

The Importance of Waterborne *Building Block* Commodities to the American Economy

The Shallow Draft Inland Waterways System



Including the:

Mississippi River System

*Gulf Intracoastal Waterway &
Connecting Waterways*

Columbia River System



Office of Ports & Domestic Shipping
Maritime Administration
U. S. Department of Transportation
Washington, DC 20590

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Executive Summary

Over the past several years much has been written and much analysis has been done regarding the throughput of the national Inland Waterways System. In this document, the Maritime Administration, assisted by Linare Consulting, provides a fresh look at the *building block* nature of the commodities that rely on our waterway transportation system. By *building block* we mean that the commodities that move on the waterways are of a basic and fundamental nature. Consequently, the economic universe to which these commodities contribute is much broader than standard estimates often provide.

Simply stated, over 650 million tons of commodities move on the inland waterway system of the United States, yet this statistic does not reveal the true nature of the economic contribution that these products provide.

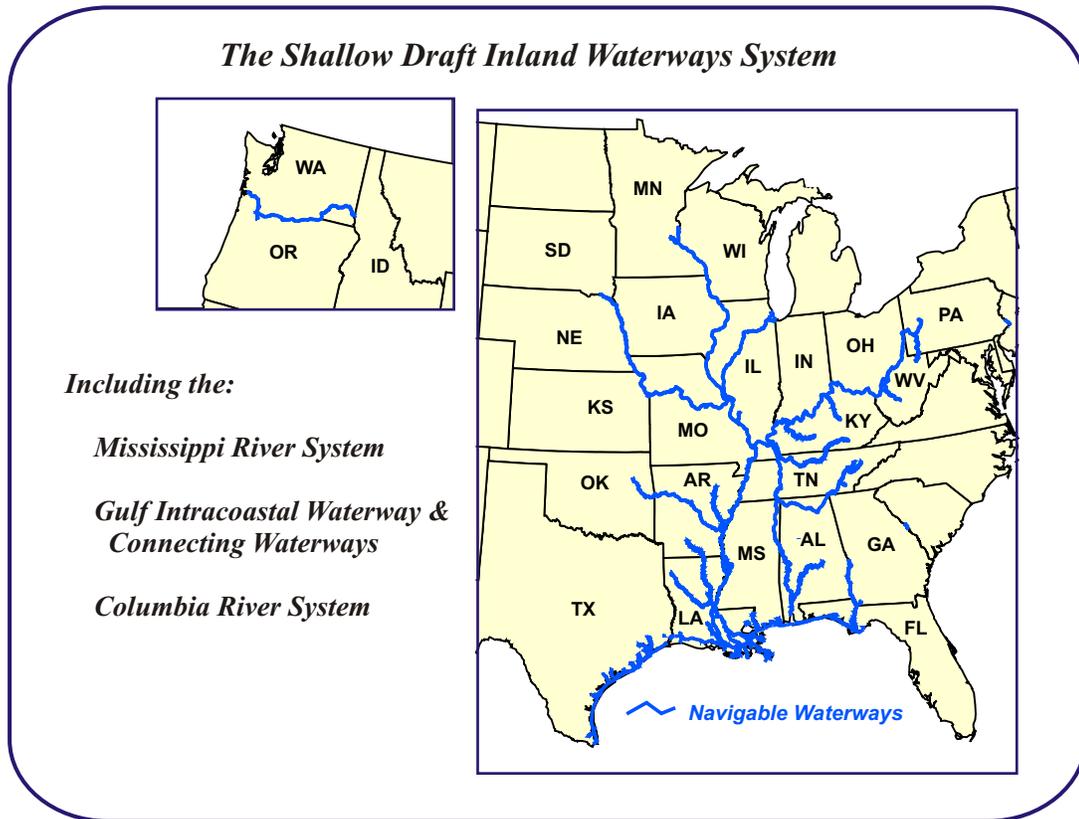
Our analysis indicates that the market value of the coal on the waterways is over \$4.9 billion and there are more than 470,000 jobs directly or indirectly associated with this traffic. Grain moving on the system has a value of \$9.6 billion and is tied to over 400,000 jobs. Waterborne petroleum and petroleum products are worth over \$34 billion, while the value of waterborne chemicals is over \$36 billion. The traffic in each of these two commodity groups is directly or indirectly associated with nearly two million jobs.

This investigation shows linkages between *building block* waterways traffic and the industries that they serve. It reinforces the concept that the waterway system of the United States is a critical part of a larger economic system that contributes billions of dollars to the economy in the form of value, employment and tax revenue.

Introduction

The shallow draft waterways system of the United States plays a major role in providing freight transportation service to the Nation and its industries and communities. Encompassing 9,000 miles of navigable channels on 23 separate waterways, this system handles over 650 million tons of commodities annually.

Traffic is loaded onto the shallow draft system in thirty-nine and is received in thirty-eight of the fifty states.



There are a variety of commodities, mostly bulk, transported in shallow draft vessels on the waterways. The leading commodity groups are:

Commodity Group	Avg Annual Tons (Millions)	Pct. Of Total
Coal	181	27.8%
Petroleum-based Fuels	125	19.2%
Minerals	109	16.8%
Grains & Agric. Products	85	13.1%
Chemicals Including Fertilizers	65	10.0%
Other	85	13.1%
Total	650	100.0%

Commodities moved on the waterways system are basic products of and inputs to the American economy. They are recognized as fundamental to industry and have been called *building block* commodities.

The Office of Ports & Domestic Shipping of the Maritime Administration, U. S. Department of Transportation, has commissioned Linare Consulting to conduct this research study to investigate the importance of certain waterborne *building block* commodities to the American economy.

In particular, this research project has investigated the following four commodities / commodity groups:

- Coal
- Petroleum & Petroleum Products
- Grains
- Chemicals

The analytic process involved the following steps:

- Computing average annual tons by commodity from U. S. Army Corps of Engineers Data.
- Applying commodity prices to obtain value of commerce (shipped and received) by commodity.
- Adjusting for imports and exports to obtain value of domestic production and consumption.
- Applying the economic analysis technique known as input-output analysis.
- Computing employment and economic output directly and indirectly associated with waterborne traffic.
- Documenting traffic patterns and results of the economic analysis for each commodity group.

Economic analysis was facilitated by use of the IMPLAN economic impact modeling package. IMPLAN uses input-output modeling techniques which trace inter-industry linkages (sales and purchases) among 505 industries which comprise the American economy. In this study IMPLAN was used to provide estimates of jobs, economic output, value added and tax payments directly and indirectly associated with production and consumption of commodities moved by water. More specifics on the analysis are provided in the Appendix.

The Role of Waterborne Coal in the National Economy

Coal is one of the principal *building block* commodities transported on the inland waterways system. On the shallow draft portion of the system, coal comprises about 180 million tons on an annual basis, which is about 27 percent of total traffic. This coal has a market value of more than \$4.9 billion.

Origins / Destinations

Waterborne coal is loaded onto the inland waterway system in twelve states. Table 1 shows the states of origin with annual tons and value of coal transported. Note that the leading state is West Virginia with nearly 52 million tons (28.5 percent of coal originated). The top four states – West Virginia, Illinois, Kentucky and Pennsylvania – account for more than 83 percent of coal originated. The pattern of originating waterborne coal is shown graphically in Figure 1.

Table 1 - Originating Waterborne Coal by State

Originating State	Average Annual Tons	Approx. Value (\$Million)
West Virginia	51,697,000	\$1,414.9
Illinois	40,569,000	\$1,110.4
Kentucky	31,649,000	\$866.2
Pennsylvania	26,657,000	\$729.6
Ohio	14,606,000	\$399.8
Alabama	11,670,000	\$319.4
Indiana	2,331,000	\$63.8
Iowa	1,455,000	\$39.8
Louisiana	388,000	\$10.6
Maryland	61,000	\$1.7
Tennessee	40,000	\$1.1
Missouri	7,000	\$0.2

Figure 1

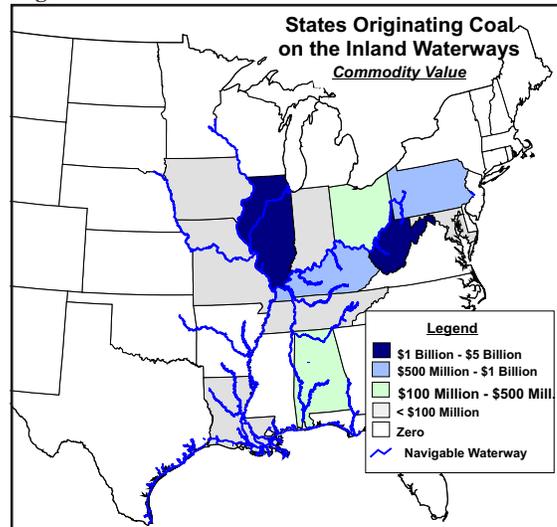


Table 2 (and Figure 2) show the pattern of coal received on the inland waterway system. There are sixteen states that receive waterborne coal. Ohio is the leading receiver of coal with more than 35 million tons (20 percent) followed by Pennsylvania at 29.4 million tons (16.5 percent). Inbound coal is more broadly distributed among the states, with eight states accounting for 94 percent of coal delivered by inland waterway.

Figure 2

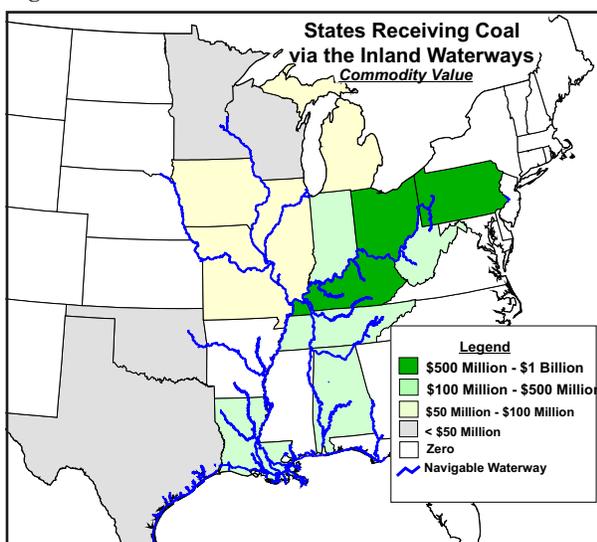


Table 2 - Terminating Waterborne Coal by State

Destination State	Average Annual Tons	Approx. Value (\$Million)
Ohio	35,565,000	\$973.4
Pennsylvania	29,445,000	\$805.9
Kentucky	19,806,000	\$542.1
Indiana	17,641,000	\$482.8
West Virginia	17,110,000	\$468.3
Louisiana	16,928,000	\$463.3
Tennessee	15,763,000	\$431.4
Alabama	14,712,000	\$402.7
Iowa	2,653,000	\$72.6
Illinois	2,425,000	\$66.4
Mississippi	2,117,000	\$58.0
Missouri	2,036,000	\$55.7
Wisconsin	1,789,000	\$49.0
Minnesota	161,000	\$4.4
Oklahoma	16,000	\$0.4
Texas	3,000	\$0.1

Economic Analysis

The value of coal moved by inland waterway – over \$4.9 billion – can be used in conjunction with input-output data and analysis to estimate its importance to the American economy. Using this form of economic analysis, output and jobs in the coal industry and in industries directly and indirectly linked to the coal industry have been estimated. Corresponding value added totals and aggregate tax revenues have also been estimated.

There are 87,500 jobs directly associated with the production and consumption of coal transported on the inland waterways.

The Direct Output (a measure of business activity, similar to sales) that results from these 87,500 jobs has a value of \$41.3 billion.

The total number of associated jobs is 474,200, which includes jobs indirectly associated with coal shipments (in industries that directly and indirectly buy from and sell to any associated industries, including industries associated through employee expenditures).

The Total Output associated with these 474,200 jobs amounts to \$91 billion.

Direct Value Added is over \$22 billion, while the Total Value Added exceeds \$54 billion. Value Added is used by economists as a measure of the increase in the value of goods as a result of the production process. Value Added is sales less the cost of intermediate goods (materials) and services.

Impacted Industries

The analysis also shows output and employment associated with waterborne coal in each of the 505 industries that comprise the American economy, some of which are much more heavily impacted than others.

Table 3 shows the twenty most strongly linked industries in terms of Output. The industry at the top of the list is the leading consumer of coal -- Power Generation and Supply – at \$28 billion. That is followed by two other industries that consume coal – Iron & Steel Mills (\$6.3 billion) and State & Local Government Electric Utilities (\$4.0 billion). The fourth industry – Coal Mining – produces the coal, and has a Direct Output impact of \$3.8 billion.

Output impacts are spread widely through the economy – 97 of the 505 industries in the analytic model show Total Output associated with waterborne coal greater than \$100 million.

Table 3 - Most Strongly Linked Industries - Output

Industry	Output (\$Million)	
	Direct	Total
Power generation and supply (investor owned)	\$28,059	\$28,727
Iron and steel mills	\$5,841	\$6,335
State and local government electric utilities	\$3,965	\$4,057
Coal mining	\$3,448	\$3,794
Wholesale trade	\$0	\$2,949
Oil and gas extraction	\$0	\$2,043
Real estate	\$0	\$1,820
Owner-occupied dwellings	\$0	\$1,772
Monetary authorities and depository credit interme	\$0	\$1,351
Food services and drinking places	\$0	\$1,232
Hospitals	\$0	\$1,171
Petroleum refineries	\$0	\$1,033
Automotive repair and maintenance- except car wash	\$0	\$1,013
Lessors of nonfinancial intangible assets	\$0	\$979
Insurance carriers	\$0	\$959
Offices of physicians- dentists- and other health	\$0	\$905
Rail transportation	\$0	\$892
Other maintenance and repair construction	\$0	\$871
Telecommunications	\$0	\$867
Truck transportation	\$0	\$859

Table 4 shows the twenty leading industries in terms of employment.

Power Generation and Supply leads with more than 55,000 jobs associated with waterborne coal. The other three directly linked industries are also among the top twenty. However, they are not at the top of the list, largely because other industries, such as Food Services and Drinking Places have lower levels of compensation (thus, more jobs per \$1 million of Output).

Associated jobs are also widely distributed through the economy – 88 of the 505 industries have more than 1,000 jobs tied to waterborne coal.

Table 4 - Most Strongly Linked Industries - Employment (Jobs)

Industry	Employment (Jobs)	
	Direct	Total
Power generation and supply (investor-owned)	53,972	55,258
Food services and drinking places	0	28,434
Wholesale trade	0	19,596
Iron and steel mills	14,785	16,034
Employment services	0	12,769
Coal mining	10,646	11,714
Other maintenance and repair construction	0	11,103
Real estate	0	10,814
Hospitals	0	9,483
Offices of physicians- dentists- and other health	0	8,840
State and local government electric utilities	8,105	8,292
Legal services	0	7,054
Automotive repair and maintenance- except car wash	0	6,824
Food and beverage stores	0	6,739
Securities- commodity contracts- investments	0	6,525
General merchandise stores	0	6,505
Nursing and residential care facilities	0	6,458
Truck transportation	0	6,409
Services to buildings and dwellings	0	5,404
Management of companies and enterprises	0	5,326

Industrial Sectors

It is also useful to group the results for individual industries into industrial sectors.

Table 5 shows the distribution of jobs associated with waterborne coal, by sector.

Note that Utilities is the most strongly linked sector with nearly 56,000 jobs affected. That is closely followed by the Manufacturing sector at 51,000 jobs, then Retail Trade at 40,000 jobs and Health & Social Services at 35,000 jobs.

Table 5 - Employment (Jobs) by Industrial Sector

Industrial Sector	Employment (Jobs)	
	Direct	Total
Agriculture, Forestry, Fishing & Hunting	0	6,712
Mining	10,646	21,352
Utilities	53,972	55,904
Construction	0	13,418
Manufacturing	14,785	51,229
Wholesale Trade	0	19,596
Transportation & Warehousing	0	27,246
Retail Trade	0	40,398
Information	0	9,622
Finance & Insurance	0	22,470
Real Estate & Rental	0	14,376
Professional - Scientific & Tech Services	0	28,848
Management of Companies	0	5,326
Administrative & Waste Services	0	29,016
Educational Services	0	8,522
Health & Social Services	0	35,205
Arts - Entertainment & Recreation	0	12,658
Accommodation & Food Services	0	32,103
Other Services	0	27,987
Government & Other	8,105	12,235
Total	87,508	474,219

Table 6 shows the distribution of Direct and Total Output associated with waterborne coal among industrial sectors.

Note that the Utilities sector has the highest value at over \$29 billion in Total Output. Next comes Manufacturing at \$15 billion. The Mining Sector follows with \$6.9 billion in Total Output tied to coal transported on the inland waterways system.

Taxes

The analysis also resulted in approximate estimates of tax payments tied to waterborne coal, as shown in Table 7.

The taxes paid in association with all linked activities amounts to about \$8 billion in federal taxes, and \$7 billion in state and local taxes, for a grand total tax payments associated with waterborne coal of nearly \$15 billion.

Table 6 - Output by Industrial Sector

Industrial Sector	Output (\$Million)	
	Direct	Total
Agriculture, Forestry, Fishing & Hunting	\$0	\$519
Mining	\$3,448	\$6,876
Utilities	\$28,059	\$29,093
Construction	\$0	\$1,098
Manufacturing	\$5,841	\$15,180
Wholesale Trade	\$0	\$2,949
Transportation & Warehousing	\$0	\$4,222
Retail Trade	\$0	\$2,234
Information	\$0	\$2,195
Finance & Insurance	\$0	\$4,105
Real Estate & Rental	\$0	\$3,367
Professional - Scientific & Tech Services	\$0	\$3,122
Management of Companies	\$0	\$703
Administrative & Waste Services	\$0	\$1,545
Educational Services	\$0	\$433
Health & Social Services	\$0	\$3,030
Arts - Entertainment & Recreation	\$0	\$611
Accommodation & Food Services	\$0	\$1,525
Other Services	\$0	\$2,155
Government & Other	\$3,965	\$6,380
Total	\$41,313	\$91,343

Table 7 - Associated Tax Payments

	Taxes Paid (\$Million)	
Federal Government		
Corporate Profits Tax	\$1,166	
Indirect Bus Tax: Custom Duty	\$180	
Indirect Bus Tax: Excise Taxes	\$580	
Indirect Bus Tax: Fed NonTaxes	\$205	
Personal Tax: Estate and Gift Tax	\$0	
Personal Tax: Income Tax	\$2,946	
Personal Tax: NonTaxes (Fines- Fees	\$31	
Social Ins Tax- Employee Contribution	\$1,534	
Social Ins Tax- Employer Contribution	\$1,336	
Total - Federal Government		\$7,978
Corporate Profits Tax	\$199	
Dividends	\$3	
Indirect Bus Tax: Motor Vehicle Lic	\$48	
Indirect Bus Tax: Other Taxes	\$296	
Indirect Bus Tax: Property Tax	\$2,250	
Indirect Bus Tax: S/L NonTaxes	\$352	
Indirect Bus Tax: Sales Tax	\$2,808	
Indirect Bus Tax: Severance Tax	\$53	
Personal Tax: Estate and Gift Tax	\$0	
Personal Tax: Income Tax	\$644	
Personal Tax: Motor Vehicle License	\$37	
Personal Tax: NonTaxes (Fines- Fees	\$123	
Personal Tax: Other Tax (Fish/Hunt)	\$9	
Personal Tax: Property Taxes	\$14	
Social Ins Tax- Employee Contribution	\$8	
Social Ins Tax- Employer Contribution	\$28	
Total - State / Local Government		\$6,873
Grand Total		\$14,850

Conclusion

This analysis shows the extent to which coal transported on the inland waterways system supports economic activity among the industries that make up the American economy.

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Waterborne Petroleum and the American Economy

Commodities Transported

Petroleum and petroleum products are principal *building block* commodities transported on the Nation's waterways system. On the shallow draft portion of the system, there are about 129 million tons of these commodities shipped on an annual basis, which is about 20 percent of total shallow-draft traffic. These commodities have a market value of more than \$34 billion.

As shown in Table 1, there are eight distinct commodities in this category. Note that fuels (gasoline, distillate fuel oil, residual fuel oil, kerosene and petroleum coke) comprise 106 million tons and have a value of nearly \$28 billion. Fuels account for more than 80 percent of both tons and value.

These fuels, and crude petroleum (another 13 percent of the total tonnage) are absolutely essential to keeping the American economy moving.

Other commodities include lubricating oils and greases. Their importance to the economy is also evident.

Table 1 - Waterborne Petroleum and Products

Commodity	Average Annual Tons	2004 Value
Gasoline	28,062,700	\$11,309,000,000
Distillate Fuel Oil	29,024,800	\$9,201,000,000
Residual Fuel Oil	40,024,200	\$6,964,000,000
Crude Petroleum	16,710,900	\$3,543,000,000
Lube Oil & Greases	3,881,000	\$2,034,000,000
Other Petroleum Products	2,606,800	\$678,000,000
Kerosene	947,200	\$309,000,000
Petro. Jelly & Waxes	13,500	\$7,000,000
Total	121,271,100	\$34,045,000,000

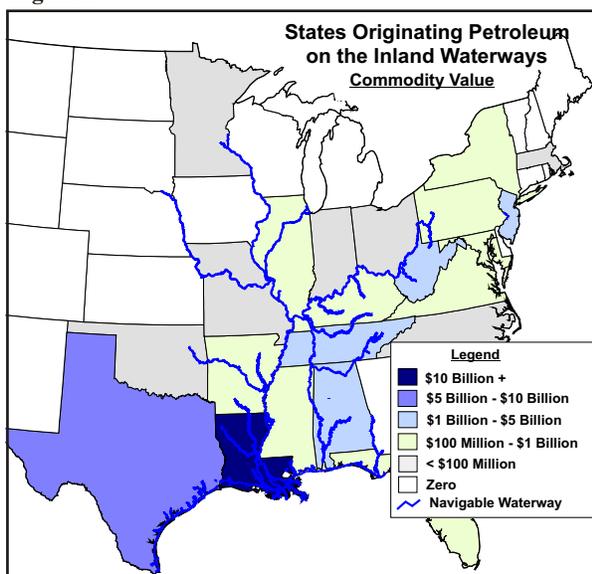
Originating Traffic

Waterborne petroleum and petroleum products are loaded onto shallow draft vessels on the Nation's waterway system in twenty-six states. Table 2 shows the states of origin with annual tons and value of commodities transported. Note that Louisiana and Texas are the leading states of origin, by far. Each has over 35 million tons and about \$10 billion in value of commodities shipped. These two states originate over 60 percent of the total. Other major states of origin are West Virginia, New Jersey, Alabama and Tennessee, each with more than \$1 billion in petroleum shipped.

Table 2 - Originating Waterborne Petroleum

State of Origin	Average Annual Tons	2004 Value
LA	38,951,865	\$10,754,000,000
TX	35,719,509	\$9,660,000,000
WV	5,565,625	\$2,037,000,000
NJ	6,028,879	\$1,847,000,000
AL	4,039,310	\$1,025,000,000
TN	2,727,060	\$1,013,000,000
NY	4,083,345	\$995,000,000
WA	3,926,718	\$953,000,000
PA	2,574,163	\$821,000,000
MS	2,263,990	\$774,000,000
IL	2,270,796	\$658,000,000
VA	1,920,833	\$625,000,000
FL	3,191,270	\$575,000,000
KY	1,112,300	\$379,000,000
OR	1,328,410	\$369,000,000
CA	1,626,878	\$314,000,000
AR	576,379	\$217,000,000
MD	495,760	\$147,000,000
IN	330,432	\$99,000,000
AK	190,966	\$67,000,000
NC	384,776	\$67,000,000
OH	209,570	\$48,000,000
MN	101,358	\$29,000,000
MA	93,821	\$24,000,000
OK	28,972	\$5,000,000
MO	11,231	\$4,000,000

Figure 1



Terminating Traffic

Waterborne petroleum and petroleum products are received via shallow draft vessels in 25 states, as shown in Table 3.

Texas and Louisiana are also the leading states for received petroleum and petroleum products (each with more than 33 million tons and over \$8 billion in value), accounting for 52 percent of received commodities.

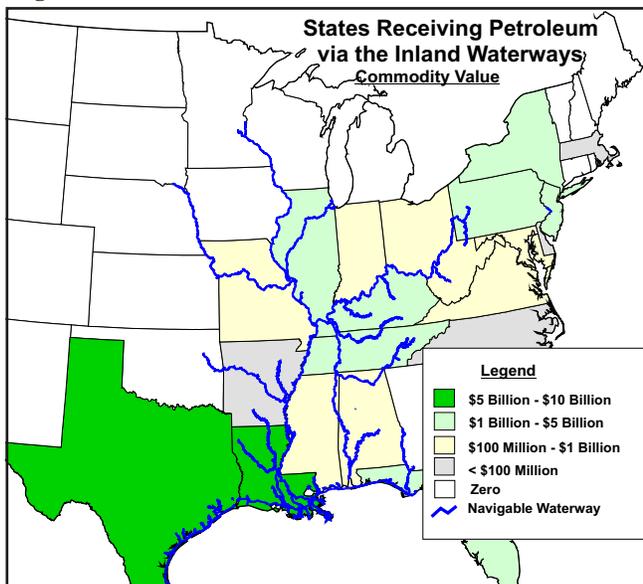
Kentucky is third with \$2.7 billion worth of petroleum received.

There are seven other states – New York, Washington, New Jersey, Tennessee, Florida, Illinois and Pennsylvania – which receive more than \$1 billion worth of these commodities via the domestic shallow-draft waterway system.

Table 3 - Terminating Waterborne Petroleum

Destination State	Average Annual Tons	2004 Value
TX	33,492,618	\$9,211,000,000
LA	33,229,879	\$8,236,000,000
KY	7,356,547	\$2,714,000,000
NY	5,838,860	\$1,709,000,000
WA	5,201,488	\$1,384,000,000
NJ	4,267,669	\$1,228,000,000
TN	3,301,579	\$1,223,000,000
FL	4,729,174	\$1,206,000,000
IL	2,939,338	\$1,028,000,000
PA	3,178,510	\$1,008,000,000
MS	3,205,254	\$937,000,000
AL	2,898,194	\$693,000,000
IN	1,892,368	\$677,000,000
WV	1,682,692	\$582,000,000
OH	1,190,750	\$444,000,000
MD	1,154,351	\$400,000,000
MO	979,053	\$374,000,000
VA	1,237,346	\$360,000,000
CA	1,626,878	\$314,000,000
OR	547,844	\$133,000,000
AK	324,291	\$116,000,000
AR	261,555	\$88,000,000
NC	393,588	\$68,000,000
DE	142,315	\$25,000,000
MA	90,522	\$23,000,000

Figure 2



Economic Analysis

The value of petroleum and petroleum products moved by inland waterway – over \$34 billion – can be used in conjunction with input-output data and analysis to estimate its importance to the American economy. Using this form of economic analysis, output and jobs in the petroleum and petroleum products industries, and in industries directly and indirectly linked to these industries, have been estimated. Corresponding value added totals and aggregate tax revenues have also been estimated.

The results are as follows:

There are 528,500 jobs directly associated with the production and consumption of petroleum and petroleum products transported on the inland waterways.

The Direct Output (a measure of business activity, similar to sales) that results from these 528,500 jobs has a value of \$123.3 billion.

The total number of associated jobs is 1,975,000, which includes indirectly linked jobs (in industries that directly and indirectly buy from and sell to any associated industries, including industries associated through employee expenditures).

The Total Output associated with these 1,975,000 jobs amounts to \$328.2 billion.

Direct Value Added is \$34.7 billion, while the Total Value Added is nearly \$144.2 billion. Value Added is used by economists as a measure of the increase in the value of goods as a result of the production process. Value Added is sales less the cost of intermediate goods (materials) and services.

Impacted Industries

The analysis also shows output and employment associated with waterborne petroleum and products in each of the 505 industries which comprise the American economy, some of which are much more heavily impacted than others.

Table 4 shows the twenty most strongly linked industries in terms of employment. Note that the directly linked industries are those which are highly dependent on the use of fuel. Truck transportation, couriers and air transportation are most prominent.

There are 51 separate industries with more than 10,000 jobs associated with waterway transportation of petroleum and petroleum products.

Note from Table 4 that several of the most strongly linked industries are not often associated with waterborne commerce. They show up because they are major factors in the American economy and are linked to activity in many other industries.

Table 4 - Most Strongly Linked Industries - Employment (Jobs)

Industry	Employment (Jobs)	
	Direct	Total
Truck transportation	134,163	166,779
Cattle ranching and farming	75,071	100,779
Food services and drinking places	0	96,680
Couriers and messengers	65,402	76,135
Wholesale trade	0	75,622
Air transportation	51,677	56,300
Highway- street- bridge- and tunnel construction	49,169	49,169
Oil and gas extraction	5,981	46,564
Employment services	0	42,967
Real estate	0	40,744
Waste management and remediation services	27,842	35,154
Automotive repair and maintenance- except car wash	0	34,253
Hospitals	0	31,668
Other new construction	30,491	30,491
Offices of physicians- dentists- and other health	0	29,533
Management of companies and enterprises	0	25,808
Food and beverage stores	0	24,517
Scenic and sightseeing transportation and support	0	23,299
General merchandise stores	0	22,923
Architectural and engineering services	0	21,602

The twenty highest industries in terms of output associated with waterborne petroleum are listed in Table 5.

Note that in terms of output, petroleum refineries are most strongly linked with nearly twice the output of the next most highly linked industry.

Various industries (Truck Transportation, Air Transportation, Couriers), which are heavily dependent on fuels, are prominent in terms of both direct and total impacts.

Several of the most highly linked industries per Table 5 – Real Estate; Lessors of Intangible Assets; Hospitals – are not often associated with waterborne commerce. They are prominent because of indirect linkages to many of the directly associated industries.

Output impacts are spread widely through the economy. There are 50 industries with associated Total Output of greater than \$1 billion.

Table 5 - Most Strongly Linked Industries - Output

Industry	Output (\$ Million)	
	Direct	Total
Petroleum refineries	\$48,865	\$55,317
Oil and gas extraction	\$3,638	\$28,325
Truck transportation	\$17,977	\$22,348
Wholesale trade	\$0	\$11,380
Air transportation	\$10,271	\$11,190
Cattle ranching and farming	\$5,636	\$7,566
Real estate	\$0	\$6,858
Couriers and messengers	\$5,604	\$6,524
Lessors of nonfinancial intangible assets	\$0	\$6,361
Other basic organic chemical manufacturing	\$5,180	\$6,299
Owner-occupied dwellings	\$0	\$5,928
Waste management and remediation services	\$4,410	\$5,568
Support activities for oil and gas operations	\$0	\$5,107
Automotive repair and maintenance- except car wash	\$0	\$5,085
Pipeline transportation	\$3,557	\$5,050
Highway- street- bridge- and tunnel construction	\$5,015	\$5,015
Monetary authorities and depository credit interme	\$0	\$4,413
Food services and drinking places	\$0	\$4,189
Insurance carriers	\$0	\$4,025
Hospitals	\$0	\$3,912

Industrial Sectors

It is also useful to group the results for individual into industrial sectors.

Table 6 shows the distribution of jobs associated with waterborne petroleum and petroleum products by industrial sector. The sector which includes Transportation and Warehousing leads with more than 366,000 associated jobs, which is more than two times as much as any other sector. Nearly 260,000 of these jobs are directly associated with waterborne petroleum.

Agriculture is the next highest sector with 182,600 jobs associated with waterborne petroleum.

The Manufacturing, Retail Trade, and Administrative & Waste Services sectors follow.

Table 6 - Employment (Jobs) by Industrial Sector

Industrial Sector	Employment (Jobs)	
	Direct	Total
Agriculture, Forestry, Fishing & Hunting	93,519	182,619
Mining	5,981	71,069
Utilities	1,934	9,042
Construction	89,350	103,138
Manufacturing	34,941	149,810
Wholesale Trade	0	75,622
Transportation & Warehousing	257,177	366,401
Retail Trade	0	145,141
Information	0	35,402
Finance & Insurance	0	81,586
Real Estate & Rental	0	55,307
Professional - Scientific & Tech Services	0	108,429
Management of Companies	0	25,808
Administrative & Waste Services	27,842	144,196
Educational Services	0	23,535
Health & Social Services	0	117,652
Arts - Entertainment & Recreation	0	29,977
Accomodation & Food Services	0	109,803
Other Services	0	109,073
Government & Other	17,745	31,651
Total	528,489	1,975,260

The Direct and Total Output associated with shipped and received waterborne petroleum and petroleum products, by industrial sector, are given in Table 7.

Note that in terms of output, Manufacturing is the most highly associated sector by far. Direct Output for the Manufacturing Sector is more than \$61 billion, while Total Output is nearly \$96 billion.

The Transportation & Warehousing Sector follows with Direct Output of \$37 billion and Total Output of nearly \$50 billion.

Taxes

The analysis also resulted in rough estimates of tax payments tied to waterborne petroleum and petroleum products.

The taxes paid in association with all linked activities amount to about \$24 billion in federal taxes and \$15 billion in state and local taxes, for a grand total of roughly \$39 billion in tax payments associated with petroleum and petroleum products.

Table 7 - Output by Industrial Sector

Industrial Sector	Output (\$ Million)	
	Direct	Total
Agriculture, Forestry, Fishing & Hunting	\$6,499	\$12,233
Mining	\$3,638	\$34,398
Utilities	\$1,006	\$5,050
Construction	\$7,981	\$9,242
Manufacturing	\$61,469	\$95,816
Wholesale Trade	\$0	\$11,380
Transportation & Warehousing	\$37,409	\$50,991
Retail Trade	\$0	\$8,025
Information	\$0	\$8,212
Finance & Insurance	\$0	\$14,922
Real Estate & Rental	\$0	\$15,406
Professional - Scientific & Tech Services	\$0	\$11,394
Management of Companies	\$0	\$3,407
Administrative & Waste Services	\$4,410	\$11,336
Educational Services	\$0	\$1,183
Health & Social Services	\$0	\$10,126
Arts - Entertainment & Recreation	\$0	\$1,542
Accommodation & Food Services	\$0	\$5,229
Other Services	\$0	\$9,381
Government & Other	\$878	\$8,964
Total	\$123,290	\$328,237

Table 8 - Associated Tax Payments

	Taxes Paid (\$Million)	
	Federal Government	State / Local Government
Corporate Profits Tax	\$2,375	
Indirect Bus Tax: Custom Duty	\$364	
Indirect Bus Tax: Excise Taxes	\$1,171	
Indirect Bus Tax: Fed NonTaxes	\$413	
Personal Tax: Estate and Gift Tax	\$0	
Personal Tax: Income Tax	\$9,959	
Personal Tax: NonTaxes (Fines- Fees	\$106	
Social Ins Tax- Employee Contribution	\$5,198	
Social Ins Tax- Employer Contribution	\$4,579	
Total - Federal Government		\$24,165
Corporate Profits Tax	\$406	
Dividends	\$6	
Indirect Bus Tax: Motor Vehicle Lic	\$97	
Indirect Bus Tax: Other Taxes	\$599	
Indirect Bus Tax: Property Tax	\$4,545	
Indirect Bus Tax: S/L NonTaxes	\$712	
Indirect Bus Tax: Sales Tax	\$5,672	
Indirect Bus Tax: Severance Tax	\$108	
Personal Tax: Estate and Gift Tax	\$0	
Personal Tax: Income Tax	\$2,177	
Personal Tax: Motor Vehicle License	\$124	
Personal Tax: NonTaxes (Fines- Fees	\$417	
Personal Tax: Other Tax (Fish/Hunt)	\$31	
Personal Tax: Property Taxes	\$47	
Social Ins Tax- Employee Contribution	\$26	
Social Ins Tax- Employer Contribution	\$95	
Total - State / Local Government		\$15,063
Grand Total		\$39,228

Conclusion

This analysis shows the extent to which petroleum and petroleum products transported in shallow draft vessels on the Nation's waterways system support economic activity throughout the industries that make up the American economy.

Prepared for
US Department of Transportation
Maritime Administration

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The Inland Waterways System and the Transport of Grain

Commodities Transported

Grains are *building block* commodities which comprise a large portion of the traffic transported on the Nation's inland waterways system. On the shallow draft part of the system, there are more than 83 million tons of these commodities shipped on an annual basis, about 13 percent of total traffic on the system. These commodities have a market value of nearly \$9.6 billion.

As shown in Table 1, there are ten distinct commodities in this category. The leading commodity is corn, with 39.5 million tons transported annually on the system (47% of total grain) and a value of \$3.6 billion (38% of total grain value). Annual soybean traffic amounts to 20.5 million tons (25%) with value of \$3.4 billion (36%). Wheat is third at 10.5 million tons and value of \$1.2 billion (13% of both tons and value).

These three leading commodities – corn, soybeans and wheat – together comprise 83% of the tonnage and 86% of the value of the grain transported on the shallow-draft inland waterways system.

Originating Traffic

Waterborne grain is loaded onto the inland waterway system in twenty-two states. Table 2 (and Figure 1) show the states of origin of all waterborne grains, with annual tons and commodity value. As expected, midwestern grain-producing states that are served by the waterways system are the leaders.

Illinois is the leading state of origin, by far, with 32.6 million tons originating (40% of total grain) and value of more than \$3.6 billion (39% of the value of waterborne grain). Iowa is next, followed by Minnesota and Missouri. These four states in the Upper Mississippi Region, account for 70% of the tonnage and 68% of the value of grain loaded onto the inland waterways system.

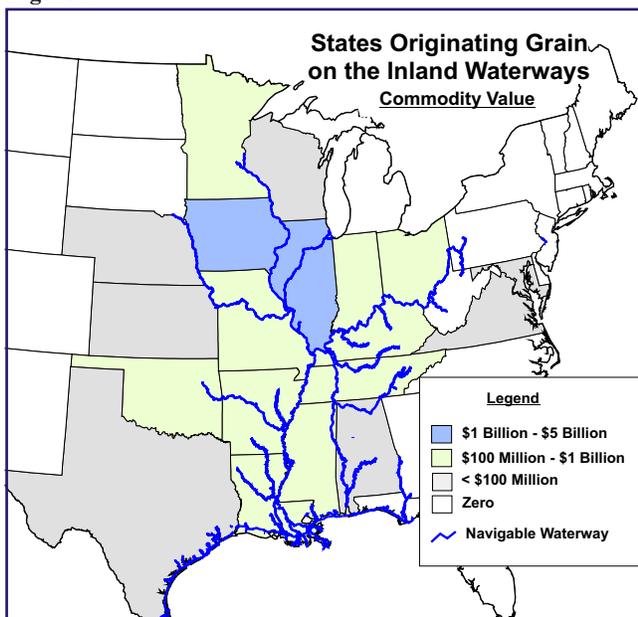
Table 1 - Waterborne Grain

Commodity	Average Annual Tons	2004 Value
Corn	39,502,000	\$3,597,500,000
Soybeans	20,552,000	\$3,425,400,000
Wheat	10,465,000	\$1,238,400,000
Prepared Animal Feed	6,658,000	\$665,800,000
Other Oilseeds	2,310,000	\$239,500,000
Rice	1,920,000	\$230,300,000
Sorghum Grains	1,301,000	\$118,500,000
Grain Mill Products	332,000	\$39,900,000
Barley & Rye	164,000	\$19,500,000
Oats	152,000	\$14,000,000
Total	83,356,000	\$9,588,800,000

Table 2 - Originating Waterborne Grain by State

State of Origin	Average Annual Tons	2004 Value
IL	33,631,000	\$3,727,800,000
IA	8,962,000	\$1,040,100,000
MN	8,557,000	\$953,700,000
MO	6,899,000	\$820,500,000
IN	3,723,000	\$415,100,000
TN	3,139,000	\$394,500,000
AR	2,889,000	\$384,300,000
WA	3,203,000	\$378,000,000
KY	3,102,000	\$364,300,000
MS	2,108,000	\$279,800,000
LA	2,202,000	\$251,900,000
OH	1,491,000	\$172,000,000
OK	1,293,000	\$154,900,000
WI	682,000	\$75,800,000
ID	600,000	\$70,700,000
VA	309,000	\$36,100,000
OR	305,000	\$36,000,000
AL	127,000	\$16,900,000
NE	61,000	\$6,800,000
MD	33,000	\$4,900,000
TX	21,000	\$2,800,000
KS	19,000	\$2,000,000

Figure 1



Since corn and soybeans are such major portions of waterborne grain, it is helpful to review separately the patterns of origins and destinations for these commodities. The states in which corn is loaded onto the system are listed in Table 2C, while states where soybean traffic is loaded are shown in Table 2S. The patterns for shipping these two grains is similar to the pattern for grain as a whole.

Table 2C - Originating Waterborne Corn by State

State of Origin	Average Annual Tons	2004 Value
IL	19,263,000	\$1,754,280,000
MN	5,671,000	\$516,500,000
IA	4,814,000	\$438,450,000
MO	3,094,000	\$281,750,000
IN	2,371,000	\$215,940,000
KY	1,605,000	\$146,170,000
OH	770,000	\$70,090,000
WI	485,000	\$44,180,000
LA	466,000	\$42,460,000
TN	388,000	\$35,300,000
MS	270,000	\$24,630,000
VA	146,000	\$13,280,000
AR	120,000	\$10,930,000
NE	22,000	\$1,960,000
KS	9,000	\$780,000
OK	2,000	\$180,000

Table 2S - Originating Waterborne Soybeans by State

State of Origin	Average Annual Tons	2004 Value
IL	7,550,000	\$1,258,320,000
IA	2,766,000	\$461,100,000
MN	2,098,000	\$349,660,000
MO	2,036,000	\$339,410,000
TN	1,002,000	\$167,090,000
AR	989,000	\$164,790,000
KY	925,000	\$154,220,000
IN	896,000	\$149,300,000
MS	861,000	\$143,440,000
LA	478,000	\$79,750,000
OH	424,000	\$70,710,000
WI	177,000	\$29,480,000
OK	148,000	\$24,640,000
VA	75,000	\$12,500,000
AL	55,000	\$9,250,000
MD	21,000	\$3,480,000
NE	13,000	\$2,200,000
TX	5,000	\$870,000

Terminating Traffic

Grains are transported on the inland waterway system to 19 states, as listed in Table 3. Note that traffic to Louisiana is far greater than any other state, and comprises over 93 percent of total grain transported. This grain is believed to be moving through terminals in Louisiana to export. The next three leading states are also places where grain can be exported by transfer to ocean-going ships.

Figure 2 graphically shows the pattern for where grain is received by water.

Table 3 - Terminating Waterborne Grain by State

Destination State	Average Annual Tons	2004 Value
LA	73,565,000	\$8,447,700,000
OR	2,332,000	\$276,600,000
AL	2,278,000	\$252,500,000
WA	1,739,000	\$206,300,000
TN	1,242,000	\$118,500,000
IL	654,000	\$98,400,000
KY	263,000	\$43,800,000
VA	245,000	\$34,400,000
MS	323,000	\$32,600,000
TX	256,000	\$30,300,000
MD	137,000	\$13,800,000
AR	117,000	\$11,900,000
OK	55,000	\$5,400,000
IN	42,000	\$4,800,000
MO	31,000	\$3,400,000
MN	27,000	\$3,000,000
WI	23,000	\$2,400,000
PA	16,000	\$1,700,000
IA	11,000	\$1,200,000

Figure 2

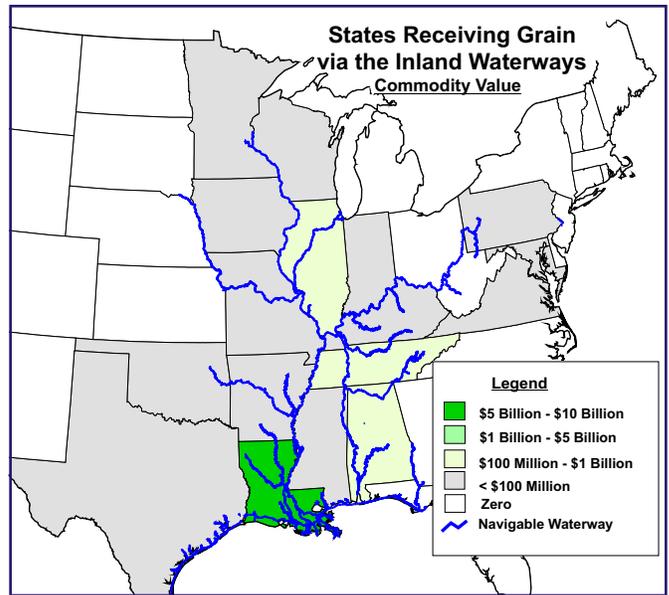


Table 3C shows the states where corn is received, while states receiving soybeans are given in Table 3S. Although there are fewer states where corn and soybeans are destined when compared with grain overall, these patterns are very similar to the patterns of grain received as a whole.

Table 3C - Terminating Waterborne Corn by State

Destination State	Average Annual Tons	2004 Value
LA	36,464,000	\$3,320,810,000
AL	1,508,000	\$137,291,000
TN	1,086,000	\$98,930,000
MS	171,000	\$15,610,000
MD	116,000	\$10,600,000
AR	66,000	\$6,050,000
IL	35,000	\$3,210,000
VA	30,000	\$2,700,000
MO	12,000	\$1,120,000
TX	12,000	\$1,050,000
IA	6,000	\$560,000
KY	2,000	\$150,000

Table 3S - Terminating Waterborne Soybeans by State

Destination State	Average Annual Tons	2004 Value
LA	19,074,000	\$3,179,060,000
AL	544,000	\$90,700,000
IL	503,000	\$83,770,000
KY	269,000	\$44,810,000
VA	131,000	\$21,800,000
MS	21,000	\$3,570,000
MD	15,000	\$2,450,000
AR	12,000	\$1,930,000
IN	6,000	\$960,000
MO	3,000	\$510,000
IA	3,000	\$450,000
MN	2,000	\$320,000
TX	2,000	\$260,000

Economic Analysis

The value of grain moved by inland waterway – over \$9.3 billion – can be used in conjunction with input-output data and analysis to estimate its importance to the American economy. Using this form of economic analysis, output and jobs in the industries that produce and consume grain and in industries directly and indirectly linked to these industries have been estimated. Corresponding value added totals and aggregate tax revenues have also been estimated.

The analysis was adjusted to reflect the fact that a majority of the grain transported is not consumed within the United States, but goes to export.

Principal findings:

There are 187,400 jobs directly associated with the production and consumption of grain transported on the inland waterways.

The Direct Output (a measure of business activity, similar to sales) that results from these 187,400 jobs has a value of \$13.6 billion.

The total number of associated jobs is 410,400 which includes indirectly linked jobs (in industries that directly and indirectly buy from and sell to any associated industries, including industries associated through employee expenditures).

The Total Output associated with these 410,400 jobs amounts to \$38.7 billion.

Direct Value Added is \$4.2 billion, while the Total Value Added exceeds \$17.5 billion. Value Added is used by economists as a measure of the increase in the value of goods as a result of the production process. Value Added is sales less the cost of intermediate goods (materials) and services.

Impacted Industries

The analysis also shows output and employment associated with waterborne grain in each of the 505 industries which comprise the American economy, some of which are much more heavily impacted than others.

Table 4 shows the twenty most strongly linked industries in terms of employment. Note that the four leading industries, and six of the top eight, are associated with agriculture.

There are also several industries not usually associated with water transport (e.g., Real Estate, Food Services and Drinking Places; Hospitals) which are also substantially linked to this commerce. This is because they are major factors in the American economy and they are linked to activity in many other industries.

There are 51 separate industries with more than 1,000 jobs associated with waterway transportation of grain.

Table 4 - Most Strongly Linked Industries - Jobs

Industry	Employment (Jobs)	
	Direct	Total
Grain farming	70,383	87,100
Oilseed farming	68,256	74,999
Cattle ranching and farming	30,173	39,367
Agriculture and forestry support activities	0	25,585
Wholesale trade	0	12,407
Real estate	0	11,347
Animal production- except cattle and poultry and e	9,198	10,397
All other crop farming	0	9,337
Food services and drinking places	0	9,242
Employment services	0	4,286
Truck transportation	0	3,664
Poultry and egg production	3,209	3,517
Hospitals	0	3,437
Offices of physicians- dentists- and other health	0	3,205
Insurance carriers	0	2,997
Automotive repair and maintenance- except car wash	0	2,961
Other animal food manufacturing	2,531	2,866
Food and beverage stores	0	2,543
General merchandise stores	0	2,418
Services to buildings and dwellings	0	2,353

Table 5 shows the twenty leading industries in terms of output. As expected, Grain Farming and Oilseed (soybean) Farming have the highest associated output, at about \$8 billion combined.

Note from Table 5 that several of the most strongly linked industries are not often associated with waterborne commerce. They show up because they are major factors in the American economy and are linked through sales to or purchases from many other industries.

Output linkages are spread widely through the economy. There are 60 industries whose Total Output associated with waterborne grain is greater than \$100 million.

Table 5 - Most Strongly Linked Industries - Output

Industry	Output (\$Million)	
	Direct	Total
Grain farming	\$4,222	\$5,225
Oilseed farming	\$3,084	\$3,388
Cattle ranching and farming	\$2,265	\$2,956
Real estate	\$0	\$1,910
Wholesale trade	\$0	\$1,867
Other animal food manufacturing	\$1,346	\$1,524
Poultry and egg production	\$854	\$936
Agriculture and forestry support activities	\$0	\$755
Animal production- except cattle and poultry	\$614	\$694
Owner-occupied dwellings	\$0	\$643
Petroleum refineries	\$0	\$632
All other crop farming	\$0	\$628
Insurance carriers	\$0	\$622
Monetary authorities and depository credit	\$0	\$564
Truck transportation	\$0	\$491
Automotive repair and maintenance- except car wash	\$0	\$439
Hospitals	\$0	\$425
Pesticide and other agricultural chemical manufact	\$0	\$420
Food services and drinking places	\$0	\$400
Telecommunications	\$0	\$383

Industrial Sectors

It is useful to group the results for individual industries into industrial sectors.

Table 6 shows the distribution of jobs associated with waterborne grain by sector.

Note that the sector that includes agriculture has the greatest total job impact with more than ten times any other sector.

Manufacturing is the next highest with nearly 22,000 jobs associated with waterborne grain.

Wholesale Trade, Retail Trade, Real Estate & Rental, and Health & Human Services are also substantially tied to grain moved on the waterways system.

Table 6 - Employment (Jobs) by Industrial Sector

Industrial Sector	Employment (Jobs)	
	Direct	Total
Agriculture, Forestry, Fishing & Hunting	181,218	251,707
Mining	0	1,679
Utilities	0	935
Construction	0	1,874
Manufacturing	6,163	21,711
Wholesale Trade	0	12,407
Transportation & Warehousing	0	10,913
Retail Trade	0	15,155
Information	0	3,955
Finance & Insurance	0	10,613
Real Estate & Rental	0	12,743
Professional - Scientific & Tech Services	0	10,846
Management of Companies	0	2,172
Administrative & Waste Services	0	10,414
Educational Services	0	2,492
Health & Social Services	0	12,767
Arts - Entertainment & Recreation	0	3,350
Accommodation & Food Services	0	10,791
Other Services	0	11,949
Government & Other	0	1,947
Total	187,381	410,422

The distribution of the Direct and Total Output by industrial sector is shown in Table 7.

Note that the sector which includes Agriculture is the highest at \$14.7 billion in Total Output. This is followed by Manufacturing at \$7.7 billion.

Six other sectors – Wholesale Trade, Transportation & Warehousing, Finance & Insurance, Real Estate & Rental, Professional Services, and Health & Social Services -- each have more than \$1 billion in Total Output associated with waterborne grain.

Table 7 - Output by Industrial Sector

Industrial Sector	Output (\$Million)	
	Direct	Total
Agriculture, Forestry, Fishing & Hunting	\$11,039	\$14,733
Mining	\$0	\$538
Utilities	\$0	\$492
Construction	\$0	\$176
Manufacturing	\$2,596	\$7,737
Wholesale Trade	\$0	\$1,867
Transportation & Warehousing	\$0	\$1,300
Retail Trade	\$0	\$838
Information	\$0	\$906
Finance & Insurance	\$0	\$1,957
Real Estate & Rental	\$0	\$2,384
Professional - Scientific & Tech Services	\$0	\$1,089
Management of Companies	\$0	\$287
Administrative & Waste Services	\$0	\$558
Educational Services	\$0	\$125
Health & Social Services	\$0	\$1,099
Arts - Entertainment & Recreation	\$0	\$174
Accommodation & Food Services	\$0	\$523
Other Services	\$0	\$960
Government & Other	\$0	\$956
Total	\$13,635	\$38,697

Table 8 - Associated Tax Payments

	Taxes Paid (\$Million)	
Federal Government		
Corporate Profits Tax	\$406	
Indirect Bus Tax: Custom Duty	\$45	
Indirect Bus Tax: Excise Taxes	\$145	
Indirect Bus Tax: Fed NonTaxes	\$51	
Personal Tax: Estate and Gift Tax	\$0	
Personal Tax: Income Tax	\$1,081	
Personal Tax: NonTaxes (Fines- Fees	\$11	
Social Ins Tax- Employee Contribution	\$555	
Social Ins Tax- Employer Contribution	\$452	
Total - Federal Government		\$2,746
Corporate Profits Tax	\$69	
Dividends	\$1	
Indirect Bus Tax: Motor Vehicle Lic	\$12	
Indirect Bus Tax: Other Taxes	\$74	
Indirect Bus Tax: Property Tax	\$562	
Indirect Bus Tax: S/L NonTaxes	\$88	
Indirect Bus Tax: Sales Tax	\$701	
Indirect Bus Tax: Severance Tax	\$13	
Personal Tax: Estate and Gift Tax	\$0	
Personal Tax: Income Tax	\$236	
Personal Tax: Motor Vehicle License	\$14	
Personal Tax: NonTaxes (Fines- Fees	\$45	
Personal Tax: Other Tax (Fish/Hunt)	\$3	
Personal Tax: Property Taxes	\$5	
Social Ins Tax- Employee Contribution	\$3	
Social Ins Tax- Employer Contribution	\$9	
Total - State / Local Government		\$1,835
Grand Total		\$4,581

Taxes

The analysis also resulted in rough estimates of tax payments tied to waterborne grain, as shown in Table 8.

The taxes paid in association with all linked activities amount to about \$2.7 billion in federal taxes and \$1.8 billion in state and local taxes, for a grand total of tax payments of about \$4.6 billion, associated with waterborne grain.

Conclusion

This analysis shows the extent to which grain transported on the inland waterways system supports economic activity throughout the industries that make up the American economy.

Prepared for
US Department of Transportation
Maritime Administration

Prepared by
LINARE CONSULTING
Pittsburgh, PA
412-343-3888
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Waterborne Chemicals and the American Economy

Commodities Transported

The Inland Waterways System plays a major role in the transportation of chemicals, *building block* commodities which feed the American economy. Corps of Engineers data shows an average of 65 million tons of chemicals transported per year, which is about 10% of total traffic.

These chemicals range in value widely, from a low of \$56 to a high of more than \$1,000 per ton. The average value is \$555 per ton, and the total value of chemicals transported exceeds \$36 billion annually.

As listed in Table 1, there are a variety of chemicals transported in shallow draft vessels. This table lists 24 specific chemicals with their annual tons and current value, rank ordered by value.

Note that hydrocarbons and other chemicals that are inputs to heavy industry comprise a large portion in terms of both tons and value.

Asphalt is one of the leading commodities in tonnage although it ranks well down on the list in terms of value.

As a group, fertilizers comprise about 17% of tonnage, but only 7% of value.

Originating Traffic

Waterborne chemicals are loaded onto the inland waterway system in twenty-two states, as listed in Table 2 and shown graphically in Figure 1. Note that 45% of the tons and 57% of the value originate in Texas. Louisiana is second, with 39% of tons and 32% of value. The leading inland state is Illinois with 5% of tons and 3% of value. The other 19 states combine for 10.4% of tonnage and 7.6% of the total value of chemicals moved on the inland waterways system.

Figure 1

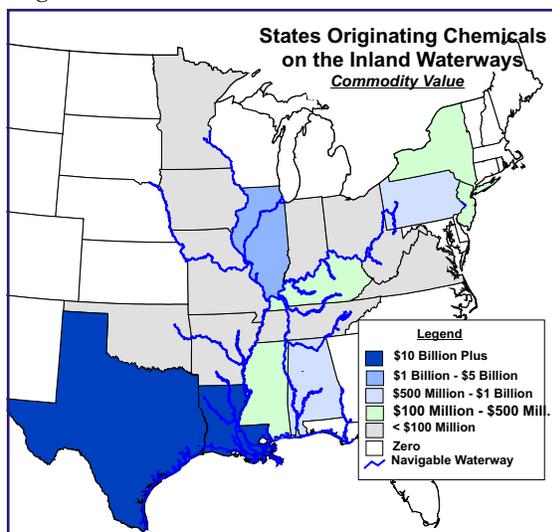


Table 1 - Waterborne Petroleum and Products

Commodity	Avg Annual Tons	2005 Value (\$Million)
Other Hydrocarbons	9,486,500	\$9,439.1
Alcohols	7,178,700	\$6,460.8
Benzene & Toluene	5,999,800	\$4,799.8
Naphtha & Solvents	5,735,000	\$3,899.8
Acyclic Hydrocarbons	2,328,900	\$1,909.7
Carboxylic Acids	1,519,300	\$1,572.5
Chemical Additives	3,324,900	\$1,542.7
Nitrogenous Fertilizer	6,166,400	\$1,479.9
Sodium Hydroxide	4,653,000	\$1,372.6
Asphalt, Tar & Pitch	7,187,400	\$826.5
Other Organic Compounds	929,500	\$688.7
Other Fertilizers & Mixes	2,404,700	\$553.1
Ammonia	914,900	\$258.0
Sulphur (Liquid)	688,400	\$254.7
Nitrogen Functional Compounds	1,018,100	\$244.3
Inorg. Elem., Oxides, & Halogen Salts	1,247,500	\$238.3
Potassic Fertilizers	1,144,700	\$223.2
Phosphatic Fertilizers	669,600	\$133.9
Metallic Salts	738,300	\$113.0
Sulphuric Acid	1,592,500	\$89.2
Other Chemical Products	231,800	\$85.8
Other Inorganic Chemicals	162,900	\$48.9
Organo - Inorganic Compounds	21,000	\$6.3
Plastics	1,700	\$0.9
Total	65,345,500	\$36,241.8

Table 2 - States of Origin of Waterborne Chemicals

Origin State	Avg Annual Tons	2005 Value (\$Million)
TX	30,801,200	\$21,058.9
LA	26,837,400	\$11,855.3
IL	3,293,900	\$1,138.3
PA	785,800	\$690.9
AL	1,258,100	\$546.4
KY	1,380,000	\$459.5
MS	1,257,700	\$315.5
NJ	364,000	\$201.6
NY	267,100	\$138.1
MN	396,100	\$65.1
IA	78,900	\$61.9
WV	91,500	\$56.1
AR	233,200	\$65.7
IN	213,400	\$49.2
TN	163,500	\$31.8
OK	178,300	\$39.7
MO	103,700	\$31.7
OH	165,800	\$19.1
VA	78,200	\$18.8
WA	8,000	\$5.5
DE	8,700	\$0.5
AK	1,200	\$0.4

Terminating Traffic

Waterborne chemicals are received in 24 states, as shown in Table 3 and Figure 2. The same three states which lead in shipped traffic also lead in received traffic – Texas, Louisiana and Illinois.

Texas is the leading state for received chemicals with 41% of tonnage and 48% of value received.

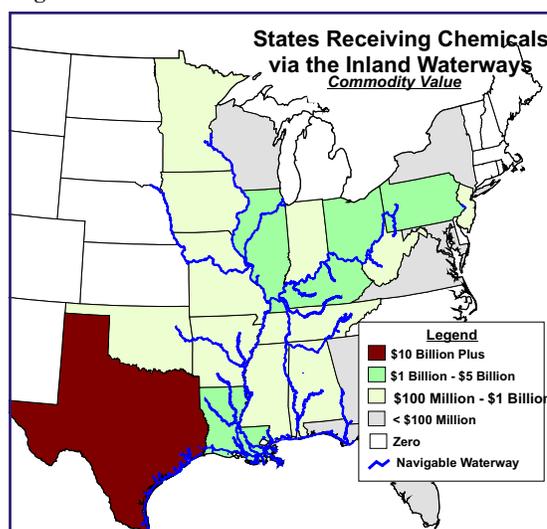
Louisiana is second at 17% of tonnage and 17% of value.

After the third ranking state, Illinois (9% of tons and 7.5% of value), the 21 remaining states account for 32.8% of tons and 26.1% of value transported. This is a wider distribution among the states than for shipped chemicals.

Table 3 - States Where Waterborne Chemicals Are Received

Destination State	Avg Annual Tons	2005 Value (\$Million)
TX	26,830,400	\$17,957.1
LA	11,148,900	\$6,208.5
IL	6,055,300	\$2,746.8
OH	3,662,500	\$1,936.7
PA	1,845,200	\$1,441.7
KY	2,187,500	\$1,254.9
AL	1,753,800	\$931.8
TN	2,418,200	\$674.1
WV	816,900	\$551.8
MS	1,232,800	\$547.3
IN	879,500	\$424.4
MO	1,850,900	\$446.8
NJ	651,900	\$333.6
MN	1,226,600	\$291.4
OK	1,092,500	\$243.2
IA	832,800	\$187.6
AR	716,800	\$170.4
NY	30,100	\$15.4
VA	94,600	\$15.2
WI	73,200	\$12.3
FL	27,600	\$10.3
MD	37,500	\$2.5
GA	6,700	\$1.6
AK	1,800	\$0.7

Figure 2



Economic Analysis

The value of chemicals moved by inland waterway – over \$36 billion – can be used in conjunction with input-output data and analysis to estimate its importance to the American economy. Using this form of economic analysis, output and jobs in the industries which produce and consume chemicals and in industries directly and indirectly linked to the these industries have been estimated. Corresponding value added totals and aggregate tax revenues have also been estimated.

This results of this analysis show the following:

There are 473,000 jobs directly associated with the production and consumption of chemicals transported on the inland waterways.

The Direct Output (a measure of business activity, similar to sales) that results from these 473,000 jobs has a value of \$130.9 billion.

The total number of associated jobs is 1,952,000, which includes indirectly linked jobs (in industries that directly and indirectly buy from and sell to any affected industries, including industries associated through employee expenditures).

The Total Output associated with these 1,952,000 jobs amounts to \$349.3 billion.

Direct Value Added is \$36.9 billion, while the Total Value Added is more than \$150 billion. Value Added is used by economists as a measure of the increase in the value of goods as a result of the production process. Value Added is sales less the cost of intermediate goods (materials) and services.

Impacted Industries

The analysis also shows output and employment associated with waterborne chemicals on each of the 505 industries which comprise the American economy, some of which are much more heavily impacted than others.

Table 4 shows the twenty most strongly linked industries in terms of employment. Note that there are a variety of industries which are directly linked. However, about half of these industries have no direct impacts, but are only indirectly linked with the directly associated industries.

Several of the most heavily impacted industries – Food Services; Employment Services; Real Estate; Hospitals – are not often associated with waterborne commerce. They show up because they are major concentrations of employment in the American economy and are linked to activity in many basic industries.

There are 54 separate industries with more than 10,000 jobs associated with waterway transportation of petroleum and petroleum products.

Table 4 - Most Strongly Linked Industries - Employment

Industry	Employment (Jobs)	
	Direct	Total
Agriculture and forestry support activities	103,760	125,132
Wholesale trade	0	99,937
Food services and drinking places	0	91,278
Truck transportation	35,215	66,375
All other crop farming	47,491	56,579
Employment services	0	41,888
Real estate	0	40,614
Management of companies and enterprises	0	38,021
Architectural and engineering services	0	33,039
Automotive repair and maintenance- except car wash	0	32,407
Cattle ranching and farming	19,705	32,221
Petrochemical manufacturing	31,899	31,899
Hospitals	0	31,538
Plastics material and resin manufacturing	27,780	30,928
Offices of physicians- dentists- and other health	0	29,411
Scenic and sightseeing transportation and support	13,195	28,805
Couriers and messengers	17,167	28,721
Other basic organic chemical manufacturing	22,916	28,075
Transit and ground passenger transportation	18,562	27,529
Other State and local government enterprises	16,757	25,790

The twenty most strongly linked industries in terms of output are listed in Table 5.

Note that the four most strongly linked industries, in both Direct and Total Output, are producers of chemicals in one way or another.

Half of the twenty industries are not directly linked but are high on the list because of indirect linkages.

Table 5 shows several of the most highly linked industries – Real Estate; Management; Automotive Repairs – that are not often associated with waterborne commerce. They are impacted through indirect linkages to many of the directly impacted industries.

Associated output is spread widely through the economy. There are 99 industries with Total Output associated with waterborne chemicals greater than \$500 million.

Table 5 - Most Strongly Linked Industries - Output

Industry	Output (\$Million)	
	Direct	Total
Other basic organic chemical manufacturing	\$31,538	\$38,638
Petroleum refineries	\$11,879	\$27,579
Plastics material and resin manufacturing	\$20,133	\$22,414
Petrochemical manufacturing	\$16,665	\$16,665
Oil and gas extraction	\$0	\$15,405
Wholesale trade	\$0	\$15,039
Truck transportation	\$4,719	\$8,894
Real estate	\$0	\$6,836
Owner-occupied dwellings	\$0	\$5,903
Paper and paperboard mills	\$4,930	\$5,881
Lessors of nonfinancial intangible assets	\$0	\$5,581
Management of companies and enterprises	\$0	\$5,019
Automotive repair and maintenance- except car wash	\$0	\$4,810
Monetary authorities and depository credit interme	\$0	\$4,642
Other State and local government enterprises	\$2,804	\$4,316
Food services and drinking places	\$0	\$3,955
Hospitals	\$0	\$3,896
All other crop farming	\$3,193	\$3,804
Agriculture and forestry support activities	\$3,062	\$3,692
Air transportation	\$2,696	\$3,671

Industrial Sectors

It is also useful to group the results for individual industries into industrial sectors.

The distribution of jobs associated with waterborne chemicals, by sector, is presented in Table 6. Note that the Manufacturing sector is the most strongly linked with nearly 285,000 total jobs associated with waterborne chemicals.

The sector which includes Agriculture follows with nearly 258,000 total jobs. This sector actually leads in Direct Employment, with 184,000 directly associated jobs.

Transportation & Warehousing is another industrial sector with a high number of jobs associated with waterborne chemicals.

Table 7 - Employment (Jobs) by Industrial Sector

Industrial Sector	Employment (Jobs)	
	Direct	Total
Agriculture, Forestry, Fishing & Hunting	184,075	257,713
Mining	0	41,072
Utilities	0	10,013
Construction	12,906	29,739
Manufacturing	143,432	284,572
Wholesale Trade	0	99,937
Transportation & Warehousing	103,833	207,768
Retail Trade	0	141,957
Information	0	35,953
Finance & Insurance	0	79,710
Real Estate & Rental	0	55,716
Professional - Scientific & Tech Services	0	132,030
Management of Companies	0	38,021
Administrative & Waste Services	7,308	110,704
Educational Services	0	24,496
Health & Social Services	0	117,141
Arts - Entertainment & Recreation	0	31,081
Accommodation & Food Services	0	106,010
Other Services	0	111,807
Government & Other	21,414	36,277
Total	472,968	1,951,716

Table 7 shows the distribution of Direct and Total Output associated with shipped and received waterborne chemicals.

Note that in terms of output, the Manufacturing sector is far ahead of any other sector. At \$157 billion, Manufacturing accounts for 45% of the total associated with waterborne chemicals.

Taxes

The analysis also resulted in estimates of tax payments tied to waterborne chemicals, as shown in Table 8.

The taxes paid in association with all linked activities amounts to about \$24.8 billion in federal taxes, and \$15.5 billion in state and local taxes, for a grand total of taxes associated with these waterborne chemicals of \$40.3 billion.

Table 7 - Output by Industrial Sector

Industrial Sector	Output (\$Million)	
	Direct	Total
Agriculture, Forestry, Fishing & Hunting	\$8,521	\$13,347
Mining	\$0	\$19,341
Utilities	\$0	\$5,839
Construction	\$1,316	\$2,863
Manufacturing	\$103,577	\$156,697
Wholesale Trade	\$0	\$15,039
Transportation & Warehousing	\$13,265	\$26,058
Retail Trade	\$0	\$7,849
Information	\$0	\$8,205
Finance & Insurance	\$0	\$14,662
Real Estate & Rental	\$0	\$14,621
Professional - Scientific & Tech Services	\$0	\$13,837
Management of Companies	\$0	\$5,019
Administrative & Waste Services	\$1,158	\$6,981
Educational Services	\$0	\$1,235
Health & Social Services	\$0	\$10,080
Arts - Entertainment & Recreation	\$0	\$1,598
Accommodation & Food Services	\$0	\$5,107
Other Services	\$0	\$9,591
Government & Other	\$3,035	\$11,306
Total	\$130,872	\$349,277

Table 8 - Associated Tax Payments

	Taxes Paid (\$Million)	
Federal Government		
Corporate Profits Tax	\$2,875	
Indirect Bus Tax: Custom Duty	\$375	
Indirect Bus Tax: Excise Taxes	\$1,206	
Indirect Bus Tax: Fed NonTaxes	\$426	
Personal Tax: Estate and Gift Tax	\$0	
Personal Tax: Income Tax	\$9,908	
Personal Tax: NonTaxes (Fines- Fees)	\$105	
Social Ins Tax- Employee Contribution	\$5,208	
Social Ins Tax- Employer Contribution	\$4,741	
Total - Federal Government		\$24,843
Corporate Profits Tax	\$491	
Dividends	\$7	
Indirect Bus Tax: Motor Vehicle Lic	\$100	
Indirect Bus Tax: Other Taxes	\$617	
Indirect Bus Tax: Property Tax	\$4,682	
Indirect Bus Tax: S/L NonTaxes	\$733	
Indirect Bus Tax: Sales Tax	\$5,842	
Indirect Bus Tax: Severance Tax	\$111	
Personal Tax: Estate and Gift Tax	\$0	
Personal Tax: Income Tax	\$2,166	
Personal Tax: Motor Vehicle License	\$124	
Personal Tax: NonTaxes (Fines- Fees)	\$415	
Personal Tax: Other Tax (Fish/Hunt)	\$31	
Personal Tax: Property Taxes	\$47	
Social Ins Tax- Employee Contribution	\$27	
Social Ins Tax- Employer Contribution	\$98	
Total - State / Local Government		\$15,491
Grand Total		\$40,334

Conclusion

This analysis shows the extent to which chemicals transported on the Nation's inland waterways system support economic activity throughout the industries that make up the American economy.

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Step-by-Step Process for Estimating Economic Value of Waterborne Commerce

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The purpose of this process is to estimate economic activity, including jobs, associated with traffic moving on the (shallow draft) inland waterways system. Along with information on traffic patterns, the economic analysis results are used to produce reader-friendly documents called *profiles*. The analysis is designed to produce two types of profiles: those focused on particular commodities or commodity groups at a regional level, including the nation as a whole; and those focused on regions (states, sub-state groups of counties, and multi-state) which encompass the full range of commodities originating and terminating within the region. The analysis uses the IMPLAN economic impact system.

This description refers to the analysis of coal at the national level, as an example.

Steps in the process:

1. Obtain traffic volume data in tons
 - a. From Corps of Engineers records
 - b. Three most recent years available
 - c. Four-digit commodity code(Note: five-digit commodity data may be preferable and will be investigated for future analysis. Also, some traffic data is masked to avoid disclosure of proprietary information. This hinders the analysis only for smaller regions or for commodities with few shippers / receivers).

2. Compute average traffic volumes over three year period
 - a. Four-digit commodity code
 - b. Tons originating within the region of interest
 - c. Tons terminating within the region of interest

3. Obtain unit prices of commodities - producer prices
 - a. Four-digit commodity code
 - b. Use government sources, as available
 - i. EIA
 - ii. USDA
 - iii. USGS
 - c. For unpublished commodities, consult with industry sources.
 - d. Obtain most current prices available (2004 or 2005) as well as for the year 2001. The economic impact model operates on 2001 data.
4. Multiply unit prices by commodity tonnage to obtain the value of waterborne commerce originating and terminating within the region of interest.
5. Adjust for imports to, and exports from, the region of interest, using US Customs data and knowledge of persons involved with the transport of the subject commodities.
6. Associate each commodity transported with the appropriate IMPLAN industry.
7. For commerce (value of traffic) originating within the region
 - a. The value of the commodities originating is a measure of *production*. This is the key to estimating economic activity, including jobs, associated with production.
 - b. Example for coal: 180,000,000 annual tons; value using 2001 producer price (70% of delivered price) = \$3,110 million. Enter \$3,110 million for IMPLAN Industry 20 – Coal Mining.
8. For commerce (value of traffic) terminating within the region of interest
 - a. The value of terminating traffic (net of exports) is a measure of demand for the commodity. For most commodities, this demand comes from industries which use them as inputs. For example, the demand for coal is due to its role in the production of electricity, iron & steel and other commodities.
 - b. There is a need to estimate production related to commodities consumed.

- c. Identify industries which are key consumers of each commodity received
 - i. Use data contained in the IMPLAN modeling system
 - ii. Estimate *portion consumed* by key producing industries
 - iii. Example, for Coal the consuming industries are:

Industry 20	Coal Mining	= 9.8% of coal demand
Industry 30	Power Generation	= 64.2% of coal demand
Industry 203	Iron & Steel Mills	= 7.3% of coal demand
Industry 498	St & Loc Govt Elec Utilities	= 9.6% of coal demand
Total		= 90.9% of coal demand
 - d. Through a series of computations involving coefficients and row and column totals from the input-output table, compute the ratio of consuming industry output to subject commodity input (Column C of Table 1).
 - e. Evaluate these ratios and eliminate consuming industries whose ratios exceed 50 or for which the relationships are counter-intuitive or are believed to be non-existent for the subject commodities when transported by water.
 - f. Column E of Table 1 shows the computation of direct output for industries which consume coal, based on consumption of \$3,012 million worth of coal. The amount consumed has been adjusted to reflect exported waterborne coal.
9. Use the value of coal shipped (\$3,110 million) and the values of commodities produced using coal received (Column E of Table 1, excluding the omitted value for Sector 20) to run the IMPLAN software with a national model. Use the Direct Effects estimates from this analysis, inflated to current (2005) dollars, for the profile.
10. Adjust the inputs to avoid double counting when estimating Total Effects. Subtract the sum of the values in Column C of Table 1 (\$2,443 million) for the Coal Industry and rerun the IMPLAN model. Use the Total Effects values from this analysis, inflated to current (2005) dollars, for the profile.
11. The IMPLAN model provides results for each of the 505 industries in the national economy as well as aggregated results for economic sectors. The model also provides rough estimates of taxes associated with the computed economic activity.

Table 1 – Distribution of Received Coal Among Consuming Sectors

A	B	C	D	E	F
Consuming Industry	Industry Share of Commodity Demand	Value of Commodity Received by Each Consuming Industry (\$ million)*	Industry Output / Commodity Input Ratio	Computed Output in Directly Linked Consuming Industries (\$ million)	Comments
20 Coal Mining	9.8%	295	10.42	N/A	Not used; waterborne coal not likely to be sold to companies within Coal Sector
30 Power Generation	64.2%	1,934	13.56	26,225	Okay
203 Iron / Steel Mills	7.3%	220	25.44	5,597	Okay
498 St / Loc Govt Elec Utilities	9.6%	289	13.05	3,771	Okay
Subtotal**	90.9%	2,443**			

* Based on \$3,012 million in value of coal received

**Does not include Industry 20 Coal Mining