions: Western Canada, Ontario and Quebec/Atlantic Canada. To supply all petroleum products to the end-users, the distribution infrastructure is composed of pipelines, ships, railways and trucks. All of these modes are used at different levels, depending on the region of Canada.

[1] For the purposes of this study, we define refineries as those that produce gasoline/distillate, heating oil, lube oil and asphalt.

The integration of biofuels into the petroleum product distribution infrastructure will have an impact on refiners, distributors and marketers. Physical differences between pure petroleum products and those blended with biofuels will affect production, distribution and storage.

Table 3 shows the production of the main petroleum products used in the transportation sector by province for the year 2009. Most provinces produce mainly motor gasoline, except for Alberta and Quebec, which produce a significant quantity of diesel fuel as well. Atlantic Canada is the primary producer of heating oil in the country. Although most provinces in Canada operate at least one refinery, Manitoba, Prince Edward Island and the territories do not have any refineries in operation.

TABLE 3 – PRODUCTION OF THE PETROLEUM PRODUCTS USED IN TRANSPORTATION BY PROVINCE, 2009 (MILLION LITRES)

Petroleum products	Atlantic provinces	Quebec	Ontario	Alberta	Other provinces and territories	Total
Motor gasoline	9,836.4	10,781.8	10,181.5	8,254.1	4,325.1	43,378.9
Diesel fuel oil	3,374.9	6,418.3	4,927.0	9,527.0	3,161.7	27,408.9
Aviation turbo fuel	939.6	1,041.7	1,186.6	1,179.4	296.6	4,643.9
Light Fuel Oil	5,954.1	1,264.2	739.3	23.2	131.3	8,112.1
Heavy Fuel Oil	3,315.1	2,494.0	530.2	77.1	334.9	6,751.3
Other Products*	1,907.6	2,687.0	7,940.0	6,159.6	1,464.1	20,158.3
Total production	**25,327.7**	**24,687.0**	**25,504.6**	**25,220.4**	**9,713.7**	**110,453.4**

* Includes propane, butane, petro-chemicals, naphtha, stove oil and kerosene, aviation gasoline, asphalt, petroleum coke, lubricant oils, still gas and others.
Source: Statistics Canada, 2010

There are currently 19 refineries under the operation of 11 refining-marketing companies in Canada. Imperial Oil, Shell and Suncor market nationally and each operate more than one refinery. Regional refineries generally have more local markets and only operate one refinery. These are North Atlantic Refining, Irving Oil and Ultramar in eastern Canada and Co-op, Husky and Chevron in western Canada. A total of 16 refineries produce a full range of petroleum products. The Husky plant in Lloydminster, Alberta and the Moose Jaw Asphalt plant in Moose Jaw, Saskatchewan produce mostly asphalt. The Nova Chemicals plant in Sarnia, Ontario is a petrochemical plant. Consequently, these last three are not considered as typical refineries for the production of fuels. Table 4 below provides a list of refineries in Canada and their production capacities. This table represents the most recent data from the National Energy Board for the year 2008. It should be noted that since a recent merger between Petro-Canada and Suncor, Petro-Canada's refineries are now under the ownership of Suncor.

TABLE 4 - REFINERIES IN CANADA: LOCATION, TYPE AND PRODUCTION CAPACITIES, 2008

Refinery	Location	Refinery type	Million litres / day
Imperial Oil	Dartmouth, NS	Cracking	13.0
Irving Oil	Saint-John, NB	Cracking	45.3
North Atlantic Refining	Come-by-Chance, NF	Cracking	18.3
Total Atlantic			**76.6**
Petro-Canada*	Montreal, QC	Cracking	20.7
Shell	Montreal, QC	Cracking	207
Ultramar	Saint-Romuald, QC	Cracking	42.1
Total Quebec			**74.8**
Imperial Oil	Nanticoke, ON	Cracking	17.8
Imperial Oil	Sarnia, ON	Coking	19.2
Shell	Sarnia, ON	Cracking	11.4
Suncor	Sarnia, ON	Hydrocracking	13.2
Nova Chemicals	Sarnia, ON	Topping	13.2
Total Ontario			**74.8**
Co-op Newgrade	Regina, SK	Hydrocracking/coking	15.6
Husky	Lloydminster, AB	Topping Asphalt	4.0
Imperial Oil	Edmonton, AB	Cracking	29.7
Petro-Canada*	Edmonton, AB	Coking	21.9
Moose-Jaw Asphalt	Moose Jaw, SK	Topping asphalt	2.5
Shell	Scotford, AB	Hydrocracking/coking	15.9
Total Prairies			**89.6**
Chevron	Burnaby, BC	Cracking	8.3
Husky Oil	Prince George, BC	Cracking	1.9
Total British Colombia			**10.2**
Total Canada			334.7

Source: NEB, 2009a; Industry Canada's Strategies Canadian Company Capabilities (CCC) website, 2009.
* It should be noted that since a recent merger between Petro-Canada and Suncor, Petro-Canada's refineries are now under the ownership of Suncor.

Most refineries in Canada were initially built to process light crude oil. Lately, significant investments have been made by some refiners in order to be able to run on heavier crude oil such as oil sands bitumen. Because of this cost aspect of the refinery margin growth, refineries' profits have not increased proportionally. Since refining companies are investing in their facilities, to modernize their equipment and expand their capacity, it is possible that refining margins will remain high in the coming years (NRCan, 2009).

However, the recent economic downturn and the associated decrease in fuel prices have caused certain planned infrastructure upgrades and/or expansions to be cancelled. As stated in the *Canadian Energy Overview* (NEB, 2009):

> Given the challenging global economic conditions, numerous capital investment projects have been deferred or cancelled. These projects were primarily aimed at increasing production and refining capacity. In Canada, the list of cancelled or deferred projects is growing and until the price of crude oil rebounds to a level that provides economic incentive for investment, incremental production volumes and refining capacity will remain in doubt.

This unfavourable investment climate may help explain the limited investments that have been made thus far (as of January 1st, 2010), in order to accommodate blending of diesel and heating oil with renewable content. Most petroleum producers are waiting for a definitive regulatory signal from the federal government regarding renewable content requirements.

2.1.1 Existing infrastructure for renewable fuels and blends

Nevertheless, some investments have been made at two refineries in the West as of January 1st 2010: at the Consumers' Co-op Refineries Ltd. (CCRL) refinery in Regina, Saskatchewan and the Chevron refinery-terminal in Burnaby, British Columbia. These investments were carried out to meet existing provincial regulations in British Columbia, Manitoba and Alberta. All of the investments have been related to the storage and blending of biodiesel at the refinery and are therefore similar investments to those found at the terminals.

2.1.2 Additional infrastructure for renewable fuels and blends

In order to protect the confidentiality of the data provided by the petroleum producers, we have grouped the discussion of anticipated new infrastructure at refineries and terminals together in Section 2.2.2. This is also logical in the sense that the types of investments that have been made or that are anticipated at refineries and terminals are in fact very similar. It can be mentioned here that although no firm plans have yet been made, some producers are considering reconfiguring existing refineries in order to commence their own production of hydrotreated vegetable oil (HVO)[2]. HVO has significant physical advantages over

[2] It should be noted that the proposed regulation does not specify the type of renewable content to be blended with diesel and heating oil. Certain hydro-cracked or hydro-treated products from renewable sources such as hydro-treated vegetable oil (HVO) are chemically indistinguishable from fossil diesel and heating oil. These types of products are admissible under the current regulations as renewable content and do not require the heating and separate storage systems that biodiesel requires.

biodiesel in that it has superior cold flow properties and higher energy content. Therefore the transportation, storage and blending of HVO does not require temperature regulation (such as heated and insulated tanks and lines), reducing infrastructure costs. However it is currently quite expensive relative to biodiesel since supply is low and it must be shipped either from Singapore or Europe. The installation of new facilities for the production of HVO in Canada would significantly reduce its costs.

2.2 Fuel storage terminals and bulk plants

Once refined, petroleum products leave the refinery and are delivered to a primary terminal where they are stored before being distributed either to a secondary terminal (bulk plant), a cardlock or a retail station. Table 5 presents the distribution of primary terminals, bulk plants and cardlocks in each province.

TABLE 5 – PRIMARY AND SECONDARY TERMINALS, BULK PLANTS AND CARDLOCKS IN CANADA, 2007

	Number of sites												
	BC	**AB**	**SK**	**MB**	**ON**	**QC**	**NB**	**NS**	**NL**	**PE**	**NT**	**YT**	**Total**
Primary terminals	15	5	3	3	22	13	2	2	8	1	2	0	76
Secondary terminals (bulk plants)	75	184	114	47	81	33	18	29	18	4	8	3	614
Cardlocks and commercial sales sites	200	334	159	77	183	121	32	17	13	1	2	4	1143

Sources: MJ Ervin and Associates, 2007, and CPPI, 2009.

Petroleum products are most commonly received at primary terminals by pipeline (for major primary terminals), marine (for coastal terminals), by truck and in a few cases by rail. Almost all primary terminals are owned by the petroleum refiners, who share their facilities to optimize efficiency. There are 76 primary terminals in Canada (CPPI, 2009).

The rationalization and consolidation of the petroleum product industry since the oil crisis of the 1970s has resulted in a reduction of the number of fuel terminals in Canada in the last 30 years. Multiple producers now load petroleum products at the same terminal, where the addition of proprietary additives takes place before distribution to bulk plants or retail stations. Blending with biofuels typically takes place at the terminals and separate tanks are required for biofuel storage before blending.

Primary terminals are, for the most part, located close to major markets and transportation modes (Sine Nomine, 2006). These terminals mostly use above-ground floating roof tanks and have a storage capacity that can range from 20 million litres to 1 billion litres. All are equipped with loading facilities for the upstream transportation of the product by marine, rail and truck. The vast majority of product leaves the primary terminals by tanker truck (MJ Ervin and Associates, 2007).

A second distribution segment of light products encompasses the transportation out of primary terminals to the bulk plants by pipeline, truck, rail or marine tanker (Sine Nomine, 2006). Bulk plants are usually located in areas where retail distribution is not economical. They operate as secondary points of storage and distribution, but also of sales, and as such are typically not shared facilities (unlike primary terminals). Product is received primarily by tanker truck directly from primary terminals. Storage capacity is usually of

the order of 400,000 to 800,000 litres in above- and below-ground tanks. There are over 600 bulk plants in Canada (MJ Ervin and Associates, 2007).

2.2.1 Existing infrastructure for renewable fuels and blends

In addition to some refineries, a large proportion of the storage and blending of biodiesel, as well as the storage of biodiesel blends, takes place at the terminals, bulk plants or cardlocks. As of January 1st, 2010, ten terminals had received modifications or upgrades to accommodate biodiesel. Seven out of the ten terminals are located in the West and are operated by Imperial Oil, Shell, Suncor. These investments were made in order to meet provincial regulations in Manitoba, Alberta and British Columbia. Three of the ten upgraded terminals are located in the East, are operated by Norcan and Canterm (under the ownership of Olco) in Montreal and Québec City and are not due to any federal or provincial regulations.

The types of investments that have been made at terminals in order to accommodate renewable content, as of January 1st 2010, are listed below:

- Truck offload facilities for B100 and/or BXX;
- Rail offload facilities for B100 and/or BXX;
- Marine offload facilities for B100 and/or BXX;
- Installation of new tanks and/or modification of existing tanks (cleaning, treating and installation of filters) for the dedicated storage of B100 and/or BXX;
- Procedural changes in tank inventory management for B100, BXX or HVO;
- Installation of temperature control equipment for tanks containing B100 or BXX: heating coils/elements, nitrogen blankets, etc.;
- Installation of in-line blending equipment;
- Installation of blending equipment on the rack;
- Line tracing to the rack and back to the tank for B100 and BXX;
- Re-programming of rack ordering software for BXX.
- Modification to isystems;
- Customer education.

Figure 1 below provides a general schematic of a terminal modified for biodiesel blending and storage.

FIGURE 1 – A TERMINAL WITH BIODIESEL

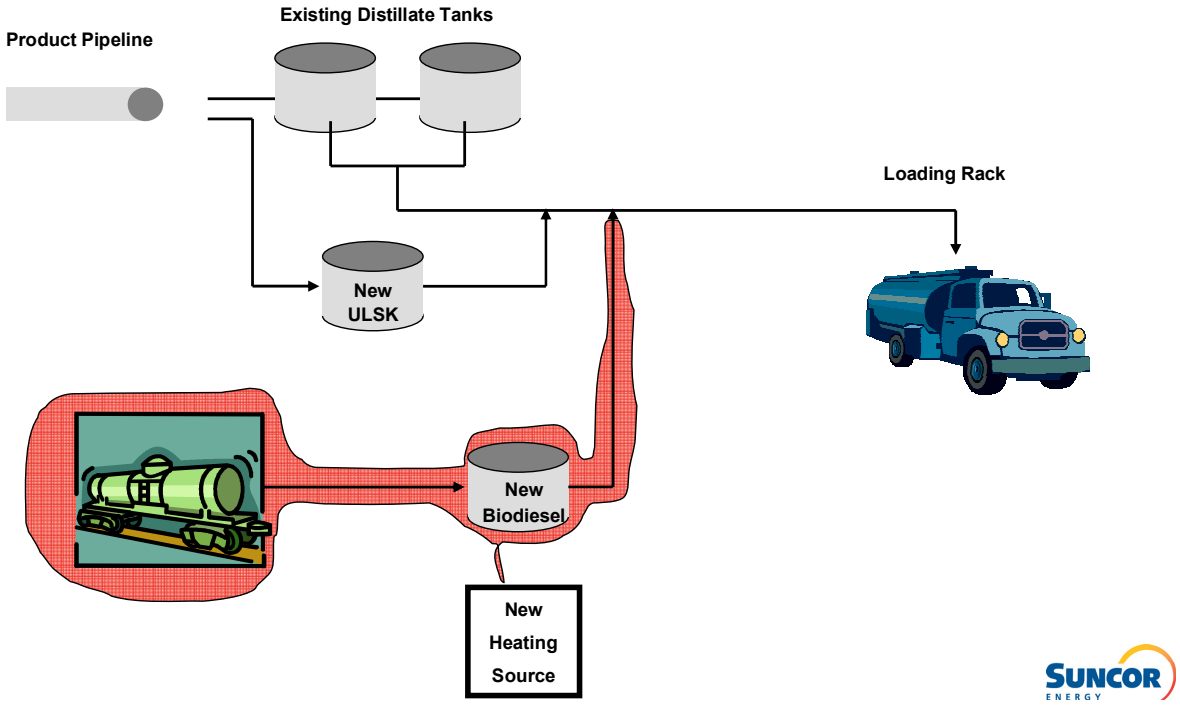


Diagram provided by Suncor Energy.

2.2.2 Additional infrastructure for renewable fuels and blends

Additional investments are anticipated at a total of 21 refineries and terminals in Canada: eight in the West, six in Ontario and seven in the East. It should be noted that all of the proposed new projects in the West are predominantly in order to meet provincial regulations. However, certain respondents have indicated that although the projects were put in place for provincial regulations, some projects would have been put in place anyway even in the absence of provincial regulations (or at least the nature of the investments would not have changed much), in order to meet the federal regulations. Also note that five of the eight projects in the West are already underway. Not surprisingly, most of the infrastructure additions are being made at the refinery and/or terminal sites serving large markets (i.e. near large urban centres) and capable of handling high volumes.

It should be noted that national refiner/marketers have the greatest flexibility in meeting the proposed federal regulations, as they can make investments strategically in large markets and/or in markets where provincial regulations already exist, in order to meet their annual national average of 2% biocontent. However, the impact of the proposed regulations in terms of cost is likely to be higher for regional producers/blenders, because they don't all have access to larger markets and they don't have the flexibility of being able to choose strategically in which market they will do their blending, yet the scale of the investments necessary remain about the same. This results in the average cost impact per litre for a regional producer/blender being higher for a regional producer/importer than for a national refiner/marketer. Of course, for the proposed federal regulations, this impact will mostly affect the regional

producers/blenders in Ontario and the East, where provincial mandates do not already exist. Regional producers/blenders in the West have already made their investments in order to meet the provincial regulations; therefore the impact of the proposed federal regulations on their operations will be minimal.

The types of investments to be made at these refineries and terminals include those listed above in Section 2.2.1 as well as the following:

- Marine tank piping modifications for the receipt of B100 or HVO;
- A rail delivery site, including:
    - Rail site preparation
    - Sewer system
    - Rail extension
    - Fire protection
    - Tank cars heating facilities
    - Unloading facilities
    - Transfer pumps
    - Traced and Insulated Transfer
    - Piping (1600 meters+);
- Disposal of contents of former tanks;
- Conversion of out-of-use alternate storage into biodiesel storage;
- New truck loading rack positions;
- Facilities for blending ULSK and B100 directly into truck and rail;
- Additional security to allow 24-hour access to refinery terminal.
- Conversion from steam heating to electric heating;
- Batch blending capability for ULSK and seasonal diesel, to be stored and subsequently blended with B100.

In the case of refinery-terminals, in some cases the heating of tanks and lines is planned to be achieved by using waste steam from the refinery.

It should also be noted that at some terminals, only a portion of truck loading rack positions for diesel will be equipped with blending equipment, whereas at other terminals, all rack positions will be equipped.

2.3 Commercial and retail sales sites

In 2008, there were 12,684 petroleum product retail stations in Canada. The retail station population has been in steady decline from a population of around 20,000 in the late 1980's. Approximately 28% of these are owned by integrated refiner-marketers such as Shell, Irving Oil, Petro-Canada, etc. The remaining 72% are owned by independent marketer-retailers that are not involved in any refining activities (MJ Ervin and Associates, 2009). Cardlocks are commercial sales stations used primarily for long-distance hauler trucks and delivery vehicles. They offer mostly diesel, but also some gasoline. There are over 1,000 cardlock and commercial facilities in Canada. The distribution of cardlocks and retail outlets across Canada in 2008 is given in Table 6.

TABLE 6– DISTRIBUTION OF RETAIL OUTLETS, 2008

	BC	AB	SK	MB	ON	QC	NB	NS	PE	NL	YT	NT	Total
Cardlocks and commercial sales sites	200	334	159	77	183	121	32	17	13	1	2	4	1143
Retail outlet population	1,400	1,610	650	646	3,413	3,452	454	428	95	439	45	52	12,684

Source: MJ Ervin and Associates, 2009.

Table 7 presents the domestic retail sales of diesel by province in 2007. It should be noted that this table is for illustrative purposes only and that the federal regulations will apply to all volumes of diesel and heating oil produced, not the volumes sold (retail or otherwise). The actual volumes being regulated for blending are much higher than what is outlined below.

TABLE 7– DOMESTIC RETAIL SALES OF DIESEL

	Retail sales 2007 (million litres)
Newfoundland and Labrador	96.6
Prince Edward Island	19.7
New Brunswick	126.3
Nova Scotia	151.5
Quebec	1248.6
Ontario	1898.6
Manitoba	199.8
Saskatchewan	272.4
Alberta	1179.5
British Columbia	481.6
Yukon, Nunavut and Territories	17.4
Canada	**5692**

Source: Statistics Canada, 2009a and 2009b.

2.3.1 Existing Infrastructure for renewable fuels and blends

As of January 1st, 2010, a total of approximately 200 sales sites (service stations, truck stops, bulk plants, etc.) had already been upgraded in order to accommodate biodiesel blends. The majority of these sites are in the East, due to Quebec already having a market for biodiesel blends, and are operated by independents. The remaining sites are in the West (no sites in Ontario). The investments in the West were put in place in order to meet the provincial regulations, whereas those in the East were not.

The types of infrastructure additions that have been put in place are:

- Cleaning of underground and overground tanks;
- Installation of new filters (100% compatible with biodiesel).

2.3.2 Additional infrastructure for renewable fuels and blends

It is estimated that approximately 1500 additional sales sites (service stations, truck stops, bulk plants, etc.) will need to be converted in order to meet the federal regulations. It should be noted that we are aware of approximately 230 of these sites that have already been upgraded, but were upgraded after January 1st, 2010, in order to meet the provincial regulations in Manitoba and British Columbia. The same infrastructure additions as those listed above in Section 2.3.1 will be installed.

2.4 Transportation

The top oil producers in the country, including Suncor, Shell and Imperial Oil are the primary owners of the distribution infrastructure for petroleum-based fuels. Depending on the region, other refiners (such as Ultramar, Irving, Federated Co-operatives, Arco, Chevron and Husky) may own more of the infrastructure, with part of the balance also going to the 120 independent marketers (Sine Nomine, 2006). The refineries listed above are the starting point for distribution throughout Canada. A first distribution segment in the petroleum industry includes the transportation of crude oil to refineries, followed by the transportation of the refined petroleum products to primary terminals for storage. As most of the crude refined in western Canada is of Canadian origin, in contrast with the crude refined in the eastern Canada that is largely imported from international sources, the average distance travelled for the transportation of crude to the refinery varies significantly between regions.

The methods used for the first distribution segment (post-refineries) varies between tanker trucks, rail, marine tankers and pipelines, depending on the quantity of fuel and the geographic location. Pipelines are a popular transportation mode, as there are 4,000 kilometres of pipelines used to send crude oil to domestic Canadian markets (SDTC, 2006). Pipelines are considered to be the safest and most energy-efficient method of distributing large amounts of fuel (NEB, 2008b). As such, pipelines have the least impact in terms or air emissions because much less energy is required to move the same quantity of fuel over the same distance.

As seen in Figure 2, there are five main pipelines in the Alberta region: two going east towards the industrial centres from the oil sands to the prairies and eastern Ontario, one going south into the United States, one going north and one going west to British Columbia (NEB, 2008b).

FIGURE 2: OIL PIPELINES REGULATED BY THE NATIONAL ENERGY BOARD

Source: NEB, 2008b

However, transportation by pipeline is used only in regions where large volumes of fuel justify their construction as the investment costs are very high (the payback period is generally 15 to 20+ years). In regions where pipelines are not available, petroleum products are moved to terminals by truck or rail and by marine tankers in the particular case of the Atlantic region. Trucking is the most expensive transportation mode, but it is also the most flexible. The rail mode of transportation requires longer lead times and consequently is not the most appropriate option when products need to be delivered quickly. Transportation fuels are usually moved by truck from terminals to storage tanks at retail sites.

Western Canada. Most of the refineries are located near Edmonton, the heart of the distribution system for petroleum products in this region. The refined products are distributed to several terminals via three pipelines and also by rail (Figure 3):

- The Trans Mountain Pipeline (TMPL) to terminals in Kamloops and Vancouver. Refineries located in British Colombia supply a third of the demand for petroleum products in the province; the rest of the demand is supplied by Edmonton's refineries through TMPL and rail to Prince George, Terrace and other locations. The Canadian National Railway (**CN)** is the principal provider of rail service for petroleum in Canada (M.J Ervin and Associates, 2007). From Vancouver, some refined products are also moved to terminals on Vancouver Island by marine barge. In case of shortfalls, petroleum products are imported from the US. The two principal marine shippers are (M.J. Ervin and Associates, 2007):

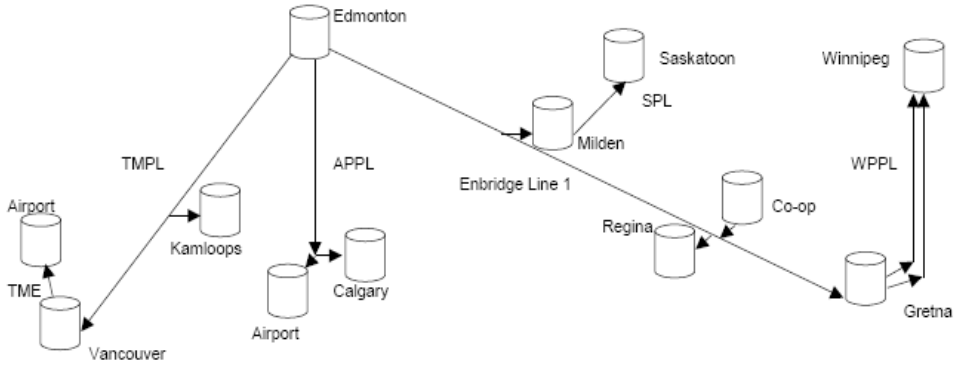
  ⇒ **Seaspan**, which operates a 4,000 m3 barge, principally between Chevron's refinery in Burnaby and Shell's terminal facility at Bare Point.

  ⇒ **Island Tug and Barge**, which operates several barges (up to 10,000 m3) for transport along the Pacific coastline.

- The Alberta Products Pipeline (APPL) to Calgary. When the APPL is used at full capacity during peak periods, refined products are shipped to southern Alberta by truck.

- The Enbridge Line 1 to Milden, Regina and Gretna. Products are then moved to Saskatoon and Winnipeg through secondary pipelines. Subsequently, Regina's refinery supplies the remaining demand of the province of Saskatchewan. From the Gretna terminal, some refined products can be injected through the Winnipeg Products Pipelines (WPPL). Subsequently, the terminals in Winnipeg supply the entire demand of Manitoba. From these terminals, it is also possible to load trucks and export products to the US. Finally, from these terminals, rail loading equipment can be used to move products to northern Ontario and consequently to supply regional markets between Winnipeg and Thunder Bay.

FIGURE 3: DISTRIBUTION NETWORK FOR PETROLEUM PRODUCTS IN WESTERN CANADA



Notes:
1) TMPL - ships crude and clean products in the same pipeline (24 inch)
2) Enbridge - Line 1 transports synthetic crude, NGL's and clean products. Products are delivered to terminals at Milden (no truck rack), Regina and Gretna (20 inch). Injections made at Edmonton & Regina.
3) APPL - 100 % clean product pipeline from Edmonton to Calgary (10 inch)
4) SPL- 100 % clean products from Milden to Saskatoon
5) WPPL- 100 % clean products from Gretna to Winnipeg via 2 pipelines (8 inch/ 10 inch)

Source: NRCan, 2007

Ontario. One refinery is located in Nanticoke and the rest are in Sarnia. Refined products are moved from these refineries by pipeline (Figure 4):

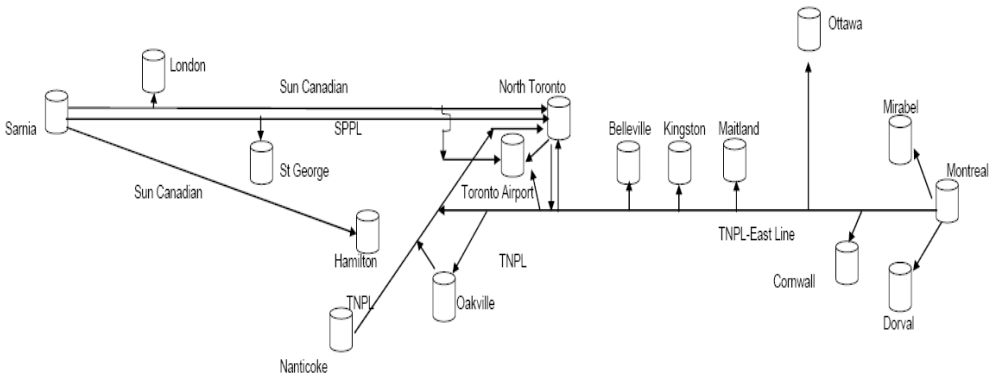
- The Sun Canadian pipeline system is used to move products from Sarnia to London, Hamilton and Toronto.

- The Sarnia Products Pipeline (SPPL) is used to ship products from Sarnia to St.George and Toronto.

- The Trans Northern Pipeline (TNPL) system allows products to be moved from Montreal refineries to southern Ontario, including Toronto. This pipeline does not have any additional capacity in case of shortages. The province of Ontario has indeed become dependent on the refinery production of Quebec for supply in petroleum products.

The northern part of Ontario is supplied from the terminals located in Sault Ste. Marie, Thunder Bay and Sudbury. In Thunder Bay, refined products are shipped by rail from Winnipeg and by marine barge from Sarnia. In Sault Ste. Marie, terminals are supplied by rail from Montreal and by marine barge from Sarnia. In Sudbury, the terminal is supplied by rail from Nanticoke.

FIGURE 4: DISTRIBUTION NETWORK FOR PETROLEUM PRODUCTS IN QUEBEC AND ONTARIO



Notes: 1) Details much more complex than shown in the Toronto and Montreal areas
2) All pipelines only move clean products.
3) Three (3) pipelines originate from Sarnia.Two (2) are operated by Sun Canadian and the 3rd by Imperial Oil.
4) The Trans- Northern Pipeline (TNPL) East line section transports products from Montreal to Ottawa and the Toronto area. Partly owned by Petro-Canada, Shell Canada Products and Imperial Oil

Source: NRCan, 2007

The province of Quebec and the Atlantic region. Contrary to the other two main regions, refined products are mainly moved by marine mode, except for the products moved to Ontario via TNPL and the products moved by rail between Saint-Romuald and Montreal (a pipeline project is under consideration for this purpose). Most marine terminals are located along the St. Lawrence River and in the Atlantic provinces.

As mentioned previously, some surpluses are generated by the refineries of these regions. Refineries in the Atlantic region export a large part of their production, mainly ultra low sulphur products, by marine cargoes to the US (as far as California). This region can also export petroleum products overseas by marine tanker when there is a demand. Finally, refined products can be shipped by vessels, rail, truck and pipeline to other locations outside the region.

Among the principal shipping operators that supply marine terminals for the regions, as well as for export to the US, are:

- **Algoma Tankers** operates five tankers with a total capacity of 80,000 m3.
- **Rigel Shipping** operates three tankers with a capacity of 10,500 m3 each.
- **Irving Oil** operates three tankers for US exports and one vessel (37,000 tonnes) for Canadian exports.
- **Coastal Shipping Ltd,** a subsidiary of Woodwards, operates three tankers principally for exports in Labrador and Nunavut.

There are numerous carriers involved in the transport of petroleum products in Canada. However, about 70% of the shipments are serviced by the top 10 to 12 common carriers (MJ Ervin and Associates, 2007).

Biofuel distribution in Canada is not achieved by the same means as fossil fuels; infrastructure must be modified for the transportation and distribution of first generation biofuels. Since the biodiesel industry is still at an embryonic phase and its development is fast, the best practices are not always used for the different distribution activities: transportation is currently done mostly by truck or rail, storage is primarily done by petroleum producers, especially for pure biodiesel for which there are no primary terminals, and blending is done largely through splash blending due to lack of infrastructure. Quebec is an exception with 65% to 75% of the blending is done by in-line injection directly at terminals.

2.4.1 Existing infrastructure for renewable fuels and blends

In general, apart from biodiesel and biodiesel blend receipt and loading facilities at refineries and terminals, refiner/marketers and blenders expect that the transportation industry (trucking, rail and marine) be responsible for the infrastructure changes necessary to meet the federal (and provincial) mandates.

A representative at the Canadian Trucking Association indicated that no noticeable increases in trucking for the transportation of renewable diesel and biodiesel blends have been observed. This is due to a lack of a federal regulation or of provincial regulations for most of the country. In the Western provinces where provincial regulations for renewable content exist, there has been an impact, but it has been small to date. A representative from the British Columbia Trucking Association (BCTA) indicated that he had not heard of any impact, positive or negative, of the provincial regulations to date. The BCTA indicated that the changes that have made have been mostly procedural, for instance: the cleaning of tanks carrying biodiesel is more challenging and must be much more thorough; and other products must be loaded and unloaded a number of times after biodiesel or biodiesel blends have been transported before jet fuel can be loaded into the same trailer. Some heated trailers had to be purchased to meet the increased demand. It should also be noted that most biodiesel is in fact currently transported in from the United States and that the majority of the impact on the transportation sector in the West is due to the transportation of biodiesel blends, which require less infrastructural adaptation (such as heated trailers).

The case is expected to be similar for rail. The impact on the Canadian marine transportation industry is expected to be small, since any changes would be the responsibility of the company from which the biodiesel is being imported.

In Ontario and the East, the volumes of biodiesel being blended are small, therefore the impact on transportation is negligible.

2.4.2 Additional infrastructure for renewable fuels and blends

For the most part, petroleum producers expect trucking, rail and marine operations to be responsible for any necessary additions to transportation infrastructure, notably heated and/or insulated tanks. In one region in the West, B5 may be transported by pipeline in the future, requiring pipeline testing and pipeline protocol changes.

It should be noted that in the United States, testing of transportation of B5 blends by pipeline (including those that transport jet fuel) has been carried out in order to determine appropriate pipeline protocol management, particularly to eliminate contamination of jet fuel. Kinder Morgan conducted its first successful test in October 2008 and is now sending regular commercial shipments of B5 (5000 barrels per

day (bpd), 10,000 bpd capacity) on its Plantation pipeline serving markets in Virginia, Georgia, North and South Carolina (Bannigan, 2010). Kinder Morgan has, however, isolated jet fuel shipments from these segments of the line (Reuters, 2009). World Energy and Northville Products Services have also conducted successful test shipments along the Colonial pipeline, which also transports jet fuel (McElroy, 2007 and NPS, 2007). Nevertheless, testing has recently slowed in the United States due to low demand and regulatory uncertainty.

The advantage of transporting biofuel blends by pipeline is that it is much faster and cost-effective. For the most part, however, biodiesel and biodiesel blends will continue to be transported by truck and rail in the meantime.

3. Necessary lead times for the planning, permitting, construction and commissioning of new infrastructure

As discussed in Section 2, some infrastructure for the blending of biocontent into diesel and heating oil has already been put into place: two refineries, seven terminals in the West and three terminals in the East. The types of investments being made, at either the refineries or at the terminals, relates to the receipt, storage, blending and loading of biodiesel and biodiesel blends. A total of approximately 200 retail sites have already been converted/upgraded in order to accommodate biodiesel blends (with an additional 200 modified since January 1, 2010). All of these investments along the supply chain were carried out to either meet existing provincial regulations in British Columbia, Manitoba and Alberta or to meet existing demand for biodiesel blends in Quebec (where there is no provincial mandate but a small market has already developed due to the use of biodiesel blends in public transportation and due to biodiesel sometimes being of lower cost relative to conventional diesel).

However, there is a need for significant additional infrastructure investments in order for the industry to be capable of meeting the 2% requirements for the proposed federal regulation. Additional investments are anticipated at a total of 21 refineries and terminals in Canada (eight in the West, six in Ontario and seven in the East) and it is estimated that approximately 1500 additional retail sites will need to be converted in order to meet the federal regulations.

The lead times for the upgrade of a terminal or refinery site, based on past investments already made, are approximately one to three years. This same range of lead times has also been estimated for new investments. Longer lead times are usually associated with larger investments, such as truck, rail and/or marine receipt facilities. Permitting and planning are typically the most time-intensive steps in the process, totaling 9 to 18 months. The planning stage is the most unpredictable at this point, as many respondents are waiting for regulatory certainty to begin their planning in earnest. Respondents noted that accelerating lead times in order to meet a mandated regulatory start date, although possible in some cases, can lead to significant cost overruns due to plans and permitting being rushed.

The lead times for retail site upgrades are very short, three to six months, since the types of modifications are minor (tank cleaning, new filters, inspections). Therefore we have not included them in the preparedness scenarios below as these modifications are typically done on an ad-hoc as-needed basis and are not the bottleneck in terms of industry preparedness for the proposed federal regulations.

3.1 Preparedness Scenarios

Below we provide a description of the existing and additional necessary renewable diesel infrastructure that could be realistically be put in place by a series of milestone dates. First we present the infrastructure that is already in place and then we describe the projects that are currently underway and their estimated completion dates. Finally, we describe the new projects that are awaiting regulatory certainty to be started and the estimated length of time required for these infrastructure additions/modifications. It should be noted that in most cases, new infrastructure will only be made operational during the Spring or Summer. This is to avoid beginning operations during the winter months, which can be more problematic due to cloud point issues. Therefore, if regulatory certainty is attained in December and a project takes a year to complete, it

will still not be made operational until at least April of the following year. This important point should be taken into account when analysing lead times for new infrastructure.

Existing infrastructure as of January 2010

Investments in new renewable diesel infrastructure have been made at two refineries in the West: at the CCRL refinery in Regina, Saskatchewan and the Chevron refinery-terminal in Burnaby, British Columbia. In addition, ten terminals had received modifications or upgrades to accommodate biodiesel. Seven out of the ten terminals are located in the West and are operated by Imperial Oil, Shell and Suncor. The investments in the West were made in order to meet provincial regulations in Manitoba and British Columbia and in anticipation of regulations in Alberta and Saskatchewan. Three of the ten upgraded terminals are located in the East, are operated by Norcan and Canterm (under the ownership of Olco) in Montreal and Québec City, and are not due to any federal or provincial regulations.

All of the investments have been related to the storage and blending of biodiesel, at the refinery or terminal, such as the installation of new B100 receipt tanks and/or modification of existing tanks (cleaning, treating and installation of filters, usually one tank per site), temperature control equipment (heating and insulation), blending equipment (in-line or at the rack), modification of blending electronics and billing systems and customer education. Three sites received truck offload facilities and two sites received rail and marine offload facilities, respectively.

A total of approximately 200 retail sites had already been converted/upgrades in order to accommodate biodiesel blends. The types of infrastructure modifications that have been put in place are relatively minor: cleaning of underground and aboveground tanks; installation of new filters (100% compatible with biodiesel) and inspections.

Projects currently underway

New infrastructure projects that are currently underway are described below and listed according to their expected completion dates. In order to preserve the confidentiality of the data provided by the respondents, refinery and terminal infrastructure additions are described together. It should be noted that all projects that are currently underway are located in the West and have been put in place in order to meet existing provincial regulations.

January 2011- It is predicted that three refinery and/or terminal upgrades in the West only could be put in place by January 2011 (although it should be noted that actual biodiesel blending would not likely occur before early April, due to cold temperatures). These infrastructure additions include truck receipt facilities for biodiesel at two sites, rail receipt facilities at one site, new tanks and lines with heating, facilities for rack blending directly into truck and rail, as well as in-line blending facilities.

June 2011- By this date, it is estimated that in addition to the infrastructure described above, additional infrastructure at one refinery/terminal could be operational. This site upgrade would include heated storage tanks and a heated in-line blending system, as well as truck offload facilities.

December 2011- No additional infrastructure is anticipated for this date.

June 2012- One additional site infrastructure upgrade could be completed by this date. It will include heated storage tanks and a heated in-line blending system, as well as truck offload facilities.

Approximately 200 additional retail sites have been upgraded to accommodate biodiesel blends since January 2010.

Projects awaiting regulatory certainty

The majority of new infrastructure projects that would be put in place in order to meet the proposed federal regulations are awaiting regulatory certainty to be put into action. These projects are described below and listed by their estimated required lead times from regulatory certainty. In order to preserve the confidentiality of the data provided by the respondents, refinery and terminal infrastructure additions are described together.

6 months- None of the planned additional infrastructure could be in place by this time.

12 months- One proposed project in the East could be completed by this time. The project involves the installation of heated storage tanks and a heated in-line blending system and a refinery or terminal site.

18 months- No additional planned infrastructure modifications could be in place by this time.

24 months- It is estimated that the majority (10 sites) of large-scale infrastructure additions could be in place by this time. In addition to the one site in the East completed at 12 months, it is expected that two refinery and/or terminal sites could be upgraded in the West, four in Ontario and three in the East. One site will invest in pipeline testing and pipeline protocol changes in order to possibly transport B5 by pipeline. Two sites will receive marine receipt and piping facilities, one site will receive rail receipt facilities and three sites will receive truck receipt facilities Three sites will receive rack blending facilities and one site will receive equipment for batch blending of ULSK with seasonal diesel. Most sites will also include heated tanks and lines as well as upgrades to blending electronics.

30+ months- For this date, in addition to the infrastructure put in place by 24 months, it is estimated that the remaining six sites comprised of one refinery and/or terminal site upgrade would be completed in the West, two in Ontario and three in the East. All six sites will receive rail receipt facilities and five will also receive truck receipt facilities. Five sites will install rack blending equipment; two will install in-line blending equipment. All sites will either install new tanks and/or clean existing tanks, as well as tank and line heating systems.

It is estimated that approximately 1500 additional retail sites will need to be converted in order to meet the federal regulations.

The discussion above is summarized in Table 8 below:

TABLE 8 - NUMBER OF REFINERY AND/OR TERMINAL SITES WITH NEW INFRASTRUCTURE ADDITIONS AND/OR UPGRADES

Number of sites (CUMULATIVE)									
	West			Ontario			East		
	Not for federal*	For federal	Total	Not for federal*	For federal	Total	Not for federal*	For federal	Total
January 2010	9	0	9	0	0	0	3	0	3
January 2011	12	0	12	0	0	0	3	0	3
June 2011	13	0	13	0	0	0	3	1	4
December 2011	13	0	13	0	0	0	3	1	4
June 2012	14	2	16	0	4	4	3	4	7
January 2013+	14	3	17	0	6	6	3	7	10

*It should be noted that although these investments were not driven in principal by the proposed federal mandate, they will of course contribute to achieving the federal 2% requirement and some respondents indicated that in some cases, the investments would not be very different if they were solely for the federal mandate.

As can be seen in Table 8, the majority of new infrastructure is estimated to be in place by June 2012, assuming a regulatory announcement on July 1st 2010. If the regulatory announcement is made after this date, it can be expected that the majority of new infrastructure will only be in place post-January 2013, since most respondents indicated that they will only move on infrastructure additions in a context of regulatory certainty.

4. Estimation of necessary incremental biodiesel and kerosene blending volumes

Tables 9 and 10 present a detailed portrait of the incremental volumes of biodiesel required for blending in a given year, broken down by month. These volumes represent necessary quantities of biodiesel over and above any provincial requirements and are based on projected demand volumes for the year 2013. The results for the West region are presented first, followed by the results for the Ontario and East regions. These two latter regions have been grouped together for this section of the analysis, because in some cases the respondents had not yet decided how they would break down their blending volumes between Ontario and Quebec. As can be seen, much lower volumes are predicted in the West than in Ontario and the East. This is due to the existing provincial regulations in the West. Yet it is interesting to note that a significant volume nonetheless is intended to be blended in the West. All of the provincial mandates in the West require a minimum of 2% renewable content in diesel and sometimes up to 5%. This would indicate that no additional biodiesel blending would be necessary in order to meet the federal 2% requirement for this region alone. However, the prediction of a significant amount of blending of biodiesel in the West indicates that some national refiner/marketers will be taking advantage of existing blending infrastructure in the West that was put in place for provincial regulations in order to meet the federal regulations. They will seek to make up the most of their national average annual requirements by blending predominantly in the Western markets. In addition, it should be noted that no incremental biodiesel requirements exist for regional producers/blenders in the West, given that they will automatically be compliant to the federal regulations using existing practices for meeting the provincial regulations.

Nevertheless, the national refiner/marketers may not be able to meet their total national annual 2% average from the Western markets alone and will be required to carry out additional blending in markets in Ontario and the East. Of course, regional producer/blenders in the East do not have the head start that those in the West have, due to a lack of existing provincial regulations in this area. Therefore significant volumes of biodiesel will be blended in Ontario and the East, as can be seen in Tables 9 and 10 below.

In both the West and the East blenders will seek to minimize blending during the winter months. Higher biodiesel concentrations are observed in the summer months and some respondents indicated that they would only blend with biodiesel during these months (B0 in the winter), blending in higher concentrations (from B2 to B5) in order to achieve the annual 2% average.

The source of the biodiesel, regardless of the region, will of course depend on availability, quality and cost, but it is predicted that it will most likely come from sources in the United States and within Canada. It is expected that product sourced from the USA will make up the bulk of the biodiesel blended in the early years, but as the market for biodiesel grows in Canada the proportion of Canadian biodiesel being blended is expected to increase.

It can also be seen in Table 9 and 10 that in both the West and the East, it is predicted that some volumes of HVO be used. This product is very desirable as it is chemically indistinguishable from conventional diesel and therefore typically does not have the same cloud point issues as biodiesel. It is currently produced in relatively low quantities and must be imported long distances (Singapore and Finland, the only countries currently producing HVO), rendering it costly. However, some respondents indicated that they are

investigating the possibility of producing this type of product themselves. As the market for HVO grows, prices are likely to come down and greater volumes of this product are likely to be used.

Tables 9 and 10 also indicate the volumes of ULSK that will be required in order to ensure that the biodiesel blends meet cloud point specifications, particularly in the wintertime. The biodiesel blend concentrations by month are also given. Once again, 2013 was used to show a year with full compliance. The situation in the West is unique because of existing provincial mandates. The marginal volumes of biodiesel being blended in order to meet the proposed federal requirements are relatively low (notably because the regional producers/blenders in the West would already be meeting the proposed federal requirement via their blending for provincial regulations). National refiner/marketers operating in this region will choose to blend in high concentrations (B5) only during the warmer months, mostly April to September, in order to help them meet their national 2% average. Therefore kerosene is required only during the season transition months of March, April, May and August, September, October.

The situation is quite different in Ontario and the East. Since there are no existing or planned provincial regulations for renewable content in diesel/heating oil in these regions, the volumes of biodiesel that will need to be blended in order to meet the federal mandate will be higher. Due to the regional nature of their operations, regional producers/blenders will have less flexibility in terms of where and when they blend with biodiesel. Therefore, in this region, there are significant volumes of biodiesel that will be blended during the winter months, which requires large volumes of kerosene. Nevertheless, in all regions blenders will seek to minimize biodiesel blending during the colder months.

Predicted sources of ULSK are largely domestic and from own production, but also from the USA, the Caribbean and the Gulf Coast.

For the purposes of comparison, Table 11 presents the annual volumes of biodiesel, HVO and ULSK required without the existence of a federal mandate. This table presents volumes for the West only and these volumes are due to existing provincial regulations in this region. The volumes being blending in Ontario and the East are relatively small, about five million litres of biodiesel annually (based on 2013 demand). There are no provincial regulations in these regions and the biodiesel being blended is largely to meet demand from public transportation authorities and municipalities in Ontario and Quebec.

Tables 12 and 13 present the marginal federal volumes and the total volumes (federal + provincial + existing) for all of Canada.

A note of caution when interpreting the information in the Tables 9 to 13 they represent a total of all submissions for a given region. Whereas some respondents indicated that they would require large volumes of ULSK, others indicated that they would not require any at all. This is due to the very different geographic and market contexts for different producers- some will be able to avoid winter blending altogether, will others will not. Some will be blending with HVO to avoid the use of ULSK. Therefore caution should be used when comparing biodiesel volumes to ULSK volumes in these Tables.

TABLE 9 – BLENDING VOLUMES AND CONCENTRATIONS FOR THE WEST- INCREMENTAL FEDERAL REGULATIONS ONLY, 2013

	January	February	March	April	May	June	July	August	September	October	November	December	TOTAL
YEAR: 2013													
Volumes of biodiesel required (m3)	0	0	2,239	7,394	7,365	6,765	7,456	7,871	8,986	1,689	0	0	**49,766**
Volumes of bio-based hydrotreated diesel (HVO) (m3)	0	0	-	5,000	5,000	5,000	5,000	5,000	5,000	-	0	0	**30,000**
Blendstock concentration			B2	B5, B2	B5	B5	B5	B5	B5, B2	B2			
Source of biodiesel			USA Domestic	USA Domestic	USA Domestic	USA Domestic	USA Domestic	USA Domestic	USA Domestic	USA Domestic			
Source of bio-based hydrotreated diesel				Singapore USA	Singapore USA	Singapore USA	Singapore USA	Singapore USA	Singapore USA				
Volumes of low pour product required (m3)	0	0	31,424	5,422	83	-	-	93	1,788	16,893	0	0	**55,704**
Type of low pour product used			ULSK	ULSK	ULSK			ULSK	ULSK	ULSK			
Source of low pour product			USA, Domestic	Own, USA, Domestic	Own, USA, Domestic			Own, USA, Domestic	Own, USA, Domestic	USA, Domestic			

TABLE 10 – BLENDING VOLUMES AND CONCENTRATIONS FOR ONTARIO AND EAST- INCREMENTAL FEDERAL REGULATIONS ONLY, 2013

	January	February	March	April	May	June	July	August	September	October	November	December	TOTAL
YEAR: 2013													
Volumes of biodiesel required (m3)	7,877	8,780	13,998	30,624	32,283	31,512	32,518	32,124	30,157	25,877	9,917	9,716	**265,385**
Volumes of bio-based hydrotreated diesel (HVO) (m3)	-	-	-	1,000	1,000	1,000	1,000	1,000	1,000	-	-	-	**6,000**
Blendstock concentration	B2	B2	B5, B2 B0-B5	B5, B2 B2 - B5	B5, B2	B5, B2	B5, B2	B5, B2	B5, B2 B2 - B5	B5, B2 B2 - B5	B2	B2	
Source of biodiesel	USA, domestic	USA, domestic	USA, domestic	USA, domestic	USA, domestic	USA, domestic	USA, domestic	USA, domestic	USA, domestic	USA, domestic	USA, domestic	USA, domestic	
Source of bio-based hydrotreated diesel				Finland, Singapore USA	Finland, Singapore	Finland, Singapore	Finland, Singapore	Finland, Singapore	Finland, Singapore	Finland, Singapore			
Volumes of low pour product required (m3)	54,391	40,755	41,079	29,828	31,282	36,788	34,604	33,163	33,050	44,788	38,349	54,201	**472,277**
Type of low pour product used	ULSK	ULSK	ULSK	ULSK	ULSK	ULSK	ULSK	ULSK	ULSK	ULSK	ULSK	ULSK	
Source of low pour product	Own, domestic, Caribbean Gulf Coast	Own, domestic, Caribbean Gulf Coast	Own, domestic, Caribbean Gulf Coast, USA	Own, domestic, Caribbean Gulf Coast, USA	Own, Domestic	Own, Domestic	Own, Domestic	Own, Domestic	Own, domestic, Caribbean Gulf Coast, USA	Own, domestic, Caribbean Gulf Coast, USA	Own, domestic, Caribbean Gulf Coast	Own, domestic, Caribbean Gulf Coast	

TABLE 11 – BLENDING VOLUMES AND CONCENTRATIONS FOR THE WEST- PROVINCIAL REGULATIONS ONLY, 2013

	January	February	March	April	May	June	July	August	September	October	November	December	TOTAL
YEAR: 2013													
Volumes of biodiesel required (m3)	5,666	5,406	6,287	17,184	30,116	31,147	28,891	30,445	22,860	6,460	5,762	5,819	**196,044**
Volumes of bio-based hydrotreated diesel (HVO) (m3)	1,924	2,933	3,697	6,905	7,901	6,721	6,727	8,175	7,091	3,695	2,834	1,559	**60,162**
Blendstock concentration	B0 - B5	B0 - B5	B0 - B5	B0 - B5	B5	B5	B5	B5	B0 - B5	B0 - B5	B0 - B5	B0 - B5	
Source of biodiesel	USA, Domestic	USA, Domestic	USA, Domestic	USA, Domestic	USA, Domestic	USA, Domestic	USA, Domestic	USA, Domestic	USA, Domestic	USA, Domestic	USA, Domestic	USA, Domestic	
Source of bio-based hydrotreated diesel	Singapore, Finland, USA	Singapore, Finland, USA	Singapore, Finland, USA	Singapore, Finland, USA	Singapore, Finland, USA	Singapore, Finland, USA	Singapore, Finland, USA	Singapore, Finland, USA	Singapore, Finland, USA	Singapore, Finland, USA	Singapore, Finland, USA	Singapore, Finland, USA	
Volumes of low pour product required (m3)	17,901	13,267	5,514	10,626	4,427	0	0	3,620	14,710	12,031	18,698	23,070	**123,865**
Type of low pour product used	ULSK	ULSK	ULSK	ULSK	ULSK	ULSK	ULSK	ULSK	ULSK	ULSK	ULSK	ULSK	
Source of low pour product	USA, Domestic, Own	USA, Domestic, Own	USA, Domestic, Own	USA, Domestic, Own	USA, Domestic, Own	USA, Domestic, Own	USA, Domestic, Own	USA, Domestic, Own	USA, Domestic, Own	USA, Domestic, Own	USA, Domestic, Own	USA, Domestic, Own	

TABLE 12 – BLENDING VOLUMES AND CONCENTRATIONS FOR CANADA- INCREMENTAL FEDERAL REGULATIONS ONLY, 2013

	January	February	March	April	May	June	July	August	September	October	November	December	TOTAL
YEAR: 2013													
Volumes of biodiesel required (m3)	7,877	8,780	16,238	38,019	39,648	38,277	39,974	39,995	39,143	27,566	9,917	9,716	**315,150**
Volumes of bio-based hydrotreated diesel (HVO) (m3)	-	-	-	6,000	6,000	6,000	6,000	6,000	6,000	-	-	-	**36,000**
Blendstock concentration	B2	B2	B5, B2, B0-B5	B5, B2, B2 - B5	B5, B2	B5, B2	B5, B2	B5, B2	B5, B2, B2 - B5	B5, B2, B2 - B5	B2	B2	
Source of biodiesel	USA, domestic	USA, domestic	USA, domestic	USA, domestic	USA, domestic	USA, domestic	USA, domestic	USA, domestic	USA, domestic	USA, domestic	USA, domestic	USA, domestic	
Source of bio-based hydrotreated diesel				Finland, Singapore, USA	Finland, Singapore	Finland, Singapore	Finland, Singapore	Finland, Singapore	Finland, Singapore	Finland, Singapore			
Volumes of low pour product required (m3)	54,391	40,755	72,503	35,250	31,366	36,788	34,604	33,256	34,838	61,681	38,349	54,201	**527,981**
Type of low pour product used	ULSK	ULSK	ULSK	ULSK	ULSK	ULSK	ULSK	ULSK	ULSK	ULSK	ULSK	ULSK	
Source of low pour product	Own, domestic, Caribbean, Gulf Coast	Own, domestic, Caribbean, Gulf Coast	Own, domestic, Caribbean, Gulf Coast, USA	Own, domestic, Caribbean, Gulf Coast, USA	Own, Domestic	Own, Domestic	Own, Domestic	Own, Domestic	Own, domestic, Caribbean, Gulf Coast, USA	Own, domestic, Caribbean, Gulf Coast, USA	Own, domestic, Caribbean, Gulf Coast	Own, domestic, Caribbean, Gulf Coast	

TABLE 13 – BLENDING VOLUMES AND CONCENTRATIONS FOR CANADA- TOTAL FEDERAL, PROVINCIAL AND EXISTING, 2013

	January	February	March	April	May	June	July	August	September	October	November	December	TOTAL
YEAR: 2013													
Volumes of biodiesel required (m3)	13,733	14,358	22,691	55,593	70,095	69,807	69,207	70,843	62,369	34,257	15,866	15,726	**514,545**
Volumes of bio-based hydrotreated diesel (HVO) (m3)	1,924	2,933	3,697	12,905	13,901	12,721	12,727	14,175	13,091	3,695	2,834	1,559	**96,162**
Blendstock concentration	B0 - B5	B0 - B5	B0 - B5	B0 - B5	B5, B2	B5, B2	B5, B2	B5, B2	B0 - B5	B0 - B5	B0 - B5	B0 - B5	
Source of biodiesel	USA, Domestic	USA, Domestic	USA, Domestic	USA, Domestic	USA, Domestic	USA, Domestic	USA, Domestic	USA, Domestic	USA, Domestic	USA, Domestic	USA, Domestic	USA, Domestic	
Source of bio-based hydrotreated diesel	Singapore, Finland, USA	Singapore, Finland, USA	Singapore, Finland, USA	Singapore, Finland, USA	Singapore, Finland, USA	Singapore, Finland, USA	Singapore, Finland, USA	Singapore, Finland, USA	Singapore, Finland, USA	Singapore, Finland, USA	Singapore, Finland, USA	Singapore, Finland, USA	
Volumes of low pour product required (m3)	73,185	54,916	78,910	46,770	36,686	37,681	35,498	37,770	50,442	74,605	57,941	78,165	**662,569**
Type of low pour product used	ULSK	ULSK	ULSK	ULSK	ULSK	ULSK	ULSK	ULSK	ULSK	ULSK	ULSK	ULSK	
Source of low pour product	Own, domestic, Caribbean, Gulf Coast	Own, domestic, Caribbean, Gulf Coast	Own, domestic, Caribbean, Gulf Coast, USA	Own, domestic, Caribbean, Gulf Coast, USA	USA, Domestic, Own	USA, Domestic, Own	USA, Domestic, Own	USA, Domestic, Own	Own, domestic, Caribbean, Gulf Coast, USA	Own, domestic, Caribbean, Gulf Coast, USA	Own, domestic, Caribbean, Gulf Coast	Own, domestic, Caribbean, Gulf Coast	

5. Costs of new infrastructure and additional kerosene volumes

There are significant costs associated with the addition of new infrastructure or the updating of existing infrastructure. The costs for the upgrade of one refinery or terminal site ranged from $0.5 million to $16.3 million, the average being around $7.5 million. The costs depend largely on the extent of the infrastructure additions. Sites that require marine and/or rail offloading infrastructure for biodiesel had the highest costs, usually in the $7 million to $16 million range. Truck offloading equipment, new tanks, equipment for heating and in-line or blending at the rack are all also significant expenses, ranging from $1 million to $7 million.

Table 14 presents the total infrastructure additions and their costs, by region, in nominal 2010 Canadian dollars:

TABLE 14 - NUMBER OF REFINERY AND/OR TERMINAL SITES RECEIVING NEW INFRASTRUCTURE ADDITIONS AND/OR UPGRADES AND THEIR COSTS

	Existing investments		Additional investments		Total	
	Number of sites	Total cost ($ million)	Number of sites	Total cost ($ million)	Number of sites	Total cost ($ million)
West	9	20.0	8	48.3	17	68.3
Ontario	0	n/a	6	42.6	6	42.6
East	3	1.7	7	68.0	10	69.7
Total Canada	12	21.7	21	158.9	33	180.6

As can be seen in Table 14, the highest costs are seen in the East. This is due to the lack of existing infrastructure relative to the West, where infrastructure investments have already been made for provincial regulations. It should be noted that although significant investments are also seen in the West, $27.6 million of the $48.3 million predicted for this region are for projects that are already underway in order to meet the provincial requirements. We have nevertheless chosen to include them here because the respondents have indicated that in many cases these projects may very likely have gone ahead to a similar extent to meet the federal requirements, even if no provincial mandate were currently in place.

There costs of upgrading a sales site (retail or commercial) is very low, from $400 - $2000 on average. However, the number of retail sites that are expected to be upgraded is high, approximately 1500. Based on estimates from the respondents, it is expected that a total of $1.8 million will need to be spent on upgrading retail sites across the country in order to sell biodiesel blends due to the proposed federal regulations.

Table 15 presents the marginal annual costs of blending with kerosene in order to meet cloud point requirements. For the purposes of this calculation we have used a price differential of 4.9 CAN cents/litre between kerosene and conventional diesel. This is based on the average historic differential in wholesale prices for kerosene and No.2 distillate during winter months (October to March) for the last three years (2007 – 2010) from the Energy Information Administration of the United States Department of Energy (EIA, 2010). Gallons were converted to litres (1 gallon = 3.785 litres) and the US price differential was converted

into Canadian currency using the average historical exchange rate for the last three years (2007 – 2010) from the Bank of Canada (Bank of Canada, 2010).

TABLE 15 – ANNUAL COSTS OF ADDITIONAL KEROSENE

	Provincial mandates only		Federal mandate only		Total	
	Volume* (m^3)	Cost (million $)	Volume* (m^3)	Cost (million $)	Volume* (m^3)	Cost (million $)
West	123,865	6.07	55,704	2.73	179,570	8.80
Ontario + East	10,723	0.53	472,277	23.14	483,000	23.67
Total Canada	134,588	6.59	527,981	25.87	662,569	32.47

*Based on 2013 demand.

As can be seen in Tables 14 and 15, the majority of the costs for new infrastructure and also for additional kerosene will be felt in the East. However, it should be noted that although technically the marginal costs of the federal regulations are lower in the West due to existing provincial regulations in that region, there have already been (and there continue to be) significant investments made, both in infrastructure and in kerosene, in order to meet the provincial regulations, which help contribute to compliance to the federal regulations.

In some cases producers and blenders will be using HVO instead of biodiesel in order to meet the federal and provincial requirements (primarily because HVO has superior cold flow properties). This is mainly due to the fact that in some regions, companies will have to blend biocontent during the winter months to adhere to provincial regualtions especially in BC, for the 5% provincial regulation. The use of HVO would also result in savings in avoided ULSK purchases as well as by reducing the need for specialized infrastructure to store and blend it.

However, HVO is currently very expensive relative to biodiesel. The price differential will vary according to changes in feedstock prices but is currently in the range of about 0.3 – 0.4 $/L. Therefore, for the provincial regulations only in the West, it is expected that about $18 - $21 million will be spent annually on HVO, based on 2013 demand (no HVO is intended to be used in Ontario and the East in the absence of federal regulations). The incremental annual costs of HVO for the federal regulations only is expected to be approximately $9 - $12 million in the West and $1.8 - $2.4 million in Ontario and the East. A significant portion of these costs are related to transportation, since for the moment and in the near future the product is only available in Singapore and Europe. It should be noted that some respondents indicated that they are considering plans to install facilities to produce this product themselves.

6. Capacity for keeping distillates with biocontent separate from those without

At the refinery and/or terminal level, biodiesel and biodiesel blends can be kept segregated from other products to avoid contamination using a variety of safeguards, which virtually all respondents indicated that they would put in place. First, biodiesel receipt facilities (marine, rail or truck) are kept entirely separate from facilities for receipt of distillates without biocontent. Biodiesel and biodiesel blends are kept in separate tanks from other distillates. Segregated facilities are used for blending, whether it is for bulk blending or for blending at the rack- segregated rack positions are converted or installed for dedicated loading of biodiesel blends (either pre-blended or blending at the rack).

Other strategies include minimizing the extent to which biodiesel is blended in cold weather regions during winter months. Biodiesel blends are transitioned out of service gradually as the summer turns to winter, much in the same way that seasonal distillates are rotated in and out of service as needed.

Despite these measures, it can never be fully guaranteed that cross-contamination cannot occur, therefore additional monitoring and testing procedures are put in place in order to keep track of acceptable levels of biocontent (of particular importance with regards to jet fuel). Some contamination can occur through shared piping/lines, however these volumes are small and not expected to have a significant impact.

At the cardlock/retail level, in general there is no intention to install infrastructure in order to ensure segregation of biodiesel blends from other diesel products, as the refiner/marketers and retailers have no intention to explicitly market these products separately.

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Appendix A – Petroleum producer questionnaire

National Renewable Diesel Demonstration Initiative Infrastructure Project

Questionnaire

Please return the following questionnaire to natalie.lambert@ecoressources.com.

If you have any questions regarding this questionnaire, please contact:

Natalie Lambert: (514) 787-1724 x233

Camil Lagacé: (514) 894-5474

Dany Lemieux: (418) 780-0158

Thank you for your cooperation on this project.

QUESTION 1

*Provide a list of the infrastructure that your company **has already put in place** in order to accommodate the production, distribution and sale of biodiesel blends, **AS AT January 1st, 2010**. Please indicate if this is new infrastructure or if it is an addition/modification of existing infrastructure. Please also indicate the total lead time required for the addition/modification as well as the total costs. Finally, please also indicate the proportion of the investment that was made in anticipation of the proposed federal 2% mandate.*

Refineries

1.1 Describe in detail the additions and modifications made at each refinery and the total lead time that was required for the addition/modification (including planning, permitting, construction and commissioning) as well as the total costs incurred for the addition/modification **as at January 1st 2010**.

Refinery name/location	**Detailed description of the addition/ modification in order to accommodate biodiesel blends**	**Total lead time required for the addition/ modification (from planning to commissioning)**	**Total cost of the addition/ modification**	**Proportion of the investment attributable to the proposed federal mandate**

Terminals/Cardlocks

1.2 Describe in detail (including the number of additional tanks, their capacities, etc.) the additions and modifications made at each terminal and/or cardlock, the total lead time that was required for the addition/modification (including planning, permitting, construction and commissioning) and the total costs incurred for the addition/modification **as at January 1st 2010**.

Terminal/Cardlock name/location	Detailed description of addition/ modification in order to accommodate biodiesel blends (storage, tracing, blending, modifications at the rack, etc.)	Total lead time required for addition/ modification (from conception to commissioning)	Estimated total cost of the addition/ modification	Proportion of the investment attributable to the proposed federal mandate

Retailers

1.3 Number of retail sites already offering biodiesel blends or already upgraded to deal with biodiesel blends **as at January 1st 2010**:

1.4 Location of retail sites capable of handling biodiesel blends:

1.5 Describe in detail the types of additions/modifications that were made at the retail sites (number of new tanks, their capacities, heating equipment, new lines, etc):

1.6 Describe what products these retail sites are offering, which blends (B2, B5, B10) and for which markets:

1.7 Average lead time (from planning to commissioning) for a retail site upgrade:

Distribution/Transportation

1.8 Describe any purchases of new trucks or modifications of existing trucks and other transportation infrastructure that has been carried out **as at January 1st 2010** in order to accommodate the transportation of biodiesel and biodiesel blends:

Biodiesel blend production and distribution circuits

1.9 Describe in general your company's principal biodiesel blend production and distribution circuits **as at January 1st, 2010**. Describe where biodiesel is being blended, where the biodiesel is being sourced from, how it is being blended (splash blending or in-line) and to which markets it is being sent.

QUESTION 2

*Provide a list of the **additional** infrastructure that your company would need to put in place in order to meet the proposed federal 2% mandate. List only the **additional** infrastructure needed over and above what has been listed for Question 1. Please indicate if this is new infrastructure or if it is an addition/modification of existing infrastructure. Also provide the estimated total lead times required for the implementation of this infrastructure and their estimated costs.*

Refineries

2.1 Describe in detail the **additional** modifications that would need to be made at each refinery in order to meet the proposed federal 2% regulation. Also describe the total estimated lead time required for the addition/modification (including planning, permitting, construction and commissioning) and the estimated cost of the addition/modification.

Refinery name/location	Detailed description of the addition/ modification	Estimated total lead time required for the addition/modification	Estimated total cost of the addition/modification

Terminals/Cardlocks

2.2 Describe in detail (including the number of additional tanks, their capacities, etc.) the **additional** modifications required at each terminal and/or cardlock in order to meet the proposed federal 2% regulation. Also describe the total lead time that would be required for the addition/modification and the estimated total cost of the addition/modification.

Terminal/Cardlock name/location	Detailed description of the addition/ modification	Estimated total lead time required for the addition/modification	Estimated total cost of the addition/modification

Retailers

2.3 Number of retail sites that would need **additional** upgrades in order to meet the proposed federal 2% requirement:

2.4 Potential locations of retail sites needing upgrading:

2.5 Describe in detail the types of additions/modifications that would need to be made at these retail sites (number of new tanks, their capacities, heating equipment, new lines, etc) **and their estimated costs**:

2.6 Estimated average lead time (from planning to commissioning) for a retail site upgrade:

Distribution/Transportation

2.7 Describe any **additional** purchases of new trucks or modifications of existing trucks and other transportation infrastructure that has been carried out in order to accommodate the transportation of biodiesel and biodiesel blends:

QUESTION 3

*Outline your company's **existing** biodiesel and ULSD/ULSK requirements as well as your company's **additional** biodiesel and ULSD/ULSK requirements should the federal 2% mandate take effect. Please use the Excel spreadsheet provided*

3.1 Please complete the Excel spreadsheet attached with your projected requirements for traditional biodiesel, bio-based hydrocracked product and ULSD/ULSK for 2010 – 2013, assuming in one case that the federal mandate does not pass and assuming in the other case that it does pass. Data is requested by region: West (BC, AB, SK, MN), Ontario and East (QC and Atlantic provinces). For each region that applies to your company, please complete both the "No federal mandate" tab and "With federal mandate." Please complete ALL tabs in the spreadsheet that apply to your company. Please contact any of the team members if you have any questions on how to complete the spreadsheet.

3.2 Please indicate your company's strategy for minimizing ULSD/ULSK requirements (i.e. summer blending only, hydrocracking, etc.):

3.3 Is your company currently using or planning to use hydrocracking processes at the refinery level? Please explain:

QUESTION 4

4.1 Please describe qualitatively your company's ability to ensure that distillate pools with biocontent can be kept separate from those without as well as the implications of doing so: