U.S. Northern Tier Crude Market Issues

Phase 1 Interim Report: Background Market Analysis

Prepared for:

North Dakota Petroleum Council (NDPC)

North Dakota Oil & Gas Research Council (NDOGRC)

February 2007

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PURVIN & GERTZ INC.

Outline

Introduction

- The North Dakota Petroleum Council (NDPC) and the North Dakota Oil & Gas Research Council (NDOGRC), acting through an NDPC Task Force, retained Purvin & Gertz, Inc. (PGI) to provide an analysis of the North Dakota crude oil market, with emphasis on transportation constraints currently affecting crude oil producers in North Dakota and surrounding areas.
- Crude oil produced in North Dakota is transported to refineries in the state, as well as in the Midwest and Rocky Mountain regions.
- The study region for this report is defined to include North Dakota and those regions served by crude oil from North Dakota.
- This report presents the results of Task 1 of PGI's assignment for the NDPC, as described on the following page.

Introduction (cont'd)

- **Task 1: Background Market Analysis**
  - The scope of work for this task includes the following deliverables:
    - Identify potential downstream markets for North Dakota crude oils
    - Describe pipeline infrastructure for crude oil transportation in/around North Dakota
    - Present supply/demand balance for crude oil in markets served by North Dakota
- **Task 2: Impact of Crude Oil Quality Regulation on Pipeline Capacity**
  - The scope of work for this task includes the following deliverables:
    - PGI to prepare an evaluation of the potential impact of changes in pipeline quality regulation on pipeline capacity
    - For potential quality bank development, PGI to prepare an estimate of the impacts to shippers if a quality bank were in effect on the Enbridge North Dakota system
    - PGI to provide an overview of quality bank principles and examples of pipeline quality banks in use around the world

Phase 1 Report Summary

- U.S. Northern Tier crude oil production is growing, and is forecast to peak within the next five years, based on current understanding of the resource potential
- North Dakota crude oil production has historically served the following markets:
  - Tesoro refinery at Mandan, ND
  - Southern PADD IV refineries (Wyoming, Utah, Colorado)
  - Northern PADD II refineries (Upper Midwest/Great Lakes)
- North Dakota crude oil delivered from Enbridge ND onto the Enbridge mainline at Clearbrook, MN serves the large refining market in PADD II
  - Enbridge ND volume is small relative to total crude consumed in PADD II
  - Relative to the sweet crude consumed in PADD II, the Enbridge ND volume is more significant, though still readily absorbed into the market
- Bowman Co. (North Dakota) crude oil delivered into Butte system for delivery into Guernsey, WY market region

Phase 1 Report Summary (cont'd)

- The PGI forecast calls for a growing crude oil deficit in PADD II and PADD IV, requiring increasing imports from Canada
- Pipeline infrastructure currently stretched with rapid pace of new localized production
  - Transportation constraints impacting ability of producers in North Dakota and surrounding areas to deliver crude oil to markets in PADD II or IV
  - Future balance projections indicate need for incremental import capacity

Study Background

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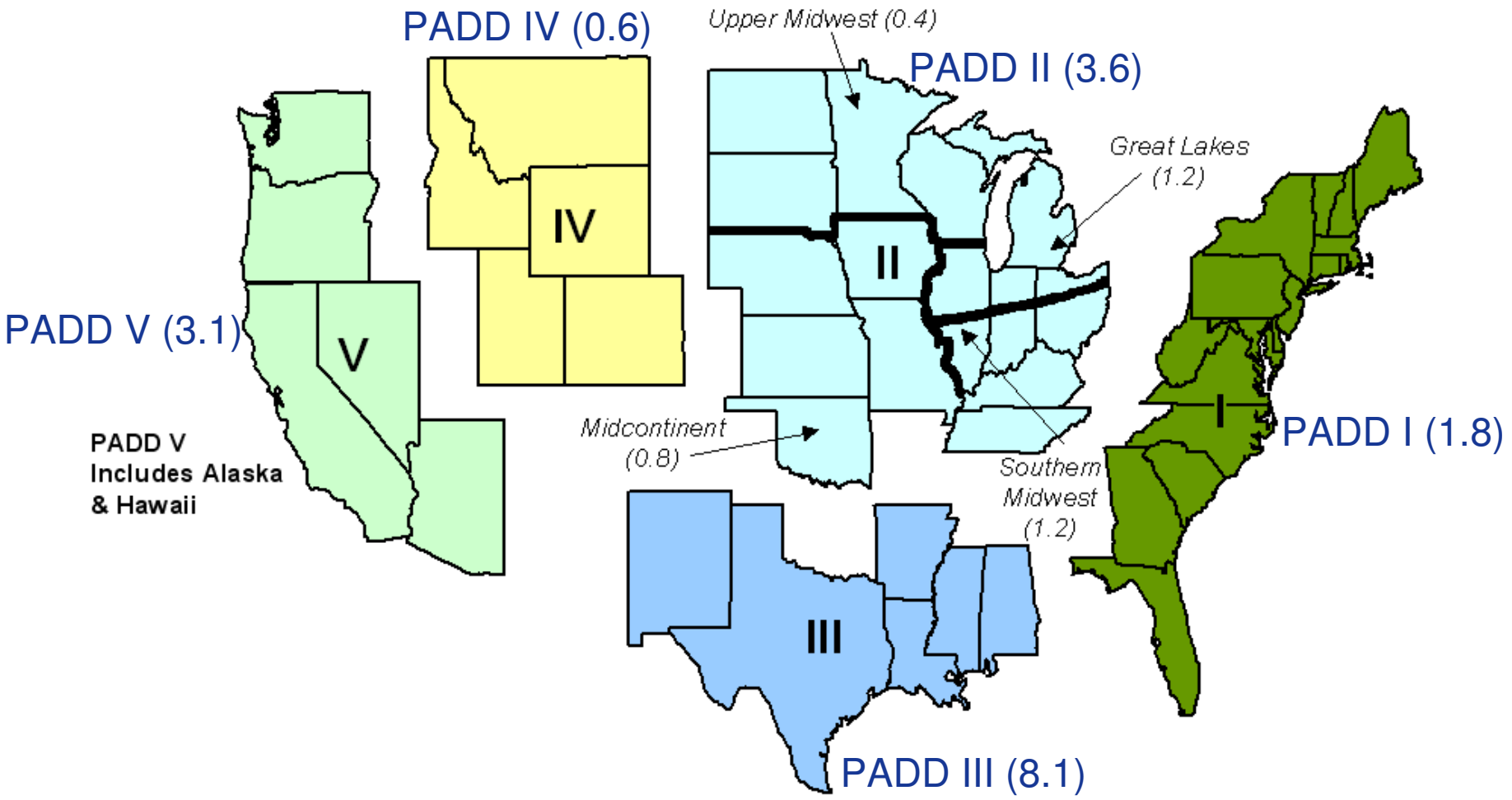
Methodology

- Production data by county were compiled for North Dakota all PADD IV states to develop state-wide forecasts to 2020
  - Montana crude production was separated into East and West regions to recognize the separate market for Richland County production
  - Potential future production estimated using PGI proprietary models and information from public sources
- Quality estimates for crude oil production were made using proprietary PGI methods
- PGI prepared crude oil balances for PADD IV and II, including forecast supply of North Dakota crude oil
  - Balances were constructed for sweet, sour and heavy grades
  - Balances for 2005-10 include known pipeline transportation limits
- Consumption of crude oil by type for each refining region were forecast using known expansion information

U.S. Petroleum Administration for Defense Districts (PADD)



Refinery Crude Capacity (million B/D)

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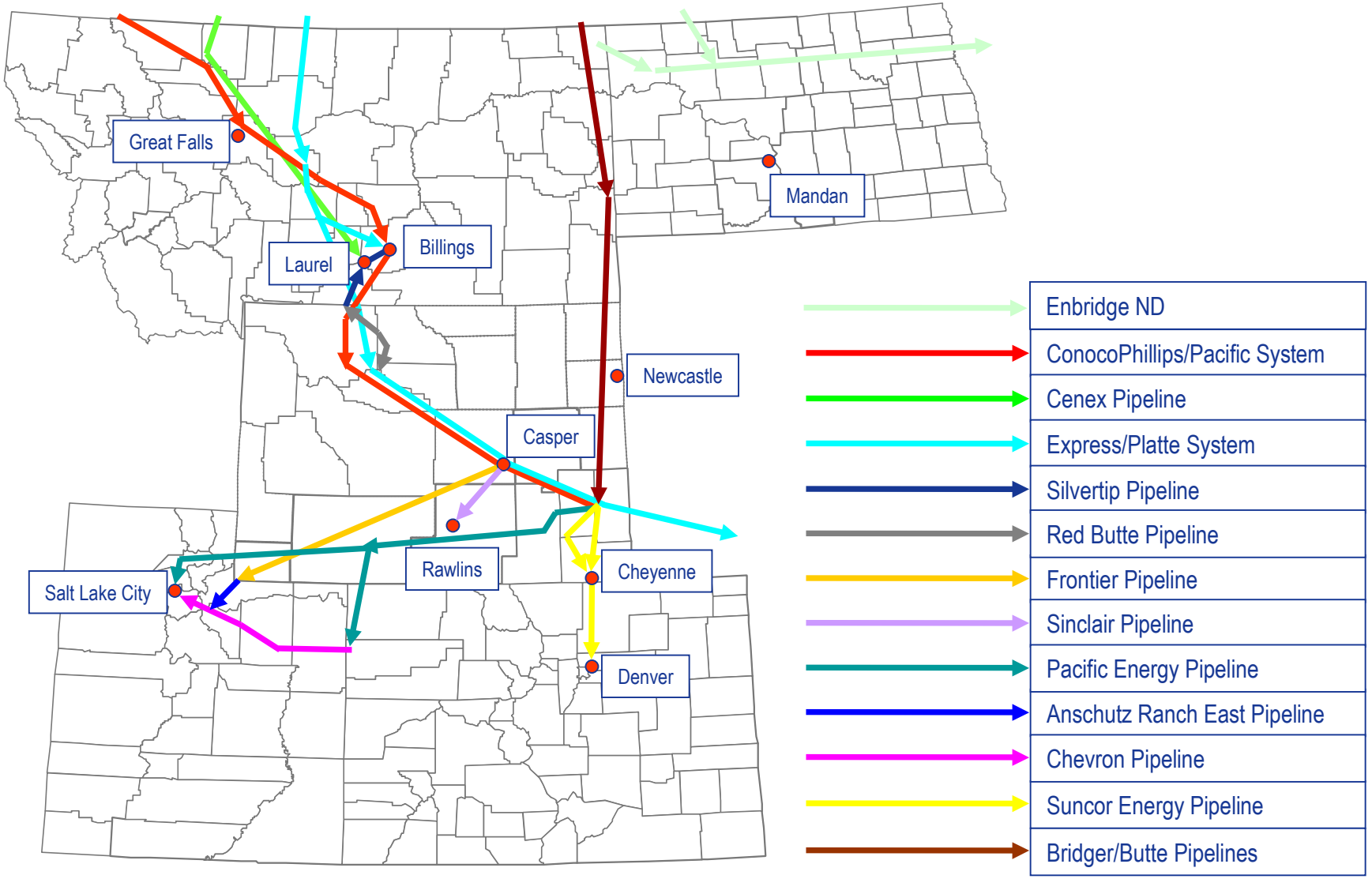
Northern Tier Pipelines

- Pipelines connect PADD IV with large supply (Western Canada) and refining centers (PADD II)
- Historical apportionment on pipelines means new shippers may be allocated only a small portion of available capacity
  - Important issue for new production
- Main gathering systems
  - Tesoro High Plains (THPP)
  - Plains All American
  - Belle Fourche
- Mainline systems
  - Enbridge ND (only system with expansion plans)
  - Bridger/Butte
  - Platte

Rocky Mountain Major Crude Oil Pipelines



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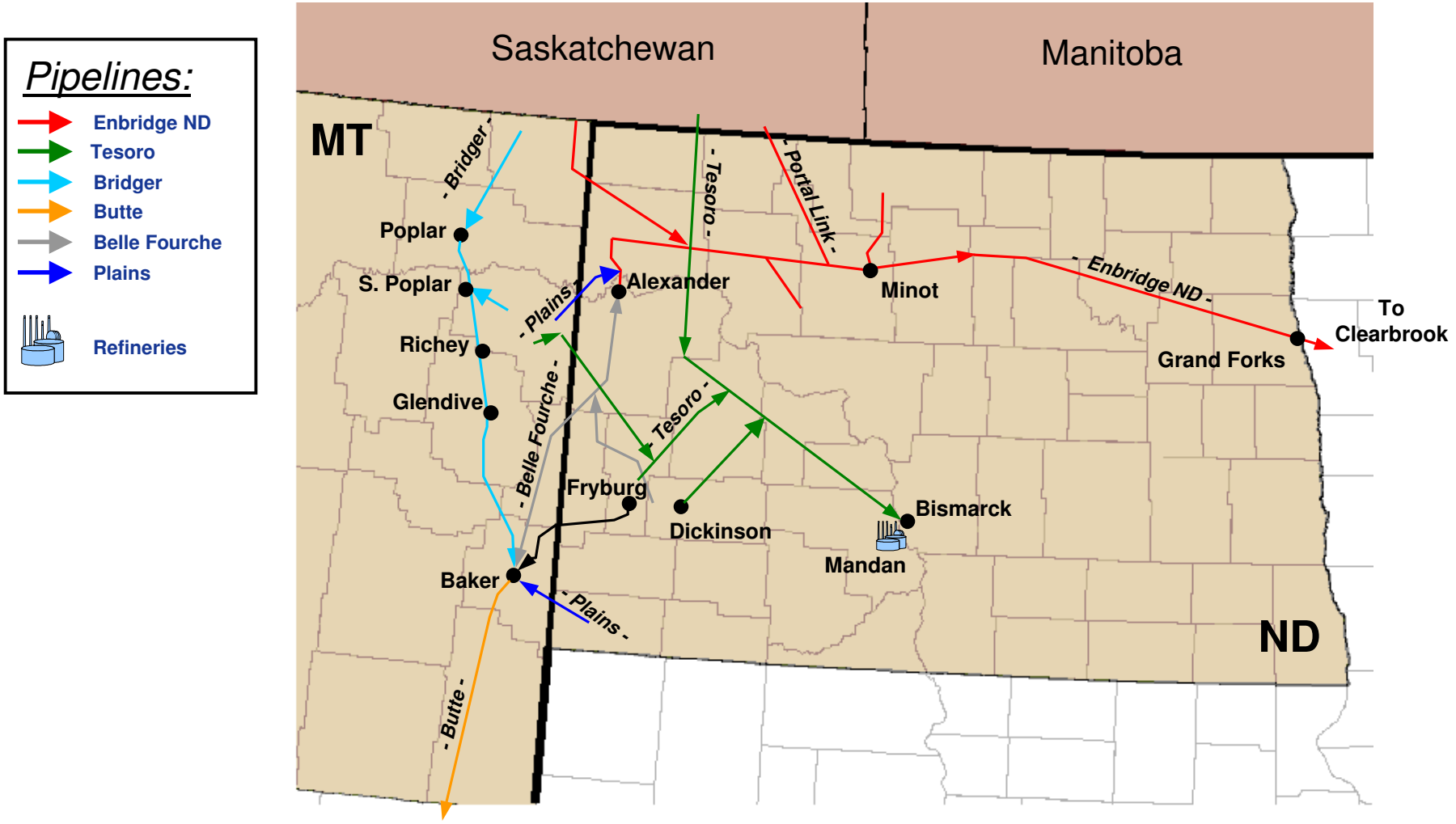
North Dakota and Eastern Montana Crude Oil Infrastructure



Note: Many details of various gathering systems are not shown

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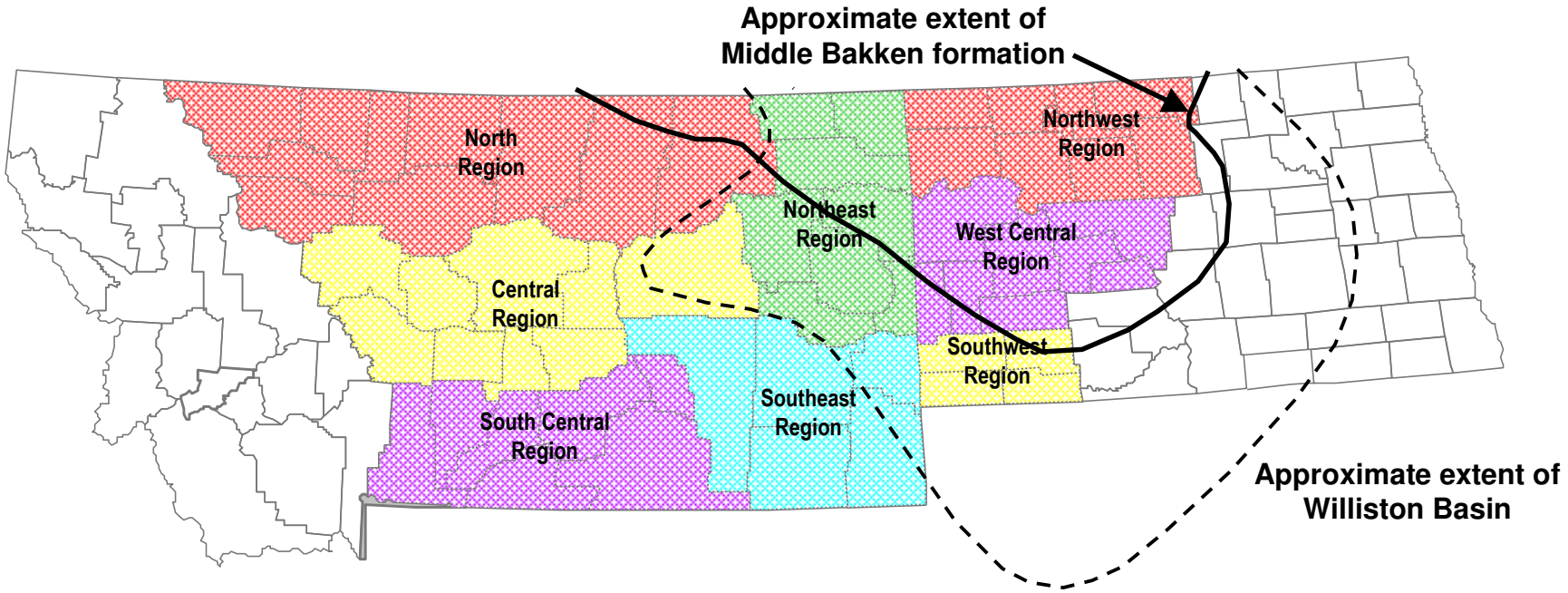
Crude Oil
Supply/Demand Balances

Williston Basin
Crude Oil Production Regions



- Northeast Montana production from the middle Bakken formation is characterized by very low sulfur & high gravity
- West Central North Dakota (Middle Bakken formation) has been less intensively explored
- Southwest region (Bowman Co.) accounts for most new production in North Dakota
  - Ordovician Red River formation
  - Crude quality indicated to be variable
  - Production from this formation in Canada yields medium gravity, high sulfur crude (typical Midale quality)

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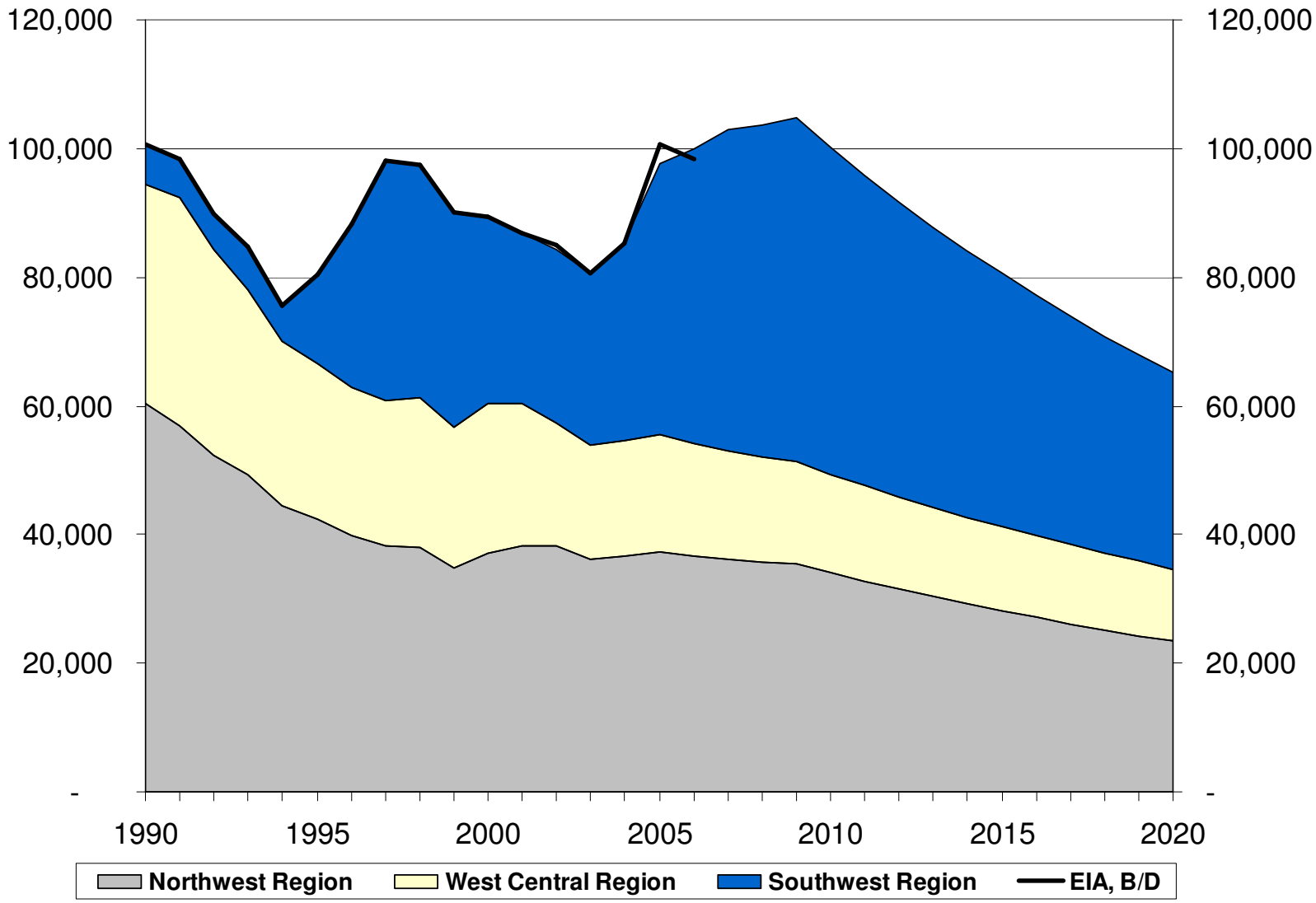
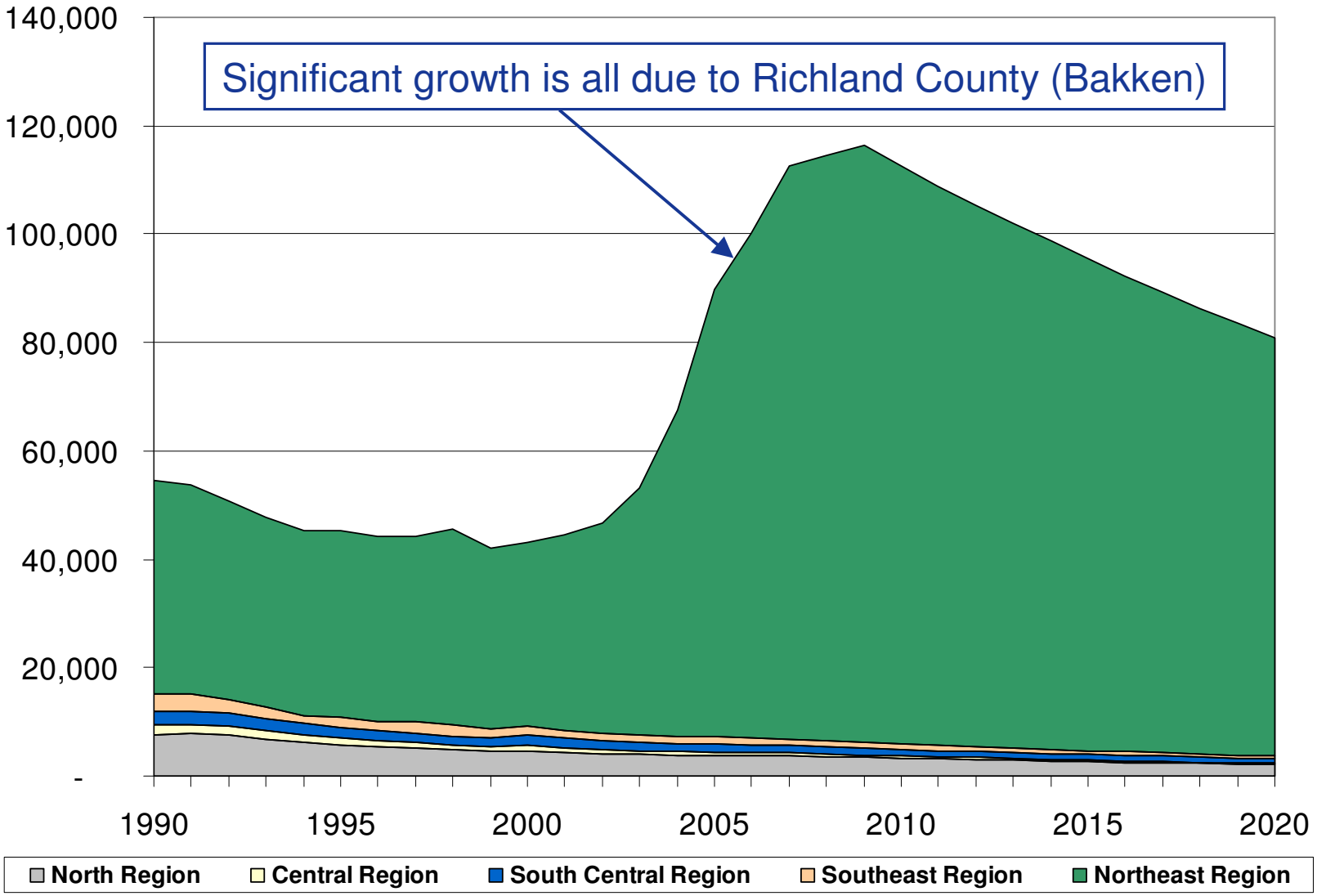
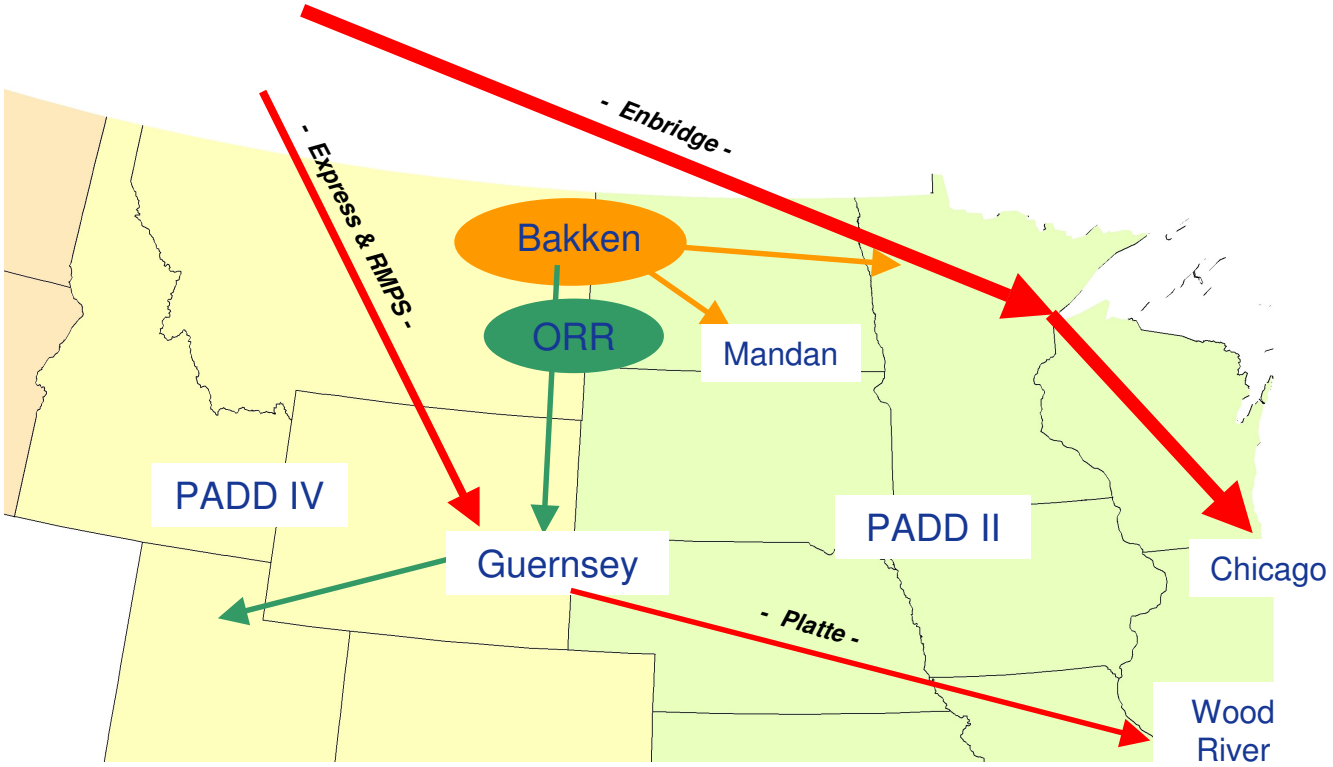
North Dakota Crude Oil Production Outlook
(Barrels per Day)



Montana Crude Oil Production Outlook
(Barrels per Day)



Regional Crude Balances
Infrastructure Constraints



Northeast MT and West Central ND production from Bakken formation forced east into PADD II. Production from Southwest ND (ORR) forced south. Access to large PADD II markets limited by shortage of pipeline capacity out of Williston Basin region. Term contract "through barrels" occupy Express/Platte system.

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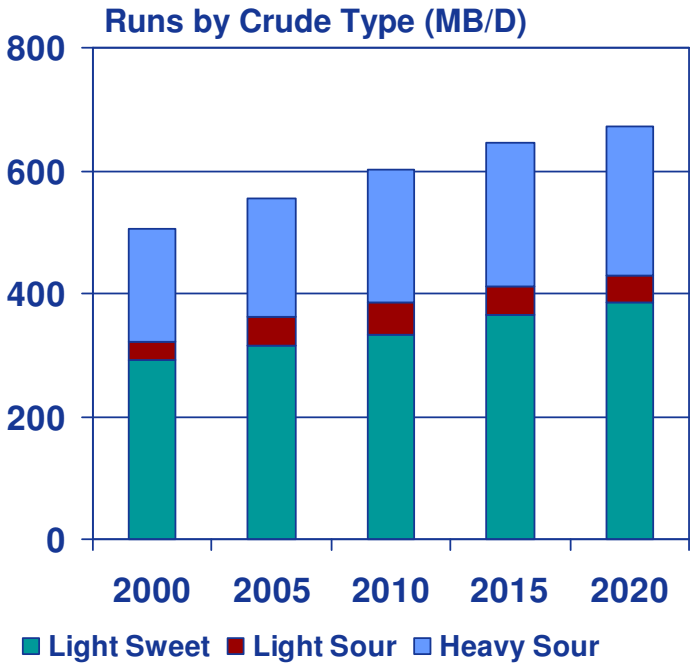
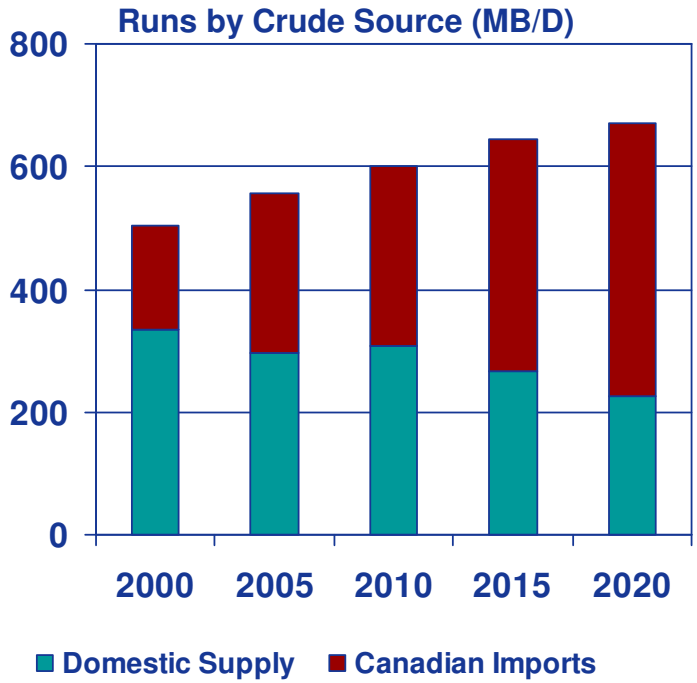
PADD IV Crude Oil Balance

- PADD IV is a small refining market, with 590,000 B/D of capacity in 15 refineries
  - Regional supply has traditionally included domestic light sweet and imported Canadian heavy
- Crude runs are forecast to grow, in line with strong regional demand
  - Crude runs were around 560,000 B/D in 2006, mainly light sweet crude
  - As local production declines, Canadian crude is likely to become the dominant supply source, approaching 50 percent by 2010





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North Dakota Crude Oil Balance by Crude Oil Type
(Thousand Barrels per Day)

	2000	2004	2005	2006	2007	2008	2009	2010	2015	2020
Light Sweet Crude Oil										
Production	71.2	68.3	79.2	81.4	84.3	85.2	86.4	82.5	66.1	53.3
Net Imports / (Exports)	0.2	-	-	-	-	-	-	-	-	-
Net Interstate Transfers In / (Out)	(22.5)	(17.8)	(28.8)	(29.0)	(31.0)	(31.6)	(32.0)	(27.0)	(8.6)	5.6
Supply Adjustments	-	-	-	-	-	-	-	-	-	-
Consumption	48.9	50.5	50.4	52.4	53.3	53.6	54.3	55.6	57.5	58.9
Light Sour Crude Oil										
Production	12.9	12.0	12.9	13.0	13.1	13.0	12.9	12.4	10.1	8.3
Net Imports / (Exports)	0.0	3.4	3.4	3.4	3.5	3.8	3.8	3.5	3.3	2.7
Net Interstate Transfers In / (Out)	(12.9)	(12.0)	(12.9)	(13.0)	(13.1)	(13.0)	(12.9)	(12.4)	(10.1)	(8.3)
Supply Adjustments	-	-	-	-	-	-	-	-	-	-
Consumption	0.0	3.4	3.4	3.4	3.5	3.8	3.8	3.5	3.3	2.7
Heavy Sour Crude Oil										
Production	5.5	5.1	5.5	5.6	5.6	5.6	5.5	5.3	4.3	3.5
Net Imports / (Exports)	-	-	-	-	-	-	-	-	-	-
Net Interstate Transfers In / (Out)	(5.5)	(5.1)	(5.5)	(5.6)	(5.6)	(5.6)	(5.5)	(5.3)	(4.3)	(3.5)
Supply Adjustments	-	-	-	-	-	-	-	-	-	-
Consumption	-	-	-	-	-	-	-	-	-	-
Total Crude Oil										
Production	89.6	85.4	97.7	100.0	103.0	103.8	104.8	100.2	80.5	65.1
Net Imports / (Exports)	0.2	3.4	3.4	3.4	3.5	3.8	3.8	3.5	3.3	2.7
Net Interstate Transfers In / (Out)	(40.9)	(34.9)	(47.3)	(47.6)	(49.7)	(50.1)	(50.5)	(44.6)	(23.0)	(6.2)
Supply Adjustments	-	-	-	-	-	-	-	-	-	-
Consumption	48.9	53.9	53.8	55.8	56.8	57.4	58.1	59.1	60.8	61.6

- ND production is forecast to be mainly light sweet crude
- Transfers out of the state account for about half of production

Montana Crude Oil Balance by Crude Oil Type
(Thousand Barrels per Day)

	2000	2004	2005	2006	2007	2008	2009	2010	2015	2020
Light Sweet Crude Oil										
Production	22.9	44.5	64.0	73.2	84.3	86.0	87.8	84.9	72.2	61.3
Net Imports / (Exports)	9.5	33.1	32.3	32.9	33.6	26.0	26.5	26.9	29.5	31.2
Net Interstate Transfers In / (Out)	(20.7)	(44.5)	(64.0)	(73.2)	(84.3)	(86.0)	(87.8)	(84.9)	(72.2)	(61.3)
Supply Adjustments	2.2	-	-	-	-	-	-	-	-	-
Consumption	9.5	33.1	32.3	32.9	33.6	26.0	26.5	26.9	29.5	31.2
Light Sour Crude Oil										
Production	16.5	17.4	17.6	17.7	17.9	17.7	17.6	16.9	14.2	11.7
Net Imports / (Exports)	9.3	7.6	7.7	7.9	8.1	8.2	8.1	8.1	7.6	6.8
Net Interstate Transfers In / (Out)	(12.4)	(17.4)	(17.6)	(17.7)	(17.9)	(17.7)	(17.6)	(16.9)	(14.2)	(11.7)
Supply Adjustments	4.2	-	-	-	-	-	-	-	-	-
Consumption	9.3	7.6	7.7	7.9	8.1	8.2	8.1	8.1	7.6	6.8
Heavy Sour Crude Oil										
Production	3.8	5.8	8.2	9.3	10.6	10.7	10.9	10.6	9.1	7.9
Net Imports / (Exports)	101.4	94.8	98.4	100.9	103.3	114.5	117.6	121.3	139.7	152.3
Net Interstate Transfers In / (Out)	37.2	32.9	28.2	26.6	24.9	23.8	22.8	21.6	16.5	12.5
Supply Adjustments	3.3	-	-	-	-	-	-	-	-	-
Consumption	145.6	133.5	134.8	136.8	138.8	149.1	151.3	153.5	165.4	172.6
Total Crude Oil										
Production	43.2	67.7	89.8	100.2	112.7	114.4	116.3	112.5	95.5	80.9
Net Imports / (Exports)	120.1	135.5	138.4	141.7	145.0	148.7	152.2	156.3	176.8	190.3
Net Interstate Transfers In / (Out)	4.2	(29.0)	(53.4)	(64.3)	(77.2)	(79.8)	(82.5)	(80.2)	(69.8)	(60.5)
Supply Adjustments	9.7	-	-	-	-	-	-	-	-	-
Consumption	164.3	174.2	174.8	177.6	180.5	183.3	186.0	188.5	202.4	210.7

- MT production is forecast to be mainly light sweet crude
- Significant Canadian imports enter PADD IV through MT

PADD IV & North Dakota Crude Oil Balance by Crude Oil Type
(Thousand Barrels per Day)

	2000	2004	2005	2006	2007	2008	2009	2010	2015	2020
Light Sweet Crude Oil										
Production	229.9	290.1	302.7	301.4	300.7	288.4	276.7	265.6	217.2	178.9
Net Imports / (Exports)	60.5	102.8	100.7	96.9	103.8	101.9	114.1	125.9	174.0	214.2
Net Interstate Transfers In / (Out)	(27.7)	(70.2)	(81.5)	(81.4)	(81.1)	(74.3)	(68.0)	(61.9)	(34.7)	(13.4)
Supply Adjustments	1.9	-	-	-	-	-	-	-	-	-
Consumption	260.8	322.6	321.9	316.9	323.4	316.0	322.8	329.7	356.6	379.7
Light Sour Crude Oil										
Production	52.0	54.5	54.5	53.5	52.6	50.5	48.6	46.7	38.2	31.3
Net Imports / (Exports)	38.6	25.9	51.6	52.2	52.0	66.4	66.9	67.4	67.4	67.5
Net Interstate Transfers In / (Out)	(27.7)	(21.8)	(42.1)	(41.6)	(41.1)	(39.5)	(38.0)	(36.5)	(29.9)	(24.4)
Supply Adjustments	4.3	1.0	1.1	1.1	1.0	1.0	0.9	0.9	0.8	0.6
Consumption	58.6	57.6	62.9	63.1	62.5	76.5	76.5	76.7	74.9	73.7
Heavy Sour Crude Oil										
Production	73.7	73.4	73.2	71.5	69.9	66.9	64.0	61.3	49.4	40.0
Net Imports / (Exports)	128.8	135.1	139.2	153.7	158.7	164.7	171.3	177.6	202.2	223.3
Net Interstate Transfers In / (Out)	(6.0)	(5.2)	(6.3)	(6.5)	(6.7)	(6.5)	(6.4)	(6.3)	(5.7)	(5.3)
Supply Adjustments	9.1	0.4	0.4	0.4	0.4	0.3	0.3	0.3	0.3	0.2
Consumption	205.1	202.9	205.8	218.4	221.6	224.8	228.6	232.3	245.6	257.7
Heavy Sweet (Wax)										
Production	19.1	31.0	33.3	32.6	31.9	30.8	29.7	28.7	24.0	20.1
Net Imports / (Exports)	-	-	-	-	-	-	-	-	-	-
Net Interstate Transfers In / (Out)	-	-	-	-	-	-	-	-	-	-
Supply Adjustments	-	-	-	-	-	-	-	-	-	-
Consumption	19.1	31.0	33.3	32.6	31.9	30.8	29.7	28.7	24.0	20.1
Total Crude Oil										
Production	374.7	448.9	463.7	459.0	455.1	436.6	419.0	402.3	328.8	270.3
Net Imports / (Exports)	227.9	263.8	291.5	302.8	314.5	333.0	352.2	370.9	443.6	504.9
Net Interstate Transfers In / (Out)	(61.3)	(97.2)	(129.9)	(129.4)	(128.9)	(120.3)	(112.4)	(104.7)	(70.3)	(43.1)
Supply Adjustments	15.4	1.4	1.5	1.4	1.4	1.3	1.3	1.2	1.0	0.8
Consumption	543.6	614.1	623.8	631.0	639.4	648.0	657.6	667.3	701.1	731.3

Crude Oil Balance for PADD IV and ND (2005)
(Thousand Barrels per Day)

	Montana		Other	North	
	West	East	PADD IV	Dakota	Total
Production	7	83	250	98	438
Net Imports/(Exports)	378	7		3	388
Interstate Transfers In/(Out)					
Express/Western Corridor	(210)		210		
Plains gathering system		(22)		22	
Butte		(68)	68		
Enbridge ND				(69)	(69)
Platte			(145)		(145)
Giant			(10)		(10)
Interstate Transfers In/(Out)	(210)	(90)	123	(47)	(224)
Adjustments					
Consumption	175	(0)	373	54	602

Note: PGI estimate of regional balance. Figures are indicative and may not agree with other source material.

Crude Oil Balance for PADD IV and ND (2006)
(Thousand Barrels per Day)

	Montana West	Montana East	Other PADD IV	North Dakota	Total
Production	7	93	249	100	449
Net Imports/(Exports)	392	7		3	402
Interstate Transfers In/(Out)					
Express/Western Corridor	(221)		221		
Plains gathering system		(31)		31	
Butte		(69)	69		
Enbridge ND				(78)	(78)
Platte			(148)		(148)
Giant			(10)		(10)
Interstate Transfers In/(Out)	(221)	(100)	132	(47)	(236)
Adjustments					
Consumption	178	0	381	56	615

- Pipeline infrastructure stretched by rapid increases in Williston Basin crude production
- PGI balances indicate Butte not fully loaded, but recent information suggests it is (use of DRA, historical apportionment)

Note: PGI estimate of regional balance. Figures are indicative and may not agree with other source material.

Crude Oil Balance for PADD IV and ND (2007)
(Thousand Barrels per Day)

	Montana West	Montana East	Other PADD IV	North Dakota	Total
Production	7	106	248	103	464
Net Imports/(Exports)	397	7		4	408
Interstate Transfers In/(Out)					
Express/Western Corridor	(224)		224		
Plains gathering system		(41)		41	
Butte		(72)	72		
Enbridge ND				(90)	(90)
Platte			(147)		(147)
Giant			(10)		(10)
Interstate Transfers In/(Out)	(224)	(113)	139	(49)	(247)
Adjustments					
Consumption	180	(0)	387	57	624

- Growth in production expected to result in continued pipeline capacity constraints this year

Note: PGI estimate of regional balance. Figures are indicative and may not agree with other source material.

Crude Oil Balance for PADD IV and ND (2010)
(Thousand Barrels per Day)

	Montana West	Montana East	Other PADD IV	North Dakota	Total
Production	6	107	224	100	437
Net Imports/(Exports)	468	7		4	479
Interstate Transfers In/(Out)					
Express/Western Corridor	(285)		285		
Plains gathering system		(65)		65	
Butte		(49)	49		
Enbridge ND				(110)	(110)
Platte			(148)		(148)
Giant			(10)		(10)
Interstate Transfers In/(Out)	(285)	(114)	176	(45)	(268)
Adjustments					
Consumption	189	(0)	400	59	647

- Production decline in PADD IV and increase in regional crude runs result in increased call on Canadian imports
- Additional capacity in Western MT import pipelines and Enbridge ND required

Crude Oil Balance for PADD IV and ND (2015)
(Thousand Barrels per Day)

	Montana West	Montana East	Other PADD IV	North Dakota	Total
Production	5	91	180	81	356
Net Imports/(Exports)	577	20		3	600
Interstate Transfers In/(Out)					
Express/Western Corridor	(380)		380		
Plains gathering system		(87)		87	
Butte		(24)	24		
Enbridge ND				(110)	(110)
Platte			(145)		(145)
Giant			(10)		(10)
Interstate Transfers In/(Out)	(380)	(111)	249	(23)	(265)
Adjustments					
Consumption	202	(0)	429	61	692

- Continuation of PADD IV production declines and increase in regional crude runs through 2015
- Further expansion of Western MT import pipelines forecast

Crude Oil Balance in Williston Basin
(Thousand Barrels per Day)

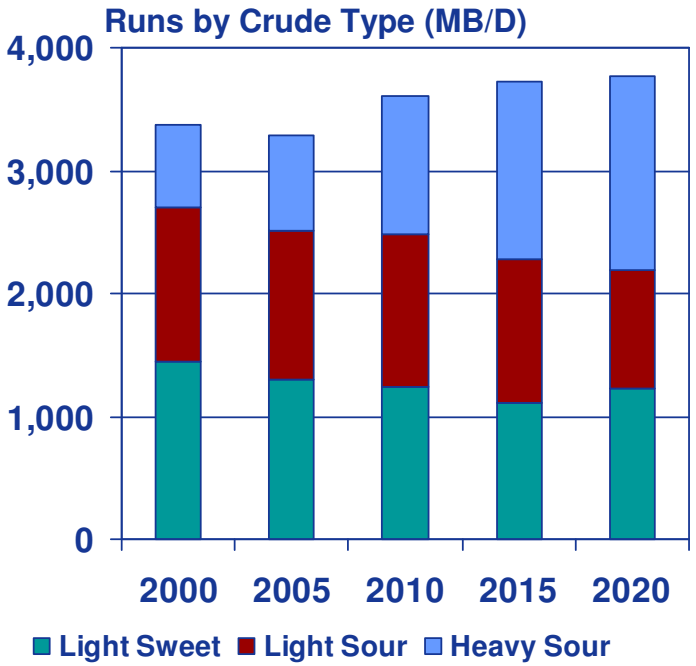
Year	2005	2006	2007	2010	2015
Production	180	193	209	207	171
Net Imports/(Exports)	10	10	11	11	23
Interstate Transfers In/(Out)					
Butte	(68)	(69)	(72)	(49)	(24)
Enbridge ND	(69)	(78)	(90)	(110)	(110)
Subtotal	(137)	(147)	(162)	(159)	(134)
Consumption (Mandan)	54	57	57	58	61

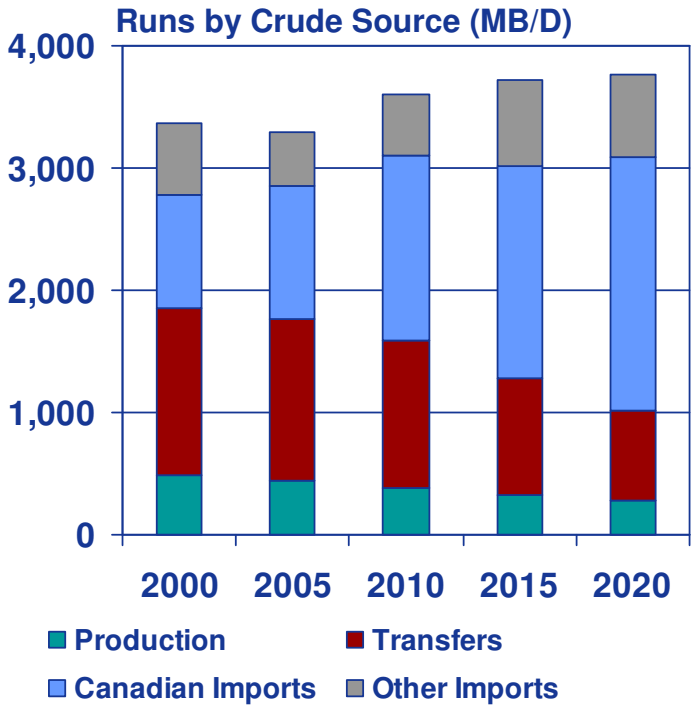
- Utilization of Enbridge ND system projected to increase with Williston Basin production, filling expansion capacity

Note: PGI estimate. Williston Basin balance defined to include Eastern MT and ND.
Figures are indicative and may not agree with other source material.

PADD II Crude Oil Balance

- PADD II is a significant crude production region, but it still depends on imports and transfers for nearly 90 percent of its crude supply
  - This dependence will continue to increase as production declines and runs increase
- Crude runs totaled 3.4 million B/D in 2006
  - Overall, crude runs have shifted towards a more sour and heavier slate
  - Sweet crude runs still account for about 40 percent of the total





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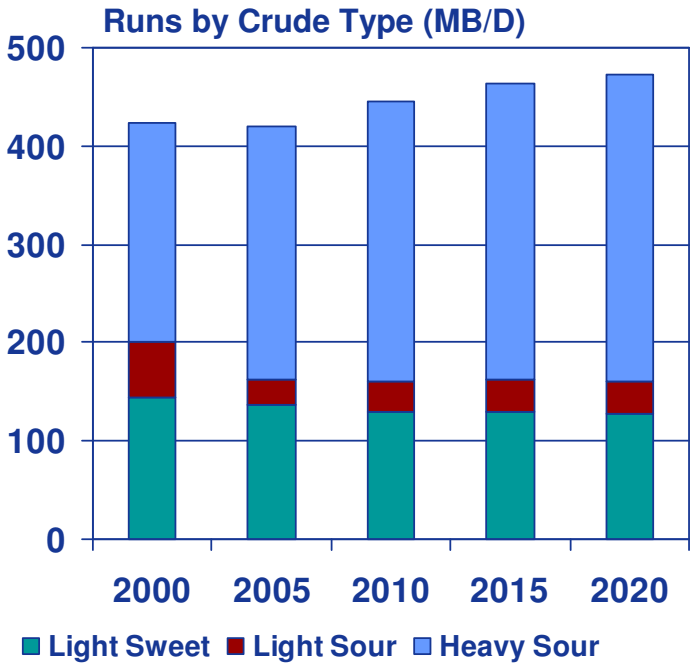
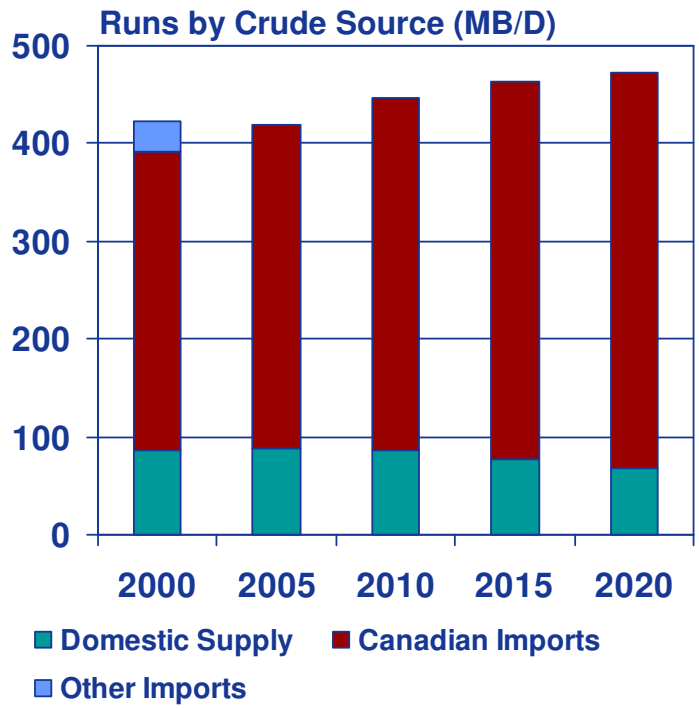
Upper Midwest Crude Oil Balance

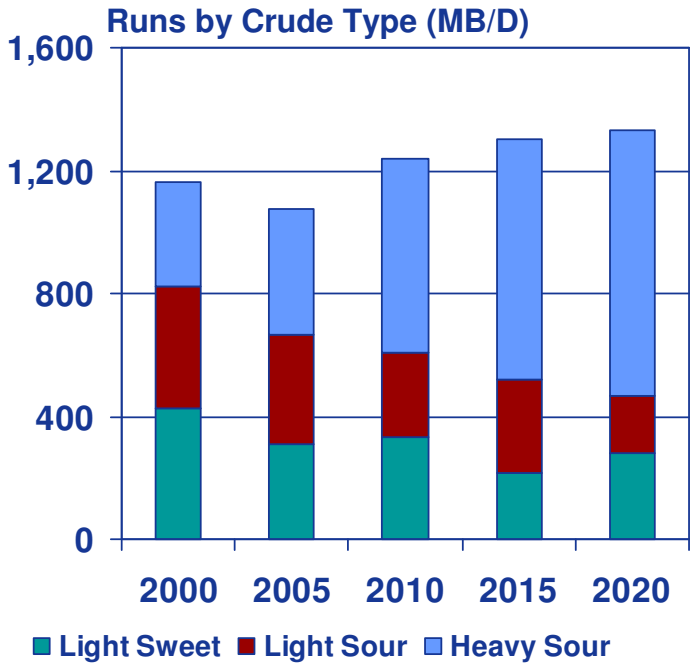
- Refinery runs in the Upper Midwest (see map on pg. 9) are dominated by heavy crude
  - Flint Hills Resources refinery (Rosemount, MN) accounts for almost 60% of regional capacity
  - Canadian imports are dominant in this region, mainly heavy grades
  - Sweet crude requirements come mainly from the Williston Basin, supplemented with light crude imports from Canada

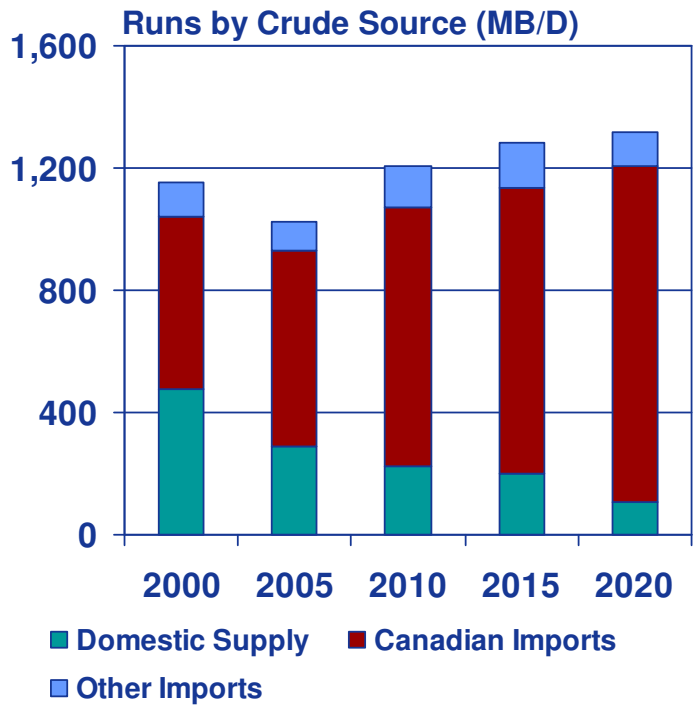




Great Lakes Crude Oil Balance

- Midwest regional refineries have combined capacity of 2.3 million B/D, including:
  - Great Lakes region, centered at Chicago/Toledo (1.2 million B/D)
  - Southern Midwest region, centered at Wood River (1.2 million B/D)
- Great Lakes (see map on pg. 9) has advantageous access to Canadian crudes
  - Regional crude production accounts for less than 5 percent of refinery runs
  - Refiners are dependent on crude oil imports and transfers from other PADDs





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