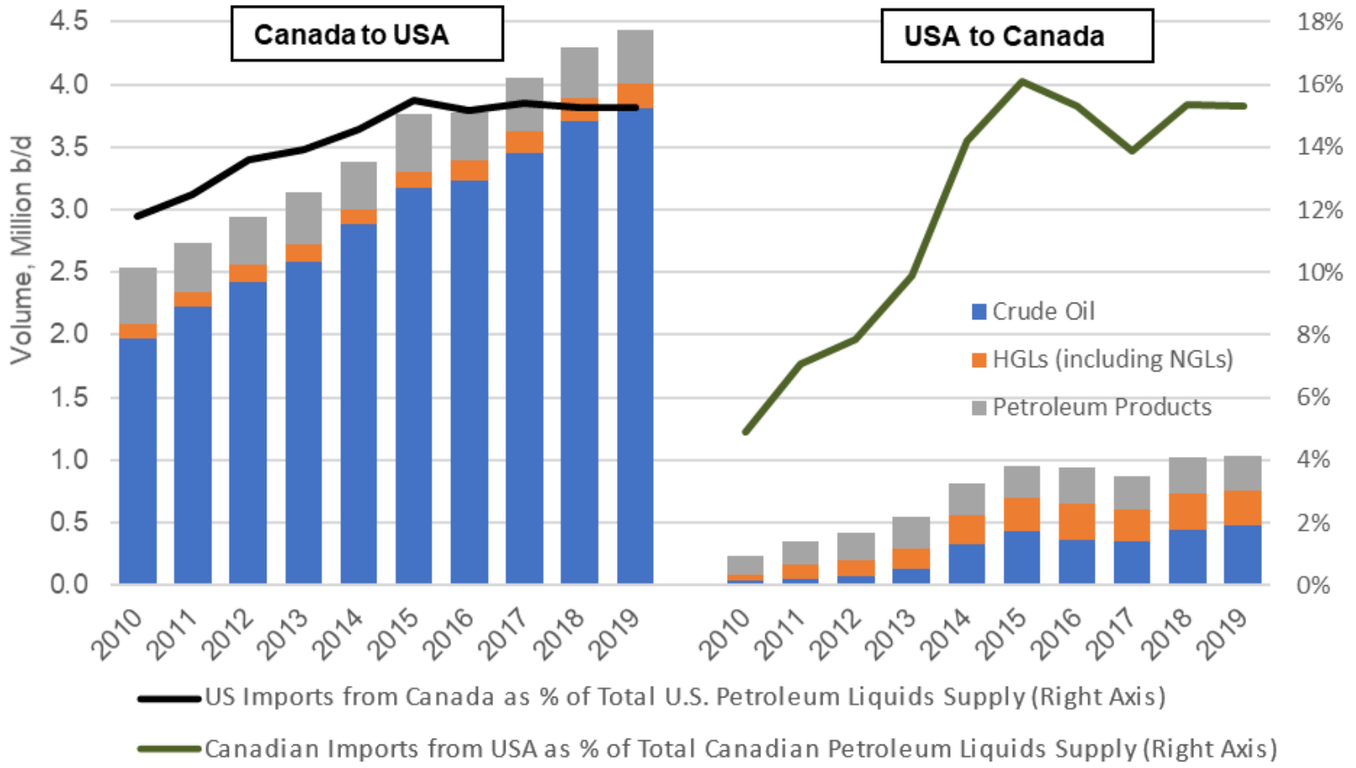
Cross-Border Petroleum Liquids Trade Study – Key Takeaways

March 2021

U.S.-Canada Petroleum Liquids Trade Doubled Over the Past Decade

- U.S.-Canada petroleum liquids trade doubled over the past decade, increasing from approximately 2.75 million barrels per day (b/d) in 2010 to nearly 5.5 million b/d in 2019.
- The trade relationship works both ways with each country relying on the other for approximately 15% of total petroleum liquids supply.
- Trade volumes in both directions are dominated by crude oil. Crude oil trade growth has been primarily driven by heavy crude oil shipped from Western Canada to the U.S. Midwest and Gulf Coast by pipeline and rail, and light crude oil from North Dakota and Texas shipped to Eastern Canada by pipeline and marine vessel.

U.S.-Canada Petroleum Liquids Trade Volume by Direction and Commodity, 2010-2019

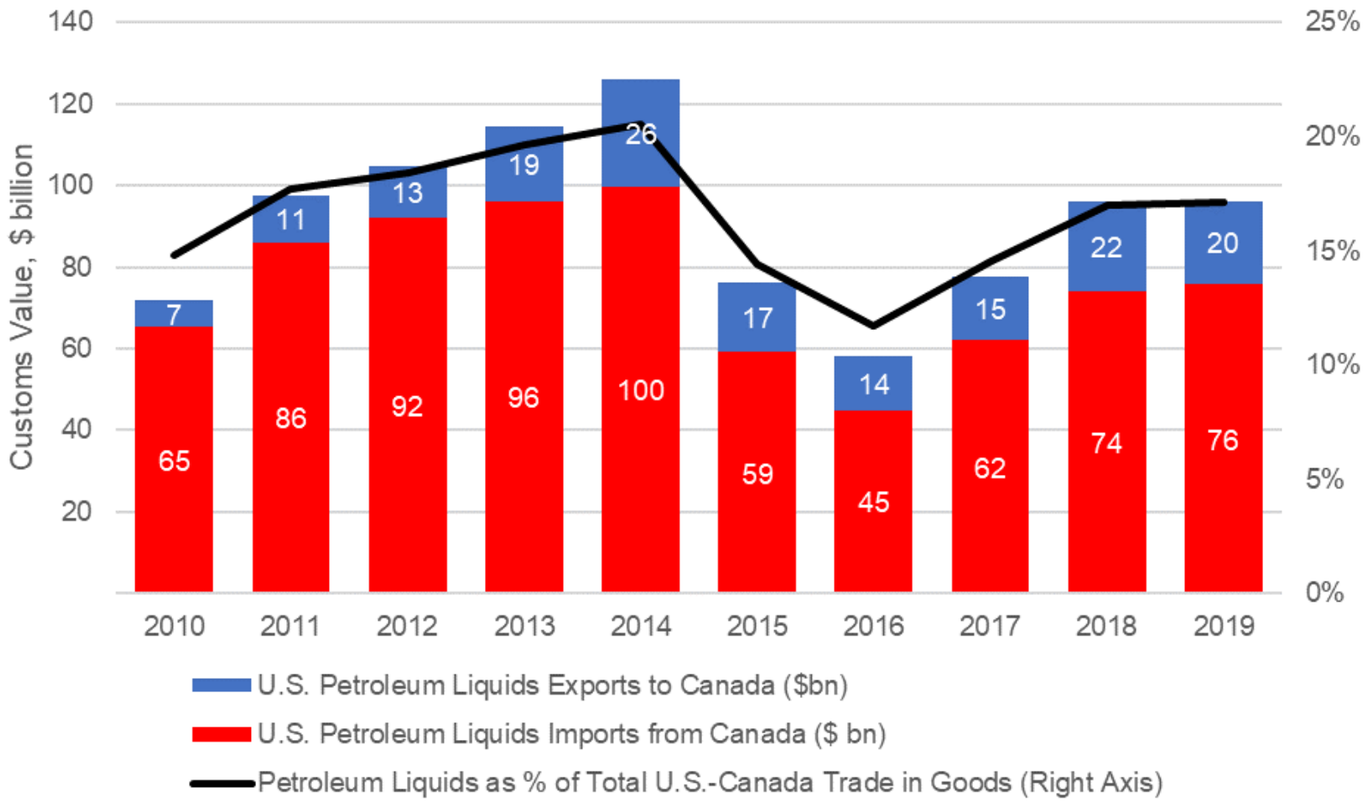


Source: ICF analysis of U.S. Energy Information (EIA) and Canadian Energy Regulator (CER) data

Petroleum Liquids Make Up a Significant Share of Total U.S.-Canada Trade

- Over the past decade the U.S.-Canada petroleum liquids trade value has fluctuated between $59 billion and $126 billion, accounting for approximately 10% to 20% of total U.S.-Canada trade in goods.
  - Although trade volumes steadily increased during this period, the total trade value fluctuated due to changes in petroleum prices.
- In 2019, the U.S.-Canada petroleum liquids trade ($96 billion) was almost as large as the total U.S.-Canada trade in vehicles ($102 billion).

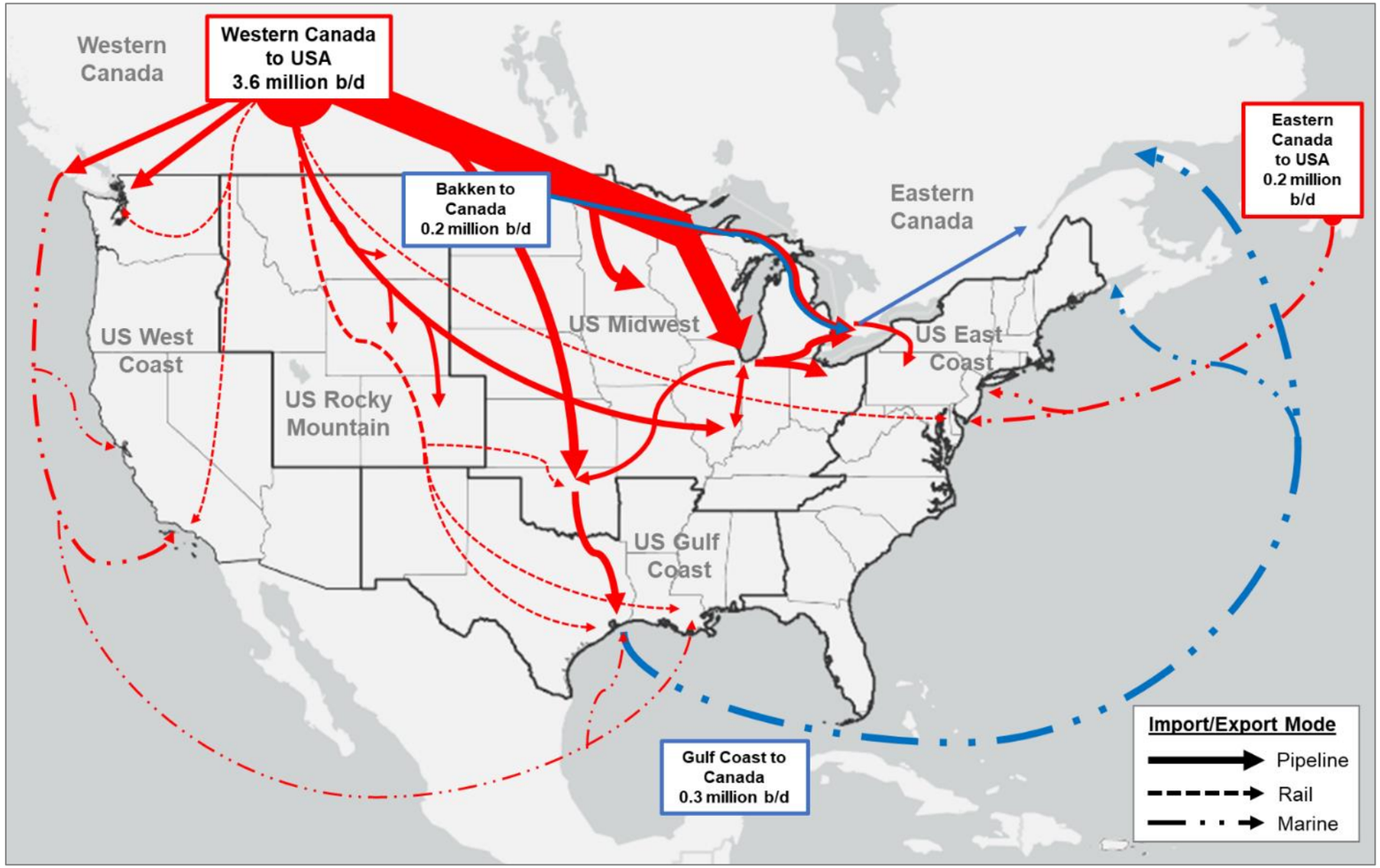
U.S.-Canada Petroleum Liquids Trade Value by Direction, 2010-2019



Note: Denominator for total U.S.-Canada trade in goods only. Excludes trade in services and U.S. exports to Canada of foreign goods (re-exports)
Source: ICF analysis U.S. Census Bureau (USA Trade Online) data

U.S. and Canadian Crude Oil Markets are Increasingly Integrated

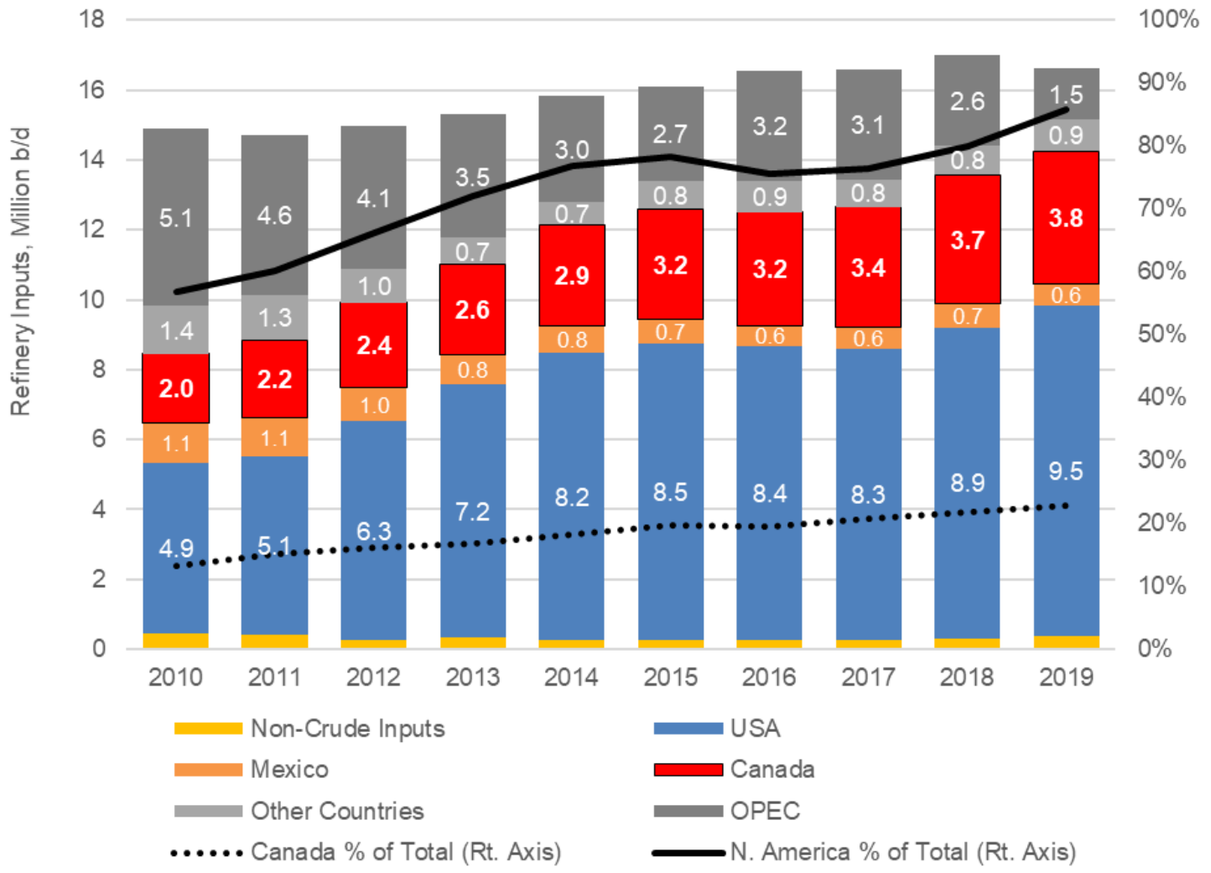
- There are multiple pathways for crude oil from Canada to the U.S. and vice versa.
- Although the largest pathways are out of Western Canada into the U.S. Midwest and down to the U.S. Gulf Coast, substantial volume also move by between the U.S. and Canada by rail and marine vessel.



Canadian Imports Have Helped the United States Reduce Reliance on OPEC Crude Oil

- Increased imports of Canadian crude oil in tandem with booming domestic production have allowed U.S. refiners to significantly reduce crude oil imports from OPEC and other overseas suppliers.
- Over the past decade, U.S. oil imports from OPEC countries have fallen 70%, from 5.1 million b/d in 2010 to 1.5 million b/d in 2019.
- In 2019, U.S. Gulf Coast refiners imported nearly 900,000 b/d of crude oil from OPEC and other countries outside North America (Canada or Mexico). Most of this volume was heavy crude oil that could not be replaced by domestic light oil. These imports could be further reduced with the completion of new pipeline capacity to ship heavy oil from Western Canada to the U.S. Gulf Coast.

U.S. Refinery Crude Inputs by Origin, 2010-2019

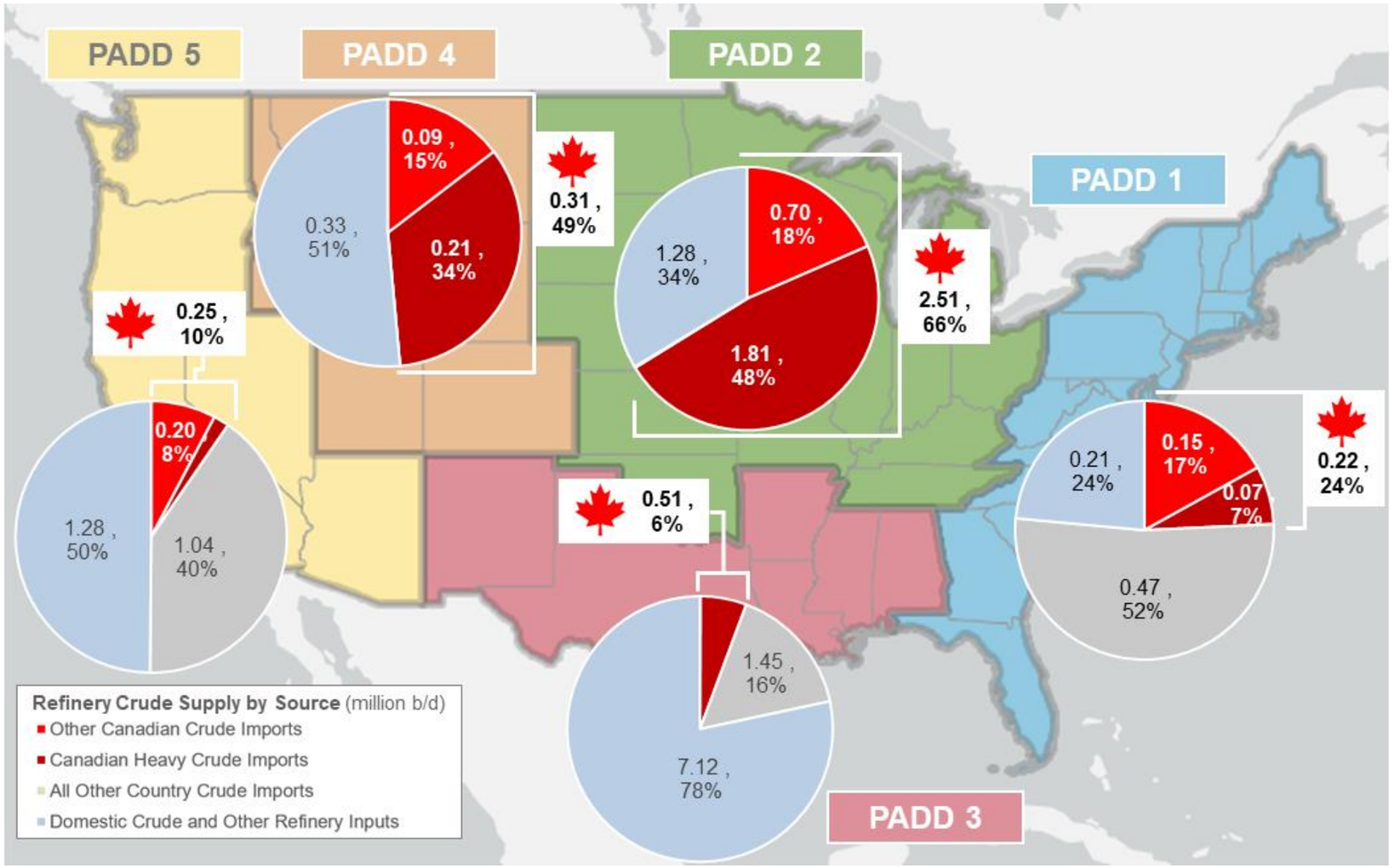


Source: ICF analysis of EIA data

Inland U.S. Refining Markets are the Most Integrated With Canadian Oil Markets

- The majority of Canadian oil imports—3.3 out of 3.8 million b/d—are processed at refineries in the Central United States—in the Midwest, Gulf Coast, and Rocky Mountain Regions.
- These regions primarily receive Canadian oil by pipeline, though significant volumes are also delivered to the Gulf Coat by rail.
- The U.S. Midwest and Rocky Mountain regions are the most integrated with Canadian oil markets, with Canadian imports accounting for 66% and 49% of total refinery crude runs, respectively.

U.S. Regional Refinery Crude Inputs by Origin, 2019

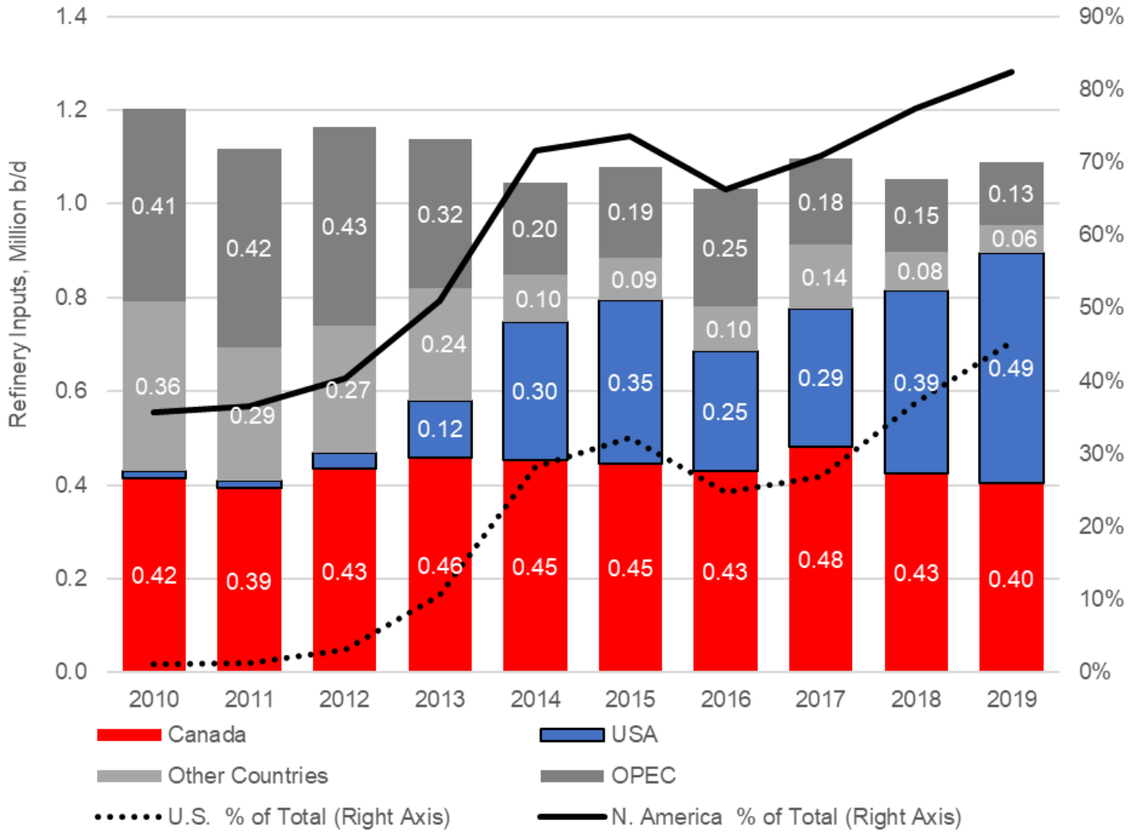


Source: ICF analysis of EIA data

Eastern Canadian Refineries Have Become Increasingly Integrated with U.S. Crude Oil Markets

- Over the past decade, imports of U.S. crude oil to Eastern Canadian refineries have increased ten-fold, from 50,000 b/d in 2010 to 500,000 b/d in 2019. These imports are delivered both by marine vessel from the U.S. Gulf Coast and by pipeline from North Dakota.
- Increased imports from the U.S. have largely crowded out imports from other sources, which fell more than 85% from 2010 to 2019.
- As of 2019, U.S. crude oil accounted for more than 45% of total refinery crude runs in Eastern Canada. In addition, much of the domestic Canadian crude run at Eastern Canadian refineries is shipped from Western Canada on pipeline systems that pass through the United States before entering Eastern Canada. Altogether, it is estimated that 80 to 90% of all oil refined in Eastern Canada comes from or passes through the United States.

Eastern Canadian Refinery Crude Inputs by Origin, 2010-2019

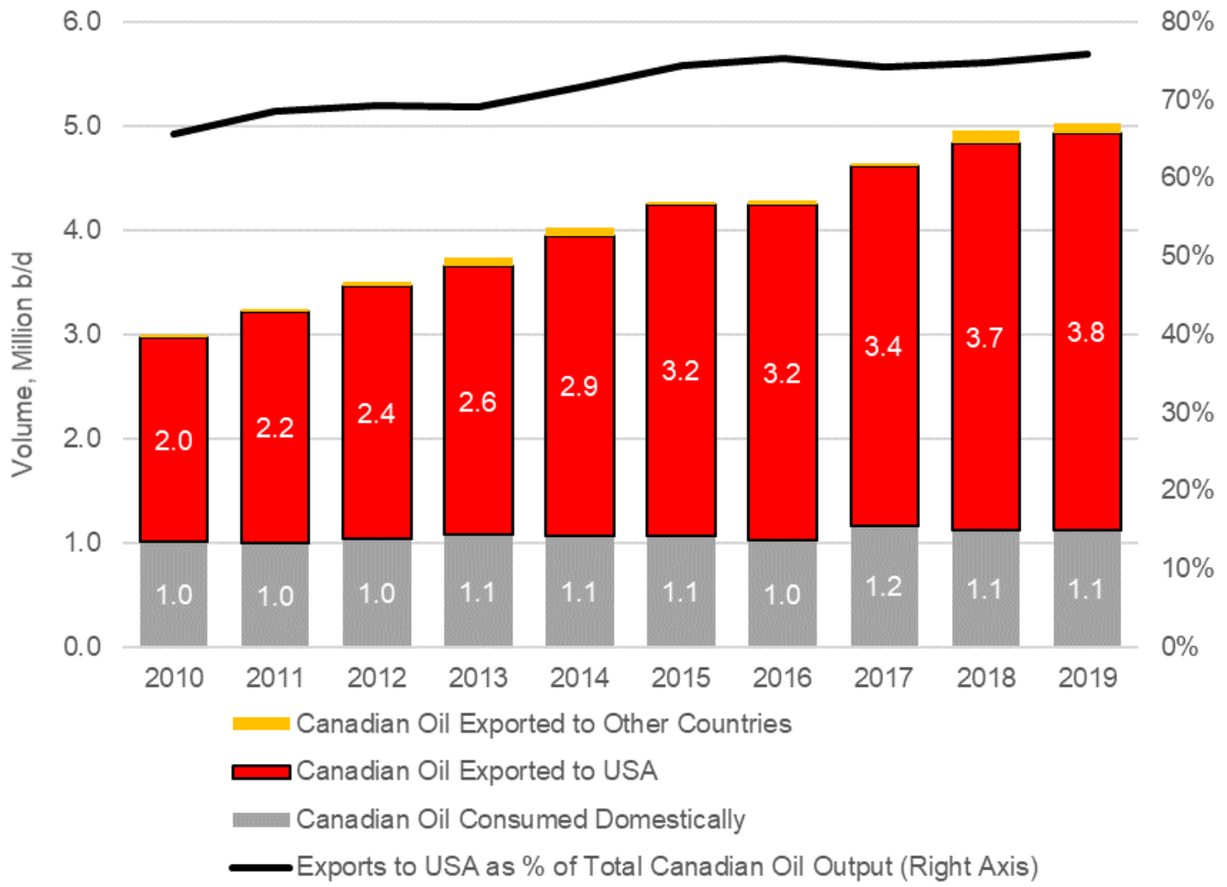


Source: ICF analysis of Statistics Canada and CER data

The U.S. is a Natural Market for Canadian Oil Exports

- Virtually all of Canada's oil production is either consumed in Canada or exported to the United States, with exports to the U.S. accounting for more than 75% of total Canadian oil production in 2019.
- U.S. refiners are a natural market for landlocked Western Canadian heavy oil production because many refineries in the U.S. Midwest and Pacific Northwest can be easily accessed by pipeline and are—in some cases—hundreds of miles closer than refineries in the more populous Eastern Canada.
- Furthermore, Western Canada's heavy, high-sulfur crude oil requires additional processing in order to refine and many U.S. refiners have specifically configured their facilities in order to process Canadian heavy oil.

Canadian Crude Oil Production by Destination Market, 2010-2019



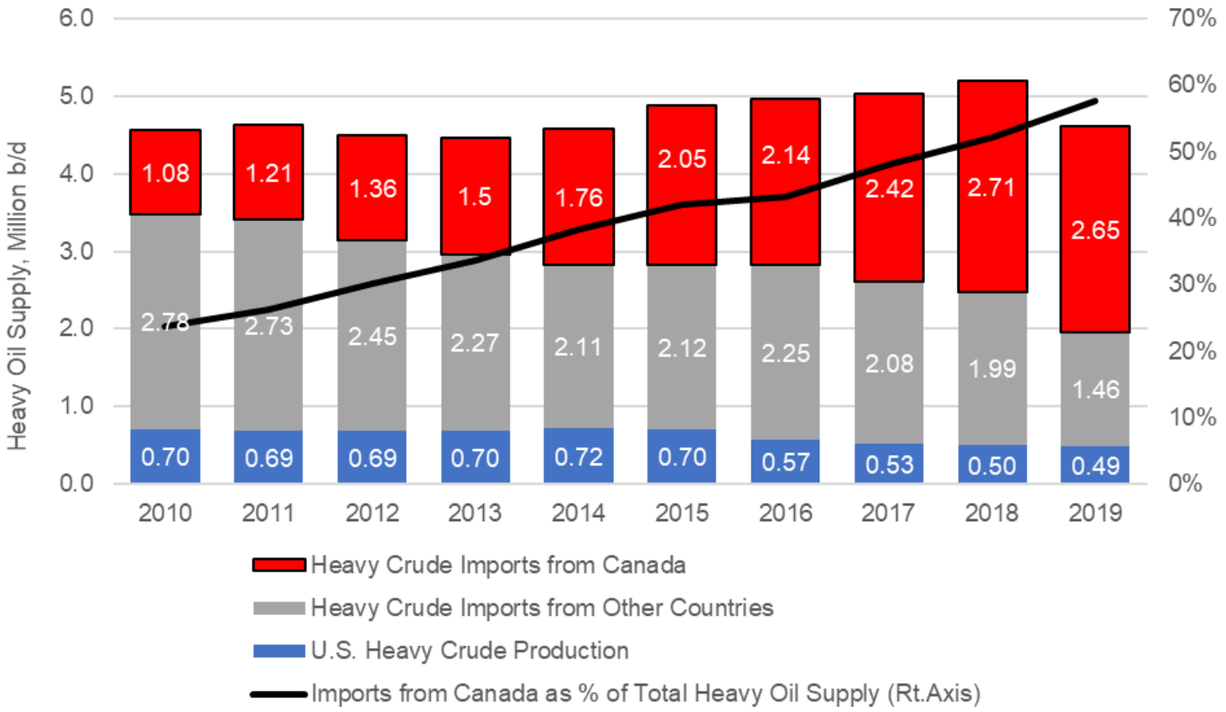
Source: ICF analysis of EIA and Statistics Canada data

Note: Total production volume includes crude oil and lease condensate as well as lighter hydrocarbons (diluent) blended with oil sands bitumen to lower its viscosity to meet pipeline and rail specification for transport. In 2019, blended diluent accounted for an estimated 0.6 million b/d of Canada's oil production.

U.S. Refiners Rely on Canada for More than Half of Total Heavy Oil Supply

- U.S. heavy oil refiners relied on Canada for approximately 2.7 million b/d of heavy crude in 2018 and 2019, equal to more than 50% of total heavy oil supply.
- Typically, refineries configured to run heavy crude oil cannot easily switch to lighter crude grades without affecting operations, including refining capacity and yields.
- Increased imports of Canadian heavy oil have allowed U.S. refiners—particularly in the U.S. Gulf Coast region—to reduce heavy oil imports from OPEC suppliers, such as Venezuela and Saudi Arabia. Imports from OPEC could be further reduced with the completion of new pipeline capacity to ship heavy oil from Western Canada to the U.S. Gulf Coast.

U.S. Reliance on Canadian Heavy Oil, 2015-2019

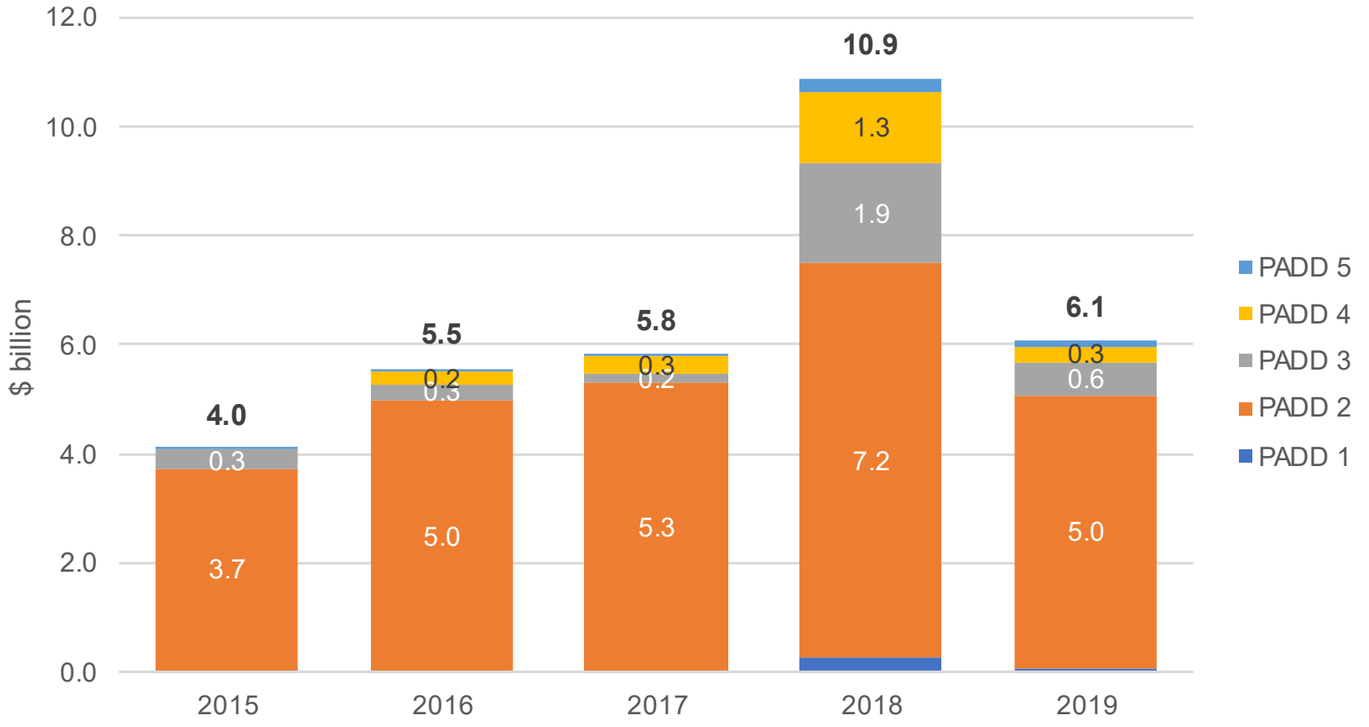


Source: ICF analysis of EIA data

Refining Heavy Canadian Crude Oil Provides Billions in Economic Benefits to U.S. Refiners

- ICF estimated economic benefits by analyzing the impact on refinery margins (product revenues less crude costs) of running Canadian heavy oil versus available replacement crudes in regional U.S. refining markets. This analysis considered both the delivered costs of each crude and the product yields of each crude. Total economic benefits were then calculated by multiplying estimated per-barrel refinery margin impacts by total volumes of Canadian heavy crude processed in each refining market.
- ICF's analysis found that annual benefits grew from $4.0 billion in 2015 to $6.1 billion in 2019 with most benefits in each year accruing to refiners in the U.S. Midwest region.
  - Economic benefits spiked in 2018 due to steep discounts for Canadian heavy crude oil due to oversupply situations caused by a pipeline outage (Q1 2018) and a busy U.S. Midwest refinery maintenance season (Q3/Q4 2018).

Economic Benefits of Refining Canadian Heavy Oil by Region, 2010-2019

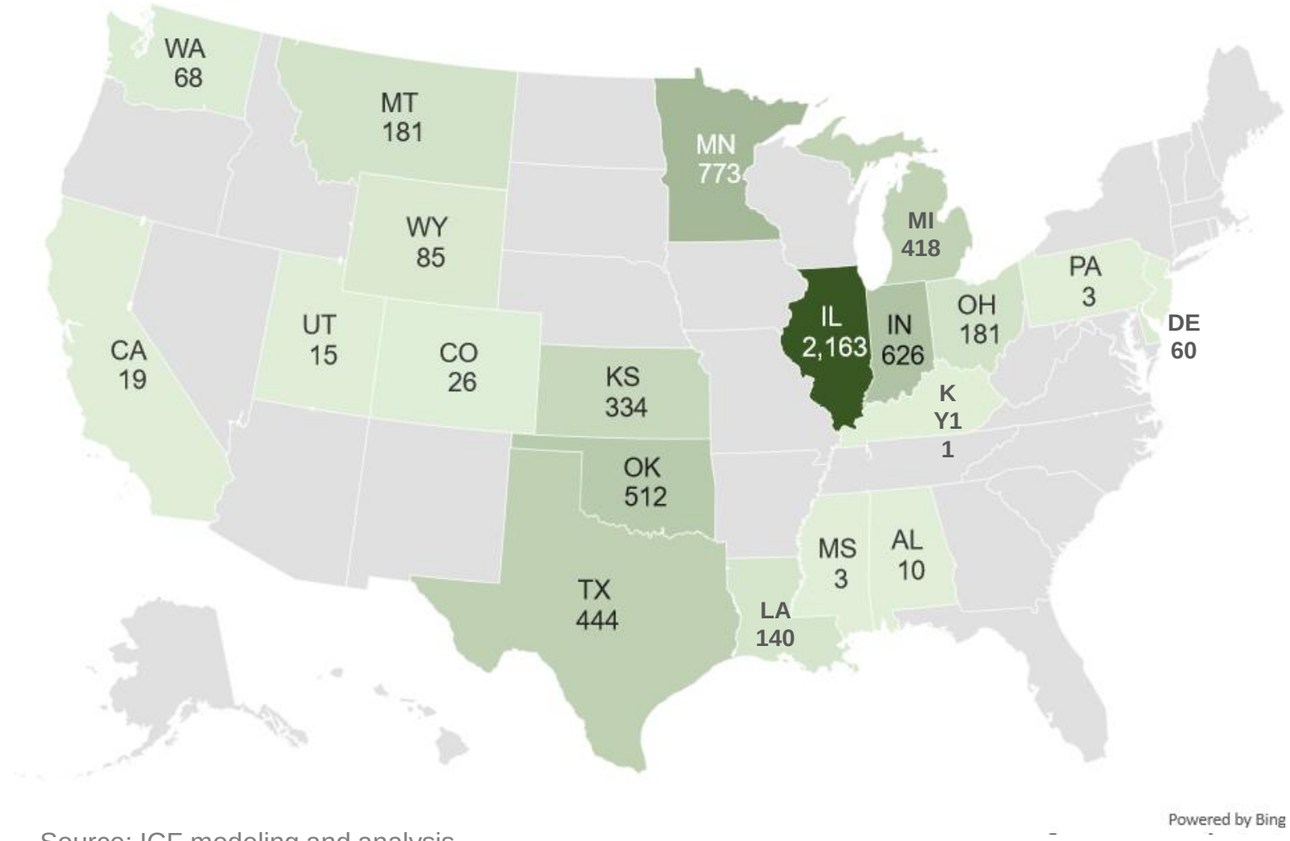


Source: ICF modeling and analysis

Economic Benefits Accrue to Refiners in Several States, Contributing to Gross State Product

- ICF estimated economic benefits for individual states based on the volumes of Canadian heavy crude oil refined in the state and estimated refinery margin impacts within the state's refining market.
- The benefits presented contribute to the Gross State Product of each state via increased gross operating surpluses in each state's industrial sector and via taxes on higher in-state earnings.
- ICF's analysis shows the largest benefits in Illinois, Minnesota, Indiana, Oklahoma, Texas, and Michigan.
- In aggregate, the processing of lower-cost Canadian heavy oil also likely reduces product prices as cost-advantaged heavy oil refiners compete on price. These benefits are shared among the states where lower-cost products are sold.

Economic Benefits of Processing Canadian Heavy Crude Oil by State ($ million), 2019



Source: ICF modeling and analysis