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Fuelled Up.

An Updated Overview and Outlook of Canada's
Propane Market and Industry





Fuelled Up Canada's Propane Market and Industry.

The footprint of Canada's low-emission propane industry is expanding. Population increases will keep residential propane demand growth steady in the coming years and propane use in the agriculture, transportation and Indigenous and remote communities are expected to be above-average.



Propane production is on the rise

Forecast to increase by **20%** by 2025



Exports of propane fuel Asia



Canadian propane being exported to Asian countries



Jobs are increasing

17,000 in 2016 → **21,000** 2017-25 (average)



Propane industry has a strong impact on Canada's economy

\$3.5 B GDP in 2016 → **\$4.4 B** GDP in 2017-25 (average)



Switching **vehicle fleets** and **power generation** to propane will help **reduce** GHG emissions

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Fuelled Up: An Updated Overview and Outlook of Canada's Propane Market and Industry

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Preface

Canada's propane industry spans an extensive and complex supply chain connecting producers and end-users. Markets for Canadian propane are just as versatile and include multiple energy uses across wholesale- and retail-level end-use sectors, non-energy uses such as petrochemical feedstock, and exports to regional and overseas international markets.

This report takes stock of the current and historical supply chain landscape and provides a comprehensive market outlook for Canada's propane to 2025. Estimates of the Canadian propane industry's footprint across the economy are developed and presented. The report also highlights domestic energy market factors, policy developments, key issues, and opportunities that may shape the industry's outlook in the coming years.

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EXECUTIVE SUMMARY

Fuelled Up: An Updated Overview and Outlook of Canada's Propane Market and Industry

At a Glance

- Canada's propane industry has an extensive supply chain, from extraction to end use. Markets for this versatile fuel are also diverse.
- Propane production levels are expected to increase significantly in the coming years. Domestic demand will be supported by an emerging propane-based petrochemical industry, and exports will increasingly be diverted from U.S. to overseas markets.
- The industry's economic footprint extends across Canada's regions and sectors, supporting many jobs and generating millions of dollars in taxes and revenues.
- Fuel-switching opportunities across various sectors can have a significant impact on propane demand and supply, while reducing Canada's GHG emissions.

Exports to the U.S. are a significant outlet for Canadian propane today, with exports accounting for about one-half of total demand.

Canada's propane industry spans an extensive supply chain from extraction to end use. Many businesses across the country make up the industry's robust distribution network, including oil and gas production companies; processing and storage firms; transportation and logistics businesses; and wholesale and retail fuel sellers.

Canadian propane markets are just as diverse, with most of the supply coming from gas plants across Canada and with industrial, commercial, and residential users accounting for a significant share of domestic demand—mainly across Ontario, Alberta, and Quebec. Exports to the U.S. are a significant outlet for Canadian propane today, with exports accounting for about one-half of total demand. Increasingly, Canadian propane exports are going to overseas markets.

Over the outlook period (2017–25), Canadian propane supplies are expected to increase by more than 20 per cent, driven by steady natural gas production levels (and the increasing amounts of natural gas liquids available in that gas) and further supported by midstream infrastructure investments. The demand side of the market will also change significantly in the coming years, driven by two key trends:

- large increases in domestic demand for propane used as a petrochemical feedstock;
- a continued westward shift in exports that will see a large portion of Canadian propane redirected to overseas liquefied petroleum gas (LPG) markets.

The contribution of Canada's propane industry to the Canadian economy is measured based on the final value of Canadian propane sales. In 2016, \$4 billion worth of Canadian propane was estimated to support a significant level of economic activities across the country. These economic activities included:

- close to \$3.5 billion in value-added gross domestic product (GDP);

The outlook for Canada's propane markets and the industry's contribution to the Canadian economy are favourable.

- more than 17,000 jobs across Canada;
- over \$900 million in municipal, provincial, and federal tax and royalty revenues.

Between 2017 and 2025, with sales expected to expand favourably, an annual average of \$4.4 billion (2016 \$) worth of Canadian propane sales are estimated to support:

- close to \$4.4 billion in GDP across Canada per year;
- close to 21,000 jobs annually across the economy;
- close to \$1 billion per year in government revenues, including indirect taxes, personal income taxes, corporate taxes, carbon taxes, royalties, and payroll taxes across Canada.

The outlook for Canada's propane markets and the industry's contribution to the Canadian economy are favourable, and there are various factors that may support stronger industry growth in the coming years. These include:

- growing prospects for petrochemicals, driven by technology innovation and consumer demand;
- recent export terminal projects to diversify exports toward overseas markets;
- evolving environmental considerations and power generation needs in Canada's remote communities.

We also estimate that fuel-switching opportunities across various end-use sectors in Canada have the potential to boost propane demand and sales significantly, while helping to reduce Canada's greenhouse gas emissions. Some of our findings show that the industry could maximize its potential by:

- applying propane to hybrid renewable energy power generation projects in remote communities;
- having evidence-based knowledge of the likely environmental and economic impacts of propane uses in end-use sectors;
- supporting value-added and economic diversification policies.

We expect the insights presented in this report can provide a sensible and clear road map for the industry's future, potential challenges, and ways in which it can maximize potential opportunities across the country.

CHAPTER 1

Canada's Propane Market: Overview and Outlook

Chapter Summary

- Propane production in Canada comes primarily from natural gas processing. Production levels have largely been affected by natural gas market developments.
- Domestic demand is diverse and is influenced by economic conditions, large-users' fuel flexibility, and weather events.
- Canadian exports go primarily to U.S. markets, but have increasingly been diverted to overseas markets in recent years.
- Canadian propane production levels are expected to increase by over 20 per cent between 2016 and 2025, driven by steady natural gas production levels, rising natural gas liquids (NGLs) volumes in the gas, and midstream infrastructure investments.

Propane Supply in Canada

Production

In the last decade, Canadian propane production levels have fluctuated across production sources and regions. When we include extraction as a gas plant natural gas liquid (NGL) (over 90 per cent of the total) and production as a refinery liquefied petroleum gas (LPG) (under 10 per cent), Canada's total propane production levels were estimated at close to 220 kb/d (thousands of barrels per day) for 2016.¹ (See Table 1.)

However, recent developments have affected gas plant propane production levels. These include the complex interplay between natural gas production levels and trade flows, gas composition and NGLs extraction economics, and the evolving processing and transportation infrastructure. In turn, these developments have influenced regional propane production levels across Canada. (See Chart 1.) These trends are anticipated to continue to influence the outlook for Canadian propane production in the coming years.

Table 1
Canadian Propane Production
(kb/d)

	2006	07	08	09	10	11	12	13	14	15	16	10-yr net change	10-yr CAGR (%)
Gas plants	185	181	173	161	156	155	168	172	174	175	201	16.4	0.9
Refineries	35	34	32	33	32	31	33	33	25	20	18	-16.4	-6.2
Total	220	215	205	195	188	186	202	205	200	194	219	-0.5	-0.0
Western Canada	118	113	108	108	104	108	120	125	126	124	143	25.0	1.9
Eastern Canada	102	102	97	87	84	78	82	79	73	70	77	-25.0	-2.8

CAGR = compound annual growth rate

Note: Totals may not be exact due to rounding.

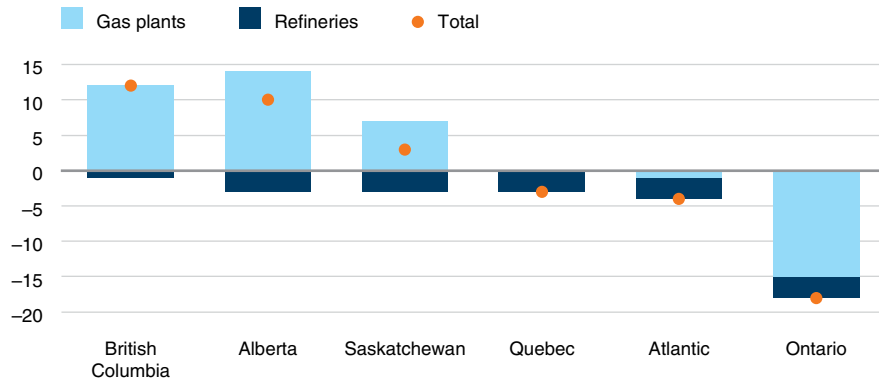
Sources: The Conference Board of Canada; Canadian Association of Petroleum Producers (CAPP), *Statistical Handbook*; Government of British Columbia, "Natural Gas & Oil Statistics"; Statistics Canada, CANSIM table 128-0012.

¹ Including propane volumes from off-gas processing facilities—estimated at around 10 kb/d for 2016—the total production level for 2016 is closer to the 230 kb/d mark. However, we have excluded propane production volumes from this source due to historical data availability and reliability issues.

Chart 1

Net Changes in Canadian Propane Production Between 2006 and 2016

(kb/d)



Sources: The Conference Board of Canada; CAPP; Government of British Columbia; Statistics Canada, CANSIM table 128-0012.

Imports

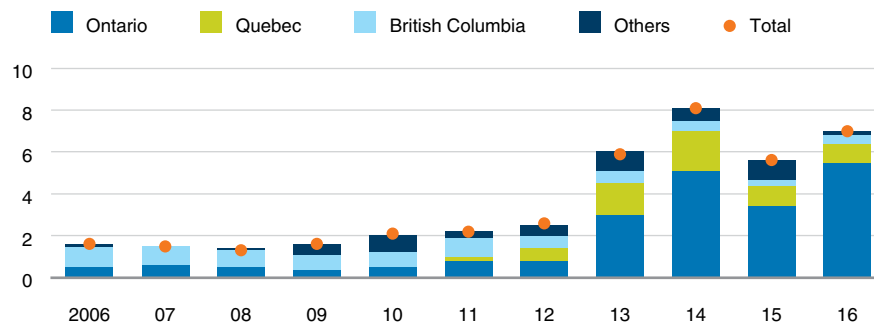
Import volumes are relatively small in comparison to propane production and demand levels.² Nevertheless, Canadian propane imports grew from 1.6 kb/d in 2006 to around 7 kb/d in 2016, rising to a peak of 8.1 kb/d in 2014. (See Chart 2.) This increase can be attributed to higher flows into Ontario and Quebec, generally caused by a cold snap that spiked regional heating needs at the time, and a transition in the ethylene-cracking feedstock for Ontario petrochemical manufacturers.

Total Supply

Canadian propane supplies fluctuated between 2006 and 2016 (see Table 2), mainly because of lower natural gas and LPG production levels. Higher import volumes also played a role in the supply changes witnessed in that period.

² Imports accounted for an average of 3 per cent of total Canadian domestic demand in the last decade—with import dependency being the highest (but still low) in British Columbia (at 10 per cent), as well as in Saskatchewan and Quebec (5 per cent each).

Chart 2
Canadian Propane Imports
(kb/d)



Sources: The Conference Board of Canada; Statistics Canada, CANSIM table 128-0012.

Table 2
Canadian Propane Supply
(kb/d)

	2006	07	08	09	10	11	12	13	14	15	16	10-yr net change	10-yr CAGR (%)
Production	220	215	205	195	188	186	202	205	200	194	220	0	0.0
Western Canada	118	113	108	108	104	108	120	125	126	124	143	25	1.9
Eastern Canada	102	102	97	87	84	78	82	79	73	70	77	-25	-2.8
Imports	2	1	1	2	2	2	3	6	8	6	7	5	15.9
Western Canada	1	1	1	1	2	1	1	1	1	1	0	-1	-8.1
Eastern Canada	0	1	0	0	1	1	1	5	7	5	6	6	29.8
Supply adjustments*	2	10	19	8	2	19	49	12	-12	18	-4	-6	n.a.
Total supply	223	227	226	204	192	208	253	222	196	218	223	-1	0.0

n.a. = not applicable

*supply adjustments include changes in inventories, inter-product transfers, and statistical adjustments

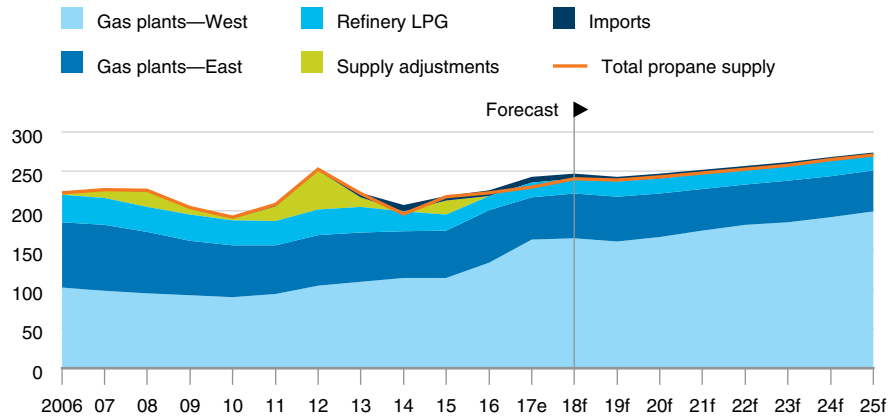
CAGR = compound annual growth rate

Sources: The Conference Board of Canada; CAPP; Government of British Columbia; Statistics Canada, CANSIM table 128-0012.

Supply Outlook

Canadian propane supply is expected to increase from just over 220 kb/d in 2016 to more than 270 kb/d by 2025. This represents a 21 per cent increase over the outlook from the previous decade. (See Chart 3.) The increase in supply will be mainly driven by rising propane production from gas plants in Alberta and British Columbia. In turn, supported by steady natural gas production levels, a continued focus on liquids-rich natural gas development, and ongoing midstream infrastructure investments.

Chart 3
Canadian Propane Supply Outlook
 (kb/d)



e = estimate; f = forecast
 Source: The Conference Board of Canada.

Propane Demand in Canada

Overview

Domestic Demand

As a versatile fuel, propane has a wide range of energy and non-energy applications. (See “Propane’s Energy Uses in Canada.”)

Propane’s Energy Uses in Canada

Households

- Furnaces
- Hot water heaters
- Fireplaces and patio heaters
- Ovens and cooktops
- Fridges and dryers
- Pool heaters and generators

Transportation

- School and transit buses
- Taxis and limousines
- Courier vans
- Police cars
- Trucks and vans of all sizes

Agriculture

- Heating livestock facilities, including barns and brooding pens
- Heating commercial greenhouses
- Powering irrigation systems
- Drying grains and crops
- Controlling pests and weeds without chemicals

Industry

- Mining operations—powering generators, remote camp heating, cooking and refrigeration, and specialized operational equipment
- Construction work site heating
- Powering forklifts
- Heat for metal processing
- Back-up power generation at key institutions

Other Uses

- Sideline heaters at professional football games
- Road crews laying hot asphalt
- As a propellant in aerosol cans—propane is non-toxic and doesn't harm the earth's ozone layer
- Commercial lawn mowers
- Commercial food service—in permanent kitchens, at catered events, or in food trucks
- As a petrochemical feedstock to make plastics products

Source: Canadian Propane Association, "Propane Applications."

In 2016, Canadian propane demand was estimated at 107 kb/d, equivalent to 48 per cent of total supply. Alberta and Ontario were the largest regional markets in Canada, accounting for about 33 and 40 per cent of total propane demand respectively. (See Table 3.)

Table 3

Canadian Domestic Propane Demand

(kb/d)

	2006	07	08	09	10	11	12	13	14	15	16	10-yr net change	10-yr CAGR (%)
Industrial use	32	34	36	34	38	42	51	44	41	39	36	4	1.1
Commercial use	20	23	25	23	25	27	31	26	25	24	26	6	2.6
Residential use	9	11	11	10	11	12	14	11	10	10	12	2	2.3
Non-energy use	20	20	20	17	19	24	32	18	10	9	11	-9	-5.4
Transportation use	8	9	10	8	9	9	10	8	7	7	8	0	0.4
Agricultural use	5	6	6	5	6	7	7	6	6	6	7	2	2.9
Producers' own use	7	6	6	5	4	5	6	6	5	7	6	-1	-0.8
Total domestic demand	102	109	115	102	111	126	151	119	104	103	107	5	0.5
Wholesale-level*	59	60	63	55	60	71	89	68	56	55	54	-5	-0.9
Retail-level	43	49	52	47	50	55	62	51	48	48	53	10	2.2
By region													
Alberta	31	32	33	30	35	42	53	45	40	40	36	5	1.4
Other Western Canada	15	17	19	17	15	14	16	15	15	14	11	-3	-2.6
Western Canada total	46	48	52	47	51	56	69	60	55	54	47	1	0.3
Ontario	36	40	44	40	44	54	66	43	34	32	43	8	2.0
Other Eastern Canada	21	20	18	14	16	16	16	16	16	17	17	-4	-2.0
Eastern Canada total	56	60	62	55	60	70	83	59	49	49	60	4	0.7

CAGR = compound annual growth rate

*including industrial, non-energy, and producer own-use segments. Retail-level includes all other end-use segments.

Note: Totals may not be exact due to rounding.

Sources: The Conference Board of Canada; Statistics Canada, CANSIM table 128-0012.

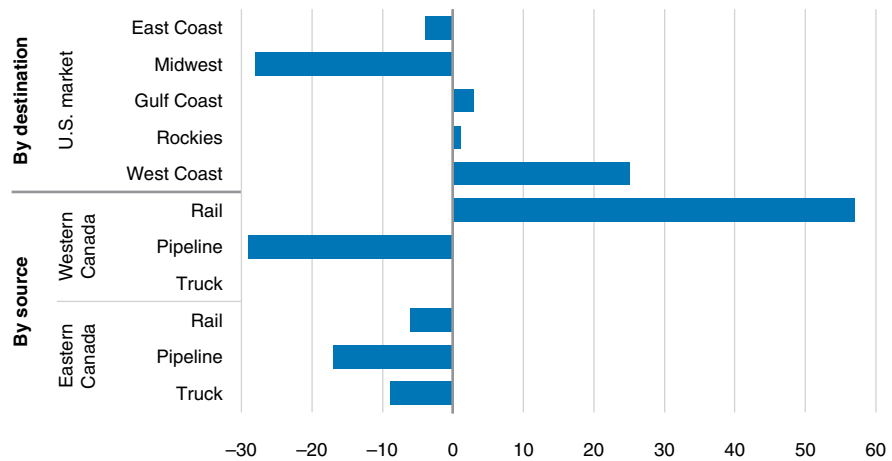
The industrial sector has been the largest user of propane in Canada in recent years, accounting for over one-third of total Canadian demand—with up to 80 per cent of demand coming from mining and oil and gas extraction industries. Producers' own use and agriculture were less than 10 per cent of the overall demand.

Exports

Exports are a key outlet for Canadian propane. While domestic markets played a vital role in supporting propane production during the reference period, export levels have fluctuated in the past decade—declining between 2006 and 2010, and then generally increasing thereafter. Nevertheless, overall export volumes have remained unchanged during the period.

Historically, the U.S. has been the primary market for Canadian propane, but in 2014 Kinder Morgan halted propane shipments from Canada to the U.S. on its 1,900-mile Cochin pipeline. Without the Cochin pipeline, most of the propane export demand is expected to come from new export markets rather than U.S. markets. In addition, the destination, source, and transportation modes of Canadian propane exports have also seen some changes—for example, exports through rail increased significantly between 2014 and 2016 (see Chart 4), resulting in declining exports from Eastern Canada and downward pressure on spot market prices in Western Canada—to compensate for higher transportation costs.

Chart 4
Net Change in Canadian Propane Exports Between 2006 and 2016
 (kb/d)



Sources: The Conference Board of Canada; National Energy Board, Commodity Tracking System—Natural Gas Liquids.

Total Demand

Total demand for Canadian propane was roughly split between domestic demand and exports in 2016. The regional distribution was about 40 per cent for Eastern Canada and 60 per cent for Western Canada. (See Table 4.)

Table 4

Total Canadian Propane Disposition

(kb/d)

	2006	07	08	09	10	11	12	13	14	15	16	10-yr net change	10-yr CAGR (%)
Domestic demand	102	109	115	102	111	126	151	119	104	103	107	5	0
Exports	119	117	110	99	81	81	99	100	90	112	115	-4	0
Total disposition	221	226	225	201	192	208	250	220	194	215	222	1	0
Western Canada	105	106	113	102	94	104	123	114	107	126	134	29	3
Eastern Canada	116	120	112	99	97	104	127	106	87	89	88	-28	-3

CAGR = compound annual growth rate

Note: Totals may not be exact due to rounding.

Sources: The Conference Board of Canada; Statistics Canada, CANSIM table 128-0012.

Demand Outlook

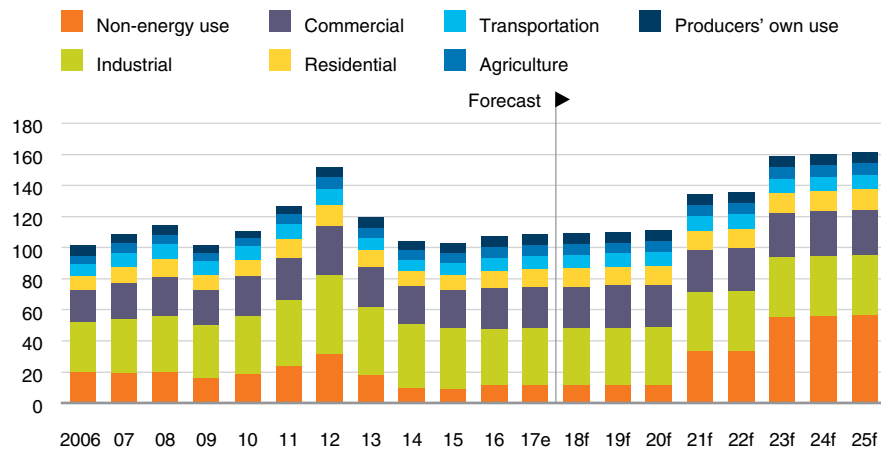
Domestic Demand

We are projecting domestic demand for propane to generally align with trends in population and economic growth across most of Canada's end-use sectors and regions. Meanwhile, wide availability of propane and price competitiveness, coupled with policy support, will provide a significant boost to propane use in Alberta's petrochemical sector—with the potential for total propane demand in Canada to increase to more than 50 per cent by 2025. Much of the growth in domestic demand is expected to take place after 2020. (See charts 5 and 6.)

Chart 5

Domestic Propane Demand, by End Use

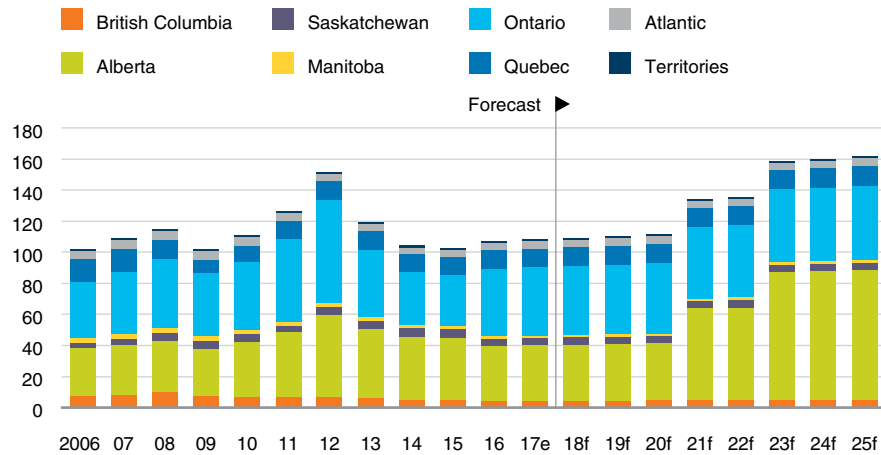
(kb/d)



e = estimate; f = forecast

Source: The Conference Board of Canada.

Chart 6
Domestic Propane Demand
 (kb/d)



e = estimate; f = forecast
 Source: The Conference Board of Canada.

Industrial Propane Demand

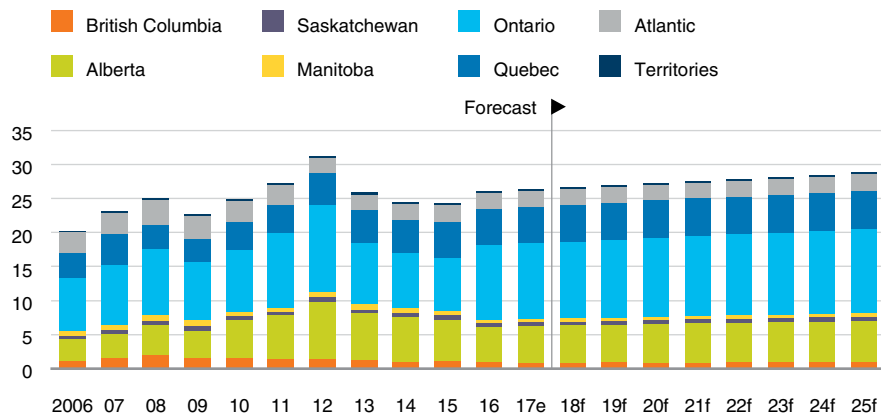
The industrial sector is Canada's largest user of propane. The oil and gas industry accounted for most of the sector's total use of propane in 2015, followed by mining, construction, and manufacturing. Going forward, industrial propane demand is expected to grow only moderately through 2025. The outlook follows the trend in industrial production and reflects ongoing efforts to improve energy efficiency, as well as competition from natural gas.

Commercial Propane Demand

Currently, the commercial sector is the second-largest end-use sector for propane. Ontario, Alberta, and Quebec account for more than 80 per cent of Canada's commercial propane demand.

Through 2025, commercial propane demand is projected to rise more slowly than GDP, as energy-efficiency measures kick in across the Canadian economy. However, propane consumption in Ontario, Alberta, and Quebec could increase over the outlook period as fuel-switching initiatives take effect. We also expect that commercial demand for propane will follow economic and population trends in the regions. (See Chart 7.)

Chart 7
Commercial Propane Demand
 (kb/d)

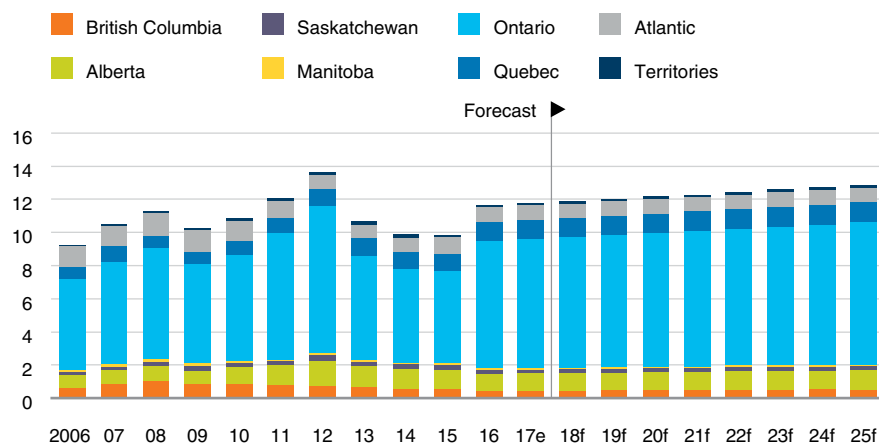


e = estimate; f = forecast
 Source: The Conference Board of Canada.

Residential Propane Demand

Energy demand in Canada’s residential sector is dominated by space and water heating applications, followed by appliances, lighting, and space cooling. As illustrated in Chart 8, Ontario draws almost two-thirds of total residential propane consumption in Canada, and this share is expected to hold through the outlook period.

Chart 8
Residential Propane Demand
(kb/d)



e = estimate; f = forecast
Source: The Conference Board of Canada.

Transportation Propane Demand

Propane used as an automotive fuel was less than 1 per cent of all fuels used for road transportation across Canada in 2015. Yet, propane is the third most used fuel in road transportation after gasoline and diesel. Demand for propane in the road transport sector was dominated by light-duty (LD) freight trucks and passenger cars. (See Table 5.)

Table 5
Estimated Stock of Propane Vehicles in Canada
(number, 2015)

	Passenger cars	Light-duty passenger trucks	Light- and medium-duty freight trucks	Total propane vehicles	Propane fuelling stations
British Columbia	11,351	3,679	9,228	24,259	144
Alberta	4,167	4,519	4,154	12,841	180
Saskatchewan	279	121	323	723	115
Manitoba	464	159	1,273	1,897	90
Ontario	24,953	7,113	18,222	50,288	88
Quebec	1,862	679	1,088	3,629	163

(continued ...)

Table 5 (cont'd)

Estimated Stock of Propane Vehicles in Canada

(number, 2015)

	Passenger cars	Light-duty passenger trucks	Light- and medium-duty freight trucks	Total propane vehicles	Propane fuelling stations
New Brunswick	26	8	20	54	7
Newfoundland & Labrador	21	6	19	46	0
Nova Scotia	172	48	101	320	2
Prince Edward Island	0	9	0	9	2
Territories	n.a.	n.a.	n.a.	n.a.	5
Total Canada	43,295	16,341	34,429	94,065	796

n.a. = not available

Note: Totals may not add up due to rounding.

Sources: The Conference Board of Canada; Natural Resources Canada, "Comprehensive Energy Use Database."

We project that road transportation demand for propane will rise by about 2 per cent annually. In the future, we anticipate that road transportation will be the second fastest growing demand sector for propane.

Agricultural Propane Demand

Propane's share of the Canadian agriculture sector's total fuel demand was estimated at just over 3 per cent in 2015. Ontario and Quebec represent about 40 per cent of Canada's agricultural sector GDP. At the same time, they account for more than 90 per cent of total agricultural propane demand. In 2015, Manitoba and Alberta each consumed about 3 per cent of propane for agricultural purposes. In the future, we anticipate ongoing improvements in energy efficiency will limit demand growth in the sector.

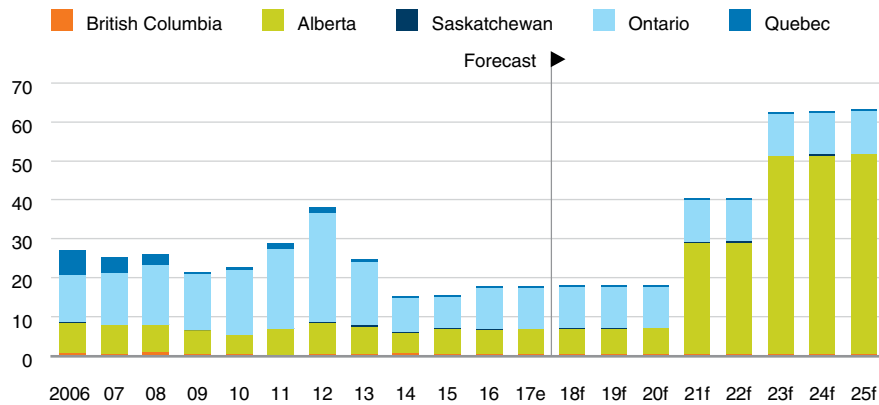
Producer Consumption and Non-Energy Demand

Propane used by NGL fractionation plants and crude oil refineries to produce specification propane is measured as *producer consumption*. Propane used as a petrochemical feedstock is considered *non-energy demand*. The two categories combined are illustrated in Chart 9.

Chart 9

Producer Consumption and Non-Energy Propane Demand

(kb/d)



e = estimate; f = forecast
Source: The Conference Board of Canada.

Recently announced plans for new propane-to-polypropylene petrochemical facilities in Alberta suggest that, by 2021, propane consumption in the new facilities could significantly increase petrochemical propane demand.

These projects include:

- Inter Pipeline's \$3.5-billion Heartland Petrochemical Complex in Strathcona County, which is currently under construction and expected to begin operations in 2021. The project will convert Western Canadian propane into propylene and then to polypropylene—a common plastic polymer used in everyday consumer products.
- The \$3.7-billion Canada Kuwait Petrochemical Corporation's project (a joint venture between Pembina and Kuwait's Petrochemical Industries Company) to be built in Sturgeon County. This project is assumed to come online by 2023.

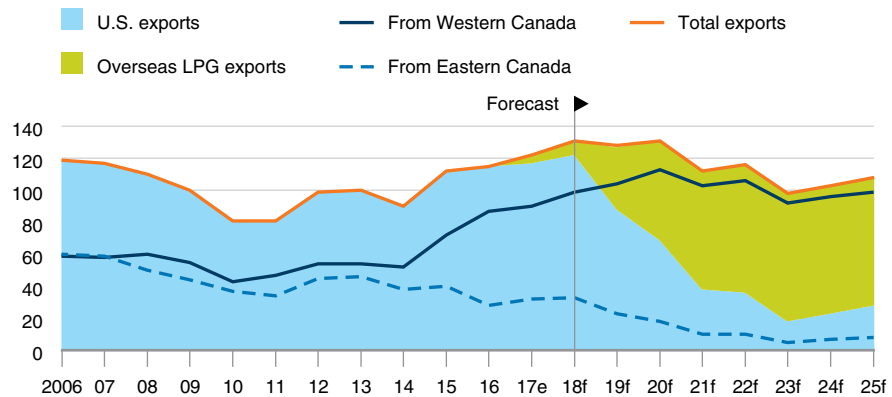
Exports

Net exports of Canadian propane are estimated to decline between 2016 and 2025. However, during this period, exports will vary widely—ranging from 100 kb/d to about 130 kb/d. Chart 10 illustrates i) that exports will increasingly go to overseas markets (a destination trend); and ii) that

exports will increasingly come out of Western Canada, rather than Eastern Canada (a source trend). The need for a more diversified export-customer base for Canada’s propane, and growing demand from Asian markets, has encouraged new export terminal project proposals in recent times.

Projects like the joint venture between Calgary-based AltaGas and Royal Vopak to develop the Ridley Island Propane Export Terminal in British Columbia—the first such facility on Canada’s West Coast—point to huge export opportunities for the industry. The project is to be designed to ship 1.2 million tons of propane per annum, with approximately 96,000 cubic meters of storage capacity.³ Pembina Pipeline Corporation has also approved construction of an export terminal at Prince Rupert, British Columbia, to be used to send Western Canadian propane to markets in Asia and Central America. The project is expected to be in service by mid-2020, with a propane export capacity of about 25,000 barrels per day.⁴

Chart 10
Canadian Propane Exports, by Regional Source and Destination
 (kb/d)



Source: The Conference Board of Canada.

3 Hydrocarbons Technology, “Ridley Island Propane Export Terminal Project.”

4 Canadian Press, The, “Pembina Pipeline Approves Construction.”

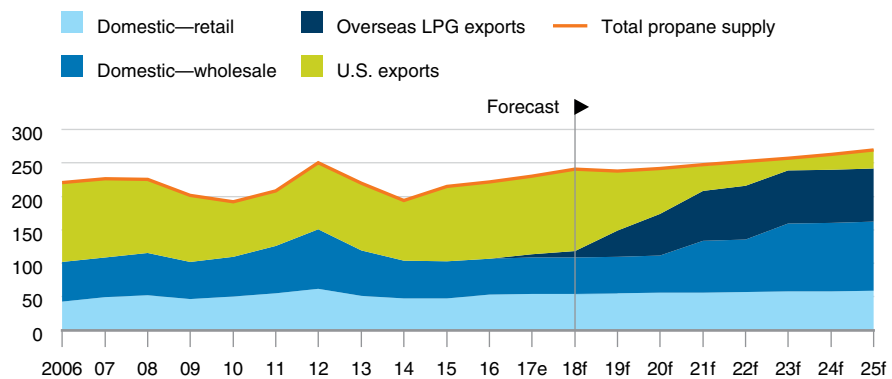
Total Demand

Consistent with higher production and supply levels, overall Canadian propane disposition is expected to increase considerably over the outlook—growing by close to 50 kb/d by 2025—relative to 2016's levels. (See Chart 11.) Domestic demand will account for most of the increases on the disposition side, with over 80 per cent of the net increase in domestic demand coming from new petrochemical plants in Alberta. Increases across all other domestic demand sectors will remain moderate—at about 1 per cent per year—and will be driven by population and economic growth trends.

Both the development of a propane-based petrochemical sector in Alberta and the completion of overseas LPG export terminals in British Columbia will be the biggest developments shaping Canada's propane markets over the coming years.

Chart 11
Total Canadian Propane Disposition, by Domestic End Use and Export Destination

(kb/d)



e = estimate; f = forecast
Source: The Conference Board of Canada.

CHAPTER 2

Economic Footprint of Canada's Propane Industry

Chapter Summary

- Real propane sales are estimated to average \$4.4 billion annually between 2017 and 2025—compared to \$4 billion in 2016. This increase will be driven by petrochemical feedstock demand and exports to overseas markets.
- In 2016, propane sales produced an estimated \$3.5 billion in GDP across Canada, supported over 17,000 jobs, and generated over \$900 million in government revenues.
- Between 2017 and 2025, the industry's economic footprint is projected to reach \$4.4 billion in GDP per year, sustaining over 21,000 jobs while generating over \$1.1 billion per year in government taxes and royalties.

Estimated Value of Canadian Propane Sales

Canada's propane industry's economic footprint is significant and lays the groundwork for future market opportunities. To quantify the economic footprint, the monetary value of propane derived from volumes and prices through the supply chain is estimated.

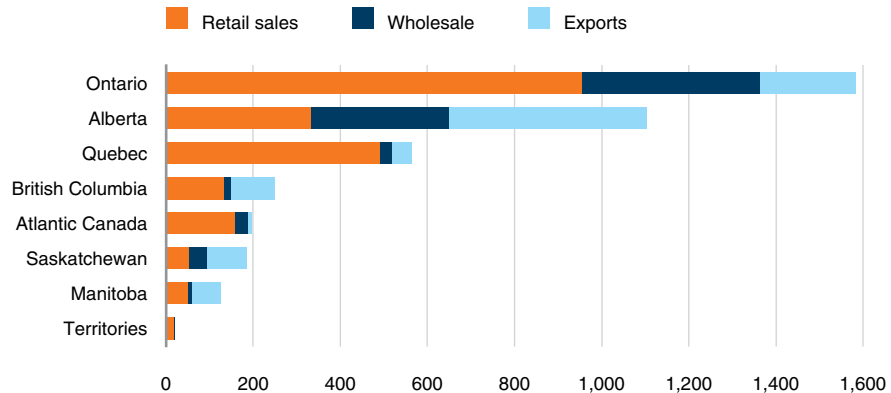
Nominal Value of Sales

Total Canadian propane sales, including domestic and export sales, was roughly \$4 billion in 2016.¹ Eastern Canada's sales accounted for up to 60 per cent of the total, with Ontario accounting for over two-thirds at close to \$1.6 billion. (See Chart 12.) Alberta had over \$1.1 billion in

Chart 12

Canadian Propane Sales in 2016, by Region and End Use

(\$ millions)

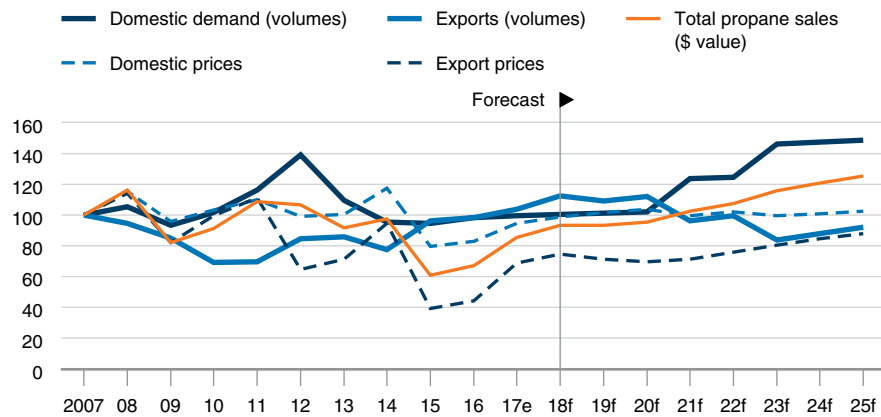


Sources: The Conference Board of Canada; Statistics Canada, Table 25-10-0026-01.

¹ Note that the final propane domestic sales values as presented in this chapter include retail-level fuel/excise and sales taxes across each province and territory as per Natural Resources Canada 2017.

sales, which represents about 30 per cent of the total. In the future, we anticipate that price levels for domestic sales and exports will increase—driven by strong domestic demand from the petrochemical sector and favourable overseas LPG export prices. (See Chart 13.)

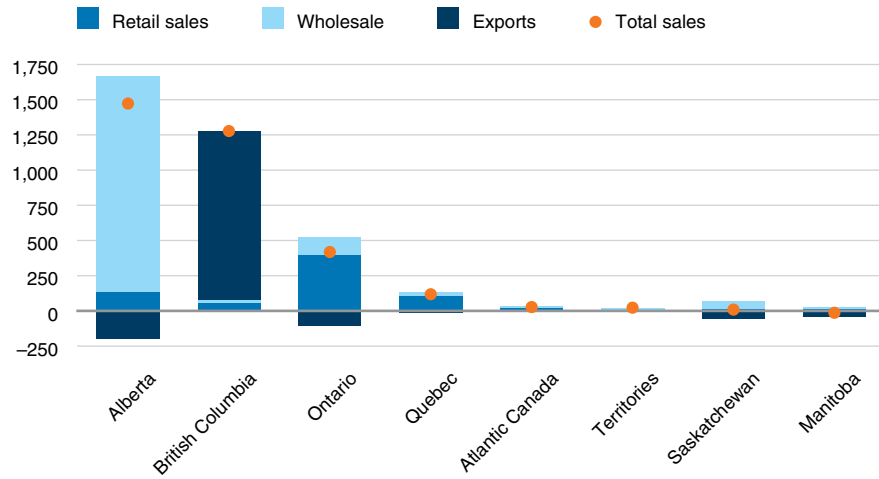
Chart 13
Canadian Propane Sales Trends (Prices vs. Volumes)
 (2007 = 100)



e = estimate; f = forecast
 Source: The Conference Board of Canada.

Overall, Canadian propane sales are expected to increase to \$7.4 billion by 2025—supported by higher prices and volumes. This will be more apparent across Alberta, British Columbia, and Ontario. (See Chart 14.)

Chart 14
Net Change in Canadian Propane Sales Between 2016 and 2025, by Region and End Use
(\$ millions)



Source: The Conference Board of Canada.

Real Value of Sales

Adjusting for price levels improves estimates of propane's economic footprint over the outlook time frame. Total Canadian propane sales, in real terms, are expected to increase primarily across Alberta and British Columbia. Specifically, real, or price-adjusted, propane sales are estimated to increase from \$4 billion (2016 \$) in 2016 to close to \$4.9 billion by 2025,² averaging \$4.4 billion per year between 2017 and 2025. This increase will be driven by domestic petrochemical feedstock demand and propane exports to overseas markets.

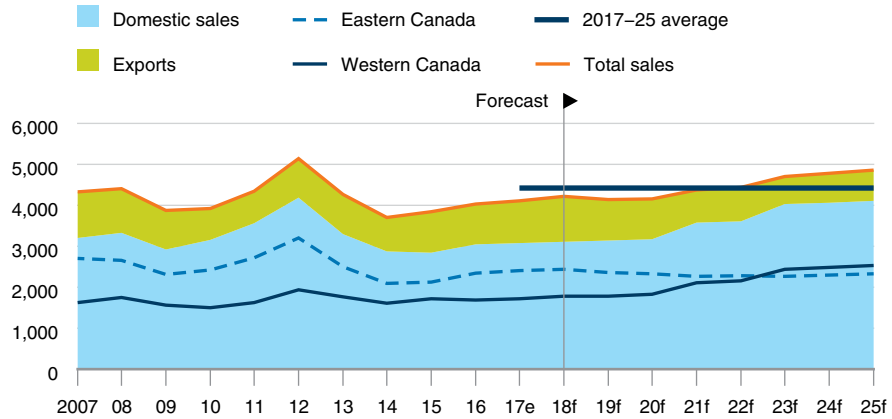
(See Chart 15.)

² This represents a 21 per cent increase—equivalent to the increase in total volume sales—compared to a more than 85 per cent increase in nominal sales, again indicating that a significant driver of propane sales over the forecast is increasing prices (both domestically and at the export level).

Chart 15

Total (Price-Adjusted) Canadian Propane Sales, by Segment and Region

(2016 \$ millions)



e = estimate; f = forecast
Source: The Conference Board of Canada.

Canadian Propane Industry’s Economic Footprint in 2016 and 2017–25

National Impacts

At the national level, \$4 billion worth of propane sales in 2016 meant that Canada’s propane industry supported \$3.5 billion in GDP in that same year.³ This included labour income of \$1.3 billion, supporting close to 17,200 jobs across the economy. Furthermore, over \$900 million in government revenues are estimated to have been generated by this level of economic activity. (See Table 6.)

3 All dollar values in this section of the report refer to 2016 \$.

Table 6
Canada's Propane Industry Economic Footprint
(2016 \$ millions)

	2016					2017–25 (annual average)				
	Sales	GDP	labour income	Employment (number)	Government revenues	Sales	GDP	labour income	Employment (number)	Government revenues
British Columbia	250	275	93	1,653	84	562	584	186	3,273	171
Alberta	1,104	2,308	879	8,963	507	1,277	2,989	1,139	11,594	594
Saskatchewan	184	238	47	706	37	140	190	39	600	32
Manitoba	127	63	19	352	14	89	56	17	325	11
Ontario	1,583	412	210	3,649	174	1,562	378	197	3,439	222
Quebec	564	134	67	1,286	68	571	127	64	1,244	69
Atlantic Canada	196	64	29	569	20	193	58	26	493	23
Territories	21	5	1	18	1	23	5	1	19	2
Total Canada	4,029	3,498	1,344	17,196	905	4,417	4,386	1,670	20,987	1,125
<i>Multiplier (per \$ millions of sales)</i>	<i>n.a.</i>	<i>0.9</i>	<i>0.3</i>	<i>4.3</i>	<i>0.2</i>	<i>n.a.</i>	<i>1.0</i>	<i>0.4</i>	<i>4.8</i>	<i>0.3</i>

n.a. = not available

Note: Totals may not be exact due to rounding.

Sources: The Conference Board of Canada; Statistics Canada, "Supply and Use and Input-Output Tables."

Over the outlook time frame (2017–25), the industry's price-adjusted sales are expected to average \$4.4 billion per year. This will support \$4.4 billion in GDP and close to 21,000 jobs and will contribute over \$1.1 billion in revenues annually to all levels of government across Canada.

Accordingly, we project that every million dollars of Canadian propane sales will support the following levels of economic activity across Canada:⁴

- \$0.9 million in 2016 and \$1 million from 2017–25 in GDP across Canada;
- 4.3 jobs in 2016 and 4.8 jobs from 2017–25 across the Canadian economy;
- \$0.2 million in 2016 and \$0.3 million from 2017–25 in various types and levels of government revenues across the country.

4 These are known as the industry's economic multipliers. Note that changes in multipliers across the two time frames are the result of changes in the sales-mix across Canada.

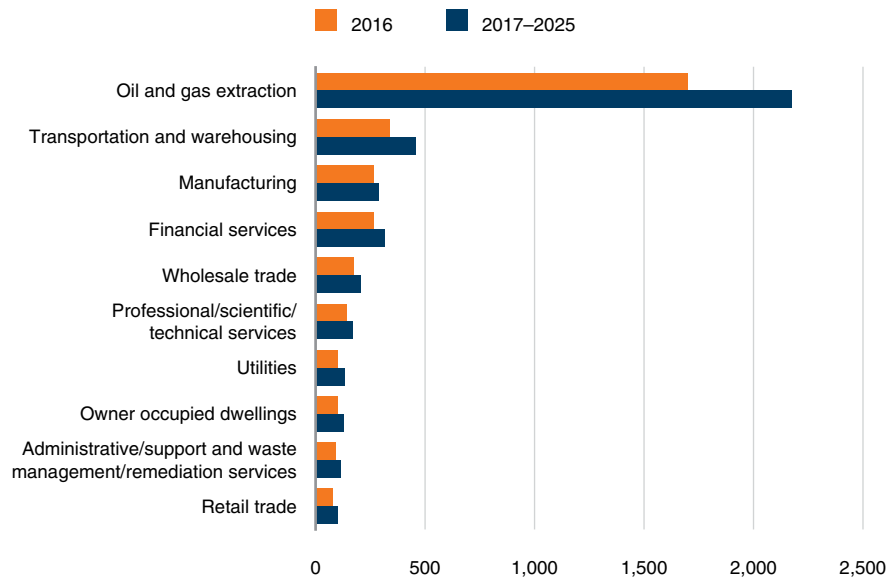
Regional-Level Impacts

Alberta accounts for two-thirds of all GDP impacts and over one-half of total employment and government revenue impacts. Ontario and British Columbia account for about a third of the industry’s economic footprint. It is important to note that oil and gas extraction accounts for a significant share of the industry activities, for both GDP and employment impacts. (See charts 16 and 17.)

Chart 16

Economic Footprint by Industry Segment (Top 10 Only), GDP

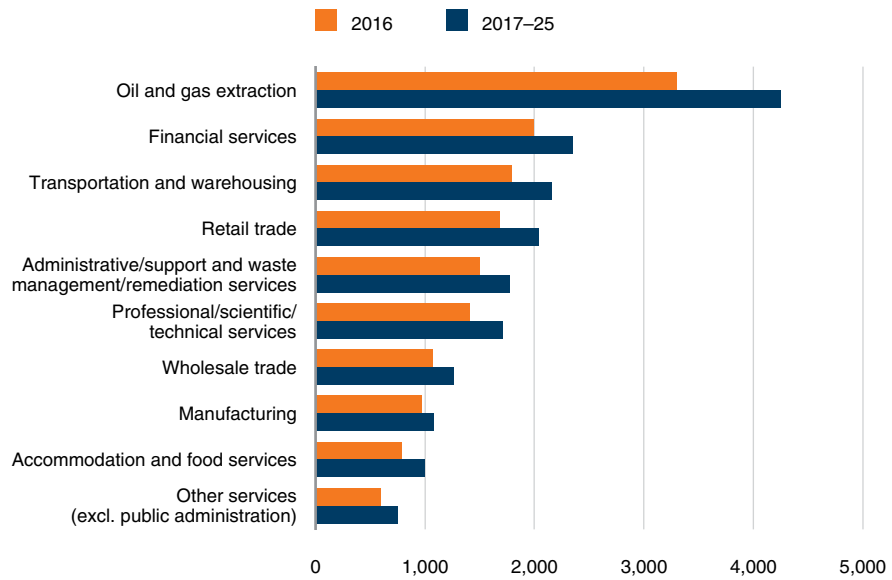
(2016 \$ millions)



Sources: The Conference Board of Canada; Statistics Canada, "Supply and Use and Input-Output Tables."

Chart 17

Economic Footprint by Industry Segment (Top 10 Only), Employment
(number of workers)



Sources: The Conference Board of Canada; Statistics Canada, "Supply and Use and Input-Output Tables."

Industry-Level Impacts

As illustrated in Chart 16, the top five industries account for about 80 per cent of the industry's footprint, indicating that the GDP impacts are mainly concentrated across a handful of industries. The economic footprint is more pronounced in the oil and gas extraction industry (which includes support activities such as drilling services). This is followed by transportation and warehousing (including transportation services via railways, pipelines, and trucks); manufacturing; financial services; and wholesale industries.

From an employment perspective, the benefits of Canada's propane industry are more evenly spread across the economy. However, the oil and gas extraction sector also leads the pack with about 20 per cent of the employment impacts, while other sectors like financial services; transportation and warehousing; administrative support and waste management and remediation services; and the professional services each account for around 10 per cent of the employment impacts.

Fiscal Impacts

By type of tax, indirect taxes and personal income taxes each account for over 30 cents of every dollar generated in tax revenues from the industry's activities. (See Table 7.) Government revenues collected at the provincial level account for around 50 cents out of every dollar of fiscal impacts generated by the industry. This is followed by revenues collected by the federal government (at around 40 per cent of the total) and municipal governments (at around 10 per cent).

Table 7
Government Tax Revenues

	2016				2017–25 (annual average)			
	Municipal	Provincial	Federal	Total	Municipal	Provincial	Federal	Total
Indirect taxes	87	156	67	309	103	176	76	355
Personal income taxes	0	96	189	285	0	112	224	336
Corporate income taxes	0	61	99	160	0	72	120	192
Royalties	0	83	0	83	0	99	0	99
Carbon taxes	0	30	0	30	0	99	0	99
Other taxes	0	10	27	37	0	12	32	43
Total taxes and royalties	87	436	382	905	103	571	451	1,125

Note: Totals may not add up due to rounding.

Sources: The Conference Board of Canada; Statistics Canada, "Supply and Use and Input-Output Tables."

Without question, Canada's propane industry's economic footprint is significant—including GDP, employment impacts across the country and different segments of the economy, and high levels of government tax revenues. Although the outlook for Canadian propane markets is generally favourable, some opportunities and challenges for the coming years are worth keeping in mind.

CHAPTER 3

The Way Forward: Key Issues and Opportunities for Propane in Canada's Transition to a Low-Carbon Economy

Chapter Summary

- Rising costs of diesel and gasoline fuels, increasing energy demand, innovations in technology, and environmental issues relating to air quality and GHG emissions suggest propane can offer fuel-switching options in market sectors like automotive fleet and power generation.
- Innovations in propane-solar hybrid technologies can support sustainable power generation in remote communities.
- In a future low-carbon economy, propane market penetration will most likely be shaped by its price competitiveness and lower comparative emissions relative to other fossil fuels. This will have positive impact on the economy, while helping to reduce Canada's emissions.

The propane industry is vulnerable to uncertainties from timing of infrastructural investments and seasonal changes in supply and demand.

Key Issues and Opportunities

Over the past 10 years, propane markets in Canada have been influenced by the combined effects of volatile oil and gas prices, swings in economic outlook, advancements in renewable energy technologies, and evolving environmental policies. While many of these factors have resulted in increased challenges for propane supply and demand, they have also created new opportunities for the propane industry to be competitive in Canada’s transition to a low-carbon economy.

Building on the findings and forecasts in the previous chapters, we explore some key issues that may shape the future role of propane in Canada’s energy mix through a strengths, weaknesses, opportunities, and threats (SWOT) lens. The general picture that emerges is that the propane industry has huge resource and locational advantages, as well as demand for high-value products like polypropylene and new export market opportunities, but is vulnerable to uncertainties from timing of infrastructural investments and seasonal changes in supply and demand.

Strengths

- access to a large resource base
- business and investor-friendly environment
- versatility as fuel and feedstock
- low-carbon attributes
- locational advantages

Weaknesses

- sensitivity to natural gas dynamics
- variability in NGLs content
- uncertainty for NGLs production because of market economics

- uncertainty of demand due to timing of infrastructure projects undergoing construction
- inadequate propane storage facilities in remote communities

Opportunities

- increasing availability of propane
- government incentives on petrochemicals
- technology innovation and polypropylene demand
- relative increase in transport sector propane demand
- increasing energy demand in remote areas
- new export terminal and markets

Threats

- weakened U.S. export potential
- carbon pricing
- decline in overall residential housing markets
- decline in the use of propane for urban transit bus fleets
- vulnerability to seasonal changes
- competition with other fuel sources
- diesel fuel subsidies in remote communities

Opportunities for the Future—An Environmental and Economic Analysis

In the future, we anticipate domestic propane demand to evolve through the gradual expansion of diversified, multi-user sectors. For example, in the residential, commercial, agriculture, and transportation sectors, this expansion will be driven by population and economic growth, energy-efficiency improvements, and low-carbon government policies. Within this segment, propane will compete with other fuels based on security of supply, end-use technology options, cost advantages, and low-emissions impact.

This backdrop informs the analyses on market opportunities, such as automotive fleet and power generation in remote communities, where the evidence suggests that propane can satisfy the needs of consumers in a low-carbon economy.

Propane as an Automotive Fuel: Value Analysis for the Fleet Industry

The use of propane as a transportation fuel has significant potential for growth due to its ability to reduce greenhouse gas emissions and fuel consumption costs. Transport fleets are dynamic, and operators historically have focused on price, service characteristics, convenience in operations, features, style, fuel economy, and maintenance costs when choosing a vehicle. Of these factors, only fuel economy relates directly to emissions. Subsidies for electric vehicle (EV) purchases have addressed the price premium that currently exists for EVs and are designed to increase adoption and reduce emissions. The emissions reduction achieved, however, depends on whether life-cycle emissions are considered.

Reducing Environmental Emissions

In 2016, the transportation sector was the second-largest source of GHG emissions in Canada, accounting for 25.0 per cent (173 Mt CO₂ eq) of total national emissions.¹ For road transportation, GHG emissions, in recent times, have generally increased in most road vehicle types used by fleet operators, although cars have seen a 25 per cent drop in GHG emissions between 1995 and 2015.² (See Table 8.) For fleet operators, switching to a low carbon fuel to reduce emissions footprint should be an important consideration.

1 Environment and Climate Change Canada, *Canadian Environmental Sustainability Indicators*.

2 Natural Resources Canada, "Transportation Sector—GHG Emissions."

Table 8
On-Road Transportation Sector—GHG Emissions
(Mt)

	1995	2005	2015
GHG emissions by vehicle type			
Cars	47.5	43	35.7
Light-duty trucks	27.6	40	47.6
Medium-duty trucks	10.1	14.5	21.3
Heavy-duty trucks	22.4	32.3	34.8
Motorcycles	0.1	0.2	0.4
School buses	1.1	0.9	0.9
Urban transit	1.8	2.4	2.5
Inter-city buses	0.6	0.5	0.4

Source: Natural Resources Canada, "Transportation Sector—GHG Emissions."

GHG Emissions (CO₂ Indicator)

According to data from the British Columbia Ministry of Environment, propane's carbon dioxide (CO₂) emissions in fleet vehicles are lower by more than 30 per cent compared to gasoline.³ In comparison to diesel, propane has up to 40 per cent less carbon dioxide emissions in both trucks and cars. (See Table 9.) These values resonate strongly with results from earlier experimental work conducted by the Argonne National Laboratory, which found that light-duty propane vehicles produce 21 to 24 per cent less GHG than gasoline vehicles.⁴

Regulated Emissions (NO_x Indicator)

Propane offers opportunities for significant reductions in nitrogen oxides (NO_x) emissions. Light-duty vehicles and trucks running on propane generally emitted over 94 per cent less NO_x than gasoline and 87 per cent less NO_x than diesel.⁵ When considered along with the CO₂ emissions values, as shown in Table 9, we observe that propane-fuelled vehicle emissions are below those of the equivalent class of vehicles that uses conventional fuels like diesel and gasoline.

3 British Columbia Ministry of Environment, *Methodology for Reporting*.

4 Wang and Huang, *A Full Fuel-Cycle Analysis*.

5 British Columbia Ministry of Environment, *Methodology for Reporting*.

Table 9
Fleet Fuel Emissions Tracking

Transport mode	Fuel type	Emission factor	
		CO ₂ (g/L)	NO _x (g/L)
Light-duty vehicle	Gasoline	2,175	0.47
	Diesel	2,556	0.22
	Propane	1,510	0.028
Light-duty truck (includes SUV and minivan)	Gasoline	2,175	0.58
	Diesel	2,556	0.22
	Propane	1,510	0.028
Heavy-duty truck	Gasoline	2,175	0.20
	Diesel	2,556	0.15
	Propane	n.a.	n.a.

n.a. = not available

Source: British Columbia Ministry of Environment, *Methodology for Reporting B.C. Public Sector Greenhouse Gas Emissions, 2011*.

Economic Competitiveness

Fuel Consumption Costs

Fuel cost is a major operating cost for fleet operators. Fuel costs are usually determined by the distance travelled, vehicle fuel efficiency, and fuel price. Average retail fuel prices in Canada for gasoline increased by 21.5 cents per litre over the one-year period of August 2017–18.⁶ In the same period, the average price per litre of diesel increased by 23.3 cents, whereas the price of auto propane increased by only 7.7 cents. (See Table 10.) This indicates that the market penetration of propane will most likely be influenced by its price competitiveness with diesel and gasoline. But price competitiveness may not be the only factor that drives propane demand in the fleet market sector. While propane has a lower energy content by volume than gasoline and diesel (about 1.4 litres of propane is needed to travel the same distance as one litre of gasoline), it still is less expensive than gasoline on an energy-content-adjusted basis.⁷

⁶ Natural Resources Canada, "Average Retail Fuel Prices in Canada."

⁷ Natural Resources Canada, *Alternative Fuels in Canada*.

Table 10
Comparison of Average Retail Fuel Prices in Canada From 2017
(cents per litre)

Product	August 2018	Change from 2017
Regular gasoline	134.1	21.5
Mid-grade gasoline	147.4	21.5
Premium gasoline	152.3	22.0
Diesel	128.5	23.3
Auto propane	88.8	7.7

Source: Natural Resources Canada, "Average Retail Fuel Prices in Canada."

Motor Fuel Tax Subsidies

The federal alternative fuel excise tax exemptions and provincial subsidies provide a significant financial incentive for the use of propane as a motor vehicle fuel. Table 11 shows the federal and provincial consumption taxes on petroleum products. Propane is exempt from the excise tax. Overall, these taxes are much lower (and sometimes non-existent) for propane compared with gasoline or diesel.

Table 11
Federal and Provincial Consumption Taxes on Petroleum Products
(cents/litre or %, as indicated)

	Gasoline	Diesel	Auto propane
Federal taxes			
Excise tax	10	4	0
Goods and services tax	5%	5%	5%
Provincial fuel taxes			
Newfoundland and Labrador	33	21.5	7
Prince Edward Island	13.1	20.2	n.a.
Nova Scotia	15.5	15.4	7
New Brunswick	15.5	21.5	6.7
Quebec	19.2	20.2	n.a.
Ontario	14.7	14.3	4.3
Manitoba	14	14	3
Saskatchewan	15	15	9
Alberta	13	13	9.4

(continued ...)

Table 11 (cont'd)

Federal and Provincial Consumption Taxes on Petroleum Products
(cents/litre or %, as indicated)

	Gasoline	Diesel	Auto propane
British Columbia plus carbon tax*	14.5	15	2.7
	6.67	7.67	4.62
Yukon	6.2	7.2	n.a.
Northwest Territories**	10.7/6.4	9.1	n.a.
Nunavut**	10.7/6.4	9.1	n.a.

*British Columbia applies a carbon tax on all fuels.

**In the Northwest Territories and Nunavut, gasoline is taxed at 6.4 cents per litre in communities not served by a highway system.

n.a. = not available

Source: Natural Resources Canada, "Fuel Consumption Taxes in Canada."

Case Study of Regina School Propane Bus Fleet

In 2016, LP3 Transportation Solutions, a school bus company, collaborated with École St. Mary, Regina Catholic School Division (RCSD), to provide 89 Blue Bird propane school buses for students in Regina.

The aim was to help reduce emissions from the existing school bus fleet. According to Blue Bird officials, the fleet of propane buses is the largest in Saskatchewan that are equipped with a 6.8L V10 Ford engine and powered by a ROUSH CleanTech propane fuel system. Internal test results show that the buses emit about 80 per cent fewer hydrocarbons and particulate matter when compared with diesel-powered buses.

"Our new fleet of school buses fueled by propane means cleaner air around our students and drivers, and within our community," said Domenic Scuglia, RCSD's director of education. "At Regina Catholic Schools, we always consider our students' needs first when we make any decision inside and outside of the classroom."

In addition to the environmental benefits, the new buses have the capacity to start in freezing conditions. The buses also have excellent heat retention capacity and about 50 per cent lower noise levels compared with diesel-fuelled buses.

Source: Alternative Fuels—School Bus Fleet.⁸

8 School Bus Fleet, "Canada District Switches Entire School Bus Fleet to Propane."

Fuel-Switching for Power Generation in Remote Communities

Up to 300 remote communities spread across Canada have no connection to the North American electrical grid or its gas distribution pipelines. These communities rely mostly on electricity supplied by expensive and emission-intensive diesel-fuel generators. (See Table 12.)

Table 13 provides a summary of annual fuel consumed by electric utility plants across Canada. The gap between propane and diesel indicates a relatively huge market opportunity for the propane industry for diesel displacement with propane. A higher substitution rate for this opportunity area would theoretically result in a higher market size.

Table 12
Total Generation Capacity of Fossil Fuel Power Plants in Remote Communities by Province, 2011

Province or territory	Type of fossil fuel (FF) generation	Total FF capacity (kW)	Total number of sites
Alberta	Diesel	1,450	1
British Columbia	Diesel	70,957	15
Manitoba	Diesel	7,175	7
Newfoundland	Diesel	24,293	28
Northwest Territories	Diesel/Natural gas	114,681	34
Nunavut	Diesel	50,295	26
Ontario	Diesel	25,570	38
Quebec	Diesel	106,925	24
Saskatchewan	Diesel	350	1
Yukon	Diesel	51,600	13

Sources: Natural Resources Canada; Royer, Status of Remote/Off-Grid Communities in Canada.

Table 13
Annual Fuel Consumed by Electric Utility Thermal Plants in Canada
(kilolitres)

Fuel consumed for electric power generation	2012	2013	2014	2015	2016
Diesel	103,930	107,286	154,893	156,279	148,940
Propane	28	32	33	58	0

Source: Statistics Canada, Table 25-10-0017-01.

Bio-propane has the same characteristics as fossil-fuel propane and can be utilized the same way.

Propane-Renewable Energy Hybrid Power Application

Advances in propane-solar hybrid technologies are expected to support increasing levels of hybrid power generation in the future. Like diesel generators, propane-fuelled generators can respond effectively to changes in load, or in response to variable renewable energy production, to balance generation and demand in real time.

A demonstration project in the remote community of Xeni Gwet'in in British Columbia is currently helping residents reduce their reliance on diesel-generated power.⁹ The \$4.5-million solar-propane hybrid system is designed to provide electricity for 67 homes and eight community buildings.¹⁰ It is expected to reduce diesel consumption by 143,000 litres per year, which represents a savings of more than \$150,000 every year.

Economic Competitiveness

Cost and Security of Supply

The lack of nearby gas plants and refineries means that propane is usually transported by rail and truck to remote communities, adding to the cost of the product and supply uncertainties. To address this problem, on-site production of bio-propane can help propane be more competitive in remote communities, eliminating costs associated with transporting it from outside locations. Gas conversion technologies that use various waste and residues as feedstock can convert this waste into bio-propane, creating additional environmental value in communities.

From a fuel-product perspective, bio-propane has the same characteristics as fossil-fuel propane and can be utilized the same way. Producing bio-propane on site can enhance propane availability and distribution in remote locations, especially in propane-renewable energy hybrid systems.

⁹ Brevifolia Consulting, "Solar-Diesel Project Review and Oversight."

¹⁰ BC Gov News, "Hybrid Solar Power Burns Cleaner for Xeni Gwet'in."

Environmental Emissions

Stationary diesel generators are used in many remote communities throughout Canada. Emissions from diesel engine exhaust have been classified as carcinogenic by the World Health Organization (WHO). The prevalent use of diesel engines in these communities affects local air quality and greenhouse gas emissions, especially in situations where engines operate 24 hours a day, often near homes and schools. Burning substantial amounts of diesel produces greenhouse gas emissions in addition to those transportation-related emissions associated with delivering fuel. This contributes to climate change, which negatively affects the communities.¹¹

Emissions profiles for a propane-solar PV hybrid power generation system were compared to a diesel-solar PV hybrid power generation system based on simulation results from a feasibility study. Both systems used solar as the secondary fuel. According to simulation results, in propane-versus-diesel generators that have the same capacity factor, average change in emissions reduction was about 45 per cent for the propane-solar hybrid generators. (See Table 14.)

Table 14
Comparison of Emissions Profiles of Propane and Diesel Hybrid Power Generators

Emissions	(kg/year)		% difference
	Diesel-solar PV hybrid	Propane-solar PV hybrid	
Carbon dioxide	3,679	2,110	42.6
Carbon monoxide	9.08	4.42	51.3
Particulate material	0.66	0.33	50.0
Sulfur dioxide	7.39	4.38	40.7
Nitrogen oxides	81	39.40	41.6

Source: Adouane and others, "Feasibility Study of a Hybrid Plants (Photovoltaic-LPG Generator) System for Rural Electrification."

11 Advanced Energy Centre, *Enabling a Clean Energy Future*.

In the period from 2012 to 2017, companies invested over \$1 billion in Canadian petrochemical projects.

Value-Added Petrochemical Opportunities

Value-added and economic diversification policies are a key driver behind the growing demand for propane as a petrochemical feedstock in the domestic market. The integrated set of upstream and midstream infrastructure assets that connects Canadian producers to end-users and markets across the world, and the huge size of the country's oil and gas reserves, creates an opportunity for petrochemical projects that would convert propane derivatives into plastics.

In the period from 2012 to 2017, companies invested over \$1 billion in Canadian petrochemical projects—funds that have mainly been spent on existing projects that turn ethane into building blocks for plastics manufacturing.¹² However, the Petrochemicals Diversification Program (PDP) recently introduced in Alberta has encouraged multi-billion-dollar propane-to-polypropylene (PP) petrochemical infrastructure facility projects—all of which will strengthen the gas-based petrochemicals sector to take advantage of rapidly growing worldwide demand for consumer products that require plastics and other chemical inputs.

Net Impact of Domestic Market Opportunities

After taking stock of the competitive landscape for propane across Canada's end-use sectors and considering the implications that climate-change and value-added policies might have on domestic demand, the equivalent value of sales for these opportunities is estimated at \$5.1 billion (in 2016 \$), which is 1.7 times greater than the \$3-billion estimate for Canada's domestic propane sales in 2016. (See Table 15.) In addition, we quantify the impact on Canada's GHG emissions from these opportunities to be a net reduction of close to 2 million tonnes (Mt) of GHGs per year, equivalent to shutting down a 250-megawatt coal power plant for a year.

12 Morgan, "Canada Sat on the Sidelines."

Table 15
Incremental Domestic Market Opportunities for Propane in Canada and Net Impact on GHGs

Sector	Assumption	Subsector	Target markets			Incremental propane demand		Estimated value of incremental propane sales	GHG emissions impact (Mt of CO ₂ e/yr)		
			Region	Competitive advantages	Competitive challenges	PJ/yr	kb/d	2016 \$ millions	Avoided GHG emissions	Propane GHG emissions	Net emissions impact
Non-energy use	Additional (i.e., third) PDH plant from second round of Alberta's PDP program	Petrochemical feedstock for manufacturing polymers	Alberta (potential in Ontario, but mainly imports)	Affordability, availability, and government support in Alberta	Competition with ethane and natural gas as alternative feedstocks	33	22	329	0.0	0.4	0.4
Power generation	Replace diesel fuel oil, light fuel oil, kerosene, and heavy fuel oil use in the sector (1% of sector's fuel use in 2015)	n.a.	Atlantic Canada and northern territories	General fuel price advantage with and without carbon price; reduced carbon footprint	Delivery infrastructure availability and end-use equipment replacement; competition for market share with natural gas and electricity	45	30	454	-3.3	2.7	-0.6
Industrial	Replace heavy fuel oil use in the sector (1% of sector's fuel use in 2015)	Mining and construction industries	Alberta, British Columbia, northern territories, Ontario, and Quebec			30	21	308	-2.3	1.8	-0.4
Commercial	Replace light fuel oil, kerosene, and heavy fuel oil use in the sector (3% of sector's fuel use in 2015)	Office buildings, health care and education facilities, retail and hospitality outlets	Atlantic Canada, Quebec, and Ontario			35	24	993	-2.5	2.2	-0.3
Residential	Replace heating oil use in the sector (4% of sector's fuel use in 2015)	Space and water heating	Atlantic Canada, Quebec, and Ontario			69	47	2,032	-4.9	4.3	-0.6
Transportation	Capture 1% of market share from diesel and gasoline (88% of sector's fuel use in 2015)	Road transportation	Across Canada			23	16	606	-1.6	1.4	-0.2
Agriculture	Replace light fuel oil, kerosene, and heavy fuel oil use in the sector (16% of sector's fuel use in 2015)	Non-motive uses	Saskatchewan and Ontario			16	11	430	-1.2	1.0	-0.2
Total								252	170	5,150	-15.8

PJ = petajoules
Note: Totals may not be exact due to rounding.
Sources: The Conference Board of Canada; Natural Resources Canada (CEUD).

CHAPTER 4

Overall Assessment and Recommendations

Chapter Summary

- The combined effects of evolving government policies and changes in propane supply and demand have influenced the scope of propane markets in Canada.
- These factors have resulted in increased challenges and unique opportunities for the propane industry to be competitive in Canada's transition to a low-carbon economy.
- Future research is recommended on the strategic steps the propane industry can take to maximize global and domestic market share for Canadian propane in the 21st century and beyond.

It is evident that propane markets in Canada have been influenced by the combined effects of volatile oil and gas prices, swings in economic outlook, advancements in renewable energy technologies, evolving government policies, and changes in propane supply and demand. While many of these factors have resulted in increased challenges for propane supply and demand, they have also created new opportunities for the propane industry to be competitive in Canada's transition to a low-carbon economy.

Some of the forward-looking observations that have been discussed in the report include the following:

- Recent export terminal projects present an opportunity to expand Canadian propane production levels and to diversify exports toward overseas markets.
- Value-added policies and a strong investment appetite that support the development of propane-based petrochemical projects can expand the outlook for domestic demand beyond what is currently estimated.
- Hybrid solar-propane power systems are an excellent fuel-switching option to deliver consistent and affordable electricity to remote and rural areas, at lower economic costs and with lower environmental emissions.

Now is the time for the propane industry to step forward and take advantage of these opportunities. The challenge will require taking strategic steps and giving more thought to how to maximize global and domestic market share for Canadian propane in the 21st century and beyond. Some of the immediate actions are captured in the following recommendations:

- The propane industry should support policy initiatives like Alberta's PDP that seek to create value-added products for export from petrochemical processing. Incremental demand for propane arising from these policies could increase the value of the resource and boost supply and demand, and may result in additional market opportunities along the value chain.
- The propane industry should promote the broader benefits and performance of propane in the context of a transition to a low-carbon and clean-growth economy, ensuring that its affordability and low-carbon footprint attributes are positioned to meet the needs of a changing, modern economy.
- It would also be useful to prioritize the study and analysis of potential fuel-switching opportunities across Canada. This should include a thorough assessment of infrastructure and equipment investment, fuel-switching programs, and financial models that can facilitate fuel-switching for end-users across different sectors.
- The propane industry should build knowledge capacity for power generation and run demonstration models in remote communities. The innovative development in the Xeni Gwet'in community qualifies as a good model of practice. It is important to have a comprehensive understanding of the economic and GHG emissions benefits of propane for remote communities in Canada. Such benefits and models should be communicated widely to encourage uptake in remote communities.

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APPENDIX A

List of Abbreviations and Acronyms

CAPP—Canadian Association of Petroleum Producers

CPA—Canadian Propane Association

CANSIM—Canadian Socio-Economic Information Management System
(Statistics Canada database)

CAGR—compound annual growth rate

CEUD—Comprehensive Energy Use Database (Natural
Resources Canada)

EJ—exajoule

GHG—greenhouse gas

GDP—gross domestic product

IO—input output (models)

kg—kilogram

LD—light-duty (trucks)

LPG—liquefied petroleum gas

NEB—National Energy Board

NGLs—natural gas liquids

PDP—Petrochemicals Diversification Program

PJ—petajoule

kb/d—thousands of barrels per day

APPENDIX B

Supplementary Regional-Level Summaries

Table 1
Canadian Propane Supply, by Source and Region
(kb/d)

Region/year	Gas plants			Refineries			Total production			Imports			Adjustments			Total supply		
	2007	16	25f	2007	16	25f	2007	16	25f	2007	16	25f	2007	16	25f	2007	16	25f
British Columbia	6.0	18.4	37.3	1.8	1.1	1.1	7.8	19.4	38.4	0.9	0.4	0.2	0.4	-0.3	-0.3	9.1	19.5	38.4
Alberta	90.7	108.6	153.4	7.0	3.1	3.2	97.8	111.7	156.6	0.0	0.1	0.0	4.7	-1.9	-1.5	102.5	109.9	155.1
Saskatchewan	0.7	7.3	7.9	6.2	4.1	4.2	7.0	11.4	12.1	0.0	0.0	0.0	0.3	-0.2	-0.2	7.3	11.3	12.0
Manitoba	0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-0.0	-0.0	0.0	0.0	0.0
Ontario	81.1	65.2	51.1	5.3	2.4	2.4	86.4	67.6	53.5	0.6	5.5	3.5	4.2	-1.2	-1.0	91.2	71.9	56.0
Quebec	0.0	0.0		6.4	3.4	3.4	6.4	3.4	3.4	0.0	0.9	0.6	0.3	-0.1	-0.1	6.7	4.2	3.9
Atlantic Canada	2.7	1.7	1.0	7.0	4.3	4.4	9.6	6.0	5.4	0.0	0.1	0.0	0.5	-0.1	-0.1	10.1	6.0	5.4
Territories	0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Canada	181.3	201.2	250.8	33.7	18.4	18.6	215.0	219.6	269.4	1.5	7.0	4.4	10.5	-3.8	-3.0	227.0	222.8	270.8

f = forecast

Note: Totals may not add up due to rounding.

Sources: The Conference Board of Canada; Canadian Association of Petroleum Producers (CAPP); Government of British Columbia; Statistics Canada, CANSIM table 128-0012.

Table 2
Canadian Propane Demand, by Use and Region
(kb/d)

Region/year	Producer's own use		Non-energy (feedstock)		Industrial		Commercial		Residential		Transportation		Agriculture		Total domestic demand		Exports		Total disposition	
	2016	25f	2016	25f	2016	25f	2016	25f	2016	25f	2016	25f	2016	25f	2016	25f	2016	25f	2016	25f
British Columbia	0.4	0.5	0.0	0.0	1.0	1.0	0.9	1.0	0.5	0.5	1.6	1.9	0.1	0.1	4.5	5.1	15.7	80.0	20.2	85.1
Alberta	5.5	6.0	0.8	45.3	21.9	23.9	5.3	6.1	1.0	1.2	0.9	1.1	0.2	0.2	35.5	83.7	55.6	15.8	91.1	99.5
Saskatchewan	0.2	0.2	0.0	0.0	3.2	3.4	0.6	0.6	0.2	0.2	0.1	0.1	0.0	0.0	4.4	4.7	8.6	2.1	13.0	6.8
Manitoba	0.0	0.0	0.0	0.0	0.8	0.9	0.4	0.5	0.1	0.1	0.1	0.1	0.2	0.3	1.7	1.8	7.3	1.5	9.0	3.3
Ontario	0.2	0.2	10.1	10.6	6.4	7.0	11.0	12.3	7.7	8.6	4.9	5.8	3.0	3.2	43.3	47.6	22.0	6.5	65.3	54.1
Quebec	0.0	0.0	0.5	0.5	1.3	1.4	5.3	5.7	1.1	1.2	0.5	0.6	3.4	3.6	12.2	13.0	4.7	1.8	16.9	14.8
New Brunswick	0.0	0.0	0.0	0.0	0.7	0.8	0.8	0.8	0.2	0.2	0.0	0.0	0.0	0.0	1.7	1.8	0.9	0.2	2.7	2.0
Nova Scotia	0.0	0.0	0.0	0.0	0.3	0.3	0.8	0.9	0.4	0.4	0.0	0.0	0.0	0.0	1.6	1.6	0.0	0.0	1.6	1.6
Newfoundland and Labrador	0.0	0.0	0.0	0.0	0.1	0.1	0.7	0.7	0.3	0.3	0.0	0.0	0.0	0.0	1.0	1.0	0.0	0.0	1.0	1.0
Prince Edward Island	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.0	0.0	0.1	0.1
Territories	0.0	0.0	0.0	0.0	0.5	0.6	0.2	0.3	0.1	0.2	0.0	0.0	0.0	0.0	0.9	1.0			0.9	1.0
Canada	6.4	6.9	11.4	56.4	36.3	39.4	26.1	28.8	11.6	12.9	8.2	9.7	7.0	7.5	107.0	161.5	114.7	107.9	221.8	269.4

f = forecast

Note: Totals may not add up due to rounding.

Sources: The Conference Board of Canada; Statistics Canada CANSIM table 128-0012.

Table 3
Canadian Propane Sales, by Use and Region
(\$ millions)

Region/year	Producer's own use		Non-energy (feedstock)		Industrial		Commercial		Residential		Transportation		Agriculture		Total domestic demand		Exports		Total disposition	
	2016	25f	2016	25f	2016	25f	2016	25f	2016	25f	2016	25f	2016	25f	2016	25f	2016	25f	2016	25f
British Columbia	4	12	0	0	11	26	40	54	23	31	70	103	3	4	150	231	99	1,298	250	1,529
Alberta	64	147	0	1,113	255	588	235	329	49	70	40	61	8	11	652	2,319	453	258	1,104	2,578
Saskatchewan	2	6	0	0	38	84	31	41	14	18	6	8	2	3	94	160	91	35	184	195
Manitoba	0	0	0	0	10	22	26	34	6	8	4	6	13	17	60	87	67	24	127	111
Ontario	5	7	270	319	134	210	388	544	300	421	170	254	98	135	1,365	1,889	218	111	1,583	1,999
Quebec	1	0	0	15	28	42	251	306	59	72	26	33	154	184	519	652	45	30	564	682
New Brunswick	1	0	0	0	15	23	39	41	12	12	1	1	1	1	68	77	8	4	77	81
Nova Scotia	1	0	0	0	8	9	35	45	18	23	1	2	1	1	64	80	1	0	65	80
Newfoundland and Labrador	1	0	0	0	2	3	33	36	14	15	0	0	0	0	49	54	0	0	49	54
Prince Edward Island	0	0	0	0	0	0	3	3	2	2	0	0	0	0	6	6	0	0	6	6
Territories	0	0	0	0	2	15	11	16	7	10	1	1	0	0	21	42	0	0	21	42
Canada	78	172	270	1,447	503	1,021	1,091	1,449	504	682	319	469	282	357	3,046	5,598	982	1,759	4,029	7,357

f = forecast
Note: Totals may not add up due to rounding.
Sources: The Conference Board of Canada; Statistics Canada CANSIM table 128-0012.

Table 4
Fiscal Impacts of Canada's Propane Industry Economic Footprint, 2017–25
(annual average; 2016 \$ millions)

Type	Level	British Columbia	Alberta	Saskatchewan	Manitoba	Ontario	Quebec	Atlantic	Territories	Canada
Indirect taxes	Municipal	17	63	3	1	13	4	1	0	103
	Provincial	35	46	9	3	60	19	5	0	176
	Federal	10	32	2	1	22	7	3	0	76
	Total	61	141	14	5	94	30	10	1	355
Personal income taxes	Municipal							0	0	0
	Provincial	15	66	3	1	15	9	3	0	112
	Federal	32	145	5	2	29	7	3	0	224
	Total	47	212	8	3	44	17	6	0	336
Corporate income taxes	Municipal							0	0	0
	Provincial	12	42	2	1	11	4	1	0	72
	Federal	24	68	4	1	17	4	1	0	120
	Total	36	110	6	2	28	8	3	0	192
Other taxes	Municipal							0	0	0
	Provincial	2	6	0	0	2	1	0	0	12
	Federal	4	20	1	0	4	1	1	0	32
	Total	6	26	1	0	6	3	1	0	43

(continued ...)

Table 4 (cont'd)

Fiscal Impacts of Canada's Propane Industry Economic Footprint, 2017–25

(annual average; 2016 \$ millions)

Type	Level	British Columbia	Alberta	Saskatchewan	Manitoba	Ontario	Quebec	Atlantic	Territories	Canada
Royalties	Municipal							0	0	0
	Provincial	9	90	0	0	0	0	0	0	99
	Federal							0	0	0
	Total	9	90	0	0	0	0	0	0	99
Carbon tax	Municipal							0	0	0
	Provincial	12	15	4	1	50	12	4	1	99
	Federal							0	0	0
	Total	12	15	4	1	50	12	4	1	99
Total taxes & royalties	Municipal	17	63	3	1	13	4	1	0	103
	Provincial	84	265	18	6	137	45	14	1	571
	Federal	70	266	11	4	71	19	9	1	451
	Total	171	594	32	11	222	69	23	2	1,125

Note: Totals may not add up due to rounding.

Sources: The Conference Board of Canada; Statistics Canada, "Supply and Use and Input-Output Tables."

APPENDIX C

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