INFORMATION BRIEF
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Minnesota's Petroleum Infrastructure: Pipelines, Refineries, Terminals

Minnesota has no indigenous sources of petroleum so it must import both crude oil and refined oil products for use by its residents. The state has two crude oil refineries and an extensive system of pipelines that distribute refined petroleum products throughout the state. This information brief describes the state's infrastructure for importing, refining, and distributing crude oil and refined petroleum products.

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More than five billion gallons of petroleum products were produced in or imported into Minnesota in 2015.[1] As a state with no indigenous sources of petroleum, Minnesota must import both the crude oil its petroleum refineries process and additional quantities of refined products, such as gasoline and fuel oil, that its residents demand.

Minnesota has two petroleum refineries, which produce more than two-thirds of the state's petroleum products. Seventy percent of these products are refined from Canadian crude oil, supplemented by supplies from North Dakota's Bakken field. An extensive system of pipelines brings crude oil to Minnesota's refineries and distributes refined products throughout the state, including products transported from refineries located in three other states. Twenty-five major petroleum storage terminals located along the routes of these pipelines, 15 in Minnesota, store refined petroleum products. The stored products are accessed by rail and truck for delivery to retailers throughout Minnesota.

Crude Oil Pipelines

Increased oil production from tar sands in western Canada and the successful deployment of advanced drilling techniques—hydraulic fracturing (fracking) and horizontal drilling—in the Bakken oil field of North Dakota have required the expansion of pipeline systems to transport higher volumes of crude oil from these areas. While Minnesota's refineries have expanded their capacity by about 7 percent since 2013, most of these new supplies being transported through Minnesota are destined for delivery to refineries in eastern and southern states and eastern Canada.

Canadian Crude

Crude oil from the western Canadian province of Alberta is transported to Minnesota's refineries on the world's longest crude and liquids pipeline system, the 3,100-mile Enbridge Mainline System. Originating in the Canadian supply hubs of Edmonton and Hardisty, it proceeds southeast and crosses the U.S. border at Neche, North Dakota. It enters Minnesota near its northwest corner, then continues eastward to a large terminal station at Clearbrook, Minnesota, before heading to Superior, Wisconsin, and then further east. In Superior, there is an Enbridge storage terminal and a 50,000-barrel per-day refinery owned by Calumet Specialty Products Partners. The American portion of the Enbridge line is known as the Lakehead System. (See Figure 1, page 6)

Enbridge has undertaken several pipeline projects in Minnesota in recent years to transport the increased Canadian supplies:

- The LSr project, a 313-mile pipeline between Cromer, Manitoba, and Clearbrook, runs parallel to Enbridge's Mainline and was completed in 2009. It carries 186,000 barrels per

[1] Minnesota Department of Revenue, Petroleum Tax Unit, *2015 Minnesota Petroleum Tax Summary,* http://www.revenue.state.mn.us/businesses/petroleum/Documents/2015%20Petroleum%20%20Summary.pdf.

day of light and medium density crude oil, freeing up Enbridge's other lines to transport heavier Canadian crude.

- The Alberta Clipper project, also running parallel to Enbridge's existing line to Clearbrook, began transporting 450,000 barrels per day from Canada in 2010. It received Certificates of Need from the Minnesota Public Utilities Commission to expand its capacity to 570,000 barrels per day in August 2013, and to 800,000 barrels per day in November 2014, but is awaiting the issuance of a Presidential Permit from the U.S. Department of State, which is required of pipeline projects that cross an international boundary. These increases are to be achieved not by constructing new or larger pipelines, but by building new pumping stations along the route of the existing line. While awaiting the permit, Enbridge has implemented a temporary alternative method to transport the increased volumes through existing pipelines that does not require federal approval.[2]

- Enbridge's Line 3 is a 1,097-mile pipeline that is part of its Mainline System. Constructed in the 1960s with a capacity of 760,000 barrels per day, it has, because of age and safety issues, operated since 2008 under voluntary pressure restrictions that reduce its capacity by about 50 percent, to 390,000 barrels per day. In April 2015, Enbridge submitted a Certificate of Need application to the Public Utilities Commission to replace the 337 miles of pipe that traverse Minnesota, in order to restore the pipeline's original capacity. While the current route from Canada to Clearbrook will not change, east of Clearbrook, a new route is proposed that will head due south to the northern border of Wadena County, then turn east to reconnect with the original Line 3 route at the eastern border of Minnesota in Carlton County.[3]

- The last leg of Canadian crude oil's Minnesota journey is on the Minnesota Pipeline, whose original route travels southeast from Clearbrook to Twin Cities refineries. A new southwestern loop, Line 4, also known as the MinnCan pipeline, entered service in 2010 (see Figure 1), expanding capacity by 165,000 barrels per day to a total of 465,000 barrels per day. The company is currently seeking a Certificate of Need to provide Line 4 with excess capacity through the construction of six new pumping stations, so that when any part of the MinnCan system is removed from service for testing or repairs, the

[2] Enbridge has constructed two interconnections north of the Canadian border between the heavy-oil carrying Alberta Clipper and a parallel light-oil pipeline known as Line 3 that will allow these two lines to transfer their supplies to each other. A similar set of interconnections constructed 16 miles south of the border, beyond the jurisdictional limit of the State Department's Presidential Permits for both lines, allows the supplies to be switched back to their original pipelines. Enbridge is replacing the border segment of Line 3 to enable it to handle the increased volumes. The State Department determined that this arrangement did not require its authorization, an opinion that was upheld in federal court in December 2015. Enbridge Energy, Response to Minnesota Department of Commerce Information Request No. 33, *In the Matter of the Application of Enbridge Energy, Limited Partnership for a Certificate of Need for the Line 67 (Alberta Clipper) Station Upgrade Project – Phase 2 – in Marshall, Clearwater, Itasca, Kittson, Red Lake, Cass, and St. Louis Counties*, Minnesota Public Utilities Commission (MPUC), Docket No. PL-9/CN-13-153, September 2014; "Judge rejects bid to block Alberta Clipper pipeline upgrade," Associated Press, December 9, 2015, http://www.mprnews.org/story/2015/12/09/pipeline-upgrade-ruling.

[3] Enbridge Energy, Limited Partnership, *Route Permit Application for the Minnesota Public Utilities Commission, Line 3 Replacement Project*, MPUC Docket No. PL-9/PPL-15-137, April 2015, pp. 2-1 to 2-4.

system can continue to meet the needs of Minnesota's refineries. When the project is complete, Line 4 will have a capacity of 350,000 barrels per day.[4]

These expansion projects compensate for Minnesota's loss of a Canadian crude supply source in 2013 when the Wood River Pipeline, originating in Illinois, ceased crude oil deliveries. It received Canadian supplies through the Kinder Morgan and Platte pipelines systems, located in Montana and Wyoming, respectively, and shipped up to 90,000 barrels per day of crude through Iowa to Twin Cities refineries.[5]

Domestic Crude

Nearly all of the domestic crude oil processed in Minnesota's refineries originates in North Dakota, whose production increased from less than 100,000 barrels per day in 2005 to a peak of 1.2 million barrels per day in June 2015.[6] The oil produced from that state's Bakken field is known as shale oil, a light oil found in low-permeability sedimentary formations. A mixture of water, gas, and chemicals is injected into these formations at high pressure through a horizontally-drilled well, releasing the oil from the shale.

Enbridge's North Dakota Pipeline, which extends to the northeastern tip of Montana, transports Bakken oil to Clearbrook, Minnesota, where it continues to the Twin Cities and Superior refineries. In 2012, capacity was expanded from 80,000 to 210,000 barrels per day. About 60,000 barrels per day enter the Minnesota Pipeline for transport to Twin Cities refineries.[7]

The Bakken Expansion Project, which began operating in the first quarter of 2013, transports 145,000 barrels per day of crude northward to Enbridge's Main Line in Cromer, Manitoba, and then through existing lines in Minnesota to Superior.

Another Enbridge pipeline designed to bring Bakken oil eastward was the Sandpiper Pipeline, proposed in 2012 to transport 225,000 barrels per day from western North Dakota through Clearbrook, Minnesota, terminating in Superior, Wisconsin. Enbridge's intent was to "relocate the interconnection between the North Dakota Pipeline System and the Lakehead System from Clearbrook to Superior, thereby providing direct access to a vast pipeline network serving the Midcontinent, Midwest, and Gulf Coast regions of the United States and eastern Canada."[8] The

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[4] Minnesota Public Utilities Commission, *Staff Briefing Papers, In the Matter of the Application of Minnesota Pipeline Company, LLC for a Certificate of Need for the Minnesota Pipeline Reliability Project to Increase Pumping Capacity on Line 4 Crude Oil Pipeline in Hubbard, Wadena, Morrison, Meeker, McLeod, and Scott Counties Minnesota*, MPUC Docket No. Pl-5/CN-14-320, September 30, 2014, p. 3.

[5] Minnesota Pipeline Company, LLC, *In the Matter of the Application for a Certificate of Need for the Minnesota Pipeline Reliability Project*, MPUC Docket No. PL-5/CN-14-320, July 25, 2014, pp. 39-42.

[6] State of North Dakota, "North Dakota Monthly Oil Production Statistics," *North Dakota Drilling and Production Statistics*, pp. 13, 15, https://www.dmr.nd.gov/oilgas/stats/historicaloilprodstats.pdf.

[7] U.S. Federal Regulatory Commission, *North Dakota Pipeline Company LLC, Order on Petition for Declaratory Order*, Docket No. OR14-21-000, 147 FERC ¶61,121, p. 2, http://www.ferc.gov/whats-new/comm-meet/2014/051514/G-1.pdf.

[8] *Ibid.*

project would also have provided "major benefits to producers of Bakken crude by permitting production to reach market hubs that provide premium netbacks to area producers."[9]

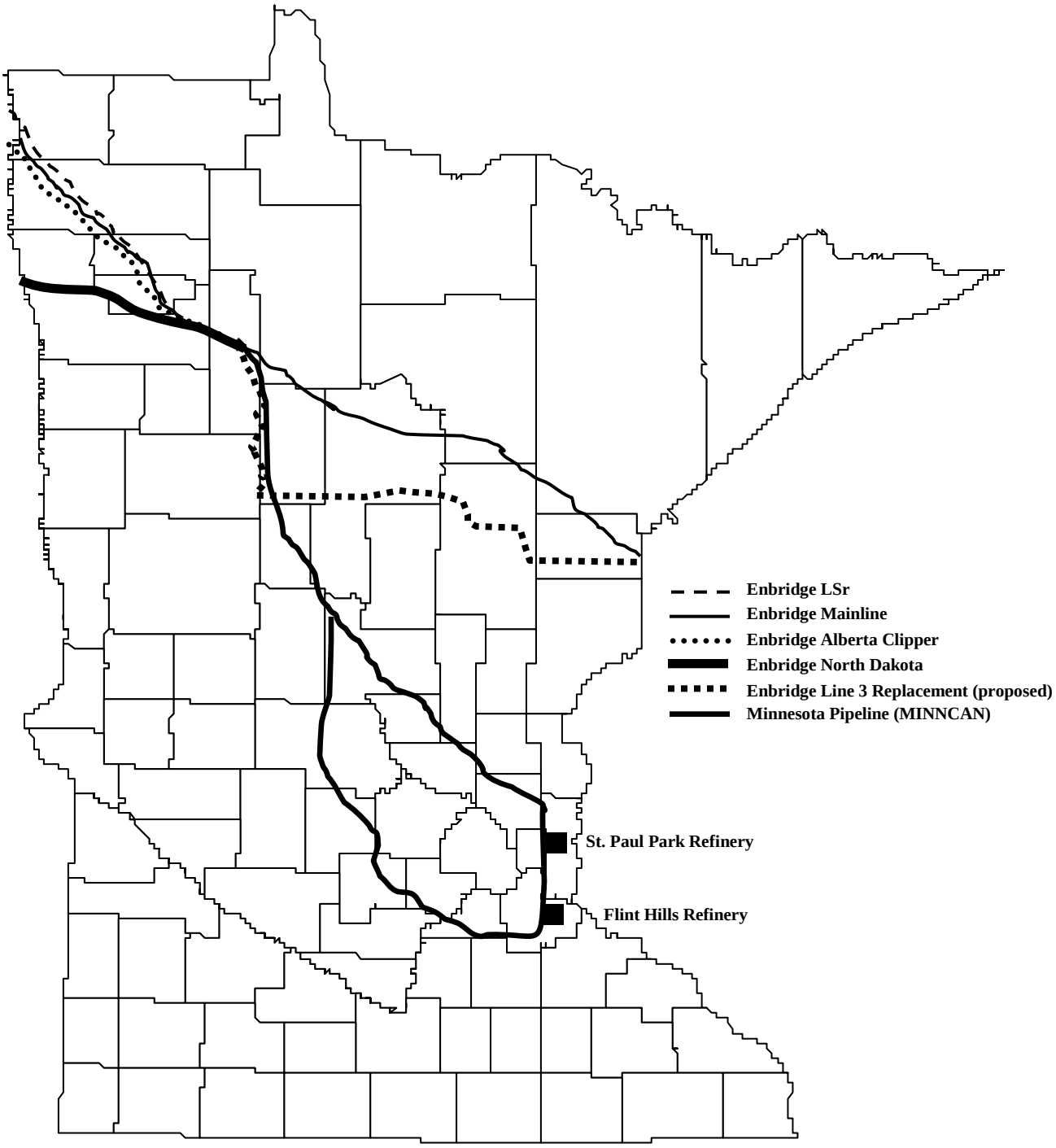
The company's application for a Certificate of Need for the Sandpiper Pipeline was withdrawn in September 2015.[10] The oil will instead be transported through the Dakota Access pipeline, scheduled to begin operation at the end of 2016, on a route traversing South Dakota, Iowa, and Illinois, where it will interconnect with pipelines traveling to the Gulf Coast and other refining markets.[11]

[9] *Ibid*., p. 1.

[10] The issuance of a Certificate of Need by the Minnesota Public Utilities Commission in June 2015 for the Sandpiper Pipeline was challenged on the grounds that it was improper absent a thorough environmental review of alternate routes. In August 2015, Enbridge announced it was partnering with Marathon Petroleum to buy a stake in the Bakken Pipeline System, which includes the Dakota Access pipeline. At the end of that month, the Minnesota Department of Commerce advised Enbridge that it was suspending environmental review work on Sandpiper until the company made its intentions clear with regard to the project. The company withdrew its Certificate of Need application on September 1. Two weeks later, the Minnesota Court of Appeals issued a decision requiring a full-scale environmental review before a Certificate of Need was issued for Sandpiper. Mike Hughlett, "Enbridge Energy Pulling Plug on Sandpiper Pipeline," *Star Tribune*, September 2, 2016, http://www.startribune.com/enbridge-energy-pulling-plug-on-sandpiper-pipeline/392082361/.

[11] U.S. Federal Energy Regulatory Commission, *Dakota Access LLC, Declaratory Order*, Docket No. OR14-42-000, FERC ¶61,275, pp. 1, 2, 4, http://www.ferc.gov/CalendarFiles/20141224114029-OR14-42-000.pdf.

Figure 1: Crude Oil Pipelines and Petroleum Refineries



Crude Oil Transportation by Rail

The rapid rise in North Dakota shale oil production in recent years outstripped the capacity of existing pipelines to transport these supplies to petroleum refineries. As a result, a high proportion of North Dakota crude has been transported by rail. In June 2011, only an estimated 15 percent of North Dakota supplies used that mode of transportation. Two years later, that figure jumped to 75 percent, falling to 50 percent in June 2015.[12]

However, while many of those trains move through Minnesota,[13] they do not deliver crude to Minnesota's refineries; their primary destination is refineries on the east coast. In 2015, less than 0.1 percent of the crude oil received by refineries in 15 Midwestern states arrived by rail, compared with 12 percent for east coast states, and 6 percent for west coast states.[14] In the first quarter of 2016, U.S. crude shipments by rail fell 45 percent from the same period a year earlier, due in part to the shrinking price differential between Midwestern and imported crudes, providing coastal refineries a strong incentive in favor of foreign supplies.[15]

Petroleum Refineries

Minnesota Refineries

The Flint Hills Resources refinery in Rosemount and Western Refining's St. Paul Park facility refined an estimated 130 million barrels of crude oil in 2015.[16]

[12] North Dakota Pipeline Authority, *Annual Report, July 1, 2014 – June 30, 2015*, p. 9.

[13] A Minnesota Department of Transportation map shows the number of weekly trains carrying crude on various rail lines in Minnesota as of October 2015: http://www.dot.state.mn.us/ofrw/maps/CrudeOilRoutesStatewide.pdf.

[14] U.S. Department of Energy, Energy Information Administration, *Refinery Receipts of Crude Oil by Method of Transportation,* http://www.eia.gov/dnav/pet/pet_pnp_caprec_dcu_r20_a.htm.

[15] U.S. Department of Energy, Energy Information Administration, "Crude-by-rail volumes to the East Coast drop as imports rise," *This Week in Petroleum*, July 13, 2016, https://www.eia.gov/petroleum/weekly/archive/2016/160707/includes/analysis_print.cfm.

[16] This estimate was calculated by multiplying the net input of crude oil to all refineries in Minnesota, North Dakota, and Wisconsin in 2015 (175.5 million barrels) times the proportion of refinery capacity in those states accounted for by Minnesota's capacity (.743). U.S. Department of Energy, Energy Information Administration, *Refinery and Blender Net Input, 2015*, http://www.eia.gov/dnav/pet/pet_pnp_inpt_a_epc0_yir_mbbl_a.htm; U.S. Department of Energy, Energy Information Administration, *Refinery Capacity Report*, Table 1, Number and Capacity of Operating Petroleum Refineries by PAD District and State as of January 1, 2016, http://www.eia.gov/dnav/pet/pet_pnp_cap1_dcu_nus_a.htm.

The Flint Hills facility is owned by Koch Industries, Inc. Northern Tier Energy, which has owned the St. Paul Park refinery since 2011, merged with Western Refining in June 2016.

The refineries differ significantly in certain respects. Flint Hills is more than three times larger, with a capacity of 290,000 barrels per day, compared with St. Paul Park's 88,900.[17] About 80 percent of the crude processed by Flint Hills comes from Canada, compared with 41 percent for St. Paul Park.[18]

In 2015, the St. Paul Park facility produced 712 million gallons of gasoline, 511 million gallons of distillate fuel oil, and 168 million gallons of asphalt. Eighty-eight percent of the gasoline and diesel was sold in Minnesota, more than 400 million gallons of which were retailed through the 264 company-operated and franchised SuperAmerica stores located in the state.[19]

The Flint Hills Resources refinery supplies about half of Minnesota's motor fuel and 40 percent of Wisconsin's,[20] as well as the bulk of jet fuel for the Minneapolis-St. Paul International Airport.

Minnesota refineries exported about 149 million gallons of gasoline and 59 million gallons of fuel oil to other states in 2015.[21]

Non-Minnesota Refineries

Minnesota also receives refined petroleum products from refineries in other states, including the following:

- Tesoro's 74,600-barrel per-day Mandan, North Dakota, refinery, which processes mostly low-sulfur crude from that state. About 65 percent of the gasoline and 20 percent of the diesel produced at the refinery are shipped to Minnesota and Wisconsin. Refinery capacity was expanded from 58,000 to 68,000 barrels per day in June 2012.[22]

- The 50,000-barrel per-day Superior, Wisconsin, refinery purchased by Calumet Specialty Products Partners from the Murphy Oil Company in 2011. It receives crude from Canada and North Dakota.

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[17] *Ibid.*, *Refinery Capacity Report*, Table 3, Capacity of Operable Petroleum Refineries by State and Individual Refinery as of January 1, 2016, http://www.eia.gov/petroleum/refinerycapacity/table3.pdf. These figures are based on a "calendar day," 24-hour operation including standard downtime for inspection, maintenance, and repair. The comparable figures for a "stream day"—with no allowances for downtime—are 339,000 and 97,800, respectively.

[18] David Shaffer, "St. Paul Park Refinery increasingly focuses on Bakken oil," *Star Tribune*, June 23, 2015, http://www.startribune.com/st-paul-park-refinery-increasingly-focuses-on-bakken-oil/308916331/; U.S. Securities and Exchange Commission, *Northern Tier Energy, LP, Form 10-K for the year ended December 31, 2015*, filed February 2, 2016, p. 4, https://www.sec.gov/Archives/edgar/data/1533454/000162828016011855/nti-12312015x10k.htm.

[19] *Form 10-K*, p. 9.

[20] David Shaffer, "Flint Hills Resources plans 750 million in capital investment at its Minnesota refinery," *Star Tribune*, February 4, 2016, http://www.startribune.com/flint-hills-resources-plans-750-million-in-capital-investment-at-its-minnesota-refinery/367759651/.

[21] *2015 Minnesota Petroleum Tax Summary*.

[22] James McPherson, "ND refinery plans outage for expansion project," *Associated Press*, June 1, 2012, https://www.pddnet.com/news/2012/06/nd-refinery-plans-outage-expansion-project.

- British Petroleum's (BP) refinery in Whiting, Indiana, with a capacity of 430,000 barrels per day, which processes crude from Canada, West Texas, and the Gulf of Mexico.

Refined Products Pipelines and Terminals

Refined petroleum products are brought one step closer to consumers via a system of pipelines and 25 storage terminals, 15 of which are located in Minnesota.

The Magellan Midstream Partners pipeline system, the largest common carrier pipeline shipping refined petroleum products in the United States, distributes the largest proportion of the refined products produced in Minnesota's refineries. As shown in Figure 2, Magellan operates six terminals where trucks and, in some cases, rail cars, load these products for distribution to smaller storage facilities and retailers. Each of Minnesota's refineries also operates a terminal where these product transfers take place.

Refineries in other states also distribute refined products in Minnesota. The Mandan, North Dakota, refinery transports products through its proprietary NuStar Pipeline, which supplies the company's petroleum terminals in Moorhead, Sauk Center, and Roseville.[23] The Superior, Wisconsin, refinery distributes refined products to Minnesota through the Magellan Pipeline system and has a terminal in Duluth. BP's Whiting, Indiana, refinery brings petroleum products to Minnesota through a proprietary pipeline that enters the state in Fillmore County and delivers product to BP's terminal in Spring Valley and to the NuStar terminal in Roseville.

Seventy-six smaller terminals throughout the state store petroleum products for local distribution.[24] They are among the 402 petroleum products distributors licensed by the Minnesota Department of Revenue, including importers, refiners, petroleum storage facilities (bulk plants), and owners of truck and tanker fleets that distribute these products by truck to retailers and end users.[25] According to the Minnesota Department of Commerce, Minnesota also draws petroleum products from ten terminals located near its borders in adjacent states and in Canada.[26]

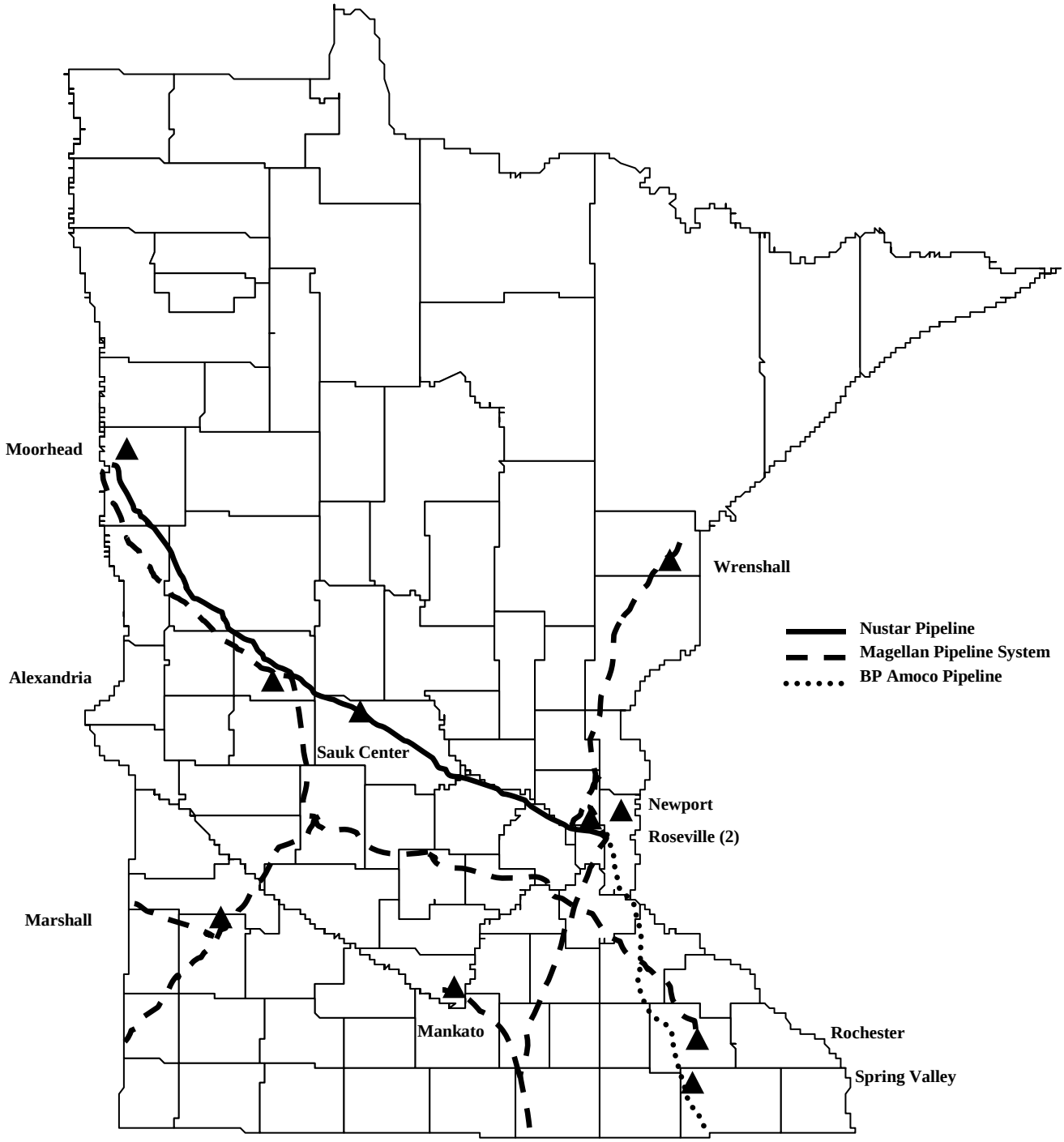
[23] Some products from the Mandan refinery are also transported to Minnesota by truck from Magellan terminals in the Dakotas.

[24] U.S. Census Bureau, *County Business Patterns 2014*, petroleum bulk stations and terminals (NAICS code 424710), http://factfinder.census.gov/faces/tableservices/jsf/pages/productview.xhtml?src=bkmk.

[25] Minnesota Department of Revenue, Petroleum Tax, Excel spreadsheet, Petroleum Licensed Distributors, http://www.revenue.state.mn.us/businesses/petroleum/Pages/Tax-Information.aspx.

[26] Julie Quinn, director, Division of Weights and Measures, Minnesota Department of Commerce.

Figure 2: Refined Petroleum Products Pipelines and Terminals



Notes: (1) Terminals at the Flint Hills and St. Paul Park refineries are not shown on the map.
(2) Both Magellan and Nustar operate terminals in Roseville.

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