



FALL
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Issue #7

FUEL *for thought*



Just this month, the United States Energy Information Administration published its 2014 *International Energy Outlook*, examining the global future of petroleum and other liquid fuels out to 2040. The report reinforces that global markets have entered a period of dynamic change — in both supply and demand. Growth in demand for fuels is now focused on the emerging economies of China, India, and the Middle East, while fuels demand

in North America, Europe, and other regions has peaked. Changing dynamics notwithstanding, the report projects petroleum fuels will remain the dominant energy source for transportation in Canada throughout the forecast period. While new motor vehicle fuel efficiency gains will offset growth in transportation, the end result is stable Canadian demand for these fuels over the next 25 years.

Moving people and goods requires some 85 billion litres of transportation fuels each year — for cars, trucks, trains, airplanes and ships.

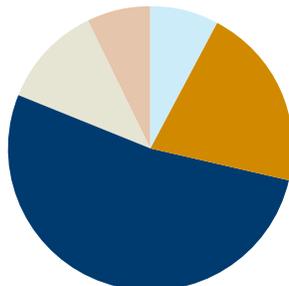
Petroleum fuels are vital enablers of transportation, and will continue to support the movement of millions of people and billions of tonnes of goods and products vital to our country's economic strength, well into the future.

Few countries depend on transportation as much as Canada. Our comprehensive road, air, rail and marine transportation systems link St. John's to Vancouver, Toronto to Iqaluit and

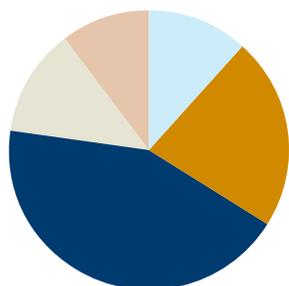
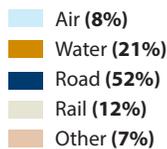


TRANSPORTATION MAKES TRADE POSSIBLE

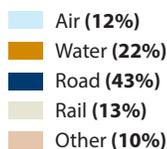
International merchandise trade by mode (current value, in millions of US\$ *)



1990
Total trade: \$242 billion



2012
Total trade: \$917 billion



Canada's international merchandise trade has grown nearly fourfold since 1990. Trucks continue to do the heavy lifting, but air, water, rail and other modes of transport are playing a growing role as Canada diversifies its markets.

*Source: North American Transportation Statistics database

Canada to the rest of the globe. Moving people and goods requires some 85 billion litres of transportation fuels each year — for cars, trucks, trains, airplanes and ships.

Getting the right fuels to the right place at the right time is a complex task. Seasonal and regional variations in fuel demand and fuel formulations, unpredictable weather conditions and unforeseen transport and logistics problems add significant complexity. So how does it all happen?

A complex and comprehensive fuel infrastructure

Canada's transportation energy infrastructure includes 18 refineries in seven provinces, supported by a complex network of pipelines, trains, trucks and ships, primary and secondary fuel distribution terminals, and some 12,000 wholesale and retail sites, operated and overseen by 100,000 Canadians in communities across the country. It's the product of more than a century of investments that have responded to dramatic changes in Canada's fuels landscape — Canada's oil boom, trade growth, population growth and demographic changes, the development of new communities, evolving vehicle technologies, increasingly stringent environmental regulations and fluctuations in world energy markets.

Canada's fuels market comprises two distinct supply "orbits": Western Canada and Eastern Canada. The West, supplied mainly by crude oil from Alberta and Saskatchewan, includes eight refineries with a combined product output of 36.6 billion litres per year, or one third of Canada's total refining output. These refineries supply fuels to the four western provinces, the Yukon, the Northwest Territories, and the western-most part of northern Ontario.

The East supply orbit traditionally depended on crude oil imports and oil production from Atlantic Canada, but is increasingly processing crude oil from Western Canada and the U.S. It accounts for 10 of Canada's 18 refineries that produce roughly two thirds of Canada's refinery output — about 76 billion litres per year. These refineries supply Ontario, Quebec and four Atlantic Provinces. As in the West, there is also a significant degree of interprovincial fuels trade, in particular from Quebec to Ontario, where in-province production meets only about 80 percent of provincial demand.

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Eastern supply capacity considerably exceeds demand, so the East is a significant fuels exporter, principally to the U.S. Northeast. The Atlantic Provinces' share of Canada's refining output has grown from some 18 percent in the early 90s to nearly one quarter of national production in recent years, and accounts for over 60 percent of Canada's fuel exports. While Canada is a net fuel exporter to the U.S., fuels flow both ways across the Canada-U.S. border as refiners strive to match production to shifting market demand.

From the refinery, fuels — gasoline, diesel, aviation fuel, marine fuel — are loaded onto trucks, trains, and ships, or moved by pipeline to bulk plants, terminals and eventually to retail outlets, commercial consumers and farms across Canada. Geographic and seasonal variations in fuel formulations complicate distribution. For example, diesel fuel is sensitive to cold temperatures that reduce flow characteristics and may impact engine performance. In any given region, diesel formulations can change up to 24 times per year to provide adequate cold flow performance.

With gasoline, the performance issue is volatility. Volatility characteristics must be continuously adjusted with seasonal temperature changes to minimize risks of vapour lock, engine stalling and poor operability. Climate and geographic variations across the country result in up to 10 seasonal adjustments to gasoline formulation in eight distinct Canadian geographic zones, to ensure that the fuel remains "fit-for-purpose".

Distribution is further complicated by federal and provincial biofuels mandates, which fragment the Canadian fuels market and create impediments to inter-provincial trade.

Continuous improvement

Today's clean, high-quality fuels have constantly evolved to meet changing consumer expectations and deliver superior environmental performance. Lead content was phased out in the 90s and benzene has been slashed to less than one percent of 1999 levels. Refiners have invested \$5 billion since 2005 to cut sulphur levels by more than 97 percent in diesel and 90 percent in gasoline. And there's more to come — new federal Tier 3 standards will result in gasoline containing 97 percent less sulphur than it did in 2004. Combined with new vehicle technologies, this will reduce tailpipe emissions of smog-forming air pollutants by 80 percent. Clean burning Ultra Low Sulphur Diesel and low sulphur, unleaded gasoline have dramatically reduced vehicle emissions, contributing to better air quality, and improving Canadians' health.

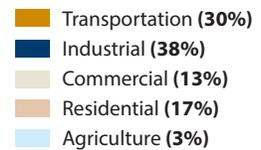
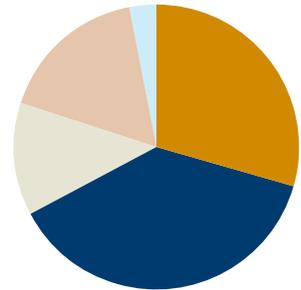
Transportation affects almost every aspect of our life. The movement of people and goods is essential to our economy and standard of living. Shaped by more than a century of innovation and



investment, our extensive fuel production and distribution infrastructure delivers the right fuel, to the right place, at the right time, powering 95 percent of Canadian transportation. Canadians can be confident petroleum fuels will continue to meet their expectations for convenient, reliable, high-quality, competitively-priced transportation fuels. No other fuel delivers comparable value.

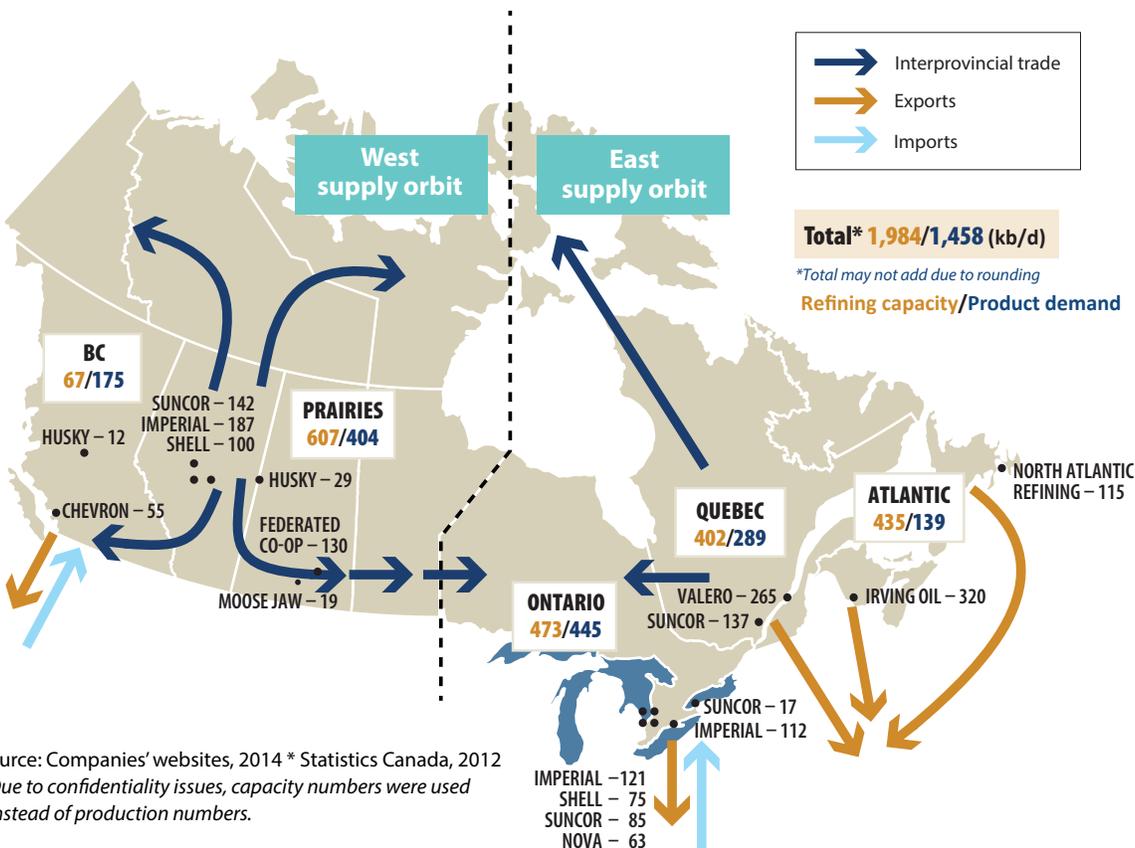
CANADA'S ENERGY USE BY SECTOR, 2011

30 percent of all energy used in Canada powers transportation



Source: Natural Resources Canada, 2014

Refined petroleum product flow



Source: Companies' websites, 2014 * Statistics Canada, 2012
 *Due to confidentiality issues, capacity numbers were used instead of production numbers.

Joining forces for the safe transport of dangerous goods

“Safe operations have always been the top priority of the industries involved in the production and transport of Canada’s transportation fuels”.

— PETER BOAG,
PRESIDENT
AND CEO OF
CANADIAN FUELS

The Canadian Fuels Association and its members recently joined the Transportation Community Awareness and Emergency Response initiative (TRANSCAER®) as part of a commitment to the safe transport of dangerous goods.

TRANSCAER® was started in Canada in 1985 by the Chemistry Industry Association of Canada (CIAC). Today, it is led by CIAC and the Railway Association of Canada (RAC). TRANSCAER® members work with municipalities, emergency responders, and residents in communities along transportation routes, to make sure they are informed about the products being moved through their area, and are prepared to respond to potential incidents involving dangerous goods.

“Safe operations have always been the top priority of the industries involved in the production and transport of Canada’s transportation fuels. Canadian Fuels’ participation in TRANSCAER® builds on our members’ dedication to safe operations that extends beyond refineries, through a complex distribution network of pipelines, trucks, terminals and retail sites, and into the



communities where they operate,” said Peter Boag, President and CEO of Canadian Fuels.

Canadian Fuels and its members will contribute knowledge and expertise to the initiative.

The CIAC and RAC have recently launched a new logo and website for the TRANSCAER® initiative. For more information, visit www.transcaer.ca.



Used oil recycling programs gaining ground in Atlantic Canada

Following the successful introduction in 2014 of New Brunswick's used oil recycling program, managed by the Société de gestion des huiles usagées de l'Atlantique | Atlantic Used Oil Management Association (SOGHUOMA), the government of Prince Edward Island has followed suit and announced its Materials Stewardships and Recycling Regulation, that includes vehicle fluids, will come into effect on October 1, 2014. The new rules will require brand owners or importers of oil, oil filters, antifreeze, lubricants and brake cleaner to collect and recycle their products and containers sold in PEI. The program will also be managed by SOGHUOMA and financed by environmental fees.

Newfoundland and Labrador is also expected to launch its provincial used oil recycling regulations this year, while Nova Scotia is in the process of legislating changes under its solid waste management regulations. In Quebec, the Société de gestion des huiles usagées has achieved recycling rates of 79 percent for used oil filters, 99 percent for used oil containers and 92 percent for used oil. If improperly

disposed of, a litre of used oil can contaminate one million litres of water.

The Canadian Fuels Association and its members have been instrumental in working with governments and stakeholders to establish used oil recycling programs in British Columbia, Alberta, Saskatchewan, Manitoba, Quebec and New Brunswick.



GHG cap-and-trade: a solution where Quebecers aren't ready to feel the pinch

A recent Léger Marketing poll commissioned by the Montreal Economic Institute (MEI) reached an interesting conclusion — Quebecers support in principle their province's cap-and-trade program to reduce greenhouse gas (GHG) emissions, but are far less enthusiastic about it when they learn the price tag.

The poll, conducted online from August 11–14, revealed that 57 percent of Quebecers aren't even aware of the cap-and-trade program for GHG emissions. The program will require Quebec companies that produce or import fuels into the province, to buy credits in a carbon market involving Quebec and California, as of January 1, 2015.

While 54 percent of respondents initially supported the Quebec government's GHG initiative, approval dropped to 36 percent when they were informed that the carbon market could lead to a three cents per litre increase in the price of gasoline, according to a MEI assessment. The poll also found that 44 percent of respondents believe Quebec should wait for other jurisdictions to join the GHG cap-and-trade program, while 36 percent support moving ahead.

More information on the poll can be found at www.iedm.org/node/50049.



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tech talk

Engine technologies

New engine technologies are helping make vehicles more efficient and reducing GHG emissions.

Courtesy of Natural Resources Canada*, here is a look at technologies that are making today's new engines lightweight, powerful, fuel efficient and significantly more reliable and long-lasting than in the past, with longer service intervals.



Direct injection systems allow for better control of the fuel-air mixture, and can reduce fuel consumption by 1 to 3%.

Shaken, not stirred: direct injection

Direct fuel injection systems can optimize fuel delivery by injecting fuel directly into the cylinder at a high pressure, in contrast to conventional systems that inject fuel into the intake air stream at a lower pressure. Direct injection systems allow for better control of the fuel-air mixture, and can reduce fuel consumption by 1 to 3%.

I'll take two: cylinder on demand

No engine needs maximum power output all the time. Cylinder deactivation systems or CDS are typically used in 8 or 6-cylinder engines. These systems shut down half of the engine's cylinders when only a small percentage of the engine's available power is needed, such as when driving at a constant speed on a level road, decelerating, or going downhill.

Cylinder deactivation systems can reduce fuel consumption by 4 to 10%.

For the driver, the vehicle's computer manages everything — giving you the power you need when you need it, and reducing it when you don't.

Take a deeeeep breath: turbocharging

Engines can achieve more power if more air and fuel can be forced into the cylinders for each combustion cycle. Turbochargers compress recycled exhaust gases into the intake manifold, which is then forced into the cylinder of the engine. This provides two benefits.

First, there is more air and fuel providing a larger combustion reaction and more power.

Second, less work is required from the piston to pull the air/fuel mixture into the combustion chamber.

Turbochargers are able to force air into the engine's cylinders, in contrast to a naturally aspirated engine that draws air in at atmospheric pressure. This enables a smaller displacement turbocharged engine to produce the same power as a larger displacement naturally aspirated engine.

The use of a downsized turbocharged engine can reduce fuel consumption by 2 to 6% for equal vehicle performance.

Variable valve timing

Just like humans, the engine in your car needs to breathe. Engine valves control the intake of fresh air/fuel mixture and the exhaust of combustion gases. And, just like humans, an engine's breathing rate is based on exertion.

Conventional valve control systems provide a single fixed timing, which means engine breathing is not adjusted or optimized for different requirements. Variable valve timing adjusts the engine's timing and breathing based on the operating conditions of the engine.

VVT can reduce fuel consumption by about 1 to 6%.

Natural Resources Canada suggests you shop carefully, and choose the combination of engine features that best suit your driving style.

* Source: Government of Canada, www.nrcan.gc.ca/energy/efficiency/transportation/cars-light-trucks/buying/16214

Getting the facts straight on oil industry subsidies

The Montreal Economic Institute (MEI) recently published an economic note debunking common myths on oil industry subsidies. Some groups claim that Canada's oil industry receives billions of dollars in subsidies, which reduce the price of fuels and encourage consumption. The report examined government subsidy programs and concluded that subsidies are limited and that most government programs identified as oil industry subsidies are in fact a common tax treatment applied to all natural resource industries.

The MEI paper defines subsidies as financial support from governments aimed at promoting a specific activity, which can entail direct spending by governments or tax breaks. An International Energy Agency assessment notes that oil industry subsidies typically take the form of fossil-fuel consumption subsidies, which encourage fuel consumption by reducing retail prices (the Venezuelan government, for instance, spends at least \$12–15 billion annually to keep gas prices at about one-and-a-half cents per litre).

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The MEI paper notes that in 2012, Canadians paid on average 31 percent in taxes for gasoline at the pump, or over 39 cents per litre, totalling \$5.4 billion and \$8.3 billion in federal and provincial taxes respectively. Taxes have the reverse effect of consumption subsidies by discouraging the use of fossil fuels.

The report identifies two tax expenditure programs that can be counted as subsidies: accelerated capital cost allowances for oil sands projects and the Atlantic Investment Tax Credit, which total \$211 million per year. The MEI notes

ECONOMIC NOTE

Montreal Economic Institute
Ideas for a More Prosperous Nation

Is the Canadian Oil Industry Subsidized?

by Youri Chassin

Environmental activists, and certain political parties, maintain that the Canadian oil industry is heavily subsidized. Is this statement true? And what exactly is meant by "subsidies"?

According to the International Energy Agency, fossil fuel subsidies in the world usually take the form of consumption subsidies. These subsidies totalled US\$409 billion in 2010, and led to lower gas prices at the pump and to lower prices for natural gas as well as for electricity produced from fossil fuels.²

Fossil-fuel consumption subsidies are generally found in countries with a non-negligible share of the world's oil and natural gas producers (Iran, Saudi Arabia, Russia, Venezuela) for the purpose of keeping prices below their market levels.

In Canada, there are no fossil-fuel consumption subsidies.³ On the contrary, the use of these energy sources is systematically taxed, which discourages their consumption, the opposite of a subsidy's effect. In 2012, gasoline taxes in Canada averaged 39.3 cents per litre, representing approximately 31% of the pump price.⁴ Federal excise taxes on fuel totalled \$5.4 billion a year, while provincial taxes amounted to \$8.3 billion. As a result, each Canadian pays an average of \$395 a year in taxes related to fuel consumption.⁵

Production Subsidies and Tax Expenditures

The website of the Global Subsidies Initiative estimates that total fossil-fuel production subsidies around the world are on the order of \$100 billion a year, far less than total consumption subsidies.⁶ According to

a 2010 study carried out by this organization, the federal and provincial governments subsidized the oil industry to the tune of \$2.8 billion in 2009, the federal government's share being \$1.4 billion.⁷ It is this contested study⁸ that is the main source of the claim that the Canadian oil industry is heavily subsidized.

A subsidy, as commonly understood, refers to government financial support paid out to an individual, a business or an organization in order to promote a certain activity. The payment can take the form of a direct expense, entailing actual spending on the part of the government, or a tax expenditure, meaning an amount of tax that would normally be due but is not collected.

In order to sketch an accurate picture of the situation, it is essential to verify which expenditures, be they direct or tax expenditures, constitute actual production subsidies. Indeed, the Global Subsidies Initiative study considers a whole series of programs to be subsidies that, for various reasons, are not (see the annex on the MEI's website for details regarding the programs and amounts mentioned).

May 2014

This Economic Note was prepared by **Youri Chassin**, an economist with the MEI who holds a master's degree in economics (Université de Montréal).

that starting in 2016, existing subsidy programs will be cut to \$71 million. Other government programs, cited by some groups as subsidies, are in fact particular tax treatments adapted to the realities of the natural resources development sector that take into account the gap between the launch of a project and commercial production. Such programs defer taxes during the initial years of new project development, when companies incur significant start-up costs and financial risk, until commercial production begins.

The MEI concludes that Canada's oil industry, which pays on average \$18 billion in taxes and royalties to different levels of government, is a net contributor to public coffers, as opposed to renewable energy industries that rely on subsidies to survive. The full economic note, titled *Is the Canadian Oil Industry Subsidized?*, can be found at www.iedm.org/48731-is-the-canadian-oil-industry-subsidized.





The authors concluded that biofuel policies have failed to deliver value to Canadians — costing \$3.00–\$3.50 for every dollar of social and environmental benefit derived from the use of biofuels.

Biofuels programs: uncertain results — real price tag

A recent study by the Macdonald-Laurier Institute casts doubt on the cost-effectiveness of taxpayer financing for biofuels programs aimed at reducing GHG emissions in the transportation sector. The authors of the study looked at the cost of federal and provincial programs that promote the use of biofuels and concluded that the per tonne CO₂ equivalent reduction cost from the production and use of biofuels could reach \$400–\$3,300 for corn ethanol and \$142 for cellulosic ethanol, contrary to the conventionally estimated benefits of \$0–\$50 per tonne. The authors concluded that biofuel policies have failed to deliver value to Canadians — costing \$3.00–\$3.50 for every dollar of social and environmental benefit derived from the use of biofuels.

The authors of the study also noted that environmental gains achieved through the use of biofuels are uncertain due to the life-cycle energy-intensity of growing and processing biofuels crops and ethanol's lower energy content when compared to gasoline, which leads to more frequent fill-ups. They recommend that governments phase out the major components of current biofuel policy because the costs far exceed the benefits and there is little prospect that this will change.

The full study report can be found here: www.macdonaldlaurier.ca/files/pdf/MLIbiofuelspaper0626.pdf



Lake Erie algae blooms — a life-cycle impact of biofuel production?

In early August, about half a million residents in Toledo, Ohio, were without water for several days when a blue-green algae bloom in Lake Erie fouled local water supplies. The algae blooms are caused by the proliferation of cyanobacteria, which produce toxins that are harmful to humans, pets and wildlife and threaten the ecosystem.

While many factors come into play, the main cause of the bloom is likely phosphorus runoff linked to the use of fertilizers on lawns, golf

courses and particularly farms, which feeds the cyanobacteria. Farming has intensified in the area, in part because of the growing demand for corn used for biofuel production.

The Lake Erie algae bloom highlights the complexity of measuring the environmental footprint of the use of biofuels in the transportation sector. Any life-cycle analysis of the impact of biofuels must be comprehensive and take into account all direct and indirect impacts of production, processing and use.



Canadian Fuels
ASSOCIATION

ASSOCIATION
canadienne des carburants

Canadian Fuels Association
1000–275 Slater Street, Ottawa, ON K1P 5H9
Tel: 613.232.3709