

**Waterway Traffic Forecasts
for the
Upper Mississippi River Basin**

Volume VII: Petroleum Products

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Waterway Traffic Forecasts for the Upper Mississippi River Basin: Petroleum Products

1.0 Introduction

Petroleum products account for a significant percentage of the freight traffic that moves on the Upper Mississippi River. In 1992, petroleum products accounted for 11% of the total freight transported on the link between Minneapolis and St. Louis, 10.7% of the total freight transported on the Illinois River, and 7% of the freight transported between St. Louis and Cairo. Exhibit 1 shows the volumes of different types of petroleum products that moved on the river in 1992. As can be seen, the primary commodities are residual fuel oil, gasoline, distillate fuel oil, and asphalt, tar and pitch. Together these four commodities accounted for over 80% of the petroleum products transported on the different river segments. Note that the volume of crude petroleum transported on the Upper Mississippi River is very small. For this reason, the report focuses exclusively on petroleum products.

2.0 The Petroleum Refining Industry

The petroleum refining industry is a fundamental part of the U.S. economy. Petroleum products are consumed in numerous manufacturing processes contributing to a wide variety of goods. The fuels derived from crude oil power industrial production, drive the transportation of people and goods, heat homes and buildings, and generate electricity for general consumption. Changes in the supply of petroleum affect every sector of the economy. The petroleum refining industry is represented by SIC industry group 2911.

The structure of the petroleum refining industry is defined by several interesting attributes. It is oligopolistic in nature and is dominated by six private companies referred to as the International Majors. The industry is also vertically integrated, which refers to the condition in which a company produces a raw material, transports it, refines or processes it, and markets the product, all as one integrated operation. A third characteristic of the industry, it is highly capital intensive. Large economies of scale and continuous production improvements are necessary to recover exceedingly high fixed costs.

The petroleum product stream begins with the extraction of crude oil from oil wells. This crude oil is shipped to refineries and is combined with inputs such as natural gas liquids, unfinished oils, gasoline, hydrocarbons, and alcohol. According to the U.S. Department of Energy's (DOE) Energy Information Administration (EIA), in 1994 refineries consumed, on average, 13.87 million barrels of crude oil per day and produced an average of 15.78 million barrels of petroleum products per day. These products include: motor gasoline, distillate fuel oil, liquefied petroleum gases, residual fuel oil, jet fuel, and petrochemicals. The products are then shipped to bulk stations where they are distributed to retailers and end users.

Exhibit 1 1992 Petroleum Product Freight Traffic on the Upper Mississippi River (Thousands of Tons)			
Commodity	Minneapolis to St. Louis	St. Louis to Cairo	Illinois River
Total	9,500	7,998	5,772
Crude Petroleum	81	36	56
Gasoline	2,409	1,617	851
Kerosene	3	0	1
Distillate Fuel Oil	1,126	873	877
Residual Fuel Oil	2,605	2,640	1,435
Lube Oil and Grease	376	438	239
Petroleum Jelly and Waxes	0	0	0
Naphtha and Solvents	273	256	201
Asphalt, Tar and Pitch	2,172	1,660	1,508
Petroleum Coke	205	221	585
Liquid Natural Gas	228	228	6
Petroleum Products, NEC	21	29	13

Source: Waterborne Commerce Statistics Center.

Along with imports and inventory changes, the net daily supply of petroleum products in 1994 was 17.69 million barrels. Of this quantity, motor gasoline accounted for 7.59 million gallons (43 percent), distillate fuel oil accounted for 3.17 million barrels (18 percent), liquefied petroleum gases accounted for 1.88 million barrels (11 percent), jet fuel accounted for 1.53 million barrels (9 percent), residual fuel oil accounted for 1 million barrels (6 percent), and other products accounted for 2.52 million barrels (14 percent).

In 1994, 165 refineries operated in the United States. These refineries were located in 33 different states and had a total distilling capacity of over 15 million barrels of crude oil per day. Exhibit 2 shows the number and capacity of operable petroleum refineries for each of these states. As can be seen, Texas has the most capacity and accounts for 26 percent of the U.S. total. Louisiana and California are the next largest refining states and account for 16 percent and 13 percent respectively. Almost nine percent of the U.S. petroleum refining capacity is located in the five-state study area, with Illinois alone accounting for almost seven percent. The ten refineries located in the Study Area are indicated in Exhibit 3. Seven of these refineries are located in close proximity to either the Upper Mississippi River or Illinois River. The refineries in Lawrenceville Illinois, Robinson Illinois, and Superior Wisconsin probably do not use the Upper Mississippi River system to ship their products. The Lawrenceville and Robinson refineries are located on the eastern border of Illinois, close to the Wabash River, whereas the Superior refinery is located along Lake Superior near Duluth, Minnesota.

EIA does not report refinery production of petroleum products by state. However, they do publish regional production data for groups of states. These groups are defined for two different tiers. In the first tier, states are grouped into Petroleum Administration for Defense (PAD) Districts. For this analysis, PAD District II is the most important group in this tier because it contains the states in the Upper Mississippi River Basin. The second tier consists of smaller groups of states called Refining Districts that are within each PAD district. For example, PAD District II contains three Refining Districts. Exhibit 4 shows a schematic of the refining districts within PAD District II.

Exhibit 5 presents 1994 net refinery production data for the U.S., EIA's PAD District II, and relevant Refining Districts within PAD District II. The Refining District which contains Iowa and Missouri is not shown because there are not any petroleum refineries located in those two states. Note that finished motor gasoline and distillate fuel oil account for over 60% of the petroleum products produced in the United States. Together, these two commodities comprise over 70% of the petroleum products produced in PAD District II. A similar pattern can be seen in the two refining districts. PAD District II produces almost 22% of the U.S. petroleum products. It maintains relatively large shares of the U.S. kerosene production as well as asphalt and road oil production: 32.07% and 40.72% respectively. A large percentage of these products are produced in the IN-IL-KY Refining District.

Exhibit 2: Number and Capacity of Operable Petroleum Refineries by PAD District and State January 1, 1995							
PAD District	State	Number of Operable Refineries			Atmospheric Crude Oil Distillation Capacity (Barrels per Calendar Day)		
		Total	Operating	Idle	Total	Operating	Idle
I	Total	18	16	2	1,571,740	1,386,740	185,000
	Delaware	1	1	0	140,000	140,000	0
	Georgia	2	1	1	33,540	5,540	28,000
	New Jersey	6	5	1	586,000	506,000	80,000
	Pennsylvania	7	7	0	747,700	670,700	77,000
	Virginia	1	1	0	53,000	53,000	0
	West Virginia	1	1	0	11,500	11,500	0
II	Total	34	33	1	3,447,465	3,431,265	16,200
	Illinois	7	7	0	1,001,765	1,001,765	0
	Indiana	3	3	0	443,100	434,400	8,700
	Kansas	4	4	0	294,800	294,800	0
	Kentucky	2	2	0	218,900	218,900	0
	Michigan	2	2	0	115,600	115,600	0
	Minnesota	2	2	0	297,100	297,100	0
	North Dakota	1	1	0	58,000	58,000	0
	Ohio	4	4	0	488,000	488,000	0
	Oklahoma	7	6	1	408,000	400,500	7,500
	Tennessee	1	1	0	89,000	89,000	0
	Wisconsin	1	1	0	33,200	33,200	0
	III	Total	65	61	4	7,010,500	6,882,900
Alabama		3	3	0	121,000	121,000	0
Arkansas		3	3	0	63,900	63,900	0
Louisiana		20	18	2	2,384,150	2,356,550	27,600
Mississippi		5	4	1	342,800	334,800	8,000
New Mexico		3	3	0	94,600	94,600	0
Texas		31	30	1	4,004,050	3,912,050	92,000
IV	Total	15	15	0	507,675	507,675	0
	Colorado	2	2	0	85,500	85,500	0
	Montana	4	4	0	141,950	141,950	0
	Utah	5	5	0	150,500	150,500	0
	Wyoming	4	4	0	129,725	129,725	0
V	Total	43	40	3	2,896,900	2,873,100	23,800
	Alaska	6	6	0	263,500	263,500	0
	Arizona	1	0	1	3,800	0	3,800
	California	25	24	1	1,910,300	1,902,200	8,100
	Hawaii	2	2	0	147,500	147,500	0
	Nevada	1	1	0	7,000	7,000	0
	Oregon	1	1	0	0	0	0
	Washington	7	6	1	564,800	552,900	11,900

Source: Energy Information Administration, Petroleum Supply Annual 1994 (May 1995).

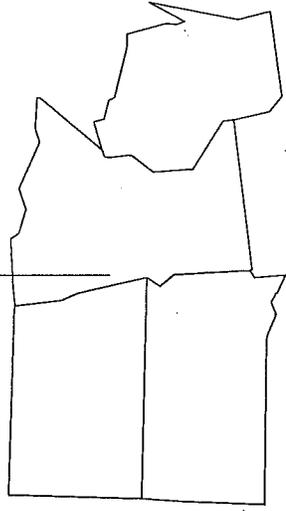
Exhibit 3: Operating Capacity of Petroleum Refineries in the Upper Mississippi River Basin (Barrels Per Calendar Day)			
State	Company	Location	Capacity
Illinois	Clark Refining and Marketing	Blue Island	80,515
	Clark Refining and Marketing	Hartford	62,500
	Indian Refining	Lawrenceville	80,750
	Marathon Oil Company	Robinson	175,000
	Mobil Oil Corporation	Joliet	188,000
	Shell Oil Corporation	Wood River	268,000
	Uno-Ven Company	Lemont (Chicago)	147,000
Indiana	Amoco Oil Company	Whiting	410,000
Minnesota	Ashland Oil Company	St. Paul	67,100
	Koch Refining Company	St. Paul (Pine Bend)	230,000
Wisconsin	Murphy Oil USA Inc.	Superior	33,200

Source: Energy Information Administration, Petroleum Supply Annual 1994 (May 1995).

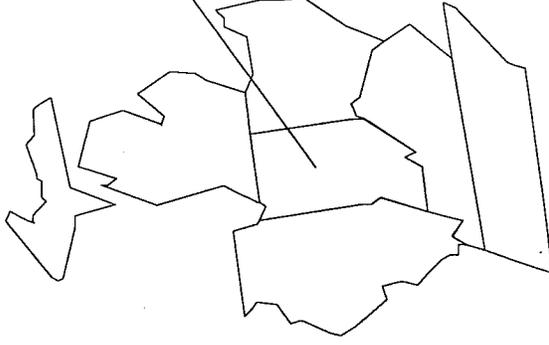
Exhibit 4

EIA Refining Districts for PAD District II

MN-WI-ND-SD



IN-IL-KY



OK-KS-MO

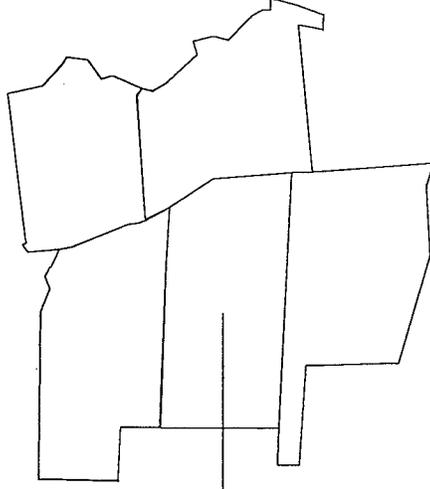


Exhibit 5
1994 Refinery Production of Petroleum Products by District

Commodity	U.S.		PAD District II		Refining District: IN-IL-KV*		Refining District: MN-WI-ND-SD	
	Thousands of Barrels	Percent of U.S. Total	Thousands of Barrels	Percent of District Total	Thousands of Barrels	Percent of District Total	Thousands of Barrels	Percent of District Total
Natural Gas Liquids and LPGs	223,157	3.87%	42,465	3.36%	30,644	3.59%	3,772	2.58%
Finished Motor Gasoline	2,621,006	45.48%	626,544	49.60%	425,236	49.77%	70,379	48.17%
Finished Aviation Gasoline	7,892	0.14%	922	0.07%	504	0.06%	308	0.21%
Jet Fuel	528,377	9.17%	73,585	5.83%	47,790	5.59%	10,175	6.96%
Kerosene	21,138	0.37%	6,779	0.54%	5,053	0.59%	874	0.60%
Distillate Fuel Oil	1,169,688	20.29%	288,699	22.85%	185,339	21.69%	34,882	23.87%
Residual Fuel Oil	301,436	5.23%	27,175	2.15%	21,457	2.51%	3,101	2.12%
Petrochemical Feedstocks	152,551	2.65%	17,130	1.36%	15,846	1.85%	0	0.00%
Special Naphthas	19,359	0.34%	4,555	0.36%	3,281	0.38%	0	0.00%
Lubricants	62,089	1.08%	8,376	0.66%	5,731	0.67%	0	0.00%
Waxes	7,637	0.13%	761	0.06%	456	0.05%	0	0.00%
Petroleum Coke	227,059	3.94%	46,886	3.71%	29,962	3.51%	7,692	5.26%
Asphalt and Road Oil	164,789	2.86%	67,103	5.31%	47,750	5.59%	9,366	6.41%
Still Gas	239,901	4.16%	48,278	3.82%	32,874	3.85%	4,896	3.35%
Miscellaneous Products	17,505	0.30%	3,938	0.31%	2,496	0.29%	672	0.46%
Total	5,763,584	100.00%	1,263,196	100.00%	854,419	100.00%	146,117	100.00%

Source: Energy Information Administration, Petroleum Supply Annual 1994 (May 1995)

The U.S. Bureau of the Census does report some state-level data for the petroleum refining industry. Exhibit 6 presents state value added data published in the *1992 Census of Manufactures*. In 1992, the petroleum refining industry contributed over nineteen billion dollars to the U.S. economy. As shown in the table, Texas, California, Louisiana, Pennsylvania and Illinois accounted for 67% of that contribution. For many states, petroleum refining data are not published to avoid disclosing data for individual companies. This is the case for both Minnesota and Wisconsin. The only data released for these states are the number of refining establishments located in each state and an employment range for the total number of employees. Using the midpoints of these ranges, we computed employment shares that were then used to allocated EIA's refining district production data to the state level. These calculations yielded the following production estimates for the states in the Upper Mississippi River Basin:

1994 Net Refinery Production (Thousands of Barrels)	
Illinois	350,141
Minnesota	132,834
Wisconsin	13,283

3.0 Consumption of Petroleum Products

The U.S. consumes over six billion barrels of petroleum products annually. While that figure has been increasing since the early 80s, it has not yet reached the peak consumption levels seen in the late 70s.

The distribution of petroleum consumption across different end products is shown in Exhibit 7. As can be seen over 40% of the petroleum products consumed in the U.S. are in the form of motor gasoline; this share has grown by over two percentage points since the early 70s. Distillate fuel is the next largest consumption category and accounts for approximately 17.5% of the U.S. petroleum product consumption. This share has remained remarkably stable since 1970, deviating by less than 1.5 percentage points over the period. The next three largest categories - LPG, jet fuel, and the catchall category "other petroleum products" - all saw their consumption shares increase over the period. The share of petroleum products consumed as residual fuel has declined notably.

The shares of total petroleum products consumed by sector are shown in Exhibit 8. The transportation sector consumes almost 65% of the annual consumption of petroleum products. This sector consists of all public and private vehicles that carry people and freight. Of the petroleum products consumed in the U.S., it consumed 100% of the jet fuel and aviation gas, over 98% of the motor gasoline, 60% of the distillate fuel, 50% of the lubricants, and 43% of the residual fuel. Note that the large increase in the transportation sector's share which occurred during the early 80s coincides with the deregulation of the motor carrier industry.

Exhibit 6 1992 Petroleum Refining by State: Value Added by Manufacture		
State	(Million Dollars)	Percent of U.S.
United States	19,101	100.00%
California	3,261	17.07%
Illinois	1,000	5.23%
Kansas	430	2.25%
Louisiana	2,557	13.39%
New Jersey	315	1.65%
New Mexico	153	0.80%
Ohio	374	1.96%
Oklahoma	368	1.92%
Pennsylvania	2,106	11.03%
Texas	4,212	22.05%
Utah	333	1.74%
Washington	253	1.32%
Wyoming	103	0.54%

Source: 1992 Census of Manufactures

Exhibit 7

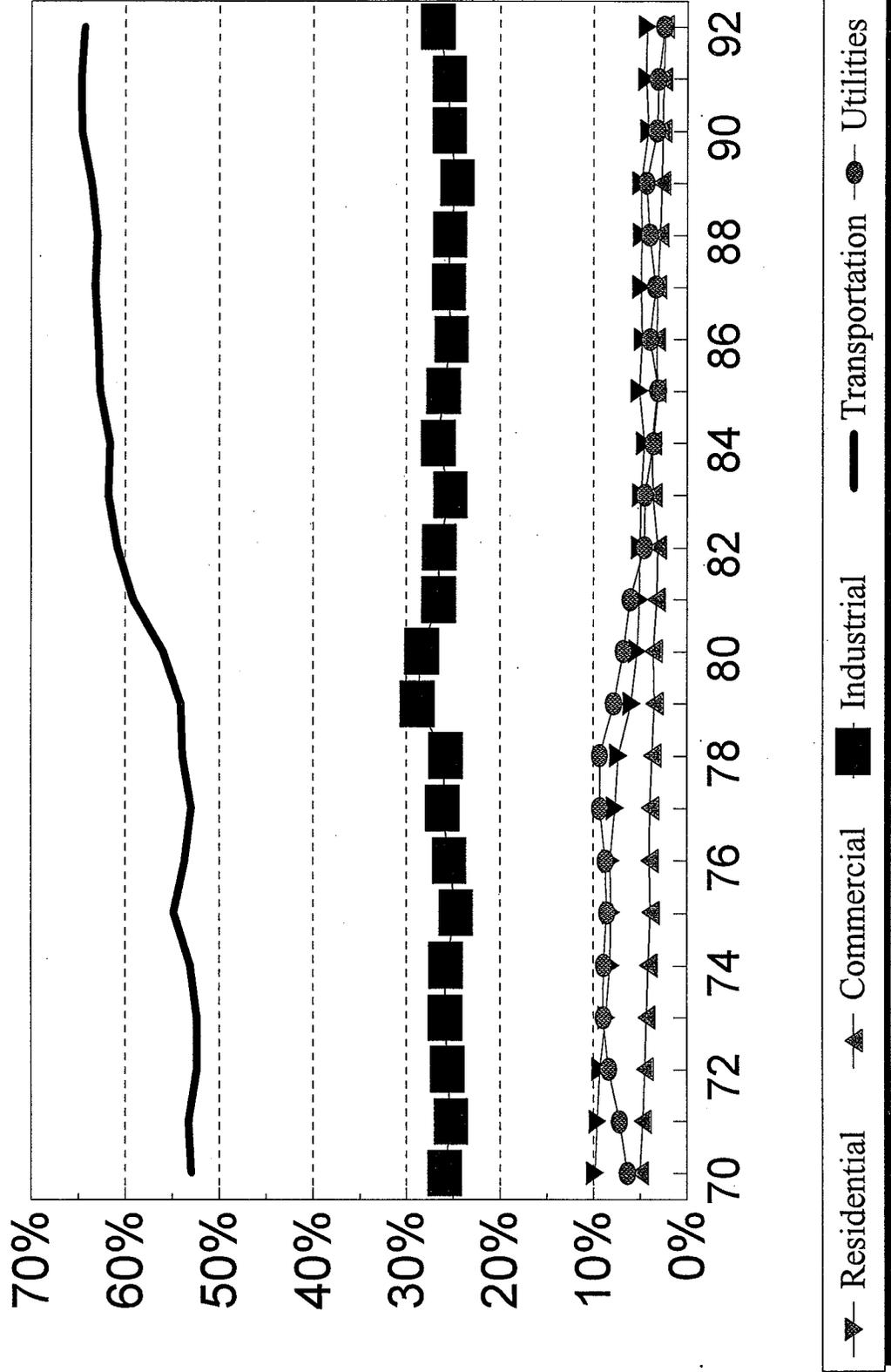
**U.S. Consumption of Petroleum by End Product
(Percent of Total Petroleum Products Consumed)**

Year	Asphalt & Road Oil	Aviation Gasoline	Distillate Fuel	Jet Fuel	Kerosene	LPG	Lubricants	Motor Gasoline	Residual Fuel	Other	Total (MI Barrels)
1970	3.04%	0.37%	17.28%	6.58%	1.79%	8.33%	0.93%	39.35%	14.99%	7.33%	5,364
1971	3.01%	0.32%	17.49%	6.65%	1.64%	8.23%	0.88%	39.54%	15.09%	7.15%	5,552
1972	2.85%	0.28%	17.79%	6.38%	1.44%	8.68%	0.88%	38.96%	15.46%	7.28%	5,991
1973	3.01%	0.27%	17.87%	6.13%	1.25%	8.37%	0.93%	38.56%	16.30%	7.31%	6,318
1974	2.90%	0.26%	17.70%	5.97%	1.05%	8.44%	0.94%	39.26%	15.84%	7.63%	6,078
1975	2.57%	0.24%	17.48%	6.13%	0.97%	8.16%	0.84%	40.89%	15.09%	7.64%	5,957
1976	2.35%	0.20%	17.95%	5.65%	0.97%	8.04%	0.88%	39.97%	16.04%	7.95%	6,390
1977	2.36%	0.21%	18.18%	5.63%	0.95%	7.72%	0.86%	38.95%	16.66%	8.47%	6,727
1978	2.54%	0.20%	18.21%	5.61%	0.93%	7.50%	0.92%	39.32%	16.03%	8.74%	6,880
1979	2.57%	0.21%	17.87%	5.81%	1.02%	8.60%	0.98%	37.99%	15.27%	9.68%	6,759
1980	2.32%	0.21%	16.80%	6.26%	0.93%	8.62%	0.93%	38.57%	14.70%	10.65%	6,243
1981	2.13%	0.19%	17.61%	6.28%	0.78%	9.13%	0.96%	41.02%	13.00%	8.89%	5,860
1982	2.24%	0.16%	17.46%	6.63%	0.84%	9.80%	0.91%	42.75%	11.23%	7.99%	5,584
1983	2.45%	0.16%	17.67%	6.87%	0.83%	9.91%	0.95%	43.48%	9.34%	8.35%	5,559
1984	2.61%	0.16%	18.09%	7.47%	0.73%	10.01%	0.99%	42.55%	8.70%	8.70%	5,756
1985	2.70%	0.17%	18.24%	7.75%	0.73%	10.17%	0.92%	43.42%	7.65%	8.24%	5,741
1986	2.76%	0.20%	17.90%	8.03%	0.61%	9.29%	0.87%	43.19%	8.72%	8.43%	5,943
1987	2.79%	0.15%	17.85%	8.32%	0.58%	9.67%	0.97%	43.24%	7.59%	8.84%	6,083
1988	2.70%	0.16%	18.07%	8.38%	0.55%	9.58%	0.90%	42.44%	7.97%	9.25%	6,326
1989	2.61%	0.14%	18.22%	8.60%	0.49%	9.63%	0.92%	42.30%	7.91%	9.19%	6,324
1990	2.84%	0.15%	17.78%	8.96%	0.26%	9.16%	0.97%	42.58%	7.24%	10.08%	6,203
1991	2.66%	0.13%	17.48%	8.80%	0.28%	10.10%	0.87%	43.01%	6.94%	9.74%	6,099
1992	2.66%	0.13%	17.49%	8.54%	0.24%	10.30%	0.87%	42.68%	6.43%	10.67%	6,233

Source: State Energy Data Report 1992: Consumption Estimates, Energy Information Administration, U.S. Department of Energy.

Exhibit 8

Petroleum Product Consumption by Sector (Percent of Total Petroleum Product Consumption)



The industrial sector's share of petroleum product consumption has remained fairly constant at just over 25%. This sector is comprised of manufacturing, mining, construction, agriculture, fisheries, and forestry industries. It consumes 100% of the asphalt and road oil, 99% of the petroleum products in the "other" category, 80% of the LPG and 18% of the distillate fuel. Petroleum products provide approximately 27.5% of the energy consumed by the industrial sector. Industry has been utilizing relatively more natural gas and electricity; as a result, this share has been gradually falling since the early 80s and is down approximately two percentage points since that time.

The three remaining sectors - residential, commercial, and utilities - together consume less than 10% of the petroleum products consumed in the U.S.: 4.3%, 2.3%, and 2.4% respectively. The fall seen in the consumption shares in these sectors can be attributed to a growing reliance on competing energy sources. The residential and commercial sectors have been switching to electricity at the expense of petroleum and natural gas whereas coal and nuclear energy sources have been replacing petroleum products used by electric utilities.

Exhibit 9 presents petroleum product consumption data for each state in the five-state Study Area. With the exception of Illinois, each state's share of U.S. consumption has declined only slightly since the early 70s. Illinois' share has declined more noticeably, having fallen almost two percentage points over the period. Exhibit 10 graphically presents petroleum product consumption levels for each of the five states in the Study Area. Between 1979 and 1981, each state significantly reduced their consumption of petroleum products. Illinois and Iowa have continued to exhibit slight downward trends in their consumption levels whereas consumption levels in Minnesota and Missouri have been growing steadily.

Exhibit 11 ranks all fifty states in terms of their consumption of petroleum products. With the exception of Iowa, the states in the Study Area are in top half of the ranking. States that border the western side of the Study Area (Nebraska, North Dakota, South Dakota) consume relatively small amounts of petroleum whereas eastern neighbors (Indiana, Ohio, Michigan) consume significant amounts.

Exhibit 9
Consumption of Petroleum Products: Illinois
 (Percent of U.S. Consumption)

Year	by End Product										by Sector					Total
	Asphalt & Road Oil	Aviation Gasoline	Distillate Fuel	Jet Fuel	Kerosene	LPG	Lubricant	Motor Gasoline	Residual Fuel	Other	Residential	Commercial	Industrial	Transportation		
1970	7.76%	1.32%	4.80%	6.41%	3.73%	6.37%	6.51%	5.07%	3.48%	5.84%	4.15%	5.02%	6.56%	4.96%	5.10%	
1971	6.82%	1.29%	5.10%	6.51%	3.55%	6.35%	6.57%	4.93%	2.85%	5.52%	4.16%	4.19%	6.07%	4.91%	4.95%	
1972	6.39%	1.02%	5.06%	7.29%	5.02%	6.34%	6.51%	4.88%	3.24%	6.01%	4.33%	4.36%	6.22%	5.07%	5.07%	
1973	6.56%	0.81%	4.69%	7.52%	5.68%	6.48%	6.46%	4.89%	2.92%	6.18%	4.33%	4.21%	6.23%	5.03%	4.98%	
1974	6.10%	0.74%	4.90%	6.94%	5.12%	6.91%	6.41%	4.85%	3.06%	6.10%	4.52%	4.63%	6.36%	4.93%	5.01%	
1975	6.68%	0.59%	4.92%	6.79%	4.52%	7.23%	6.24%	4.87%	3.13%	6.14%	4.73%	4.87%	6.53%	4.92%	5.07%	
1976	6.60%	0.53%	4.99%	7.07%	2.35%	7.73%	6.19%	4.80%	2.43%	5.56%	4.81%	4.39%	6.10%	4.86%	4.90%	
1977	6.96%	0.64%	4.66%	7.16%	2.23%	7.60%	5.98%	4.76%	2.44%	5.09%	4.66%	4.12%	5.75%	4.80%	4.77%	
1978	6.62%	0.15%	4.73%	7.03%	2.88%	7.65%	5.92%	4.83%	2.69%	5.11%	4.98%	4.41%	5.77%	4.80%	4.85%	
1979	6.20%	0.09%	4.03%	6.19%	1.33%	8.91%	5.91%	4.64%	2.83%	4.71%	3.49%	3.69%	5.81%	4.59%	4.73%	
1980	5.58%	1.02%	3.50%	5.03%	1.04%	7.21%	5.99%	4.53%	3.08%	4.43%	2.32%	2.91%	5.51%	4.26%	4.39%	
1981	4.87%	2.47%	3.34%	4.60%	1.45%	6.38%	5.95%	4.46%	2.73%	4.02%	2.30%	3.74%	5.02%	4.12%	4.18%	
1982	3.89%	2.40%	3.34%	4.50%	0.93%	4.91%	5.95%	4.41%	2.47%	4.31%	2.51%	3.40%	4.38%	4.09%	4.02%	
1983	3.94%	2.60%	3.54%	4.17%	1.39%	4.91%	6.00%	4.43%	2.64%	4.52%	2.53%	3.59%	4.61%	4.18%	4.12%	
1984	3.82%	2.23%	3.50%	0.62%	1.53%	4.53%	5.95%	4.29%	1.97%	4.25%	2.19%	3.26%	4.20%	3.66%	3.67%	
1985	4.84%	2.12%	3.07%	0.62%	1.80%	4.65%	5.96%	4.46%	1.48%	4.24%	2.19%	3.03%	4.25%	3.69%	3.68%	
1986	3.77%	1.74%	3.30%	0.43%	1.13%	5.89%	5.94%	4.23%	1.61%	4.72%	1.91%	2.12%	4.96%	3.53%	3.71%	
1987	3.71%	1.77%	3.14%	0.39%	0.87%	7.12%	5.92%	4.19%	1.51%	4.74%	1.80%	1.95%	5.51%	3.45%	3.80%	
1988	3.28%	1.87%	2.95%	0.75%	1.00%	7.48%	5.91%	4.33%	1.17%	4.83%	1.77%	2.01%	5.57%	3.56%	3.84%	
1989	4.88%	2.13%	3.00%	0.83%	1.18%	2.03%	5.96%	4.32%	0.81%	4.84%	1.72%	1.62%	3.65%	3.59%	3.34%	
1990	4.74%	1.82%	3.86%	0.71%	1.09%	2.20%	5.93%	4.56%	0.81%	4.91%	1.76%	1.79%	3.81%	3.90%	3.64%	
1991	4.89%	2.20%	3.39%	1.20%	1.19%	2.36%	6.00%	3.98%	0.82%	4.85%	1.95%	1.84%	3.75%	3.45%	3.36%	
1992	5.60%	2.20%	3.34%	1.39%	0.95%	1.94%	6.01%	4.00%	0.59%	4.91%	1.78%	1.99%	3.71%	3.46%	3.38%	

Source: State Energy Data Report 1992: Consumption Estimates, Energy Information Administration, U.S. Department of Energy.

Exhibit 9
Consumption of Petroleum Products: Iowa
(Percent of U.S. Consumption)

Year	by End Product										by Sector					Total
	Asphalt & Road Oil	Aviation Gasoline	Distillate Fuel	Jet Fuel	Kerosene	LPG	Lubricant	Gasoline	Motor Gasoline	Residual Fuel	Other	Residential	Commercial	Industrial	Transportation	
1970	1.79%	1.28%	1.48%	0.21%	0.51%	2.47%	1.40%	1.69%	0.05%	0.16%	1.78%	0.91%	1.32%	1.27%	1.24%	
1971	1.87%	1.45%	1.47%	0.18%	0.41%	2.44%	1.19%	1.70%	0.05%	0.23%	1.71%	0.90%	1.27%	1.33%	1.24%	
1972	1.74%	1.41%	1.40%	0.19%	0.59%	2.41%	1.18%	1.65%	0.05%	0.23%	1.83%	0.98%	1.17%	1.30%	1.21%	
1973	1.37%	0.58%	1.38%	0.18%	0.68%	2.40%	1.27%	1.73%	0.06%	0.23%	1.81%	0.96%	1.16%	1.36%	1.21%	
1974	1.46%	1.45%	1.38%	0.21%	0.56%	2.61%	1.26%	1.63%	0.07%	0.23%	1.81%	0.99%	1.19%	1.33%	1.21%	
1975	1.50%	1.36%	1.40%	0.23%	0.37%	2.81%	1.31%	1.60%	0.07%	0.22%	1.82%	1.03%	1.21%	1.33%	1.23%	
1976	1.63%	1.58%	1.32%	0.27%	0.35%	3.62%	1.30%	1.60%	0.09%	0.61%	1.74%	1.17%	1.46%	1.35%	1.30%	
1977	1.61%	1.46%	1.31%	0.26%	0.32%	3.44%	1.23%	1.57%	0.10%	0.66%	1.69%	1.26%	1.38%	1.33%	1.26%	
1978	1.62%	1.53%	1.35%	0.29%	0.32%	3.04%	1.22%	1.51%	0.08%	0.68%	1.66%	1.29%	1.31%	1.28%	1.22%	
1979	1.81%	1.36%	1.71%	0.26%	0.67%	2.53%	1.21%	1.50%	0.12%	0.76%	2.16%	1.62%	1.35%	1.26%	1.27%	
1980	1.17%	1.42%	1.52%	0.21%	0.29%	2.08%	1.23%	1.47%	0.05%	0.79%	1.90%	0.84%	1.21%	1.20%	1.15%	
1981	1.58%	1.46%	1.41%	0.19%	0.81%	1.85%	1.22%	1.43%	0.01%	0.46%	1.97%	0.88%	1.12%	1.15%	1.11%	
1982	1.53%	1.23%	1.67%	0.17%	0.96%	2.19%	1.22%	1.38%	0.05%	0.41%	2.21%	1.00%	1.25%	1.19%	1.20%	
1983	1.18%	1.21%	1.44%	0.15%	0.19%	2.18%	1.23%	1.34%	0.04%	0.35%	2.05%	1.13%	1.07%	1.18%	1.14%	
1984	1.23%	0.99%	1.48%	0.14%	0.43%	1.27%	1.22%	1.32%	0.03%	0.38%	1.60%	0.98%	0.89%	1.14%	1.05%	
1985	1.31%	0.83%	1.48%	0.13%	0.37%	1.46%	1.22%	1.26%	0.04%	0.38%	1.57%	1.03%	1.04%	1.08%	1.06%	
1986	1.24%	1.26%	1.50%	0.12%	0.32%	1.59%	1.22%	1.22%	0.10%	0.21%	1.67%	0.81%	1.06%	1.04%	1.03%	
1987	1.05%	1.22%	1.45%	0.15%	0.31%	1.04%	1.22%	1.20%	0.03%	0.20%	1.28%	0.78%	0.82%	1.04%	0.96%	
1988	1.29%	1.45%	1.40%	0.13%	0.31%	1.09%	1.21%	1.21%	0.05%	0.18%	1.40%	0.87%	0.82%	1.03%	0.95%	
1989	1.04%	1.23%	1.30%	0.14%	0.23%	1.18%	1.22%	1.22%	0.04%	0.17%	1.45%	0.79%	0.75%	1.04%	0.94%	
1990	0.87%	1.10%	1.38%	0.16%	0.51%	1.12%	1.22%	1.19%	0.03%	0.18%	1.39%	0.73%	0.71%	1.04%	0.93%	
1991	0.96%	1.03%	1.37%	0.17%	0.30%	1.18%	1.23%	1.24%	0.02%	0.19%	1.63%	1.23%	0.77%	1.03%	0.96%	
1992	0.85%	0.94%	1.50%	0.15%	0.28%	1.40%	1.23%	1.19%	0.03%	0.18%	1.58%	1.22%	0.91%	1.00%	0.98%	

Source: State Energy Data Report 1992: Consumption Estimates, Energy Information Administration, U.S. Department of Energy.

Exhibit 9
Consumption of Petroleum Products: Minnesota
 (Percent of U.S. Consumption)

Year	by End Product										by Sector				Total
	Asphalt & Road Oil	Aviation Gasoline	Distillate Fuel	Jet Fuel	Kerosene	LPG	Lubricant	Motor Gasoline	Residual Fuel	Other	Residential	Commercial	Industrial	Transportation	
1970	2.71%	1.39%	2.41%	0.99%	1.76%	1.99%	1.85%	2.09%	0.64%	0.80%	2.80%	1.40%	1.76%	1.76%	1.76%
1971	2.66%	1.38%	2.45%	1.08%	1.53%	2.06%	2.24%	2.09%	0.49%	0.79%	2.94%	1.49%	1.72%	1.78%	1.76%
1972	3.06%	1.52%	2.44%	1.19%	1.13%	2.00%	2.22%	2.04%	0.77%	0.82%	3.00%	1.66%	1.85%	1.76%	1.79%
1973	3.15%	1.54%	2.37%	1.34%	1.10%	1.86%	1.77%	2.02%	0.68%	0.89%	2.91%	1.55%	1.76%	1.79%	1.74%
1974	3.18%	1.51%	2.32%	1.53%	1.65%	1.80%	1.76%	2.01%	0.61%	0.87%	2.95%	1.56%	1.71%	1.81%	1.74%
1975	3.02%	1.54%	2.34%	1.54%	1.48%	1.89%	2.01%	1.98%	0.48%	0.90%	2.88%	1.54%	1.69%	1.80%	1.72%
1976	3.62%	1.67%	2.47%	1.47%	1.68%	1.71%	1.99%	1.96%	0.55%	0.77%	3.00%	1.60%	1.72%	1.75%	1.72%
1977	3.34%	1.48%	2.21%	1.39%	1.43%	1.60%	1.93%	1.94%	0.40%	0.69%	2.85%	1.46%	1.47%	1.71%	1.60%
1978	3.12%	1.72%	2.29%	1.32%	1.05%	1.42%	1.91%	1.96%	0.40%	0.67%	2.67%	1.43%	1.49%	1.73%	1.60%
1979	2.92%	1.55%	2.24%	1.44%	0.31%	1.46%	1.90%	1.97%	0.26%	0.60%	2.63%	1.26%	1.32%	1.77%	1.55%
1980	2.46%	1.48%	2.04%	1.32%	0.37%	1.43%	1.93%	1.92%	0.35%	0.56%	2.70%	1.05%	1.17%	1.71%	1.48%
1981	3.11%	1.48%	1.81%	1.23%	0.32%	1.11%	1.92%	1.87%	0.21%	0.42%	2.56%	0.89%	1.06%	1.65%	1.42%
1982	3.10%	1.32%	2.14%	1.15%	0.49%	1.37%	1.92%	1.88%	0.27%	0.54%	3.30%	1.16%	1.35%	1.63%	1.55%
1983	3.47%	1.30%	1.77%	1.06%	0.30%	1.37%	1.93%	1.91%	0.30%	0.66%	2.42%	1.90%	1.29%	1.66%	1.54%
1984	3.11%	1.39%	1.75%	1.70%	0.65%	0.87%	1.92%	1.96%	0.22%	0.63%	2.30%	1.96%	1.06%	1.77%	1.55%
1985	3.22%	1.54%	1.85%	1.75%	0.44%	0.92%	1.92%	1.83%	0.20%	0.64%	2.19%	2.04%	1.19%	1.68%	1.54%
1986	3.34%	1.88%	1.78%	1.64%	0.34%	1.14%	1.92%	1.78%	0.35%	0.61%	2.42%	1.14%	1.36%	1.63%	1.52%
1987	3.45%	1.98%	1.68%	1.12%	0.26%	0.92%	1.91%	1.78%	0.26%	0.65%	2.25%	0.97%	1.24%	1.57%	1.45%
1988	2.86%	1.66%	1.74%	0.97%	0.44%	0.93%	1.91%	1.82%	0.25%	0.78%	2.40%	1.17%	1.20%	1.57%	1.45%
1989	2.98%	1.76%	1.67%	0.86%	1.05%	1.00%	1.92%	1.82%	0.21%	0.89%	2.56%	1.19%	1.21%	1.54%	1.44%
1990	3.43%	2.38%	1.68%	0.92%	0.26%	1.05%	1.91%	1.80%	0.22%	0.88%	2.42%	2.03%	1.28%	1.51%	1.47%
1991	3.11%	2.35%	1.99%	0.93%	0.32%	1.07%	1.94%	1.87%	0.25%	0.86%	2.78%	1.28%	1.29%	1.62%	1.55%
1992	3.22%	1.68%	1.98%	1.24%	0.35%	1.25%	1.94%	1.87%	0.30%	0.91%	2.65%	1.17%	1.38%	1.67%	1.60%

Source: State Energy Data Report 1992; Consumption Estimates, Energy Information Administration, U.S. Department of Energy.

Exhibit 9
Consumption of Petroleum Products: Missouri
 (Percent of U.S. Consumption)

Year	by End Product											by Sector				Total
	Asphalt & Road Oil	Aviation Gasoline	Distillate Fuel	Jet Fuel	Kerosene	LPG	Lubricant	Motor Gasoline	Residual Fuel	Other	Residential	Commercial	Industrial	Transportation		
			Fuel	Fuel				Gasoline	Fuel							
1970	3.47%	0.90%	1.75%	2.29%	0.67%	2.63%	2.30%	2.65%	0.44%	1.35%	1.95%	1.82%	1.64%	2.48%	2.03%	
1971	3.48%	1.15%	1.69%	2.17%	0.81%	2.60%	2.22%	2.67%	0.35%	1.08%	1.96%	1.77%	1.51%	2.48%	1.98%	
1972	3.28%	1.09%	1.71%	2.19%	0.56%	2.39%	2.20%	2.62%	0.29%	1.09%	1.99%	1.61%	1.43%	2.46%	1.92%	
1973	3.57%	1.89%	1.69%	2.07%	0.52%	2.35%	2.41%	2.56%	0.28%	1.08%	2.02%	1.56%	1.52%	2.36%	1.88%	
1974	3.72%	1.87%	1.63%	2.11%	0.49%	2.42%	2.39%	2.58%	0.27%	1.07%	2.14%	1.63%	1.47%	2.38%	1.90%	
1975	3.53%	1.31%	1.71%	2.28%	0.49%	2.67%	2.57%	2.56%	0.28%	1.04%	2.29%	1.73%	1.50%	2.38%	1.94%	
1976	3.07%	1.27%	1.73%	2.18%	0.88%	2.58%	2.55%	2.55%	0.30%	1.64%	2.09%	1.70%	1.59%	2.38%	1.94%	
1977	3.13%	1.26%	1.70%	2.10%	0.76%	2.57%	2.76%	2.54%	0.33%	1.69%	2.09%	1.68%	1.59%	2.36%	1.92%	
1978	3.31%	1.51%	1.85%	2.10%	0.65%	2.55%	2.73%	2.51%	0.34%	1.73%	2.10%	1.73%	1.70%	2.33%	1.96%	
1979	2.88%	1.35%	1.92%	1.90%	0.67%	2.33%	2.73%	2.47%	0.34%	1.76%	2.22%	1.90%	1.72%	2.24%	1.92%	
1980	2.76%	1.25%	1.75%	1.60%	0.54%	1.70%	2.76%	2.45%	0.16%	1.76%	1.89%	1.27%	1.52%	2.15%	1.79%	
1981	2.54%	1.90%	1.77%	1.29%	1.19%	1.38%	2.74%	2.44%	0.09%	2.10%	2.07%	1.22%	1.53%	2.12%	1.81%	
1982	2.63%	1.61%	2.15%	1.18%	1.66%	1.64%	2.75%	2.42%	0.12%	1.81%	2.18%	1.57%	1.55%	2.19%	1.91%	
1983	2.51%	1.58%	1.73%	1.43%	0.30%	1.63%	2.77%	2.43%	0.12%	1.49%	2.40%	1.56%	1.22%	2.20%	1.85%	
1984	2.64%	1.48%	1.79%	1.31%	0.38%	0.97%	2.75%	2.45%	0.07%	1.65%	1.54%	1.33%	1.24%	2.20%	1.81%	
1985	2.77%	1.35%	1.87%	1.32%	0.35%	0.96%	2.75%	2.41%	0.17%	1.62%	1.52%	1.36%	1.31%	2.19%	1.84%	
1986	2.82%	1.37%	1.72%	1.41%	0.21%	1.07%	2.74%	2.47%	0.11%	1.62%	1.68%	1.36%	1.24%	2.22%	1.84%	
1987	2.56%	1.49%	1.77%	1.47%	0.21%	1.06%	2.73%	2.42%	0.15%	1.64%	1.62%	1.58%	1.28%	2.20%	1.85%	
1988	3.31%	1.62%	1.86%	1.38%	0.28%	1.08%	2.73%	2.42%	0.15%	1.51%	1.49%	1.48%	1.39%	2.19%	1.85%	
1989	2.75%	2.22%	1.92%	1.34%	0.37%	1.36%	2.75%	2.38%	0.11%	1.49%	1.80%	1.20%	1.33%	2.20%	1.85%	
1990	2.54%	1.40%	1.88%	1.20%	0.28%	1.21%	2.74%	2.41%	0.14%	1.58%	1.79%	1.19%	1.33%	2.17%	1.85%	
1991	2.51%	1.46%	1.91%	1.40%	0.38%	1.40%	2.77%	2.44%	0.13%	1.67%	2.26%	1.46%	1.34%	2.21%	1.91%	
1992	2.31%	1.44%	2.06%	1.41%	0.29%	1.32%	2.77%	2.45%	0.17%	1.67%	2.24%	1.57%	1.32%	2.26%	1.94%	

Source: State Energy Data Report 1992; Consumption Estimates, Energy Information Administration, U.S. Department of Energy.

Exhibit 9
Consumption of Petroleum Products: Wisconsin
(Percent of U.S. Consumption)

Year	by End Product										by Sector				Total
	Asphalt & Road Oil	Aviation Gasoline	Distillate Fuel	Jet Fuel	Kerosene	LPG	Lubricant	Motor Gasoline	Residual Fuel	Other	Residential	Commercial	Industrial	Transportation	
1970	2.87%	1.66%	2.79%	0.45%	3.13%	1.72%	1.98%	2.15%	0.37%	0.39%	3.59%	1.23%	1.48%	1.75%	1.75%
1971	2.67%	1.52%	2.73%	0.51%	2.48%	1.74%	1.99%	2.13%	0.26%	0.47%	3.51%	1.25%	1.43%	1.76%	1.71%
1972	2.58%	1.64%	2.52%	0.53%	1.78%	1.69%	1.97%	2.13%	0.26%	0.46%	3.41%	1.26%	1.31%	1.76%	1.65%
1973	2.63%	1.18%	2.43%	0.59%	1.90%	1.65%	2.07%	2.10%	0.24%	0.45%	3.42%	1.20%	1.29%	1.75%	1.62%
1974	2.07%	1.24%	2.50%	0.59%	1.73%	1.65%	2.05%	2.12%	0.20%	0.45%	3.60%	1.27%	1.21%	1.78%	1.62%
1975	1.97%	1.24%	2.55%	0.60%	1.68%	1.74%	1.85%	2.12%	0.23%	0.43%	3.52%	1.31%	1.22%	1.80%	1.64%
1976	2.39%	1.32%	2.63%	0.62%	1.25%	1.84%	1.83%	2.10%	0.31%	0.37%	3.55%	1.33%	1.29%	1.80%	1.66%
1977	1.98%	1.30%	2.51%	0.60%	1.04%	2.06%	1.76%	2.10%	0.32%	0.32%	3.53%	1.28%	1.25%	1.79%	1.62%
1978	2.33%	0.91%	2.61%	0.61%	1.08%	1.76%	1.74%	2.10%	0.33%	0.33%	3.65%	1.32%	1.19%	1.81%	1.64%
1979	1.91%	0.81%	2.66%	0.66%	0.32%	1.19%	1.73%	2.09%	0.24%	0.32%	3.87%	1.22%	1.01%	1.79%	1.55%
1980	2.08%	0.95%	2.14%	0.61%	0.38%	1.12%	1.76%	2.06%	0.19%	0.31%	3.38%	1.07%	0.83%	1.71%	1.42%
1981	1.56%	0.98%	2.03%	0.62%	0.27%	0.92%	1.74%	2.01%	0.11%	0.55%	3.46%	0.91%	0.80%	1.69%	1.42%
1982	1.69%	0.34%	2.10%	0.57%	0.51%	1.08%	1.75%	1.94%	0.34%	0.53%	3.75%	1.16%	0.94%	1.65%	1.48%
1983	1.50%	1.26%	2.08%	0.48%	0.26%	1.08%	1.76%	1.94%	0.15%	0.50%	3.09%	2.31%	0.83%	1.65%	1.46%
1984	1.01%	1.07%	2.11%	0.37%	0.39%	0.96%	1.75%	1.90%	0.13%	0.54%	3.36%	2.33%	0.73%	1.60%	1.42%
1985	1.09%	1.02%	2.16%	0.37%	0.56%	0.92%	1.75%	1.87%	0.09%	0.50%	3.33%	2.24%	0.70%	1.59%	1.43%
1986	1.25%	0.90%	2.06%	0.33%	0.26%	0.97%	1.74%	1.85%	0.20%	0.42%	3.36%	1.45%	0.76%	1.57%	1.39%
1987	1.41%	0.92%	1.95%	0.29%	0.33%	0.96%	1.74%	1.80%	0.26%	0.41%	3.13%	1.47%	0.76%	1.52%	1.36%
1988	2.00%	0.93%	2.12%	0.25%	0.20%	0.99%	1.74%	1.85%	0.22%	0.38%	3.30%	1.62%	0.82%	1.57%	1.41%
1989	2.31%	1.43%	2.11%	0.25%	0.20%	1.14%	1.75%	1.84%	0.21%	0.38%	3.21%	1.97%	0.84%	1.58%	1.42%
1990	2.09%	1.36%	2.09%	0.26%	0.30%	1.17%	1.74%	1.84%	0.25%	0.37%	3.46%	1.92%	0.85%	1.56%	1.42%
1991	2.06%	1.31%	2.16%	0.25%	0.29%	1.38%	1.76%	1.90%	0.20%	0.38%	3.95%	2.16%	0.90%	1.58%	1.48%
1992	1.87%	1.51%	2.09%	0.32%	0.34%	1.21%	1.76%	1.89%	0.21%	0.38%	3.67%	1.97%	0.81%	1.60%	1.45%

Source: State Energy Data Report 1992: Consumption Estimates, Energy Information Administration, U.S. Department of Energy.

Exhibit 10

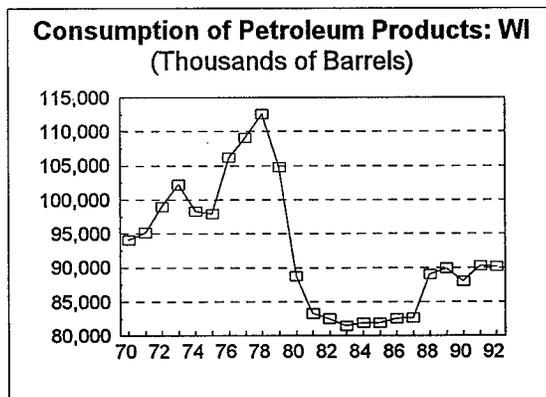
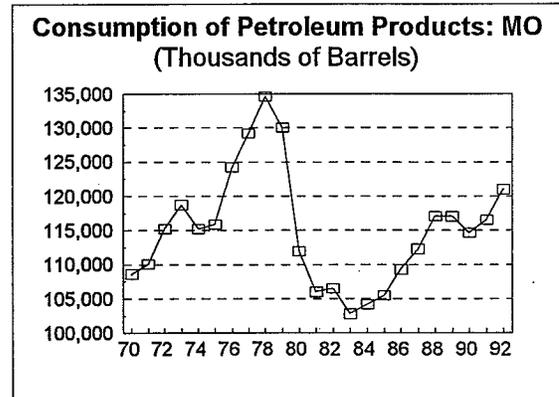
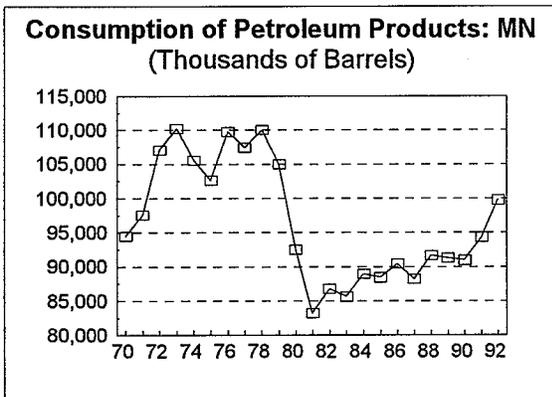
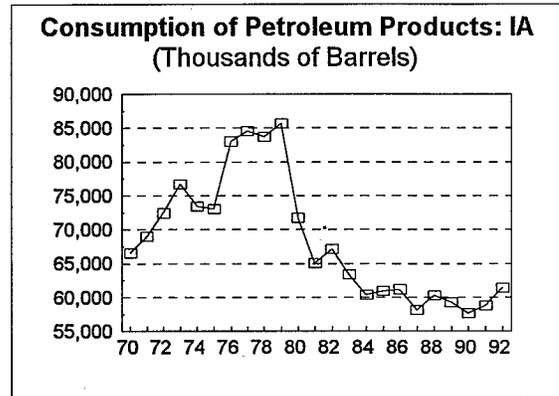
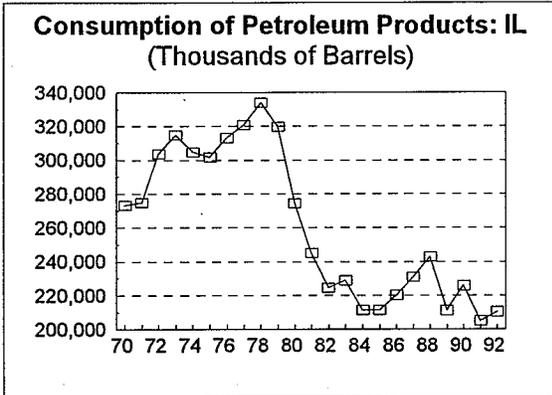


Exhibit 11
1992 Petroleum Energy Consumption by State
(Trillion Btu)

Rank	State	Consumption
1	Texas	4,664.7
2	California	3,242.5
3	Florida	1,577.1
4	New York	1,573.5
5	Louisiana	1,508.2
6	Pennsylvania	1,268.1
7	New Jersey	1,212.9
8	Illinois	1,142.6
9	Ohio	1,136.7
10	Michigan	913.6
11	Washington	860.4
12	Indiana	808.3
13	Georgia	807.8
14	North Carolina	754.3
15	Massachusetts	750.8
16	Virginia	732.2
17	Missouri	648.2
18	Tennessee	608.0
19	Minnesota	540.1
20	Kentucky	539.3
21	Alabama	538.2
22	Maryland	498.0
23	Wisconsin	481.2
24	Oklahoma	472.9
25	Mississippi	415.4
26	Connecticut	413.7
27	South Carolina	404.7
28	Kansas	395.6
29	Oregon	368.9
30	Arizona	363.7
31	Colorado	349.3
32	Iowa	320.2
33	West Virginia	295.0
34	Arkansas	286.3
35	Hawaii	258.3
36	New Mexico	241.1
37	Maine	224.9
38	Utah	207.7
39	Nebraska	206.8
40	Alaska	205.7
41	Nevada	176.4
42	Montana	149.3
43	New Hampshire	142.7
44	Delaware	140.6
45	Idaho	123.3
46	Wyoming	120.3
47	North Dakota	118.2
48	South Dakota	103.6
49	Rhode Island	100.7
50	Vermont	79.1
51	District of Columbia	33.7

Source: State Energy Data Report 1992: Consumption Estimates, Energy Information Administration, U.S. Department of Energy.

4.0 Modal Split Analysis

Only a small amount of data is available on the transportation of petroleum products in the United States. This is especially true for state or sub-state geographic areas where data often are not published to maintain the privacy of individual petroleum product shippers. Sources which compile petroleum product movements by pipeline do not seem to exist.

Furthermore, it is unlikely that the *1993 Commodity Flow Survey* (CFS), published by the U.S. Bureau of the Census, will add much to this lack of information. The CFS is being released in stages and state-level data are currently available on shipments by mode for each two-digit STCC commodity. CFS products to be released in the future are supposed to include tabulations of state-to-state flows by commodity and mode. However, these tabulations probably will not yield much modal information regarding the movement of petroleum products. Currently, many of the total state petroleum product shipments by mode are withheld for disclosure reasons and would have to be withheld in the state-to-state reports. In addition, in the STCC classification system, gasoline is included in the crude petroleum category (STCC 13) rather than in the petroleum products category (STCC 29). However, there are numerous data problems with this category in the CFS and it would be difficult to isolate the gasoline component. Note that gasoline accounts for a large percentage of the petroleum products produced in the U.S. and shipped on the Upper Mississippi River, as shown in Exhibit 5 and Exhibit 1 respectively.

According to the Eno Transportation Foundation, truck and rail together account for less than 10% of the ton-miles associated with the transportation of petroleum products in the United States. Pipelines account for approximately 60% of the ton-miles whereas water carriers account for just over 31%.

In its Petroleum Supply Annual, the Energy Information Administration (EIA) does report data on flows of petroleum products between PAD districts. The flows are shown separately for pipelines and tanker/barges but do not include intra-district movements. These flows are shown Exhibits 12-14.

Most of the inter-district shipments which involved District II were shipped by pipeline. Ninety percent of the petroleum products which moved into District II came by pipeline, the other ten percent was waterborne. Less than one percent of the petroleum products shipped from District I to District II was waterborne, whereas almost 15 percent of the petroleum products shipped from District III to District II was waterborne. On the other hand, the size of the modal shares for petroleum products leaving District II for other districts was quite different. Almost 20% of shipments leaving District II moved by water transportation. Nearly half of all shipments from District II to District I moved by water transportation. The waterborne share moving from District II to District III was the same as the waterborne share moving between these two districts in the opposite direction. Finally, 100 percent of the products that moved from District II to District IV were by pipeline.

Exhibit 12

Movements of Petroleum Products Involving PAD District II				
Year	Shipments by Mode*		Receipts by Mode*	
	Pipeline	Water	Pipeline	Water
	(% of Total)	(% of Total)	(% of Total)	(% of Total)
1988	80.83%	19.17%	87.77%	12.23%
1989	82.22%	17.78%	87.95%	12.05%
1990	78.80%	21.20%	88.22%	11.78%
1991	80.38%	19.62%	88.80%	11.20%
1992	82.03%	17.97%	89.49%	10.51%
1993	81.74%	18.26%	91.10%	8.90%
1994	80.51%	19.49%	90.28%	9.72%
1995	80.38%	19.62%	89.97%	10.03%

*Does not include intra-district movements

Source: Energy Information Administration, Petroleum Supply Annual 1994 (May 1995)

Exhibit 13

PAD District II Petroleum Product Shipments*				
by Mode and Destination				
Pipe				
Year	District			
	I	III	IV	V
	(% of Total)	(% of Total)	(% of Total)	(% of Total)
1988	24.74%	55.13%	20.13%	0.00%
1989	22.82%	55.49%	21.69%	0.00%
1990	24.01%	56.36%	19.63%	0.00%
1991	22.56%	52.23%	25.22%	0.00%
1992	22.48%	48.93%	28.59%	0.00%
1993	21.78%	47.65%	30.57%	0.00%
1994	17.12%	54.40%	28.49%	0.00%
1995	16.90%	53.56%	29.53%	0.00%
Barge				
Year	District			
	I	III	IV	V
	(% of Total)	(% of Total)	(% of Total)	(% of Total)
1988	82.14%	17.86%	0.00%	0.00%
1989	76.51%	23.49%	0.00%	0.00%
1990	75.79%	24.21%	0.00%	0.00%
1991	68.64%	31.36%	0.00%	0.00%
1992	70.21%	29.79%	0.00%	0.00%
1993	73.78%	25.88%	0.00%	0.34%
1994	67.48%	32.52%	0.00%	0.00%
1995	77.72%	22.28%	0.00%	0.00%

*Does not include intra-district movements

Source: Energy Information Administration, Petroleum Supply Annual 1994 (May 1995)

Exhibit 14

PAD District II Petroleum Product Receipts*				
by Mode and Origin				
Pipe				
Year	District			
	I	III	IV	V
	(% of Total)	(% of Total)	(% of Total)	(% of Total)
1988	22.87%	72.85%	4.28%	0.00%
1989	22.73%	72.60%	4.67%	0.00%
1990	23.90%	71.22%	4.88%	0.00%
1991	26.46%	67.51%	6.03%	0.00%
1992	25.75%	68.86%	5.39%	0.00%
1993	22.80%	71.96%	5.24%	0.00%
1994	23.32%	70.23%	6.45%	0.00%
1995	24.69%	68.19%	7.11%	0.00%
Barge				
Year	District			
	I	III	IV	V
	(% of Total)	(% of Total)	(% of Total)	(% of Total)
1988	3.12%	96.88%	0.00%	0.00%
1989	3.40%	96.59%	0.00%	0.01%
1990	3.11%	96.89%	0.00%	0.00%
1991	2.66%	97.34%	0.00%	0.00%
1992	3.23%	96.77%	0.00%	0.00%
1993	3.44%	96.56%	0.00%	0.00%
1994	1.67%	98.33%	0.00%	0.00%
1995	0.99%	99.01%	0.00%	0.00%

*Does not include intra-district movements

Source: Energy Information Administration, Petroleum Supply Annual 1994 (May 1995)

5.0 Waterway Traffic Forecasts

The waterway traffic forecasts for petroleum products are based on upon historical relationships between waterway traffic levels and proxies for supply and/or demand. Most petroleum products are transported by pipeline; however, there is no good source of pipeline data that we could forecast and compare with the water traffic. As a result, we had to forecast barge traffic directly as a function of the supply and demand proxies.

The forecasts indicate that shipments of petroleum products will remain relatively flat. Many petroleum company executives believe that water shipments of petroleum products will decrease over the next several decades. However, a few petroleum products are not readily shipped via pipeline and will continue to be moved by barge for the foreseeable future (e.g., asphalt).

For each state in the Study Area, forecasts were developed both for originating traffic and for destinating traffic. In terms of originating traffic, it was assumed that all of the barge tons of petroleum products originated either in Illinois or in Minnesota. This assumption was made because there are no petroleum refineries in the other three states. In addition, our historical barge flows are on a BEA-to-BEA origin-destination basis. Some of the BEAs overlap state boundaries and it was necessary to assign BEA originating traffic to originating states so that the traffic could be tied to state level variables.

The supply and demand proxies that were used vary by state as we attempted to use those variables that had the best explanatory power. GSP for the pipeline transportation industry in Illinois was used to explain barge traffic originating in Illinois. A negative relationship was observed, indicating that barge traffic falls as output in this competing sector increases. According to BEA's regional economic projections, GSP in the Illinois pipeline industry is expected to increase steadily over the next five years before leveling off. As shown in Exhibit 15, barge traffic originating in Illinois and carrying petroleum products is projected to remain fairly constant over the next twenty-five years before starting to fall.

For traffic originating in Minnesota, the variable with the best explanatory power was total consumption of petroleum products in Minnesota. This variable was obtained from EIA's *State Energy Data Report: Consumption Estimates* and reported in trillions of Btu's. A non-linear negative relationship was estimated, indicating that increases in Minnesota's consumption of petroleum products yield less than proportionate decreases in the amount of barge traffic originating in the state. To use the parameter estimates from this relationship to forecast waterway traffic originating in the state, it was necessary to first forecast Minnesota's total consumption of petroleum products. Minnesota's share of U.S. petroleum product consumption was assumed to remain constant at recent historical levels; this share was then multiplied by a forecast of U.S. consumption of petroleum products. In its *Annual Energy Outlook (AEO)*, the EIA forecasts to 2015 the U.S. consumption of petroleum products. We utilized these forecasts but extrapolated them to 2050 based upon the projected trend to 2015. Exhibit 16 shows the waterway traffic forecast of petroleum products originating in Minnesota; as shown, fairly low levels are anticipated throughout the forecast horizon.

Exhibit 15

Petroleum Products Originating in IL (Short Tons)

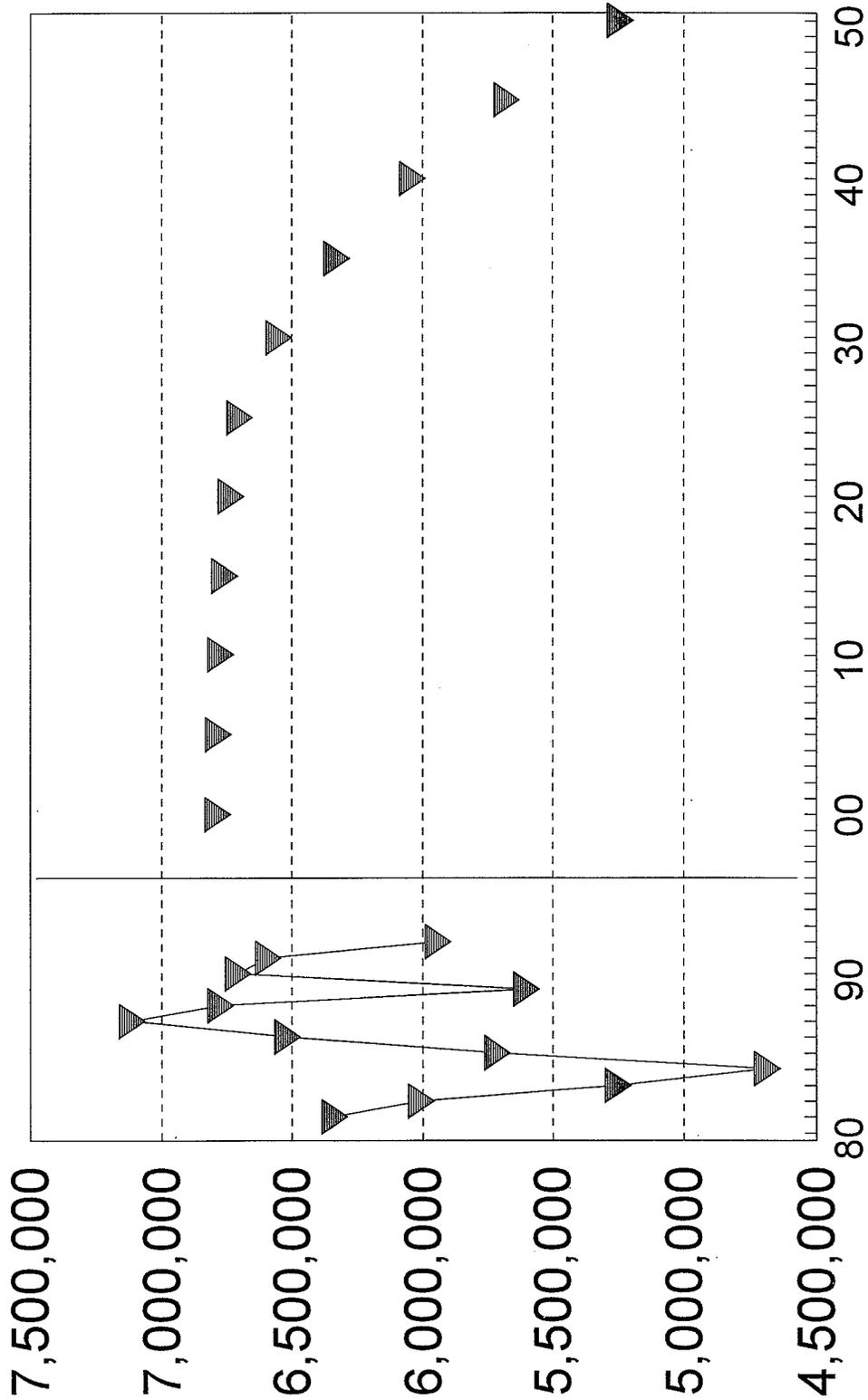
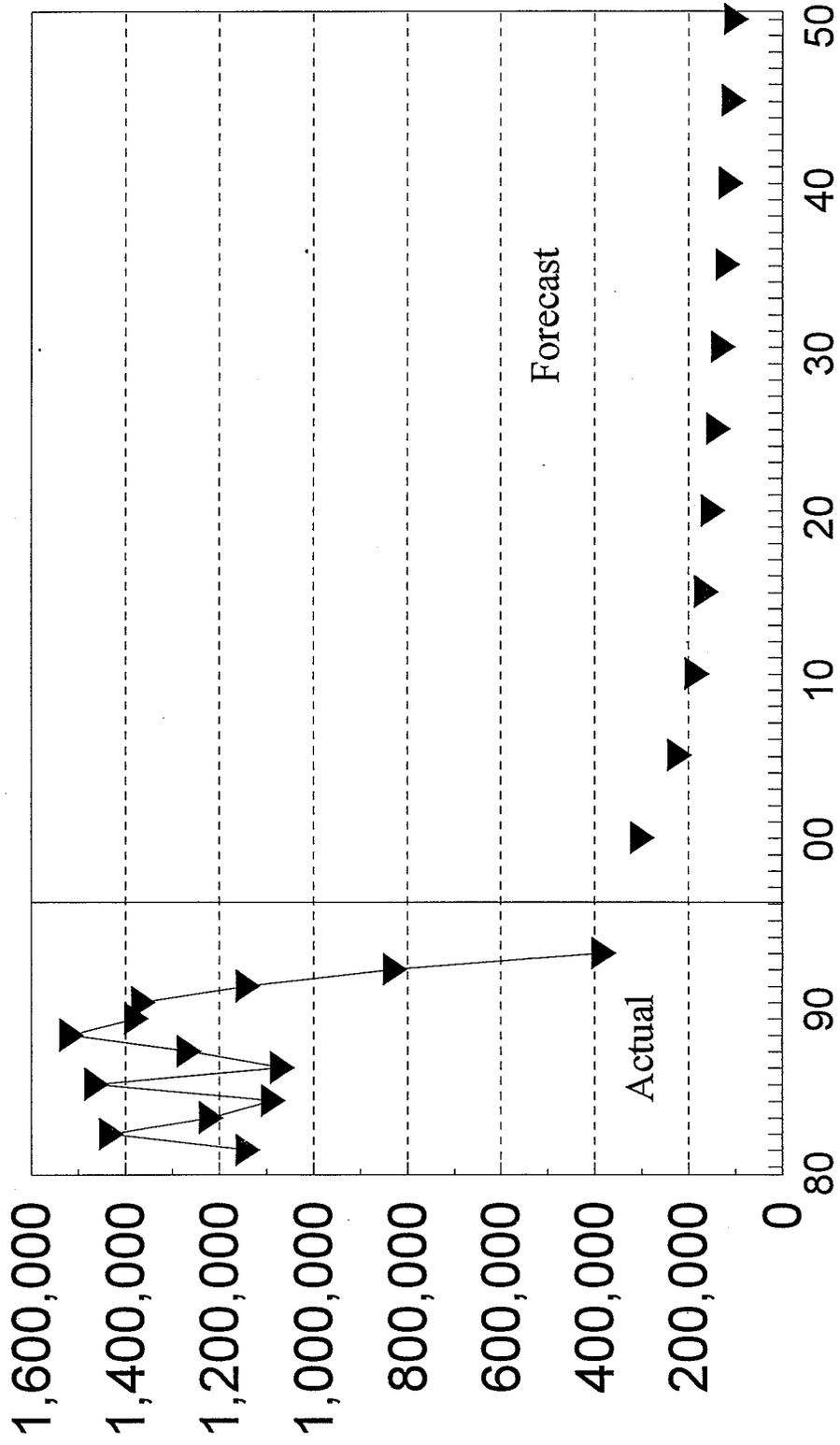


Exhibit 16

Petroleum Products Originating in MN (Short Tons)



State consumption forecasts for Illinois and Missouri were developed using the same procedure and were used to estimate destinating traffic in those states. In Illinois, the amount of petroleum products destinating in the state by barge tends to rise as the state's consumption of those products increases. In Missouri, on the other hand, a counter-intuitive negative relationship was found between destinating barge traffic and the amount of petroleum products consumed in the state. In regard to Iowa, we could not find any variable that could do as well as a simple trend in explaining the small amount of barge traffic that destinate in the state. In Minnesota, there has been a decline in the amount of barge traffic that carries petroleum products to the state. A large part of this decline is due to a steady increase in capacity initiated by Koch Refining. The refiner has not only captured the Minnesota markets but also has been increasing its share of the markets in Wisconsin. To capture this influence on barge traffic, we developed state level indices for supply (GSP in the petroleum product industry) and demand (population) and used the difference between the two to explain the destinating barge traffic. The difference has been increasing indicating that supply in the state has been growing faster than demand. As expected, a negative relationship was observed; as Minnesota's supply of petroleum products increases relative to its demand, its need for petroleum products that originate outside of the state diminishes. Exhibits 17-20 present the forecasts of destinating traffic by state.

Exhibits 21-23 tabulate the forecasts for the three main river segments of the Upper Mississippi River basin: the Illinois River, the Upper Mississippi River between the Twin Cities and the mouth of the Missouri River, and the Upper Mississippi River between the mouth of the Missouri River and the mouth of the Ohio River. The state-to-state barge traffic forecasts were first converted into flows between one of these three river segments and state origins/destinations outside of the Study Area. Origins and destinations within the Study Area were assigned to one of the three river segments and, for the given segment, the associated traffic was designated as either "inbound", "outbound", or "intra" depending upon the corresponding destination/origin. For a given flow, the most likely route was then appraised and used to develop through traffic estimates for the other two river segments. As an example, a barge flow originating in Minnesota and destinating in Louisiana would have resulted in an outbound estimate for the Twin Cities to St. Louis segment and a through traffic estimate for the Upper Mississippi River segment below St. Louis. All of barge flows were then aggregated by river segment and type of flow (outbound, inbound, intra, and through) to produce the tabulations shown in exhibits 21-23.

Exhibit 17

Petroleum Products Destinating in IL (Short Tons)

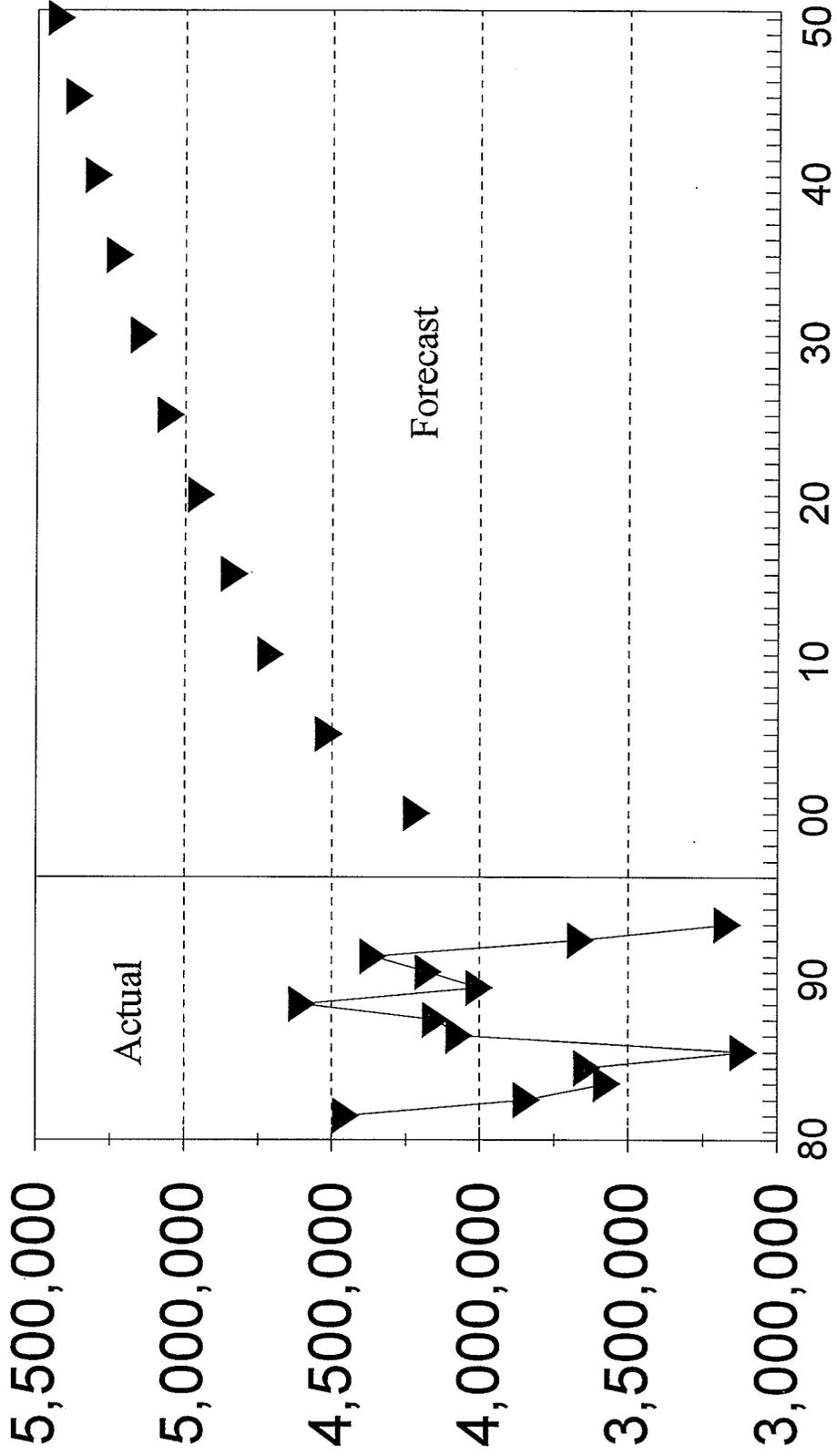


Exhibit 18

Petroleum Products Destinating in IA (Short Tons)

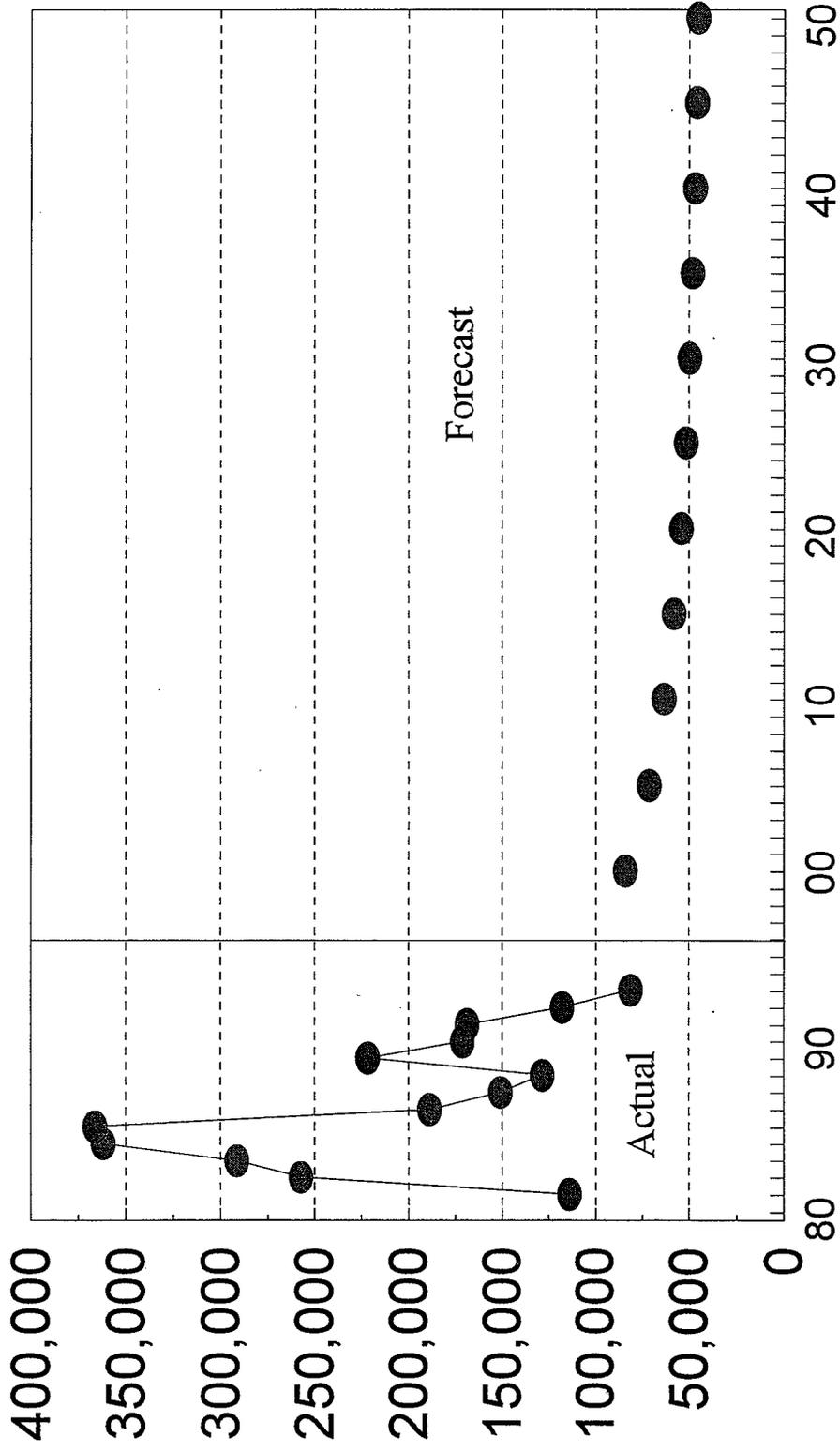


Exhibit 19

Petroleum Products Destinating in MN (Short Tons)

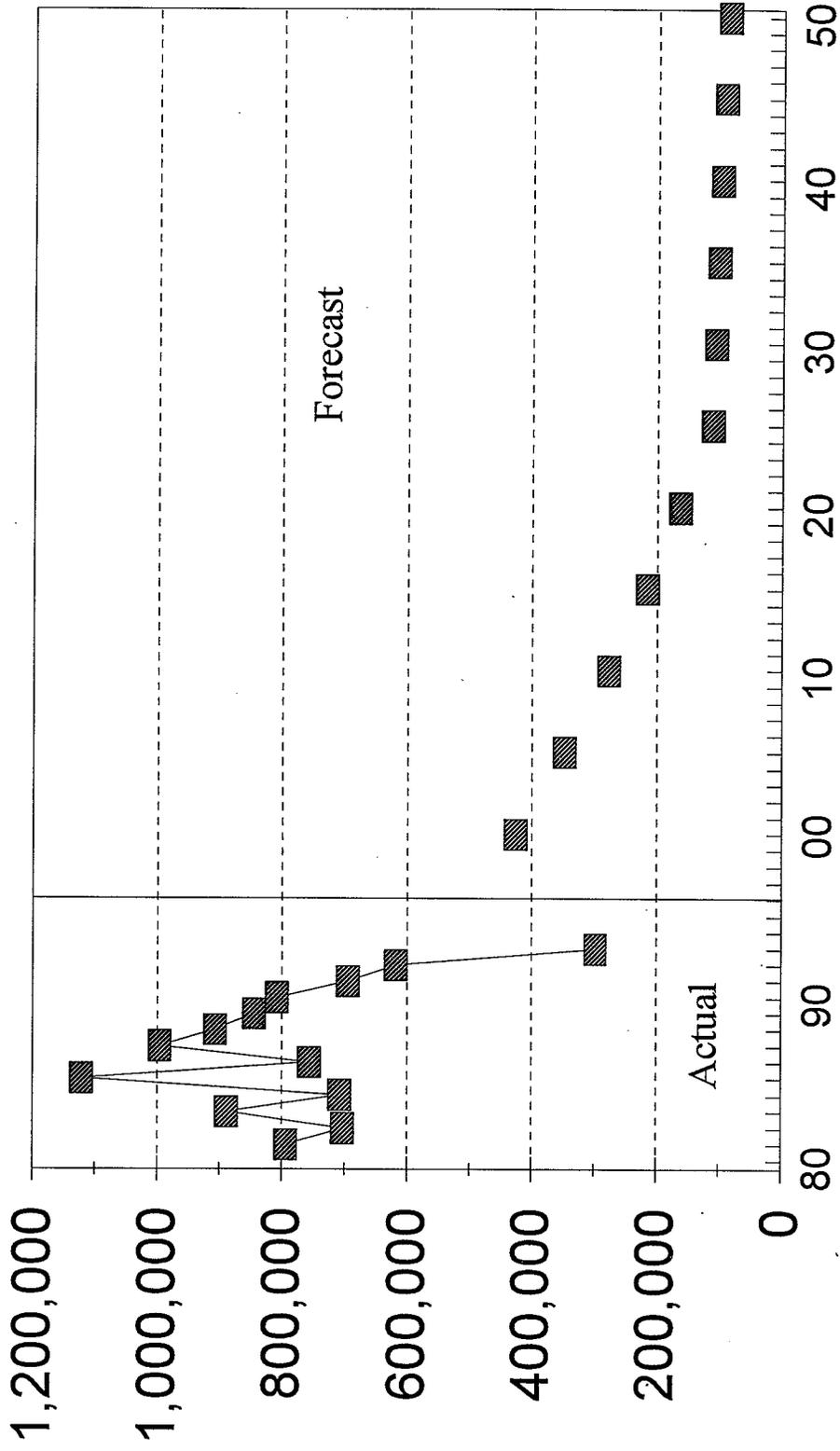


Exhibit 20

Petroleum Products Destinating in MO (Short Tons)

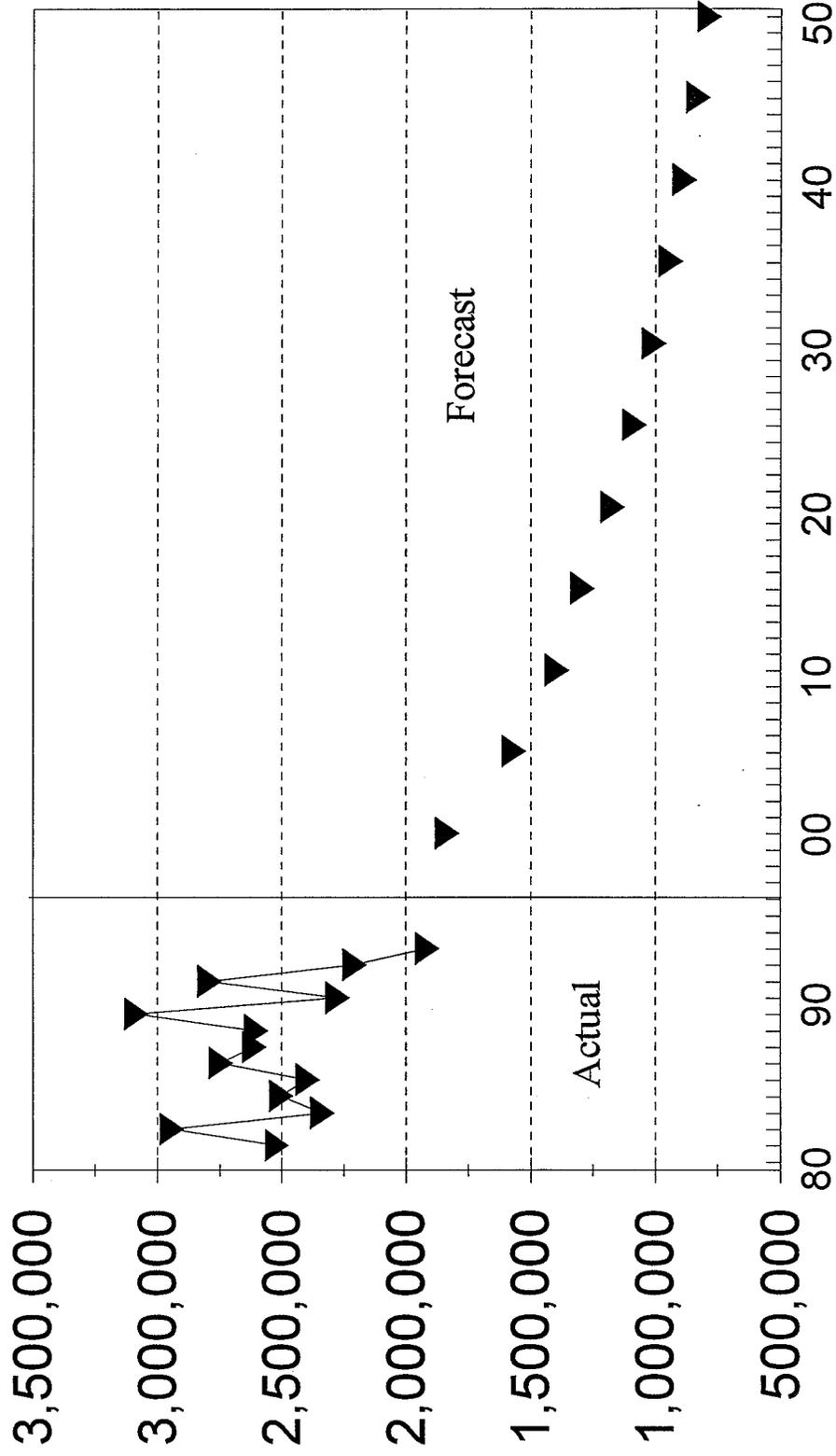


Exhibit 21					
Upper Mississippi River Traffic Projections for Petroleum Products					
(Short Tons)					
Year	Illinois Waterway				
	Outbound	Inbound	Intra	Through	Total
Avg 91-93	1,531,333	2,833,054	748,365	413,239	5,525,991
2000	1,553,259	2,944,381	1,103,660	406,641	6,007,941
2005	1,552,780	3,230,347	1,103,320	406,674	6,293,120
2010	1,550,786	3,421,179	1,101,903	407,099	6,480,966
2015	1,547,315	3,542,443	1,099,437	407,398	6,596,592
2020	1,541,486	3,655,011	1,095,295	406,237	6,698,029
2025	1,534,237	3,760,549	1,090,145	406,160	6,791,091
2030	1,499,437	3,872,891	1,065,418	404,089	6,841,836
2035	1,448,576	3,986,621	1,029,279	400,849	6,865,326
2040	1,381,654	4,103,700	981,727	396,429	6,863,510
2045	1,298,670	4,225,573	922,763	390,822	6,837,828
2050	1,199,624	4,353,334	852,387	384,025	6,789,370

Exhibit 22					
Upper Mississippi River Traffic Projections for Petroleum Products					
(Short Tons)					
Year	Twin Cities to St. Louis				
	Outbound	Inbound	Intra	Through	Total
Avg 91-93	233,211	244,513	562,228	4,877,155	5,917,107
2000	87,579	432,621	244,141	5,207,661	5,972,002
2005	66,779	410,779	186,158	5,319,310	5,983,027
2010	56,837	368,054	158,444	5,392,572	5,975,907
2015	51,650	320,987	143,983	5,435,787	5,952,407
2020	48,005	279,253	133,823	5,465,691	5,926,772
2025	44,562	237,630	124,225	5,495,353	5,901,771
2030	41,659	242,926	116,131	5,477,390	5,878,105
2035	39,154	249,328	109,149	5,430,634	5,828,265
2040	36,919	253,891	102,918	5,355,805	5,749,534
2045	34,867	253,570	97,198	5,253,442	5,639,078
2050	32,938	252,860	91,821	5,123,957	5,501,575

Exhibit 23					
Upper Mississippi River Traffic Projections for Petroleum Products					
(Short Tons)					
Year	St. Louis to Cairo				
	Outbound	Inbound	Intra	Through	Total
Avg 91-93	3,033,780	1,983,099	324,216	2,650,491	7,991,586
2000	3,439,026	1,178,988	657,775	2,442,359	7,718,147
2005	3,437,965	908,766	657,572	2,531,047	7,535,350
2010	3,433,549	738,872	656,727	2,589,420	7,418,568
2015	3,425,865	636,614	655,257	2,623,946	7,341,682
2020	3,412,959	518,940	652,789	2,654,861	7,239,549
2025	3,396,910	433,624	649,719	2,682,182	7,162,436
2030	3,319,861	372,885	634,982	2,693,753	7,021,481
2035	3,207,251	328,850	613,444	2,693,172	6,842,717
2040	3,059,079	299,422	585,103	2,680,839	6,624,443
2045	2,875,347	283,088	549,961	2,656,983	6,365,379
2050	2,656,053	278,722	508,017	2,622,323	6,065,115