K.7

(#724 in RFD Series)

INTERNATIONAL FINANCE DISCUSSION PAPERS

THE ENERGY CONTENT OF U.S. EXPORTS AND IMPORTS

by

Norman S. Fieleke

Discussion Paper No. 51, August 19, 1974

Division of International Finance

Board of Governors of the Federal Reserve System

The Energy Content of U.S. Exports and Imports

by Norman S. Fieleke*

Introduction

The recent oil crisis forcefully brought home the fact that the United States is a net importer of crude petroleum on a substantial scale. Because petroleum is an important energy source, the oil crisis immediately became an energy crisis. But crude petroleum is only one of the forms in which energy is exported and imported; coal and natural gas are other obvious examples. In addition, such natural forms are embodied in other traded products; for example, if a nation imported crude petroleum, refined it, and exported the refined product, it would be absurd to count the nation's imports of crude petroleum as its total trade in energy.1/

Input-output analysis makes it possible to estimate the total amount of energy from coal, crude petroleum, natural gas, hydropower, nuclear power, and geothermal power which is embodied in U.S. exports and competitive imports. The approach adopted in this study is to compute the quantity of energy required from these "primary" energy sources both

* The author is Assistant Adviser, Board of Governors of the Federal Reserve System. He is indebted to staff of the Bureau of Labor Statistics (BLS), especially Norman Saunders and Charles Bowman, for advice and assistance in performing the computations underlying this study. Also, the technique used in the study resembles that in Wassily Leontief's classic "Domestic Production and Foreign Trade: The American Capital Position Re-examined," Proceedings of the American Philosophical Society, 97 (September, 1953), 332-48. However, the author assumes full responsibility for the views expressed in this paper.

1/ It is recognized that petroleum is imported not only for its energy content but also for other reasons. For purposes of this study, this distinction is ignored, since consumption of petroleum (and coal, etc.) for whatever reason is tantamount to consumption of energy.

(1) to produce a million dollars' worth of U.S. exports and (2) to replace from domestic production a million dollars' worth of competitive imports. Both exports and imports are of average 1970 composition, the latest year for which the necessary input-output data are available. Thus, the study provides a rough calculation of the extent to which the United States was a net exporter or net importer of energy per million dollars of balanced trade in 1970, provided competitive imports are produced abroad with techniques that do not differ greatly from the techniques used to produce substitutes in this country, and provided the energy intensity of the relatively small volume of noncompetitive imports is not vastly different from the energy intensity of competitive imports. The results are examined both including and excluding direct exports and imports of crude petroleum, coal, and natural gas, because trade in these primary energy sources has changed dramatically since 1970 and because the main purpose of the study is to appraise the energy embodied in other traded products.

Aside from sheer curiosity, there are several reasons why it is of interest to know the energy content of a million dollars' worth of balanced trade. First, the more energy-intensive are U.S. imports relative to U.S. exports, then, other things being equal, (1) the greater is the real burden imposed on the United States by the increase in the relative price of energy, and (2) the greater will be the deterioration in the U.S. balance of trade. Second, if the United States were a net importer of energy exeluding direct net imports of crude petroleum, it would be a net importer of energy from the non-oil-exporting countries as a group, so

that the U.S. terms of trade and balance of trade would tend to deteriorate (ceteris paribus) with those countries as well as with the oil-exporting countries as a result of the increase in the relative price of energy. Finally, we can compute the net exports or imports of energy for each industrial classification and rank the classifications in order of their net energy imports, so as to obtain some idea of the relative importance of each classification as an exporter or importer of embodied energy.

Methodology

The first step in carrying out the study was to compute the value of exports of goods and services by industry class per million dollars of total 1970 exports, and to make a similar computation for competitive imports, i.e., for imports for which domestically produced substitutes are represented in the input-output tables constructed by the Commerce Department.[2]

2/ Conceptually, there is very little difference between exports and imports as reported in the balance-of-payments statistics and exports and imports as used by BLS in the input-output computations underlying this study, except that noncompetitive imports and other items (such as income flows) which could not be classified in terms of the U.S. input-output sectors are excluded from this study. Also, in this study neither exports nor imports include reexports of foreign merchandise. Both exports and imports are valued at the U.S. port of export or import. The value of imports thus includes duties as well as transportation and insurance from the foreign port. With respect to exports, because the excess of the port value over "producers'" value is accounted for by the "margin" industries (wholesale trade, etc.), the energy required by each margin industry was computed separately and then allocated as appropriate to the other producing industries to obtain the total energy requirement corresponding to the port value of each of the latter industries' output. The total value of exports included in this study is $51,835 million, and the total value of imports is $47,746 million.

It should be noted that the composition of U.S. trade in 1970 was no doubt somewhat different from the equilibrium composition, since, among other things, exchange rates were not in equilibrium, a fact which is significant because some items are more price- (or exchange-rate-) elastic than others.

The figures so derived for each industry class were then multiplied by the class's input-output coefficients for (1) crude petroleum, (2) natural gas, (3) coal, and (4) "other" primary energy sources (hydropower, nuclear power, and geothermal power), where the coefficients were expressed as dollar requirements (direct and indirect) per dollar of delivery to final demand in 1970.[3/] The resulting data showed the dollar value of crude petroleum, natural gas, coal, and "other" energy sources required, by industry class, per million dollars of total U.S. exports and competitive import replacements. These data were then divided by the appropriate unit values to yield requirements of petroleum in terms of barrels, of natural gas in cubic feet, of coal in tons, and of "other" energy sources in kilowatt hours.[4/] Finally, these "real" energy requirements data were converted into the common denominator of BTU-equivalents.[5/]

3/ For each industry class, the input-output data provide a coefficient for crude petroleum and natural gas combined; they do not provide a coefficient for crude petroleum alone and another for natural gas alone. In consultation with BLS staff, the coefficients for crude petroleum and natural gas were assumed to be 90 percent and 10 percent, respectively, of the coefficients for crude petroleum and natural gas combined, since the total output of crude petroleum and natural gas in 1970 by value was 90 percent crude petroleum and 10 percent natural gas. Similarly, for each industry class the coefficient for "other" primary energy sources was assumed to be 15 percent of the coefficient for electric utilities, since 15 percent of the value of electricity delivered to final demand was produced by hydro, nuclear, and geothermal installations.

4/ The procedure described was not followed in the case of direct imports and exports of coal, crude petroleum, and natural gas, partly because the unit values appropriate for domestic production were not appropriate for deriving the volumes of direct trade in these items. Instead, the actual volumes per million dollars of exports and imports were entered directly.

5/ The following conversion factors were employed: 5,620,900 BTUs per barrel of crude petroleum; 1,031 BTUs per cubic foot of natural gas; 24,220,000 BTUs per ton of coal; and 10,494 BTUs per kilowatt hour. See U.S. Department of the Interior, Bureau of Mines, Mineral Industry Surveys: Weekly Coal Report No. 2943, February 8, 1974, p. 3.

Results

The results are summarized in Table 1, and detail by industry class is presented in Table 2. The main contribution of this paper is to estimate the extent to which the United States imports or exports energy which is present in the "primary" energy sources that in turn are embodied in other goods. Table 1 indicates that, in terms of the definitions used in this study, the United States is a net importer of energy in forms other than the primary sources to the extent of nearly 18 billion BTUs for each million dollars' worth of balanced trade of average 1970 composition; this figure includes 11 billion BTUs derived from crude petroleum. (To put some perspective on these numbers, if an automobile obtains 15 miles per gallon of gasoline, the volume of gasoline which contains 1 billion BTUs is adequate to propel the automobile a distance of about 120,000 miles.[6/]) If direct trade in crude petroleum, natural gas, and coal is included, the table of course shows a much greater net import position, amounting to nearly 74 billion BTUs, although there is a slim net export position, amounting to 859 million BTUs, if direct trade in crude petroleum is excluded.

Table 2 shows that by industry class, and excluding direct trade in primary energy sources, the largest net imports of energy per million dollars of balanced 1970 trade occur in petroleum products, followed by blast furnaces and basic steel products, by motor vehicles, and by paper

6/ There are 5,248,000 BTUs per 42 gallon barrel of gasoline; see U.S. Department of the Interior, loc. cit. Technically, a British thermal unit is defined as the amount of heat required to raise the temperature of one pound of water 1 degree Fahrenheit at or near its maximum density.

Table 1

Energy Requirements in BTUs per Million Dollars of Total U.S. Exports and Import Replacements, 1970
(In millions of BTUs)

BTU requirements from:	Energy content of direct imports and exports of primary energy sources	Energy requirements for other imports and exports	Total
Crude petroleum			
Exports	541	28,651	29,193
Imports	74,950	39,437	114,388
Net (exports +)	-74,409	-10,786	-85,195
Natural gas			
Exports	1,824	3,076	4,900
Imports	16,774	4,234	21,008
Net (exports +)	-14,950	-1,158	-16,108
Coal			
Exports	33,501	15,038	48,539
Imports	7	20,572	20,579
Net (exports +)	33,494	-5,534	27,960
Other sources 1/			
Exports	--	1,588	1,588
Imports	--	1,797	1,797
Net (exports +)	--	-209	-209
All sources except direct imports and exports of crude petroleum			
Exports	35,325	48,354	83,679
Imports	16,781	66,040	82,820
Net (exports +)	18,544	-17,686	859
All above sources			
Exports	35,866	48,354	84,220
Imports	91,731	66,040	157,771
Net (exports +)	-55,865	-17,686	-73,551

1/ Hydropower, nuclear power, and geothermal power.
Note: Detail may not add to totals because of rounding.
Source: See Table 2 and explanation in the text.

products, in that order. The largest net exports, in order of magnitude, occur in crops and other agricultural products, chemical products, plastic materials and synthetic rubber, and air transportation.

Conclusions

It is well known that the United States is a net importer of crude petroleum. This study presents a finding that is much more significant for purposes of analyzing the effects on the nation of a rise in the price of energy. This finding is that U.S. imports as a whole seem to be considerably more energy-intensive than U.S. exports. This discovery makes much more defensible the hypothesis that higher energy prices tend to worsen both the terms and the balance of trade of the United States.

The study also suggests that if direct trade in crude petroleum is ignored, but all other trade is counted, U.S. exports tend to be slightly more energy-intensive than U.S. imports. Since the United States has substantial exports to the countries from which it imports crude petroleum, the magnitude of the 1970 U.S. energy deficit with those countries was less than is indicated by the energy component of direct crude petroleum imports; and, correspondingly, the slim energy surplus on trade excluding direct crude petroleum imports no doubt implies an energy deficit on trade with the non-oil-exporting countries. Thus the U.S. terms of trade and balance of trade with these latter countries, as

well as with the oil-exporting countries, are probably adversely affected (ceteris paribus) by the increased cost of energy.[7/]

Of course, a rise in the relative price of energy has other implications for U.S. trade. For example, if the United States has a comparative advantage in the production of energy-saving capital goods, the nation's trade balance with other energy-importing countries will tend to improve on that score. However, such considerations are beyond the scope of this study.

7/ In this connection, it should be noted that the effects of a nondiscriminatory increase in the relative price of energy on the U.S. terms and balance of trade with various areas would differ from the effects of discrimination in the foreign supply of a primary energy source such as crude petroleum.

Table 2

Energy Requirements in BTUs per Million Dollars of Total U.S. Exports and Import Replacements, 1970, by Industry Class
(In thousands of BTUs)

Code	Industry Name	BTU requirements from crude petroleum: Exports	BTU requirements from crude petroleum: Import replacements	BTU requirements from natural gas: Exports	BTU requirements from natural gas: Import replacements	BTU requirements from coal: Exports	BTU requirements from coal: Import replacements	BTU requirements from other sources[1]: Exports	BTU requirements from other sources[1]: Import replacements	Total BTU requirements: Exports	Total BTU requirements: Import replacements	NET BTU EXPORTS (+) OR IMPORTS (-) for all energy sources: Amount	Rank[2]	NET BTU EXPORTS (+) OR IMPORTS (-) for crude petroleum (Amount)
	AGRICULTURE, FORESTRY AND FISHERIES													
1.	Livestock and livestock products	24,565	101,422	2,637	10,889	7,475	32,016	1,540	6,619	36,216	150,946	-114,730	25	-76,857
2.	Crops and other agricultural products	2,268,831	473,984	243,580	50,887	404,702	79,234	88,384	17,528	3,005,496	621,632	+2,383,864	112	+1,794,847
3.	Forestry and fisheries	22,714	290,335	2,439	31,170	5,620	69,537	837	9,072	31,609	400,114	-368,505	14	-267,621
4.	Agriculture, forestry, and fishery services	9,140	0	981	0	3,620	0	537	0	14,279	0	+14,279	59	+9,140
	MINING													
5.	Iron ore mining	86,140	330,557	9,248	35,488	161,030	702,690	16,043	68,490	272,460	1,137,226	-864,766	6	-244,417
6.	Copper ore mining	12,155	20,394	1,305	2,190	20,293	34,047	3,902	6,548	37,656	63,179	-25,523	35	-8,239
7.	Other nonferrous metal ore mining	2,814	91,744	302	9,850	3,107	111,157	680	24,364	6,903	237,114	-230,211	19	-88,930
10.	Stone and clay mining and quarrying	60,226	196,673	6,466	21,115	53,587	210,096	7,619	28,910	127,898	456,793	-328,895	16	-136,447
11.	Chemical and fertilizer mining	63,465	159,404	6,814	17,114	47,711	130,401	10,138	27,763	128,127	334,681	-206,554	20	-95,939
	CONSTRUCTION													
13.	New nonresidential construction	908	0	97	0	914	0	88	0	2,007	0	+2,007	43	+908
	MANUFACTURING													
18.	Guided missiles and space vehicles	975	0	105	0	783	0	149	0	2,012	0	+2,012	44	+975
19.	Other ordnance	88,322	15,247	9,482	1,637	126,384	24,150	14,860	2,792	239,048	43,826	+195,222	98	+73,075
20.	Food products	946,074	1,233,709	132,450	132,450	562,516	771,781	79,378	106,859	1,689,537	2,244,799	-555,262	9	-287,635
21.	Tobacco manufacturing	109,785	9,365	11,786	1,005	66,695	5,864	8,580	744	196,847	16,978	+179,869	96	+100,420
22.	Broad and narrow fabrics, yarn and thread mills	113,812	271,396	12,219	29,137	124,732	312,976	14,856	36,838	265,618	650,347	-384,729	12	-157,584
23.	Miscellaneous textiles and floor coverings	37,313	193,640	4,006	20,789	37,120	220,042	3,986	22,626	82,425	457,098	-374,673	13	-156,327
24.	Hosiery and knit goods	9,166	33,451	984	3,591	10,211	41,863	1,159	4,616	21,521	83,521	-62,000	31	-24,285
25.	Apparel	68,965	246,766	7,404	26,493	70,053	259,628	10,033	36,985	156,456	569,871	-413,415	11	-177,801
26.	Miscellaneous fabricated textile products	18,352	19,725	1,970	2,118	17,946	20,923	2,451	2,815	40,719	45,581	-4,862	38	-1,373
27.	Logging, sawmills and planing mills	168,448	208,522	18,085	22,387	68,566	91,753	16,172	22,099	271,271	344,761	-73,490	28	-40,074
28.	Millwork and plywood and miscellaneous wood products	17,448	126,452	1,873	13,576	13,245	109,883	2,289	18,748	34,856	268,659	-233,803	18	-109,004
29.	Household furniture	5,089	48,449	546	5,201	5,445	57,431	702	7,258	11,782	118,339	-106,557	26	-43,360
30.	Other furniture	5,242	0	563	0	8,046	0	715	0	14,566	0	+14,566	60	+5,242
31.	Paper products	397,592	702,108	42,685	75,378	699,179	1,349,079	49,715	93,123	1,189,171	2,219,688	-1,030,517	4	-304,516
32.	Paperboard	9,014	1,622	968	174	9,869	1,879	1,001	187	20,852	3,863	+16,989	62	+7,392
33.	Publishing	50,330	20,670	5,403	2,219	39,544	19,183	5,718	2,681	100,996	44,752	+56,244	75	+29,660
34.	Printing	16,032	14,388	1,721	1,545	14,653	13,151	1,995	1,790	34,401	30,873	+3,528	47	+1,644
35.	Chemical products	2,704,210	1,511,771	290,322	162,303	1,247,427	706,012	124,225	68,988	4,366,184	2,449,075	+1,917,109	111	+1,192,439
36.	Agricultural chemicals	151,786	61,057	16,296	6,555	72,193	29,730	10,650	4,333	250,924	101,674	+149,250	94	+90,729
37.	Plastic materials and synthetic rubber	842,998	116,626	90,504	12,521	438,672	61,559	45,079	6,228	1,417,252	196,934	+1,220,318	110	+726,372
38.	Synthetic fibers	80,104	70,025	8,600	7,518	132,993	121,618	5,811	5,145	227,509	204,306	+23,203	65	+10,079
39.	Drugs	123,528	50,638	13,262	5,437	84,889	37,865	12,111	5,278	233,790	99,218	+134,572	91	+72,890
40.	Cleaning and toilet preparations	94,732	15,618	10,170	1,677	51,169	8,707	6,387	1,065	162,458	27,066	+135,392	92	+79,114
41.	Paint	49,485	878	5,313	94	16,324	295	1,982	34	73,153	1,301	+71,852	80	+48,607

Table 2

Energy Requirements in BTUs per Million Dollars of Total U.S. Exports and Import Replacements, 1970, by Industry Class
(In thousands of BTUs)

Code	INDUSTRY Name	BTU requirements from Crude petroleum: Exports	BTU requirements from Crude petroleum: Import replacements	BTU requirements from natural gas: Exports	BTU requirements from natural gas: Import replacements	BTU requirements from coal: Exports	BTU requirements from coal: Import replacements	BTU requirements from other sources[1]: Exports	BTU requirements from other sources[1]: Import replacements	Total BTU requirements: Exports	Total BTU requirements: Import replacements	NET BTU EXPORTS (+) OR IMPORTS (-): For all energy sources: Amount	Rank[2]	NET BTU EXPORTS (+) OR IMPORTS (-): For crude petroleum (Amount)
MANUFACTURING (continued)		11,749,556	25,264,502	1,261,424	2,712,379	197,875	368,763	40,791	76,171	13,249,647	28,421,815	-15,172,168	1	-13,514,946
42.	Petroleum products	73,007	145,634	7,838	15,635	65,033	142,911	7,675	16,363	153,552	320,543	-169,991	22	-72,627
43.	Rubber products	76,161	166,779	8,177	17,905	50,452	114,869	7,940	17,934	142,729	317,487	-174,758	21	-90,618
44.	Plastic products													
45.	Leather, footwear and leather products	13,242	133,403	1,422	14,322	13,295	144,436	1,859	19,946	29,818	312,106	-282,288	17	-120,161
		66,029	88,456	7,089	9,497	39,569	58,127	6,885	9,988	119,568	166,068	-46,500	32	-22,427
46.	Glass					59,970	119,835	3,036	5,820	89,245	172,287	-83,042	27	-18,145
47.	Cement, clay, concrete products	23,696	42,111	2,544	4,521									
48.	Miscellaneous stone and clay products	86,370	141,595	9,273	15,202	64,924	114,961	8,743	15,144	169,310	286,902	-117,592	24	-55,225
49.	Blast furnaces and basic steel products	274,249	820,239	40,179	88,060	2,850,911	6,809,874	72,022	168,294	3,337,362	7,886,468	-4,549,106	2	-445,990
50.	Iron and steel foundries, forging and miscellaneous	35,635	12,604	3,826	1,353	84,833	31,801	6,697	2,481	130,991	48,239	+82,752	81	+23,031
	products	68,157	100,402	7,317	10,779	57,429	84,871	9,987	14,755	142,890	210,807	-67,917	29	-32,245
51.	Primary copper metals	177,021	128,936	19,005	13,843	194,690	142,981	48,376	35,545	439,092	321,305	+117,786	87	+48,085
52.	Primary aluminum													
53.	Other primary nonferrous metal and secondary nonferrous	36,260	376,718	3,893	40,444	39,249	416,119	7,143	75,671	86,544	908,952	-822,408	7	-340,458
		6,857	25,137	736	2,699	6,306	24,800	1,240	4,874	15,139	57,510	-42,371	33	-18,280
54.	Copper rolling and drawing					61,536	46,235	15,408	11,599	141,575	104,991	+36,584	69	+15,780
55.	Aluminum rolling and drawing	58,365	42,585	6,266	4,572	34,313	34,503	6,403	6,418	82,818	79,896	+2,922	45	+2,824
56.	Other nonferrous rolling and drawing	38,020	35,196	4,082	3,779	4,223	0	826	0	9,403	0	+9,403	56	+3,933
57.	Miscellaneous nonferrous metal products	3,933	0	422	0	15,045	27,965	767	1,400	20,957	38,317	-17,360	36	-3,438
58.	Metal containers	4,646	8,084	499	868									
59.	Heating apparatus and plumbing fixtures	17,102	2,892	1,836	311	23,886	5,093	2,321	467	45,144	8,763	+36,381	68	+14,210
60.	Fabricated structural metal	74,770	22,381	8,027	2,403	203,449	65,784	13,224	4,200	299,470	94,768	+204,702	99	+52 389
61.	Screw machine products	78,861	34,433	8,466	3,697	182,931	92,027	12,871	6,257	283,129	136,414	+146,715	93	+44,428
62.	Other fabricated metal products	147,018	167,860	15,784	18,021	248,449	341,289	21,745	28,574	432,996	555,743	-122,747	23	-20,842
63.	Engines, turbines and generators	105,032	35,243	11,276	3,784	155,316	59,449	15,292	5,678	286,917	104,153	+182,764	97	+69,789
64.	Farm machinery	72,170	65,311	7,748	7,012	131,263	140,733	10,188	10,431	221,368	223,487	-2,119	40	+6,859
65.	Construction, mining and oil field machinery	353,558	21,570	37,958	2,316	617,789	46,168	55,690	3,983	1,064,995	74,036	+990,959	108	+331,988
66.	Material handling equipment	37,906	20,503	4,070	2,201	57,735	37,122	5,177	3,181	104,888	63,008	+41,880	73	+17,403
67.	Metal working machinery	102,994	51,727	11,057	5,553	144,269	81,519	16,113	8,902	274,433	147,702	+126,731	89	+51,267
68.	Special industry machinery	216,940	105,992	23,291	11,379	296,522	160,056	27,956	14,673	564,709	292,100	+272,609	104	+110,948
69.	General industrial machinery	160,843	93,937	17,268	10,085	222,383	151,561	21,995	14,428	422,489	270,011	+152,478	95	+66,906
70.	Machine shop products	2,841	0	305	0	5,025	0	610	0	8,780	0	+8,780	54	+2,841
71.	Computers and peripheral equipment	199,307	57,804	21,397	6,206	162,616	62,920	24,710	9,149	408,831	136,079	+271,952	103	+141,503
72.	Typewriters and other office machines	29,808	20,645	3,200	2,216	30,566	29,376	3,296	2,880	66,870	55,118	+11,752	58	+9,163
73.	Service industry machines	116,894	15,610	12,550	1,676	155,251	25,465	15,720	2,452	300,415	45,203	+255,212	102	+101,284
74.	Electric transmission and distribution equipment	71,542	25,248	7,681	2,711	87,938	33,554	9,729	3,645	176,890	65,157	+111,733	86	+46,294
75.	Electrical industrial apparatus	74,397	30,970	7,987	3,325	106,054	48,873	10,971	4,943	199,410	88,110	+111,299	85	+43,427
76.	Household appliances	65,938	66,820	7,079	7,174	100,347	114,367	9,552	10,585	182,917	198,945	-16,028	37	-882

Table 2

Energy Requirements in BTUs per Million Dollars of Total U.S. Exports and Import Replacements, 1970, by Industry Class
(In thousands of BTUs)

INDUSTRY Code	Name	BTU requirements from crude petroleum: Exports	BTU requirements from crude petroleum: Import replacements	BTU requirements from natural gas: Exports	BTU requirements from natural gas: Import replacements	BTU requirements from coal: Exports	BTU requirements from coal: Import replacements	BTU requirements from other sources 1/: Exports	BTU requirements from other sources 1/: Import replacements	* Total BTU requirements: Exports	* Total BTU requirements: Import replacements	NET BTU EXPORTS (+) OR IMPORTS (-): For all energy sources: Amount	Rank 2/	For crude petroleum (Amount)
	MANUFACTURING (continued)													
77.	Electric lighting and wiring	57,327	67,175	6,155	7,212	63,212	81,521	6,268	7,826	132,962	163,735	-30,773	34	-9,848
78.	Radio and TV receiving sets	41,877	453,497	4,496	48,687	37,119	449,514	5,471	65,057	88,963	1,016,754	-927,791	5	-411,620
79.	Telephone and telegraph apparatus	8,715	6,393	936	686	11,201	9,023	1,350	1,070	22,202	17,171	+5,031	48	+2,322
80.	Radio TV transmitting, signaling and detection equipment	54,617	25,374	5,864	2,724	51,914	26,159	8,440	4,219	120,835	58,476	+62,359	76	+29,243
81.	Electronic components	190,883	85,314	20,493	9,159	188,499	90,982	29,930	14,330	429,805	199,785	+230,020	100	+105,569
82.	Miscellaneous electrical machinery	50,151	44,969	5,384	4,828	50,574	59,209	6,636	7,393	112,745	116,400	-3,655	39	+5,182
83.	Motor vehicles	599,088	1,204,264	64,318	129,289	1,115,178	2,450,469	91,254	196,124	1,869,837	3,980,146	-2,110,309	3	-605,176
84.	Aircraft	441,297	49,820	47,377	5,349	431,902	51,288	71,708	8,478	992,284	114,934	+877,350	107	+391,477
85.	Ship and boat building and repair	14,447	7,047	1,551	757	26,700	14,417	2,478	1,311	45,176	23,532	+21,644	64	+7,400
86.	Railroad and other miscellaneous transportation equipment	21,832	113,121	2,344	12,145	49,247	281,008	3,342	18,586	76,765	424,860	-348,095	15	-91,289
87.	Transportation equipment, NEC	10,247	2,364	1,100	254	15,314	4,203	1,418	372	28,079	7,193	+20,886	63	+7,883
88.	Professional, scientific and controlling instruments	97,991	53,603	10,520	5,755	99,263	63,835	13,911	8,721	221,685	131,913	+89,772	83	+44,388
89.	Medical and dental instruments	37,663	8,961	4,043	962	43,856	13,987	4,384	1,285	89,946	25,195	+64,751	78	+28,702
90.	Optical and opthalmic equipment	19,235	44,430	2,065	4,770	13,997	45,883	2,122	6,530	37,420	101,614	-64,194	30	-25,195
91.	Photographic equipment and supplies	101,655	53,838	10,914	5,780	101,741	65,457	9,445	5,592	223,755	130,667	+93,088	84	+47,817
92.	Miscellaneous manufactured products	134,019	381,011	14,388	40,905	129,410	428,741	15,561	49,540	293,378	900,197	-606,819	8	-246,992
93.	Railroad transportation	99,998	13,027	10,736	1,399	30,417	3,963	3,327	433	144,478	18,822	+125,656	88	+86,971
95.	Truck transportation	70,877	0	7,609	0	8,022	0	2,100	0	88,609	0	+88,609	82	+70,877
96.	Water transportation	1,021,020	1,016,899	109,616	109,174	387,295	385,732	52,549	52,337	1,570,481	1,564,142	+6,339	51	+4,121
97.	Air transportation	1,346,122	352,703	144,519	37,866	93,262	24,436	20,440	5,356	1,604,343	420,361	+1,183,982	109	+993,419
98.	Other transporation	173,715	0	18,650	0	29,368	0	12,540	0	234,273	0	+234,273	101	+173,715
99.	Communications, except radio and TV	31,083	26,138	3,337	2,806	13,887	11,678	5,506	4,630	53,813	45,253	+8,560	53	+4,945
100.	Radio and TV broadcasting	2,580	0	277	0	1,864	0	684	0	5,405	0	+5,405	49	+2,580
101.	Electric utilities	22,925	20,180	2,461	2,166	141,012	124,126	74,151	65,272	240,550	211,744	+28,806	67	+2,745
103.	Water and sanitary service	2,469	0	265	0	4,044	0	580	0	7,358	0	+7,358	52	+2,469
	WHOLESALE AND RETAIL TRADE													
104.	Wholesale trade	26,626	0	2,859	0	8,706	0	2,219	0	40,409	0	+40,409	72	+26,626
105.	Retail trade	30,113	0	3,233	0	23,607	0	7,777	0	64,730	0	+64,730	77	+30,113
	FINANCE, INSURANCE AND REAL ESTATE													
106.	Finance	1,396	0	150	0	1,506	0	439	0	3,491	0	+3,491	46	+1,396
107.	Insurance	7,708	3,424	828	368	5,969	2,651	2,285	1,015	16,790	7,457	+9,333	55	+4,284
109.	Other real estate	231,099	0	24,811	0	83,726	0	15,227	0	354,863	0	+354,863	106	+231,099
	SERVICES													
110.	Hotels and lodging places	80,435	0	8,635	0	32,546	0	12,007	0	133,625	0	+133,625	90	+80,435
111.	Other personal services	9,477	0	1,017	0	5,264	0	1,193	0	16,952	0	+16,952	61	+9,477
112.	Miscellaneous business services	13,913	0	1,494	0	9,479	0	2,948	0	27,833	0	+27,833	66	+13,913
113.	Advertising	5,398	0	580	0	4,404	0	802	0	11,184	0	+11,184	57	+5,398
114.	Miscellaneous professional services	28,217	0	3,029	0	13,702	0	5,534	0	50,483	0	+50,483	74	+28,217
115.	Automobile repair	417	0	45	0	184	0	43	0	689	0	+689	41	+417
116.	Motion pictures	33,116	0	3,555	0	24,727	0	6,056	0	67,454	0	+67,454	79	+33,116
117.	Other amusements	20,852	0	2,239	0	12,539	0	4,569	0	40,199	0	+40,199	71	+20,852

Table 2

Energy Requirements in BTUs per Million Dollars of Total U.S. Exports and Import Replacements, 1970, by Industry Class
(In thousands of BTUs)

INDUSTRY Code	Name	BTU requirements from crude petroleum: Exports	BTU requirements from crude petroleum: Import replacements	BTU requirements from natural gas: Exports	BTU requirements from natural gas: Import replacements	BTU requirements from coal: Exports	BTU requirements from coal: Import replacements	BTU requirements from other sources 1/: Exports	BTU requirements from other sources 1/: Import replacements	Total BTU requirements: Exports	Total BTU requirements: Import replacements	NET BTU EXPORTS (+) OR IMPORTS (-): For all energy sources: Amount	For all energy sources: Rank 2/	NET BTU EXPORTS (+) OR IMPORTS (-): For crude petroleum (Amount)
	SERVICES (continued)													
118.	Doctor, dentist, and other medical services	508	0	55	0	382	0	140	0	1,085	0	+1,085	42	+508
120.	Educational services	16,573	0	1,779	0	16,316	0	4,634	0	39,303	0	+39,303	70	+16,573
	GOVERNMENT ENTERPRISES													
122.	Post office	4,503	0	483	0	1,037	0	287	0	6,310	0	+6,310	50	+4,503
124.	Other Federal enterprises	10,225	0	1,098		257,643	0	4,007		272,972	0	+272,972	105	+10,225
	DUMMY INDUSTRIES													
128.	Business travel, entertainment and gifts	0	395,789	0	42,492	0	71,088	0	13,712	0	523,080	-523,080	10	-395,789
	Subtotal, excluding direct trade in crude petroleum, coal, and natural gas	28,651,292	39,437,306	3,075,983	4,233,961	15,038,238	20,572,327	1,588,493	1,796,546	48,354,006	66,040,140	-17,686,134		-10,786,014
	Energy content of direct imports and exports of crude petroleum, coal, and natural gas	541,251	74,950,241	1,824,206	16,773,626	33,500,891	6,826			35,866,349	91,730,693	-55,864,344		-74,408,990
	TOTAL	29,192,544	114,387,546	4,900,189	21,007,587	48,539,129	20,579,153	1,588,493	1,796,546	84,220,354	157,770,833	-73,550,479		-85,195,002

1/ "Other sources" are hydropower, nuclear power, and geothermal power.

2/ In descending order of net imports. Ranking excludes direct imports and exports of crude petroleum, coal, and natural gas; the BTU content of these direct imports and exports is shown in the next-to-last row of the table.

Note: Industry classes for which there were no exports or competitive imports are omitted from the table. Detail may not add to totals because of rounding.

Source: See explanation in the text.