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INDUSTRIAL SECTOR TECHNOLOGY USE
MODEL (ISTUM): INDUSTRIAL ENERGY
USE IN THE UNITED STATES, 1974-2000. ^{##}

VOLUME 3 ^{##} APPENDIX ON SERVICE AND
FUEL DEMANDS

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PREFACE

This book is the third volume of the ISTUM (Industrial Sector Technology Use Model) report. The first volume of the report describes the primary model logic and the model's data inputs. The second volume lists and evaluates the results of one model run. This and the fourth volume give supplementary information in two sets of model data -- the energy consumption base and technology descriptions.

Chapter III of volume I, book 1 describes the ISTUM demand base and explains how that demand base was developed. Readers should treat this volume as a set of appendices to that chapter. The chapter on demands in Volume I describes the assumptions and methodology used in constructing the ISTUM demand base; this volume simply lists tables of data from that demand base. Readers will generally want to read the chapter on demands in Volume I before they examine the tables in this volume.

This book divides the demand tables into two appendices. Appendix III-1 contains detailed tables on ISTUM fuel consumption estimates, service demand forecasts, and size and load factor distributions. Appendix III-2 contains tables detailing ISTUM allocations of each industry's fuel consumption to service sectors. The tables show how the ECDB was used to develop the ISTUM demand base.

APPENDIX III-1

MISCELLANEOUS DETAILED TABLES

This appendix contains four sets of tables describing information included in the ISTUM demand base. The first set of tables describe 1974 fuel use: they disaggregate fuel consumption according to SIC, service sector, and fuel type. The next set shows 1974 fuel consumption and service demand estimates and 1980, 1985, 1990, 1995, and 2000 service demand forecasts. The third set indicates, for each service sector, the fraction of an industry's service demands that are allocated to each size-load factor category; these fractions sum to one for each industry, since a Btu of service demand can be used by only one energy consuming device. The last set of tables shows the quantities of service demand required by each service sector in 1974; since old (1974) technologies generally correspond to the fuels they consume, these service demands are disaggregated by fuel type.

SECTION I

1974 FUEL CONSUMPTION

1974 FUEL CONSUMPTION BY SERVICE SECTOR (10E12 BTUS)

	COAL	COKE-BR	DISTIL.	RESID.	MISCPET	LPG	NAT GAS	OTH GAS	HYDRO	ELEC	NEC EN	TOTAL
STEAM	013.0	1.9	321.4	696.6		25.9	2501.8	298.9		3.3	1046.2	5709.0
INT DH			57.3	14.7	10.1	95.3	1212.0	33.1		125.3	178.9	1726.8
DTY DH	6.0	33.5	15.0	196.1		69.6	107.0		0.4	7.9	0.3	436.6
INDR HT	5.3		61.7	253.6	167.4	12.8	564.9	346.9			20.6	1433.4
MCH DR			99.8	15.7	4.0	4.0	464.3	19.0	11.7	1994.4	23.0	2635.9
ELYTIC									13.0	453.5		466.5
LIQ FD					808.1						45.3	853.4
NGAS FD							485.7					485.7
LPG FD						1074.4						1074.4
MET CL	2363.1											2363.1
MISC EN					70.9	1.9				99.4		172.2
SPC HT	39.0		20.2	57.5		5.3	233.7			17.4	21.3	402.4
INDR ~C			20.1		204.7	15.7	744.9	424.0				1409.3
CALCI	229.0		24.9	20.3			406.2				44.0	724.4
GL MELT			16.7	15.0			189.9			16.2		237.8
FIRING	2.6		2.0	1.8			71.8			2.1		80.3
IRN MAK				81.0			43.0	9.0		8.0		141.0
STL MAK				49.0			60.0	6.0				115.0
STL REN				23.0			322.0	228.0		5.0		578.0
INT GEN	246.5	2.4	13.0	100.3	0.8	0.7	386.4	52.8			45.2	848.1
CAP EL									25.1	303.2		328.3
CAP DHT								364.7			125.1	489.8
COK CON		40.7										40.7
TOTAL	3704.5	2.9	661.0	1524.6	1266.0	1305.6	7793.6	1053.0		2429.4	1299.7	21034.6

		TOTAL ISTUM FUEL CONSUMPTION IN 1974					10E12 BTUS						
COAL		COKE-BR	DISTILL.	RESID.	MISCPET	LPG	NAT GAS	OTH GAS	HYDRO	ELEC	NEC EN	TOTAL	
FOOD	20	77.6	4.1	76.5	73.2		537.9			130.3	35.0	934.6	
TOBACCO	21	5.5		1.1	4.1		4.5			3.5	0.3	19.0	
TEXTILES	22	22.1		27.4	37.7		107.9			109.6	12.0	316.7	
APPAREL	23	1.4		5.6	1.9		20.2			33.2	2.5	64.8	
LUMBER, WOOD	24	3.5		43.0	10.5		91.9			63.7	40.7	253.3	
FURNITURE	25	3.3		6.0	3.0		28.7			15.8	2.2	59.0	
PAPER, ALLIED PROD	26	209.3		26.3	489.7	69.6	418.7			136.0	874.2	2223.8	
PRINTING, PUBLISH.	27	0.4		6.0	2.4		37.1			38.3	4.9	89.1	
CHEMICALS	28	339.6	3.2	127.4	173.1	725.8	1074.4	2154.5		436.9	176.1	5211.0	
PETROLEUM REFINING	29	5.3		50.3	282.0	374.0	39.6	1151.7	1083.6	83.7	3.0	3073.2	
RUBBER, MISC. PLAS	30	30.3		18.7	26.3			88.6		66.2	20.7	250.8	
LEATHER	31	1.3		3.0	3.3			5.2		5.5	3.6	21.9	
S.C.G., CONCRETE	32	233.0	26.8	76.1	49.6			708.0		163.7	44.0	1301.3	
STEEL	33	2533.4	113.6	14.7	248.6		1.1	682.1	30.6	172.0	87.2	3420.5	
ALUMINUM	33A	67.1		4.0	8.1	92.4	2.9	229.7		220.0		624.2	
OTHER PRI. METALS	33B	40.7	65.8	23.0	24.0			421.3		150.4	31.0	756.2	
FABRICATED METALS	34	12.3	2.2	25.7	17.9			234.0		98.4	16.8	407.3	
MACHINERY (~ELEC.)	35	22.3	4.8	18.8	18.3			182.0		180.5	14.4	361.1	
ELEC. MACHINERY	36	14.4	0.7	12.1	11.2			105.4		91.6	11.3	246.7	
TRANSPORT. EQUIP.	37	49.6	3.1	17.4	24.8			150.0		181.0	24.4	370.3	
MEASURING EQUIP.	38			3.6	10.1			17.1		16.8	2.9	50.5	
MISC MANUFACTURING	39	0.9		5.2	4.8			22.1		15.7	1.8	50.5	
TOTAL MANUFACTURING		3673.3	2.9	591.9	1524.6	1192.2	1187.6	7398.6	1053.0	2252.8	1234.6	20105.8	
CROPS	01			10.6		22.4	63.4	162.9		74.3		333.6	
LIVESTOCK	02					48.5	31.0	4.3		34.2		118.0	
TOTAL AGRICULTURE				10.6		70.9	94.4	167.2		108.5		451.6	
METAL MINING	10	18.5		24.6		1.2	4.8	77.4		39.3	6.0	171.8	
NONMETAL MINING	14	12.7		33.9		1.7	18.8	150.4		28.8	59.1	305.4	
TOTAL MINING		31.2		58.5		2.9	23.6	227.8		68.1	65.1	477.2	
TOTAL INDUSTRY		3704.5	2.9	661.0	1524.6	1266.0	1305.6	7793.6	1053.0	2429.4	1299.7	21034.6	

STEAM : 1974 FUEL CONSUMPTION (10**12 BTUS)											
COAL	COKE-BR	DISTIL.	RESID.	MISCPET	LPG	NAT GAS	OTH GAS	HYDRO	ELEC	NEC EN	TOTAL
71.2		57.6	55.7			320.1					504.6
4.9			2.1								7.0
20.3		25.2	34.6			70.4					150.5
0.7		2.8	0.9			12.1					16.6
3.5		38.7	5.3			55.1				31.3	133.9
3.3						11.5					14.8
166.8		22.8	329.3			209.2				845.5	1573.6
0.3		6.0	1.7								8.0
308.5		67.9	95.1			956.8				93.8	1522.0
		11.8	70.5		9.8	276.5	274.9			3.0	646.5
28.8		9.3	13.1			84.2				10.3	145.8
1.3		3.0	3.0			5.1					12.4
		10.2	10.2			29.0					49.5
77.8	1.9					153.9	24.0				257.6
36.6			12.0								48.6
7.4		18.0	7.2			80.7				16.8	130.0
22.3		16.9	16.5			71.0				13.0	139.6
13.0		10.9	10.1			17.7				11.3	62.9
32.7		11.5	16.4			59.4				16.1	136.1
		3.6	9.1							2.9	15.6
9.9		5.2	4.1			11.1				1.8	23.0
809.3	1.9	321.4	696.6		9.8	2423.8	298.9			1045.9	5598.6
					6.7				3.3		10.0
					6.7				3.3		10.0
						2.8				0.3	3.1
12.7					9.4	75.2					97.3
12.7					9.4	78.0				0.3	100.4
813.0	1.9	321.4	696.6		25.9	2501.8	298.9		3.3	1046.2	5709.0

INT DH 1: 1974 FUEL CONSUMPTION (10**12 BTUS)
 COAL COKE-BR DISTIL. RESID. MISCPET LPG NAT GAS OTH GAS HYDRO ELEC NEC EN TOTAL

FOOD	20	12.7				178.4			35.0	226.1
TOBACCO	21					4.5		3.5		8.0
TEXTILES	22					31.4			12.0	43.4
APPAREL	23					8.1		16.6		24.7
LUMBER, WOOD	24					36.8		19.1		55.9
FURNITURE	25		1.5			17.2				18.7
PRINTING, PUBLISH.	27					35.2			4.9	40.1
CHEMICALS	28							39.0		39.0
RUBBER, MISC. PLAS	30	9.3	13.2						10.3	32.8
LEATHER	31							5.5	3.6	9.1
STEEL	331				1.1	63.5	33.1		37.9	135.6
ALUMINUM	3334	4.0		10.1		114.9				129.0
OTHER PRI. METALS	334	20.7				210.5		30.1	31.0	292.3
FABRICATED METALS	34					116.9				116.9
MACHINERY (~ELEC.)	35					91.0				91.0
ELEC. MACHINERY	36					52.7				52.7
TRANSPORT. EQUIP.	37					60.0				60.0
MEASURING EQUIP.	38					8.6				8.6
MISC MANUFACTURING	39					11.1				11.1
TOTAL MANUFACTURING		46.7	14.7	10.1	1.1	1040.7	33.1	113.8	134.7	1395.0
CROPS	01	10.6			63.4	27.8		2.9		104.7
LIVESTOCK	02				19.0	3.2				22.2
TOTAL AGRICULTURE		10.6			82.4	31.0		2.9		126.9
METAL MINING	10				2.4	65.1			2.8	70.3
NONMETAL MINING	14				9.4	75.2		8.6	41.4	134.6
TOTAL MINING					11.8	140.3		8.6	44.2	204.9
TOTAL INDUSTRY		57.3	14.7	10.1	95.3	1212.0	33.1	125.3	178.9	1726.8

DTY DH | : 1974 FUEL CONSUMPTION (10**12 BTUS)

COAL	COKE-BR	DISTIL.	RESID.	MISCPET	LPG	NAT GAS	OTH GAS	HYDRO	ELEC	NEC EN	TOTAL
------	---------	---------	--------	---------	-----	---------	---------	-------	------	--------	-------

OOD	20	4.1		11.8							15.9
OBACCO	21		1.1	2.1						0.3	3.4
PAPER, ALLIED PROD	26			69.1	69.6	105.8					244.5
TEEL	331	29.4	14.7	95.6		1.2					140.9
LUMINUM	3334	6.0		5.5				0.4	7.9		19.8
OTHER PRI. METALS	334			12.0							12.0
TOTAL MANUFACTURING		6.0	33.5	15.8	196.1	69.6	107.0	0.4	7.9	0.3	436.6
TOTAL INDUSTRY		6.0	33.5	15.8	196.1	69.6	107.0	0.4	7.9	0.3	436.6

INDR HT: 1974 FUEL CONSUMPTION (10**12 BTUS)

COAL	COKE-BR	DISTIL.	RESID.	MISCPET	LPG	NAT GAS	OTH GAS	HYDRO	ELEC	NEC EN	TOTAL
------	---------	---------	--------	---------	-----	---------	---------	-------	------	--------	-------

CHEMICALS	20		45.3	53.2		190.0				20.6	309.1
PETROLEUM REFINING	29	5.3	16.5	200.4	167.4	12.8	374.9	346.9			1124.2
TOTAL MANUFACTURING		5.3	61.7	253.6	167.4	12.8	564.9	346.9		20.6	1433.4
TOTAL INDUSTRY		5.3	61.7	253.6	167.4	12.8	564.9	346.9		20.6	1433.4

MCH DR | : 1974 FUEL CONSUMPTION (10**12 BTUS)
 COAL | COKE-BR | DISTIL. | RESID. | MISCPET | LPG | NAT GAS | OTH GAS | HYDRO | ELEC | NEC EN | TOTAL |

FOOD	20									104.5		104.5
TEXTILES	22									56.1		56.1
APPAREL	23									16.6	2.5	19.1
LUMBER, WOOD	24	4.3								44.6		48.9
FURNITURE	25	6.0								15.8		21.8
PAPER, ALLIED PROD	26							10.7		247.7		258.4
PRINTING, PUBLISH.	27									38.3		38.3
CHEMICALS	28	7.1	9.5			98.4				334.6		449.6
PETROLEUM REFINING	29	1.0	6.2	1.1	0.6	20.0	19.0			98.9		146.8
RUBBER, MISC. PLAS	30									66.2		66.2
S.C.G. CONCRETE	32	20.8								132.0		152.8
STEEL	33									130.9		130.9
ALUMINUM	3334				1.0				1.0	18.5		20.5
OTHER PRI. METALS	334	2.3				210.8				105.3		318.4
FABRICATED METALS	34									98.4		98.4
MACHINERY (~ELEC.)	35									100.5		100.5
ELEC. MACHINERY	36									91.6		91.6
TRANSPORT. EQUIP.	37									101.0		101.0
MEASURING EQUIP.	38									16.8		16.8
MISC MANUFACTURING	39									15.7		15.7
TOTAL MANUFACTURING		41.5	15.7	1.1	1.6	329.2	19.0	11.7		1834.0	2.5	2256.3
CROPS	01					135.1				66.3		201.4
LIVESTOCK	02									23.9		23.9
TOTAL AGRICULTURE						135.1				90.2		225.3
METAL MINING	10	24.4		1.2	2.4					50.0	2.8	80.8
NONMETAL MINING	14	33.9		1.7						20.2	17.7	73.5
TOTAL MINING		58.3		2.9	2.4					70.2	20.5	154.3
TOTAL INDUSTRY		99.8	15.7	4.0	4.0	464.3	19.0	11.7		1994.4	23.0	2635.9

ELYTIC | : 1974 FUEL CONSUMPTION (10**12 BTUS)
 COAL | COKE-BR | DISTIL. | RESID. | MISCPET | LPG | NAT GAS | OTH GAS | HYDRO | ELEC | NEC EN | TOTAL |

CHEMICALS	28								126.8		126.8
STEEL	331								64.7		64.7
ALUMINUM	3334							13.0	247.0		260.0
OTHER PRI. METALS	334								15.0		15.0
TOTAL MANUFACTURING								13.0	453.5		466.5
TOTAL INDUSTRY								13.0	453.5		466.5

LIQ FD | : 1974 FUEL CONSUMPTION (10**12 BTUS)
 COAL | COKE-BR | DISTIL. | RESID. | MISCPET | LPG | NAT GAS | OTH GAS | HYDRO | ELEC | NEC EN | TOTAL |

CHEMICALS	28	725.8							45.3	771.1
ALUMINUM	3334	82.3								82.3
TOTAL MANUFACTURING		808.1							45.3	853.4
TOTAL INDUSTRY		808.1							45.3	853.4

NGAS ED: 1974 FUEL CONSUMPTION (10**12 BTUS)

COAL	COKE-BR	DISTIL.	RESID.	MISCPET	LPG	NAT GAS	OTH GAS	HYDRO	ELEC	NEC EN	TOTAL
------	---------	---------	--------	---------	-----	---------	---------	-------	------	--------	-------

CHEMICALS	28					485.7					485.7
TOTAL MANUFACTURING						485.7					485.7
TOTAL INDUSTRY						485.7					485.7

LPG FD |: 1974 FUEL CONSUMPTION (10**12 BTUS)
 COAL |COKE-BR|DISTIL.|RESID. |MISCPET|LPG |NAT GAS|OTH GAS|HYDRO |ELEC |NEC EN |TOTAL |

CHEMICALS	28	1074.4	1074.4
TOTAL MANUFACTURING		1074.4	1074.4
TOTAL INDUSTRY		1074.4	1074.4

MET CL 1: 1974 FUEL CONSUMPTION (10**12 BTUS)

STEEL	331	2363.1	2363.1
TOTAL MANUFACTURING		2363.1	2363.1
TOTAL INDUSTRY		2363.1	2363.1

SPC HT | : 1974 FUEL CONSUMPTION (10**12 BTUS)

COAL	COKE-BR	DISTIL	RESID.	MISCPET	LPG	NAT GAS	OTH GAS	HYDRO	ELEC	NEC EN	TOTAL
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FOOD	20	3.4	3.5	3.1		20.5					30.5
TOBACCO	21	0.6									0.6
TEXTILES	22	1.3	1.7	2.3		4.0			1.4		10.7
APPAREL	23	0.7	2.8	0.9							4.4
LUMBER, WOOD	24			5.3						9.4	14.6
FURNITURE	25			1.5						2.2	3.7
PAPER, ALLIED PROD	26			9.9		25.8					35.7
PRINTING, PUBLISH.	27	0.1		0.7		1.9					2.7
CHEMICALS	28	4.1	2.5	7.6							14.2
RUBBER, MISC. PLAS	30	1.5				4.4					5.9
LEATHER	31			0.3		0.1					0.4
S,C,G, CONCRETE	32		1.0	2.0		6.9			15.4		25.3
STEEL	33					38.5					38.5
OTHER PRI. METALS	334	4.1									4.1
FABRICATED METALS	34	4.9	7.7	10.7		36.4					59.8
MACHINERY (~ELEC.)	35		1.9	1.8		20.0			1.4		25.1
ELEC. MACHINERY	36	1.4	1.2	1.1		35.0					38.8
TRANSPORT. EQUIP.	37	16.9	5.9	8.4		30.6			8.3		70.1
MEASURING EQUIP.	38			1.0		8.6					9.6
MISC MANUFACTURING	39			0.7							0.7
TOTAL MANUFACTURING		39.0	28.2	57.5		232.6			16.8	21.3	395.4
LIVESTOCK	02					5.3	1.1		0.6		7.0
TOTAL AGRICULTURE						5.3	1.1		0.6		7.0
TOTAL INDUSTRY		39.0	28.2	57.5		5.3	233.7		17.4	21.3	402.4

MISC EN|: 1974 FUEL CONSUMPTION (10**12 BTUS)
 COAL |CCKE-BR|DISTIL.|RESID. |MISCPET|LPG |NAT GAS|OTH GAS|HYDRG |ELEC |NEC EN |TOTAL |

FOOD	20							34.6	34.6
TEXTILES	22							53.3	53.3
ALUMINUM	3334				1.9				1.9
TOTAL MANUFACTURING					1.9			87.9	89.8
CROPS	01		22.4					5.1	27.5
LIVESTOCK	02		48.5					6.4	54.9
TOTAL AGRICULTURE			70.9					11.5	82.4
TOTAL INDUSTRY			70.9		1.9			99.4	172.2

INDR ~C|: 1974 FUEL CONSUMPTION (10**12 BTUS)
 COAL |COKE-BR|DISTIL.|RESID. |MISCPET|LPG |NAT GAS|OTH GAS|HYDRO |ELEC |NEC EN |TOTAL |

CHEMICALS	28					286.7					286.7
PETROLEUM REFINING	29	20.1	204.7	15.7	458.2	424.0					1122.7
TOTAL MANUFACTURING		20.1	204.7	15.7	744.9	424.0					1409.3
TOTAL INDUSTRY		20.1	204.7	15.7	744.9	424.0					1409.3

CALCI | : 1974 FUEL CONSUMPTION (10**12 BTUS)
 COAL | COKE-BR | DISTIL. | RESID. | MISCPET | LPG | NAT GAS | OTH GAS | HYDPO | ELEC | NEC EN | TOTAL |

S,C,G, CONCRETE	32	229.0	24.9	20.3		406.2				44.0	724.4
TOTAL MANUFACTURING		229.0	24.9	20.3		406.2				44.0	724.4
TOTAL INDUSTRY		229.0	24.9	20.3		406.2				44.0	724.4

GL MELT|: 1974 FUEL CONSUMPTION (10**12 BTUS)
 COAL :|COKE-BR|DISTIL.|RESID. |MISCPET|LPG |NAT GAS|OTH GAS|HYDRO |ELEC |NEC EN |TOTAL |

S,C,G, CONCRETE	32	16.7	15.0			189.9			16.2		237.8
TOTAL MANUFACTURING		16.7	15.0			189.9			16.2		237.8
TOTAL INDUSTRY		16.7	15.0			189.9			16.2		237.8

FIRING | : 1974 FUEL CONSUMPTION (10**12 BTUS)

COAL	COKE-BR	DISTIL.	RESID.	MISC PET	LPG	NAT GAS	OTH GAS	HYDRO	ELEC	NEC EN	TOTAL
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S.C.G. CONCRETE	32	2.6		2.0	1.8		71.8		2.1		80.3
TOTAL MANUFACTURING		2.6		2.0	1.8		71.8		2.1		80.3
TOTAL INDUSTRY		2.6		2.0	1.8		71.8		2.1		80.3

IRN MAX: 1974 FUEL CONSUMPTION (10**12 BTUS)

COAL	COKE-BR	DISTIL.	RESID.	MISC PET	LPG	NAT GAS	OTH GAS	HYDRO	ELEC	NEC EN	TOTAL
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STEEL	331		81.0			43.0	9.0		8.0		141.0
TOTAL MANUFACTURING			81.0			43.0	9.0		8.0		141.0
TOTAL INDUSTRY			81.0			43.0	9.0		8.0		141.0

STL MAK: 1974 FUEL CONSUMPTION (10**12 BTUS)

COAL	COKE-DR	DISTIL.	RESID.	MISCPET	LPG	NAT GAS	OTH GAS	HYDRO	ELEC	NEC EN	TOTAL
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STEEL	331			49.0		60.0	6.0				115.0
TOTAL MANUFACTURING				49.0		60.0	6.0				115.0
TOTAL INDUSTRY				49.0		60.0	6.0				115.0

STL REN|: 1974 FUEL CONSUMPTION (10**12 BTUS)
 COAL | COKE-DR|DISTIL.|RESID. |MISCPET|LPG |NAT GAS|OTH GAS|HYDRO |ELEC |NEC EN |TOTAL |

STEEL	331	23.0	322.0	228.0	5.0	578.0
TOTAL MANUFACTURING		23.0	322.0	228.0	5.0	578.0
TOTAL INDUSTRY		23.0	322.0	228.0	5.0	578.0

INT GEN: 1974 FUEL CONSUMPTION (10**12 BTUS)

COAL	COKE-BR	DISTIL.	RESID.	MISCPET	LPG	NAT GAS	OTH GAS	HYDRO	ELEC	NEC EN	TOTAL
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FOOD	20	3.0		2.7	2.6			18.9			27.2
TEXTILES	22	0.5		0.5	0.8			2.1			3.9
PAPER, ALLIED PROD	26	42.5		3.5	81.4			77.9		28.7	234.0
CHEMICALS	28	27.0		4.7	7.7			136.9		16.4	192.7
PETROLEUM REFINING	29			0.9	4.9	0.8	0.7	22.1	18.8		48.2
S,C,G, CONCRETE	32	1.4		0.5	0.3			4.2			6.4
STEEL	331	92.5	2.4						34.0		128.9
ALUMINUM	3334	61.1			2.6			114.8			178.5
TOTAL MANUFACTURING		220.0	2.4	12.8	100.3	0.8	0.7	376.9	52.8	45.1	819.8
METAL MINING	10	18.5		0.2				9.5		0.1	28.3
TOTAL MINING		18.5		0.2				9.5		0.1	28.3
TOTAL INDUSTRY		246.5	2.4	13.0	100.3	0.8	0.7	386.4	52.8	45.2	848.1

CAP EL | : 1974 FUEL CONSUMPTION (10**12 BTUS)

COAL	COKE-BR	DISTIL.	RESID.	MISCPET	LPG	NAT GAS	OTH GAS	HYDRO	ELEC	NEC EN	TOTAL
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FOOD	20								-8.8		-8.8
TEXTILES	22								-1.3		-1.3
PAPER, ALLIED PROD	26					-10.7	-111.7		-122.4		-122.4
CHEMICALS	28						-63.5		-63.5		-63.5
PETROLEUM REFINING	29						-15.2		-15.2		-15.2
S.C.G. CONCRETE	32						-2.0		-2.0		-2.0
STEEL	331						-36.6		-36.6		-36.6
ALUMINUM	3334					-14.4	-53.4		-67.8		-67.8
TOTAL MANUFACTURING						-25.1	-292.5		-317.6		-317.6
METAL MINING	10						-10.7		-10.7		-10.7
TOTAL MINING							-10.7		-10.7		-10.7
TOTAL INDUSTRY						-25.1	-303.2		-328.3		-328.3

CAP DHT: 1974 FUEL CONSUMPTION (10**12 BTUS)

COAL	COKE-BR	DISTIL.	RESID.	MISCPET	LPG	NAT GAS	OTH GAS	HYDRO	ELEC	NEC EN	TOTAL
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STEEL	331										
TOTAL MANUFACTURING						364.7				125.1	489.8
TOTAL INDUSTRY						364.7				125.1	489.8

COK CON|: 1974 FUEL CONSUMPTION (10**12 BTUS)
 COAL |COKE-BR|DISTIL.|RESID. |MISCPET|LPG |NAT GAS|OTH GAS|HYDRO |ELEC |NEC EN |TOTAL |

CHEMICALS	20	3.2								3.2
S.C.G. CONCRETE	32	26.8								26.8
STEEL	331	147.3								147.3
OTHER PRI. METALS	334	65.8								65.8
FABRICATED METALS	34	2.2								2.2
MACHINERY (~ELEC.)	35	4.8								4.8
ELEC. MACHINERY	36	0.7								0.7
TRANSPORT. EQUIP.	37	3.1								3.1
TOTAL MANUFACTURING		40.7								40.7
TOTAL INDUSTRY		40.7								40.7

SECTION 2

SERVICE DEMAND FORECASTS

April 6, 1978

TOTAL 1978 FUEL CONSUMPTION BY SIC (10012 BTUE) 1974

	1	2	3	4	5	6	7	8	9	10	11	12
	STEAM	DIESEL	DIESEL	DIESEL	MACHINE	ELECTRIC	LIQUID	NAT GAS	LPG	MET	MISC EN	SPACE
	1	2	3	4	5	6	7	8	9	10	11	12
FOOD	201	504.6	226.1	15.9		104.5					34.6	30.5
TOBACCO	211	7.0	8.0	3.4								0.5
TEXTILES	221	150.5	43.4			56.1				53.3		10.7
APPAREL	231	16.6	24.7			19.1						4.4
LUMBER, WOOD	241	133.9	55.9			48.9						14.6
FURNITURE	251	14.0	18.7			21.0						3.7
PAPER, ALLIED PROD	261	1573.6		244.5		250.4						35.7
PRINTING, PUBLISH	271	0.0	49.1			30.3						2.7
CHEMICALS	281	1522.0	39.0		302.1	449.6	126.8	771.1	405.7	1074.4		14.2
PETROLEUM REFINING	291	646.5			1124.2	146.0						
RUBBER, PLAS, GLASS	301	145.0	32.0			66.2						5.9
LEATHER	311	12.4	9.1									0.4
S, C, G, CONCRETE	321	49.5				152.0						25.3
STEEL	3311	257.6	135.3	140.9		130.9	64.7			2363.1		30.5
ALUMINUM	33341		129.0	19.0		20.5	260.0	82.3			1.9	
OTHER PREL. METALS	3341	48.6	292.3	12.0		310.4	15.0					4.1
FABRICATED METALS	341	130.0	116.9			90.4						59.7
MACHINERY (ELEC.)	351	139.6	91.0			100.5						25.1
ELEC. MACHINERY	361	62.9	52.7			91.6						30.6
TRANSPORT, EQUIP.	371	136.1	60.0			101.0						70.1
REPAIRING, REPAIR	381	15.6	8.6			16.0						9.3
MISC MANUFACTURING	391	21.0	11.1			15.7						0.7
TOTAL MANUFACTURING	1	5599.5	1395.0	436.6	1433.4	2254.3	466.5	853.4	405.7	1074.4	2363.1	395.3
CROPS	011		104.7			201.4						27.5
LIVESTOCK	021	10.0	22.2			23.9						48.5
TOTAL AGRICULTURE	1	10.0	126.9			225.3						76.0
METAL MINING	101	3.1	70.3			80.0						0.2
NONMETAL MINING	141	97.3	134.6			73.5						
TOTAL MINING	1	100.4	204.9			153.5						0.2
TOTAL INDUSTRY	1	5700.9	1726.8	436.6	1433.4	2635.9	466.5	853.4	405.7	1074.4	2363.1	400.7

April 6, 1978

		13	14	15	16	17	18	19	20	21	22	23	24
		COAL	MELT	FIR	MAK	MAK	REBT	GEN	ELEC	HEAT	COHB		
FOOD	201							27.2	-	0.0			934.6
TOBACCO	211												19.0
TEXTILES	221							3.9	-	1.3			316.7
APPAREL	231												64.8
FURNCE, WOOD	241												253.3
FURNITURE	251												59.0
PAPER, ALLIED PROD	261							234.0	-	122.4			2223.0
PRINTING, PUBLISH	271												89.1
CHEMICALS	281	206.7						192.7	-	63.5		3.2	5211.0
PETROLEUM REFINING	291	1122.7						48.2	-	15.2			3073.2
RUBBER, MISC, PLAS	301												250.0
LEATHER	311												21.9
S,C,G, CONCRETE	321		724.4	237.0	80.3			4.4	-	2.0		26.0	1301.3
STEEL	3311					141.0	115.0	570.0	128.9	-	36.6	-489.8	3420.5
ALUMINUM	3334								170.5	-	67.8		624.2
OTHER FRI, METALS	3341											65.0	756.2
PACKAGED METALS	341											2.2	407.2
MACHINERY (ELEC.)	351											4.0	361.0
ELEC, MACHINERY	361											0.7	246.7
TRANSPORT, EQUIP.	371											3.1	370.3
MEASURING EQUIP.	381												50.5
MISC MANUFACTURING	391												50.5
TOTAL MANUFACTURING		1409.3	724.4	237.0	80.3	141.0	115.0	570.0	819.0	-	317.6	-489.8	20105.6
CEDES	011												333.6
LIVESTOCK	021												110.0
TOTAL AGRICULTURE													451.6
METAL MINING	101								20.3	-	10.7		172.0
NONMETAL MINING	141												305.4
TOTAL MINING									20.3	-	10.7		477.4
TOTAL TROUSTRY		1409.3	724.4	237.0	80.3	141.0	115.0	570.0	840.1	-	320.3	-489.8	21034.6

April 6, 1978

TOTAL 1974 SERVICE DEMANDS BY SIC (10E12 BTUS) 1974

		STEAM	DIE HT	DIE HT	DIE HT	MACHINE	ELEC-	LIQUID	HAT GAS	LPG	NET	MISC EN	SPACE
		1	2	3	4	5	6	7	8	9	10	11	12
FOOD	201	356.1	67.0	4.0		99.3						7.3	21.4
TOBACCO	211	4.9	4.1	1.0									0.4
TEXTILES	221	106.6	13.0			53.3					40.2		7.0
APPAREL	231	11.7	15.7			17.3							3.2
LODGE, WOOD	241	92.6	16.0			43.7							9.3
FURNITURE	251	10.3	5.6			16.0							2.4
PAPER, ALLIED PROD	261	1010.1		73.3		245.5							25.0
PRINTING, PUBLISH	271	5.9	12.0			36.4							1.9
CHEMICALS	281	1059.4	31.2		178.9	352.4	126.0	771.1	405.7	1074.4			9.9
PETROLEUM REFINING	291	452.0			497.0	108.3							
RUBBER, PLAS, GLAS	301	101.5	9.9			62.9							4.1
LEATHER	311	0.0	5.5										0.3
S, C, G, CONCRETE	321	35.1				131.7							20.0
STEEL	3311	100.1	40.7	42.7		124.4	64.7				2363.1		26.9
ALUMINUM	33341		30.7	10.1		10.0	260.0	02.3				1.9	
OTHER MET, METALS	3341	34.0	102.0	3.6		163.9	15.0						2.6
FABRICATED METALS	341	90.2	35.1			93.5							41.9
MACHINERY (ELEC.)	351	97.3	27.3			95.5							17.6
ELEC, MACHINERY	361	43.5	15.0			07.0							27.1
TRANSPORT, EQUIP.	371	94.5	10.0			95.9							47.7
MEASURING EQUIP.	381	10.0	2.6			16.0							6.0
MISC MANUFACTURING	391	16.2	3.3			14.9							0.5
TOTAL MANUFACTURING	1	3030.6	465.9	135.6	075.9	1077.4	466.5	053.4	405.7	1074.4	2363.1	49.4	276.7
CROPS	011		32.9			103.5						23.4	
LIVESTOCK	021	7.5	6.7			22.7						40.5	6.1
TOTAL AGRICULTURE	1	7.5	39.5			126.2						71.9	6.1
METAL MINING	101	2.0	41.4			57.0						0.2	
NONMETAL MINING	141	60.1	44.7			42.2							
TOTAL MINING	1	70.1	86.1			99.2						0.2	
TOTAL INDUSTRY	1	3900.2	591.6	135.6	075.9	2103.5	466.5	053.4	405.7	1074.4	2363.1	121.5	202.0

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		100R	101	CALCINE	GLASS	BRICK	IRON	STEEL	STEEL	INTERNAL	CAPTIVE	CAP DIR	CORE	TOTALS		
		12	COAL	13	14	BELT	15	16	17	18	19	20	21	22	23	24
FOOD	201															556.6
TOBACCO	211															10.4
TEXTILES	221															221.0
APPAREL	231															47.9
LUMBER, WOOD	241															142.3
FURNITURE	251															35.1
PAPER, ALLIED PROD	261															1381.9
PRINTING, PUBLISH	271															56.2
CHEMICALS	281	177.7												1.0		4268.4
PETROLEUM REFINING	291	696.0														1954.2
RUBBER, PLAS	301															170.3
LEATHER	311															14.6
S,C,G, CONCRETE	321		217.3		79.5		24.9							8.0		517.3
STEEL	3311							46.3	34.5	175.9				-146.9	-160.9	2791.6
ALUMINUM	33341															411.8
OTHER MET, METALS	3341													19.7		341.8
FABRICATED METALS	341													0.7		281.3
MACHINERY (ELEC)	351													1.4		239.1
ELEC, MACHINERY	361													0.2		173.6
TRANSPORT, EQUIP	371													0.9		257.1
MEASURING EQUIP	381															35.3
MISC MANUFACTURING	391															34.9
TOTAL MANUFACTURING	1	873.0	217.3		79.5		24.9	46.3	34.5	175.9				-146.9	-120.9	13931.0
CROPS	011															159.8
LIVESTOCK	021															91.4
TOTAL AGRICULTURE	1															251.2
METAL MINING	101															101.4
NONMETAL MINING	141															135.0
TOTAL MINING	1															236.4
TOTAL THOUSAND	1	873.0	217.3		79.5		24.9	46.3	34.5	175.9				-146.9	-120.9	14430.6

April 6, 1978

TOTAL ISTOM SERVICE DEMANDS BY SIC (10E12 BTUS) 1980

		1 STEAM	2 DIR HT	3 DIR HT	4 DIR HT	5 MACHINE	6 ELEC-	7 LIQUID	8 HAT GAS	9 LPG	10 NET	11 MISC EH	12 SPACE	
		1	1 INTER	2 DIRTY	3 COAL	4 DRIVE	5 LYTIC	6 FEED	7 FEED	8 FEED	9 COAL	10 LUBE	11 HEAT	12
FOOD	201	447.6	85.3	6.0		124.0						9.1	26.8	
TOBACCO	211	5.4	4.6	1.1									0.4	
TEXTILES	221	129.9	15.9			65.0						49.0	9.5	
APPAREL	231	14.7	19.6			21.6							4.0	
LUMBER, WOOD	241	128.2	23.2			60.5							12.9	
FURNITURE	251	12.6	6.8			20.4							2.9	
PAPER, ALLIED PROD	261	1186.0		85.4		286.0							29.1	
PRINTING, PUBLISH.	271	7.0	14.4			43.4							2.2	
CHEMICALS	281	1490.6	43.9		251.7	495.8	178.4	1084.9	683.4	1511.7			13.9	
PETROLEUM REFINING	291	557.2			857.6	131.3								
RUBBER, MISC. PLAS	301	151.5	14.7			93.9							6.1	
LEATHER	311	8.9	5.5										0.3	
S,C,G, CONCRETE	321	45.4				170.1							26.9	
STEEL	3311	173.6	39.2	41.2		119.8	62.4				2277.3		26.0	
ALUMINUM	33341		43.8	11.4		21.3	294.4	93.2				2.2		
OTHER MET. METALS	3341	37.0	111.8	3.9		178.4	16.3						2.9	
FABRICATED METALS	341	109.9	42.7			113.9							51.0	
MACHINERY (W/ELEC.)	351	123.2	34.6			120.9							22.3	
ELEC. MACHINERY	361	53.1	19.3			104.3							33.1	
TRANSPORT, EQUIP.	371	119.1	22.7			120.9							60.1	
MEASURING EQUIP.	381	14.4	3.4			21.3							8.0	
MISC MANUFACTURING	391	20.8	4.3			19.2							0.6	
TOTAL MANUFACTURING	1	4836.2	555.7	149.1	1109.3	2336.6	551.5	1178.1	683.4	1511.7	2277.3	60.3	339.1	
CROPS	011		41.3			130.1						29.4		
LIVESTOCK	021	9.4	8.4			28.5						61.0	7.6	
TOTAL AGRICULTURE	1	9.4	49.7			158.7						90.4	7.6	
METAL MINING	101	2.3	48.3			67.3						0.2		
NONMETAL MINING	141	79.3	52.1			49.1								
TOTAL MINING	1	81.7	100.3			116.4						0.2		
TOTAL THERMIST	1	4927.3	705.8	149.1	1109.3	2611.7	551.5	1178.1	683.4	1511.7	2277.3	150.9	346.7	

April 6, 1978

	OTHER HT	CALCINE	GLASS	BRICK	IRON	STEEL	STEEL	INTERNAL	CAPTIVE	CAP DIR	COKE	TOTALS									
	13	14	MELT	15	FIR	16	MAK	17	MAK	18	RENT	19	GEN	20	ELEC	21	HEAT	22	CONS	23	24
OOD	201																				699.7
OSACCO	211																				11.6
BOTTLES	221																				269.2
PPANEL	231																				59.9
UNDER, WOOD	241																				224.8
URFUTURE	251																				42.7
APER, ALLIED PROD	261																				1586.6
RITING, PUBLISH.	271																				67.0
HERICALS	281	250.1															1.4				6005.6
ETROLEUM REFINING	291	856.4																			2404.4
ODER, MISC. PLAS	301																				266.2
EATHER	311																				14.7
, C, G, CONCRETE	321		280.7	102.7	32.2												10.4				668.2
TEL	3311					44.6		33.2	169.5					-141.6	-155.0						2690.2
LUTION	33341																				466.3
IER PRY, METALS	3341																21.5				371.8
ABRICATED METALS	341																0.8				318.4
ACTIONERY (-ELEC.)	351																1.8				302.8
EC, MACHINERY	361																0.3				212.1
RANSFORT, EQUIP.	371																1.2				323.9
EASURING EQUIP.	381																				47.2
ISC MANUFACTURING	391																				44.9
TAL MANUFACTURING	1	1106.5	280.7	102.7	32.2	44.6		33.2	169.5					-141.6	-117.8						17098.2
SOPS	011																				200.9
IVESTOCK	021																				115.0
TIAL AGRICULTURE	1																				315.8
ETAL MINING	101																				118.1
ONMETAL MINING	141																				180.5
TIAL MINING	1																				298.7
TIAL INDUSTRY	1	1106.5	280.7	102.7	32.2	44.6		33.2	169.5					-141.6	-117.8						17712.7

STEAM	DIR HT	DIR HT	INDR HT	MACHINE	ELEC	LIQUID	HAT GAS	LFG	NET	MISC EH	SPACE	
1	1	INTER 2	DIRTY 3	COAL 4	DRIVE 5	LYTIC 6	FEED 7	FEED 8	FEED 9	COAL 10	LURE 11	HEAT 12

COMMODITY	UNIT	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989
FOOD		201	529.9	100.9	7.1	147.7							10.8	31.8
TOBACCO		211	5.9	5.0	1.2									0.4
TEXTILES		221	158.5	19.4		79.3							59.9	11.6
APPAREL		231	17.0	22.8		25.1								4.7
LUMBER, WOOD		241	145.2	26.3		68.5								14.6
FURNITURE		251	15.8	8.6		25.7								3.6
PAPER, ALLIED PROD		261	1490.6		108.6	361.3								36.8
PRINTING, PUBLISH.		271	8.5	17.5		52.9								2.7
CHEMICALS		281	2036.5	60.0		677.3	243.7	1482.3	933.6	2065.3				19.0
PETROLEUM REFINING		291	630.4			150.8	970.3							
RUBBER, MISC. PLAS		301	207.3	20.1		128.4								8.3
LEATHER		311	8.8	5.5										0.3
S,C,G, CONCRETE		321	52.3			195.1								31.0
STEEL		3311	204.2	46.1	48.4	141.0	73.4			2678.7				30.5
ALUMINUM		33341		55.4	14.4	26.9	372.1	117.8					2.7	
OTHER FRT. METALS		3341	44.8	135.2	4.7	215.6	19.7							3.5
FABRICATED METALS		341	130.4	50.7		135.2								60.6
MACHINERY (MELEC.)		351	166.5	46.7		163.4								30.1
ELEC. MACHINERY		361	75.5	27.8		153.1								47.7
TRANSPORT, EQUIP.		371	142.8	27.2		145.0								72.1
MEASURING EQUIP.		381	19.9	4.7		29.4								11.0
MISC MANUFACTURING		391	25.9	5.3		23.8								0.8
TOTAL MANUFACTURING		1	6125.0	685.2	183.9	1314.2	2946.5	709.0	1600.1	933.6	2065.3	2678.7	73.4	421.1
CROPS		011		48.9		154.0							34.9	
LIVESTOCK		021	11.2	9.9		33.8							72.2	9.0
TOTAL AGRICULTURE		1	11.2	58.8		187.8							107.0	9.0
METAL MINING		101	2.7	57.0		79.4							0.3	
NONMETAL MINING		141	93.6	61.5		58.0								
TOTAL MINING		1	96.4	118.4		137.4							0.3	
TOTAL INDUSTRY		1	6233.4	862.5	183.9	1314.2	3271.8	709.0	1600.1	933.6	2065.3	2678.7	180.7	430.1

April 6, 1978

	THIR	HT	CALCINE	GLASS	BRICK	IRON	STEEL	STEEL	INTRNAL	CAPTIVE	CAP	DIR	COKE	TOTALS									
	13	14	MELT	15	FIR	16	MAK	17	MAK	18	REHT	19	GEN	20	ELEC	21	HEAT	22	CONS	23	24		
FOOD	201																				828.2		
TOBACCO	211																				12.5		
TEXTILES	221																				328.0		
APPAREL	231																				69.6		
LUMBER, WOOD	241																				254.5		
FURNITURE	251																				53.7		
PAPER, ALLIED PROD	261																				2004.7		
PRINTING, PUBLISH	271																				81.6		
CHEMICALS	281	341.6																		1.8	8205.0		
PETROLEUM REFINING	291	968.9																			2720.4		
RUBBER, MISC, PLAS	301																				364.2		
LEATHER	311																				14.6		
S,C,G, CONCRETE	321		323.6	118.4	37.1															12.0	770.5		
STEEL	3311						52.5	39.1	199.4											166.6	182.4	3164.4	
ALUMINUM	33341																					589.4	
OTHER FRI, METALS	3341																				26.0	449.4	
FABRICATED METALS	341																				1.0	377.9	
MACHINERY (W/ELEC,)	351																				2.5	409.2	
ELEC, MACHINERY	361																				0.4	305.4	
TRANSPORT, EQUIP,	371																				1.4	380.5	
MEASURING EQUIP,	381																					65.0	
MISC MANUFACTURING	391																					55.8	
TOTAL MANUFACTURING	1	1310.6	323.6	118.4	37.1	52.5	39.1	199.4													166.6	137.4	21513.6
CROPS	011																					237.8	
LIVESTOCK	021																					136.1	
TOTAL AGRICULTURE	1																					373.9	
METAL MINING	101																					139.4	
NONMETAL MINING	141																					213.1	
TOTAL MINING	1																					352.5	
TOTAL INDUSTRY	1	1310.6	323.6	118.4	37.1	52.5	39.1	199.4													166.6	137.4	22239.9

April 6, 1978

TOTAL ISTOM SERVICE DEMANDS BY SIC (10E12 BTUS) 1990

		STEAM	DIR HT	DIR HT	INDR HT	MACHINE	ELEC-	LIQUID	HAT GAS	LEG	NET	MISC EN	SPACE
		1	2	3	4	5	6	7	8	9	10	11	12
FOOD	201	594.0	113.1	8.0		165.6						12.1	35.6
TOBACCO	211	6.2	5.3	1.3									0.5
TEXTILES	221	188.7	23.0			94.4					71.2		13.8
APPAREL	231	19.3	25.9			28.5							5.3
LUMBER, WOOD	241	158.1	28.6			74.6							15.9
FURNITURE	251	19.3	10.5			31.4							4.4
PAPER, ALLIED PROD	261	1770.4		127.5		426.9							43.5
PRINTING, PUBLISH	271	10.0	20.5			62.1							3.2
CHEMICALS	281	2709.9	79.8		457.6	901.3	324.3	1972.4	1242.4	2748.2			25.2
PETROLEUM REFINING	291	703.2			1082.4	168.2							11.7
RUBBER, MISC, PLAS	301	291.3	28.3			180.5							0.3
LEATHER	311	0.2	5.1										35.9
S,C,G, CONCRETE	321	60.6				227.2							34.5
STEEL	3311	231.0	52.2	54.8		159.5	83.0				3030.7		
ALUMINUM	33341		66.1	17.2		32.1	443.9	140.5				3.2	
OTHER PRE, METALS	3341	52.1	157.4	5.5		251.1	23.0						4.1
FABRICATED METALS	341	153.1	59.5			158.6							71.1
MACHINERY (ELEC.)	351	208.0	58.4			204.1							37.6
ELEC, MACHINERY	361	100.8	36.6			201.7							62.8
TRANSPORT, EQUIP.	371	169.2	32.2			171.8							85.4
MEASURING EQUIP.	381	25.4	6.0			37.5							14.1
MISC MANUFACTURING	391	32.1	6.6			29.6							1.0
TOTAL MANUFACTURING	1	7510.2	815.2	214.4	1539.9	3604.6	874.2	2112.9	1242.4	2748.2	3030.7	86.6	505.9
CROPS	011		54.8			172.7						39.1	
LIVESTOCK	021	12.5	11.1			37.9						80.9	10.1
TOTAL AGRICULTURE	1	12.5	65.9			210.5						120.0	10.1
METAL MINING	101	3.1	64.7			90.3						0.3	
NONMETAL MINING	141	106.4	69.8			65.9							
TOTAL MINING	1	109.5	134.6			156.1						0.3	
TOTAL INDUSTRY	1	7633.0	1015.7	214.4	1539.9	3973.3	874.2	2112.9	1242.4	2748.2	3030.7	206.8	516.0

April 6, 1978

	INDR	HT	CALCINE	GLASS	BRICK	IRON	STEEL	STEEL	INTERNAL	CAPTIVE	CAP DIR	CORE	TOTALS
	13	14	MELT	15	FIR	16	MAK	17	MAK	18	REHT	19	GEN
	20	ELEC	21	HEAT	22	CONS	23						24

FOOD	201												928.4
TOBACCO	211												13.2
TEXTILES	221												391.0
APPAREL	231												79.0
LUMBER, WOOD	241												277.1
FURNITURE	251												65.7
PAPER, ALLIED PROD	261												2368.4
PRINTING, PUBLISH	271												95.8
CHEMICALS	281	454.6										2.5	10918.2
PETROLEUM REFINING	291	1080.8											3034.6
RUBBER, MISC, PLAS	301												511.8
LEATHER	311												13.5
S,C,G, CONCRETE	321		375.0	137.2	43.0							13.9	892.8
STEEL	3311					59.4	44.2	225.6				-188.5	3580.2
ALUMINUM	33341											-206.3	703.1
OTHER FRI, METALS	3341											30.2	523.4
FABRICATED METALS	341											1.1	443.5
MACHINERY (ELEC,)	351											3.1	511.2
ELEC, MACHINERY	361											0.5	402.4
TRANSPORT, EQUIP,	371											1.7	460.3
MEASURING EQUIP,	381												82.9
MISC MANUFACTURING	391												69.3
TOTAL MANUFACTURING	1	1535.5	375.0	137.2	43.0	59.4	44.2	225.6				-188.5	26365.8
CROPS	011												266.6
LIVESTOCK	021												152.5
TOTAL AGRICULTURE	1												419.1
METAL MINING	101												158.4
NONMETAL MINING	141												242.2
TOTAL MINING	1												400.6
TOTAL INDUSTRY	1	1535.5	375.0	137.2	43.0	59.4	44.2	225.6				-188.5	27185.5

April 6, 1978

TOTAL ISTOM SERVICE DEMANDS BY SIC (10E12 BTUS) 1995

		STEAM	DIR HT	DIR HT	INDR HT	MACHINE	ELEC-	LIQUID	NAT GAS	LFG	MET	MISC EN	SPACE												
		1	1	INTER	2	DIRTY	3	COAL	4	DRIVE	5	LYTIC	6	FEED	7	FEED	8	FEED	9	COAL	10	LUPE	11	HEAT	12
FOOD	201	657.1	125.2	8.8		183.2															13.4		39.4		
TOBACCO	211	6.8	5.7	1.4																				0.5	
TEXTILES	221	219.6	26.8			109.8															82.9		16.0		
APPAREL	231	21.3	28.5			31.4																		5.8	
LUMBER, WOOD	241	170.5	30.9			80.4																		17.1	
FURNITURE	251	22.7	12.3			35.9																		5.2	
PAPER, ALLIED PROD	261	2065.4		148.5		498.2																		50.8	
PRINTING, PUBLISH.	271	11.6	23.8			71.8																		3.7	
CHEMICALS	281	3419.2	100.7			577.3	1137.3	409.2	2488.7	1567.6	3467.6													31.8	
PETROLEUM REFINING	291	777.5				1196.8	186.0																		
RUBBER, MISC. PLAS	301	374.4	36.4			232.0																		15.1	
LEATHER	311	6.7	4.2																					0.2	
S,C,G, CONCRETE	321	69.5				260.4																		41.2	
STEEL	3311	255.0	57.6	50.5		176.0	91.6				3344.5													38.1	
ALUMINUM	33341		75.4	19.7		36.7	506.4	160.3														3.7			
OTHER FRY, METALS	3341	58.7	177.2	6.2		282.6	25.9																	4.6	
FABRICATED METALS	341	172.6	67.1			178.9																		80.2	
MACHINERY (ELEC.)	351	252.2	70.8			247.5																		45.6	
ELEC, MACHINERY	361	125.2	45.5			250.5																		78.0	
TRANSPORT, EQUIP.	371	193.0	35.8			196.0																		97.4	
MEASURING EQUIP.	381	30.6	7.3			45.2																		16.9	
MISC MANUFACTURING	391	37.5	7.7			34.5																		1.2	
TOTAL MANUFACTURING	1	8948.1	939.7	245.5	1774.1	4275.2	1033.1	2649.0	1567.6	3467.6	3344.5	100.0												588.9	
CROPS	011		60.5			191.0																		43.2	
LIVESTOCK	021	13.8	12.3			41.9																		89.5	11.2
TOTAL AGRICULTURE	1	13.8	72.9			232.9																		132.7	11.2
METAL MINING	101	3.5	71.8			100.1																		0.3	
NONMETAL MINING	141	118.0	77.5			73.1																			
TOTAL MINING	1	121.5	149.2			173.1																		0.3	
TOTAL INDUSTRY	1	9083.5	1161.9	245.5	1774.1	4681.3	1033.1	2649.0	1567.6	3467.6	3344.5	233.0												600.1	

2010年12月10日

INDEX	HT	CALCIRE	GLASS	BRICK	IRON	STEEL	STEEL	INTERNAL	CAPTIVE	CAP DIR	COKE	TOTALS
1	2	3	4	5	6	7	8	9	10	11	12	13
14	15	16	17	18	19	20	21	22	23	24	25	26
27	28	29	30	31	32	33	34	35	36	37	38	39
40	41	42	43	44	45	46	47	48	49	50	51	52
53	54	55	56	57	58	59	60	61	62	63	64	65
66	67	68	69	70	71	72	73	74	75	76	77	78
79	80	81	82	83	84	85	86	87	88	89	90	91
92	93	94	95	96	97	98	99	100	101	102	103	104
105	106	107	108	109	110	111	112	113	114	115	116	117
118	119	120	121	122	123	124	125	126	127	128	129	130
131	132	133	134	135	136	137	138	139	140	141	142	143
144	145	146	147	148	149	150	151	152	153	154	155	156
157	158	159	160	161	162	163	164	165	166	167	168	169
170	171	172	173	174	175	176	177	178	179	180	181	182
183	184	185	186	187	188	189	190	191	192	193	194	195
196	197	198	199	200	201	202	203	204	205	206	207	208
209	210	211	212	213	214	215	216	217	218	219	220	221
222	223	224	225	226	227	228	229	230	231	232	233	234
235	236	237	238	239	240	241	242	243	244	245	246	247
248	249	250	251	252	253	254	255	256	257	258	259	260
261	262	263	264	265	266	267	268	269	270	271	272	273
274	275	276	277	278	279	280	281	282	283	284	285	286
287	288	289	290	291	292	293	294	295	296	297	298	299
300	301	302	303	304	305	306	307	308	309	310	311	312
313	314	315	316	317	318	319	320	321	322	323	324	325
326	327	328	329	330	331	332	333	334	335	336	337	338
339	340	341	342	343	344	345	346	347	348	349	350	351
352	353	354	355	356	357	358	359	360	361	362	363	364
365	366	367	368	369	370	371	372	373	374	375	376	377
378	379	380	381	382	383	384	385	386	387	388	389	390
391	392	393	394	395	396	397	398	399	400	401	402	403
404	405	406	407	408	409	410	411	412	413	414	415	416
417	418	419	420	421	422	423	424	425	426	427	428	

FOOD	201																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																			
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April 6, 1978

TOTAL 1STUM SERVICE DEMANDS BY SIC (10E12 BTUS) 2000

	1STEAM	2DIR HT	3DIR HT	4THR HT	5MACHINE	6ELEC-	7LIQUID	8MAT GAS	9LFG	10NET	11MISC EN	12SPACE
	1	2	3	4	5	6	7	8	9	10	11	12
FOOD	201	726.9	138.5	9.8	202.7						14.8	43.6
TOBACCO	211	7.4	6.3	1.4								0.5
TEXTILES	221	255.5	31.2		127.8					96.4		18.6
APPAREL	231	23.5	31.4		34.4							6.4
LUMBER, WOOD	241	184.0	33.3		86.8							18.5
FURNITURE	251	26.7	14.5		43.4							6.1
PAPER, ALLIED PROD	261	2411.9		173.8	581.5							59.3
PRINTING, PUBLISH	271	13.4	27.5		83.0							4.3
CHEMICALS	281	4314.3	127.1	728.5	1434.9	516.4	3140.1	1977.9	4375.3			40.2
PETROLEUM REFINING	291	859.7		1323.3	205.7							
RUBBER, MISC, PLAS	301	481.3	44.7		298.2							19.4
LEATHER	311	5.5	3.4									0.2
S,C,G, CONCRETE	321	79.6			298.3							47.2
STEEL	3311	281.4	63.5	64.7	194.2	101.1				3690.8		42.1
ALUMINUM	33341		84.0	22.4	41.8	577.7	182.9				4.2	
OTHER PET. METALS	3341	64.0	199.2	7.0	317.8	29.1						5.1
FABRICATED METALS	341	194.6	75.7		201.7							90.4
MACHINERY (WELEC.)	351	305.9	85.8		300.1							55.3
ELEC. MACHINERY	361	155.5	54.5		311.1							94.9
TRANSPORT, EQUIP.	371	220.2	41.9		223.5							111.1
MEASURING EQUIP.	381	34.9	8.8		54.5							20.4
MISC MANUFACTURING	391	43.8	9.0		40.3							1.4
TOTAL MANUFACTURING	110693.8	1086.4	281.2	2051.7	5082.0	1224.3	3323.0	1977.9	4375.3	3690.8	115.5	687.0
CROPS	011		67.1		211.3						47.8	
LIVESTOCK	021	15.3	13.6		44.3						99.0	12.4
TOTAL AGRICULTURE	1	15.3	80.7		257.7						146.8	12.4
METAL MINING	101	3.8	79.6		111.0						0.4	
NONMETAL MINING	141	130.9	85.9		81.0							
TOTAL MINING	1	134.7	165.5		192.0						0.4	
TOTAL THERUSTIC	110843.8	1332.6	281.2	2051.7	5531.7	1224.3	3323.0	1977.9	4375.3	3690.8	262.7	699.4

April 6, 1978

	INDR	HT	CALCINE	GLASS	BRICK	IRON	STEEL	STEEL	INTERNAL	CAPTIVE	CAP DIR	COKE	TOTALS
	13	14	MELT	15	FIR	16	MAK	17	MAK	18	RENT	19	GEN
	20	ELEC	21	HEAT	22	CONS	23		24				

FOOD	201												1136.2
TOBACCO	211												15.8
TEXTILES	221												529.6
APPAREL	231												96.0
LUMBER, WOOD	241												322.6
FURNITURE	251												90.7
PAPER, ALLIED PROD	261												3226.4
PRINTING, PUBLISH	271												128.2
CHEMICALS	281	723.8										3.9	17382.2
PETROLEUM REFINING	291	1321.4											3710.0
RUBBER, MISC, PLAS	301												845.6
LEATHER	311												9.2
S,C,G, CONCRETE	321		492.3	180.1	56.4							18.2	1172.2
STEEL	3311					72.3	53.9	274.7				-229.5	-251.3
ALUMINUM	33341												915.1
OTHER FRI, METALS	3341											38.3	662.4
FABRICATED METALS	341											1.4	563.8
MACHINERY (ELEC.)	351											4.5	751.7
ELEC, MACHINERY	361											0.8	620.8
TRANSPORT, EQUIP.	371											2.2	599.0
MEASURING EQUIP.	381												120.5
MISC MANUFACTURING	391												94.4
TOTAL MANUFACTURING		2045.2	492.3	180.1	56.4	72.3	53.9	274.7				-229.5	-182.0
CROPS	911												326.2
LIVESTOCK	921												186.7
TOTAL AGRICULTURE													512.9
METAL MINING	101												194.8
NONMETAL MINING	141												297.8
TOTAL MINING													492.6
TOTAL INDUSTRY		2045.2	492.3	180.1	56.4	72.3	53.9	274.7				-229.5	-182.0

SECTION 3

SIZE AND LOAD FACTOR ALLOCATIONS

STEAM SERVICE SECTOR
(ISTUM Allocation of Service Demands to Each
Size-Load Factor Category)

SIC	Industry	50 MMBtu/Hr Load Factor (Hrs/Yr)		250 MMBtu/Hr Load Factor (Hrs/Yr)	
		4000	7000	4000	7000
20	Food	.45	.05	.45	.05
21	Tobacco	.58	.06	.31	.03
22	Textiles	.42	.29	.13	.12
23	Apparel	.95	.00	.05	.00
24	Lumber and wood	.72	.13	.08	.02
25	Furniture	.81	.14	.04	.01
26	Paper and Allied Products	.06	.14	.24	.56
27	Printing and Publishing	.58	.31	.06	.03
28	Chemicals and Allied Products	.10	.30	.15	.45
29	Petroleum Refining and Related Products	.01	.04	.19	.76
30	Rubber and Miscellaneous Plastics	.13	.38	.13	.38
31	Leather Products	.90	.10	.00	.00
32	Stone, Clay, Glass, and Concrete Products	.25	.25	.25	.25
331	Steel	.09	.21	.21	.49
3334	Aluminum	.00	.00	.00	.00
334	Other Primary Metals	.09	.21	.21	.49
34	Fabricated Metals	.52	.22	.17	.07
35	Machinery (Except Electrical)	.34	.06	.26	.04
36	Electrical Machinery	.76	.08	.15	.01
37	Transportation Equipment	.64	.16	.16	.04
38	Measuring Equipment	.48	.12	.22	.08
39	Miscellaneous Manufacturing Industries	.64	.16	.16	.04
01	Crops	.00	.00	.00	.00
02	Livestock	.30	.10	.00	.00
10	Metal Mining	.40	.60	.00	.00
14	Nonmetal Mining	.40	.60	.00	.00
	All Industry Average (Weighted by 1974 Service Demands)	.13	.13	.21	.41

DIRECT HEAT (DIRTY)

(ISTUM Allocation of Service Demands to Each
Size-Load Factor Category)

SIC	Industry	10 MMBtu/Hr Load Factor (Hrs/Yr)	50 MMBtu/Hr Load Factor (Hrs/Yr)
		6500	6500
20	Food	.30	.20
21	Tobacco	.30	.20
26	Paper and Allied Products	.30	.20
331	Steel	.30	.20
3334	Aluminum	.30	.20
334	Other Primary Metals	.30	.20
	All Industry Average (Weighted by Service Demands)	.30	.20

NATURAL GAS FEEDSTOCKS

(ISTUM Allocation of Service Demands to Each
Size-Load Factor Category)

SIC	Industry	250 MMBtu/Hr (Hrs/year) 7500
28	Chemicals and Allied Products	1.00

INDIRECT HEAT -- NOT COAL CAPABLE

(ISTUM Allocation of Service Demands to Each
Size-Load Factor Category)

SIC	Industry	250 MMBtu/Hr (Hrs/year) 7500
28	Chemicals and Allied Products	1.00
29	Petroleum Refining and Related Products	1.00

DIRECT HEAT (INTERMEDIATE)

(ISTUM Allocation of Service Demands to Each
Size-Load Factor Category)

SIC	Industry	10 MMBtu/Hr Load Factor (Hrs/Yr)		50 MMBtu/Hr Load Factor (Hrs/Yr)	
		2000	5500	2000	5500
20	Food	.35	.35	.15	.15
21	Tobacco	.72	.08	.13	.02
22	Textiles	.24	.56	.06	.14
23	Apparel	.90	.10	.00	.00
24	Lumber and Wood	.40	.10	.40	.10
25	Furniture	.90	.10	.00	.00
26	Paper and Allied Products	.00	.00	.00	.00
27	Printing and Publishing	.80	.20	.00	.00
28	Chemicals and Allied Products	.05	.45	.05	.45
29	Petroleum Refining and Related Products	.00	.00	.00	.00
30	Rubber and Miscellaneous Plastics	.09	.72	.02	.13
31	Leather Products	.90	.10	.00	.00
32	Stone, Clay, Glass, and Concrete Products	.04	.36	.06	.54
331	Steel	.03	.27	.07	.53
3334	Aluminum	.08	.72	.02	.13
334	Other Primary Metals	.08	.72	.02	.13
34	Fabricated Metals	.28	.42	.12	.13
35	Machinery (Except Electrical)	.23	.42	.12	.13
36	Electrical Machinery	.28	.42	.12	.13
37	Transportation Equipment	.40	.60	.00	.00
38	Measuring Equipment	.40	.60	.00	.00
39	Miscellaneous Manufacturing Industries	.40	.60	.00	.00
01	Crops	.96	.10	.00	.00
02	Livestock	.90	.10	.00	.00
10	Metal Mining	.40	.60	.00	.00
14	Nonmetal Mining	.40	.60	.00	.00
	All Industry Average (Weighted by 1974 Service Demands)	.32	.46	.06	.16

MACHINE DRIVE

(ISTUM Allocation of Service Demands to Each
Size-Load Factor Category)

SIC	Industry	20 MMStu/Hr Load Factor (Hrs/Yr)		100 MMStu/Hr Load Factor (Hrs/Yr)	
		4000	7000	4000	7000
20	Food	.72	.08	.18	.02
21	Tobacco	.00	.00	.00	.00
22	Textiles	.34	.36	.06	.04
23	Apparel	1.00	.00	.00	.00
24	Lumber and Wood	.32	.08	.48	.12
25	Furniture	.31	.09	.09	.01
26	Paper and Allied Products	.06	.14	.24	.36
27	Printing and Publishing	.31	.09	.09	.01
28	Chemicals and Allied Products	.12	.28	.13	.42
29	Petroleum Refining and Related Products	.02	.08	.13	.72
30	Rubber and Miscellaneous Plastics	.15	.35	.15	.35
31	Leather Products	.00	.00	.00	.00
32	Stone, Clay, Glass, and Concrete Products	.20	.30	.20	.30
331	Steel	.00	.00	.20	.30
3334	Aluminum	.01	.09	.09	.31
334	Other Primary Metals	.09	.21	.21	.49
34	Fabricated Metals	.45	.05	.45	.05
35	Machinery (Except Electrical)	.45	.05	.45	.05
36	Electrical Machinery	.45	.05	.45	.05
37	Transportation Equipment	.13	.02	.72	.08
38	Measuring Equipment	.34	.06	.36	.04
39	Miscellaneous Manufacturing Industries	.31	.09	.09	.01
01	Crops	1.00	.00	.00	.00
02	Livestock	.30	.00	.10	.00
10	Metal Mining	.70	.00	.30	.00
14	Nonmetal Mining	.70	.00	.30	.00
	All Industry (Average weighted by Service Demands)	.30	.14	.25	.31

INDIRECT HEAT -- COAL CAPABLE

(ISTUM Allocation of Service Demands to Each
Size-Load Factor Category)

<u>SIC</u>	<u>Industry</u>	250 MMBtu/Hr
		<u>Load Factor (Hrs./Yr.)</u> <u>7500</u>
28	Chemicals and Allied Products	1.00
29	Petroleum Refining and Related Products	1.00

ELECTROLYTIC

(ISTUM Allocation of Service Demands to Each
Size-Load Factor Category)

<u>SIC</u>	<u>Industry</u>	600 MMBtu/Hr
		<u>Load Factor (Hrs./Yr.)</u> <u>6300</u>
28	Chemicals and Allied Products	1.00
331	Steel	1.00
3334	Aluminum	1.00
334	Other Primary Metals	1.00

LIQUID FEEDSTOCKS

(ISTUM Allocation of Service Demands to Each
Size-Load Factor Category)

<u>SIC</u>	<u>Industry</u>	250 MMBtu/Hr
		<u>Load Factor (Hrs./Yr.)</u> <u>7500</u>
28	Chemicals and Allied Products	1.00
3334	Aluminum	1.00

SPACE HEAT

(ISTUM Allocation of Service Demands to Each
Size-Load Factor Category)

SIC	Industry	25 MBtu/Hr Load Factor (Hrs/Yr)		100 MBtu/Hr Load Factor (Hrs/Yr)	
		2500	3500	2500	3500
20	Food	.30	.25	.25	.20
21	Tobacco	.11	.09	.44	.36
22	Textiles	.25	.25	.25	.25
23	Apparel	.47	.02	.47	.02
24	Lumber and Wood	.30	.30	.20	.20
25	Furniture	.56	.14	.24	.06
26	Paper and Allied Products	.15	.60	.05	.20
27	Printing and Publishing	.33	.27	.22	.13
28	Chemicals and Allied Products	.06	.09	.34	.51
29	Petroleum Refining and Related Products	.00	.00	.00	.00
30	Rubber and Miscellaneous Plastics	.12	.08	.48	.32
31	Leather Products	.64	.16	.16	.04
32	Stone, Clay, Glass, and Concrete Products	.27	.22	.27	.22
331	Steel	.55	.30	.10	.05
3334	Aluminum	.00	.00	.00	.00
334	Other Primary Metals	.55	.30	.10	.05
34	Fabricated Metals	.28	.12	.42	.13
35	Machinery (Except Electrical)	.04	.00	.35	.09
36	Electrical Machinery	.52	.17	.22	.07
37	Transportation Equipment	.11	.09	.44	.36
38	Measuring Equipment	.09	.00	.35	.04
39	Miscellaneous Manufacturing Industries	.32	.08	.48	.12
01	Crops	.00	.00	.00	.00
02	Livestock	.90	.10	.00	.00
10	Metal Mining	.00	.00	.00	.00
14	Nonmetal Mining	.00	.00	.00	.00
	Total All Industry (Weighted by 1974 Service Demands)	.23	.30	.33	.20

CALCINING

(ISTUM Allocation of Service Demands to Each
Size-Load Factor Category)

<u>SIC</u>	<u>Industry</u>	40 MMBtu/Hr
		Load Factor (Hrs./Yr.)
		<u>7000</u>
32	Stone, Clay, Glass, and Concrete Products	1.00

BRICK FIRING

(ISTUM Allocation of Service Demands to Each
Size-Load Factor Category)

<u>SIC</u>	<u>Industry</u>	13.1 MMBtu/Hr
		Load Factor (Hrs./Yr.)
		<u>7000</u>
32	Stone, Clay, Glass, and Concrete Products	1.00

GLASS MELTING

(ISTUM Allocation of Service Demands to Each
Size-load Factor Category)

<u>SIC</u>	<u>Industry</u>	41.6 MMBtu/Hr	66.7 MMBtu/Hr
		Load Factor (Hrs./Yr.)	Load Factor (Hrs./Yr.)
		<u>7000</u>	<u>7000</u>
32	Stone, Clay, Glass, and Concrete Products	.75	.25

STEEL REHEATING

(ISTUM Allocation of Service Demands to Each
Size-Load Factor Category)

<u>SIC</u>	<u>Industry</u>	3 MMBtu/Hr	60 MMBtu/Hr
		Load Factor (Hrs/Yr) 5500	Load Factors (Hrs/Yr) 5500
331	Steel	.20	.30

IRON MAKING

(ISTUM Allocation of Service Demands to Each
Size-Load Factor Category)

<u>SIC</u>	<u>Industry</u>	1.6 MMBtu/Hr	133 MMBtu/Hr
		Load Factor (Hrs/Yr) 5000	Load Factor (Hrs/Yr) 5000
331	Steel	.30	.20

SECTION 4

SERVICE DEMANDS SUPPLIED BY EACH FUEL IN 1974

STEAM

SERVICE SECTOR #1

STEAM 11 1974 SERVICE DEMANDS FOR OLD TECHNOLOGIES (10**12 BTUS)

		COAL	RESID.	LPG	NAT GAS	OTH GAS	ELEC	HEC EN	TOTAL
FOOD	201	49.8	82.2		224.1				356.1
BEACCO	211	3.5	1.4						4.9
TEXTILES	221	14.2	43.1		49.3				106.6
CLOTHES	231	0.5	2.8		8.5				11.7
FURNITURE	241	2.4	32.7		38.6		18.8		92.6
HAIR, ALLIED PROD	251	2.3			8.0				10.3
PRINTING, PUBLISH.	261	114.8	247.6		146.4		507.3		1018.1
PHARMACEUTICALS	271	0.2	5.7						5.9
PETROLEUM REFINING	281	215.9	173.7		669.8				1059.4
CHIMICALS	291		60.0		392.8				452.8
LEATHER, MISCL. PLAS	301	20.1	22.4		58.9				101.5
TEXTILES	311	0.9	4.3		3.6				8.8
CEMENT, C, G, CONCRETE	321		14.8		20.3				35.1
STEEL	3311	55.6			107.7	16.8			180.1
OTHER FRI. METALS	3341	25.6	8.4						34.0
REFRIGERATED METALS	341	5.2	28.6		56.4				90.2
MACHINERY (ELEC.)	351	15.6	32.0		49.7				97.3
ELEC. MACHINERY	361	9.1	15.2		19.2				43.5
TRANSPORT. EQUIP.	371	22.9	29.7		41.9				94.5
MEASURING EQUIP.	381		10.8						10.8
PREC. MANUFACTURING	391	0.6	7.8		7.7				16.2
TOTAL MANUFACTURING	1	561.3	823.3		1903.0	16.8		526.1	3830.6
LIVESTOCK	021				4.7		2.8		7.5
TOTAL AGRICULTURE	1				4.7		2.8		7.5
MINING	101		0.2		1.8				2.0
NONMETAL MINING	141	8.9	6.6		52.6				68.1
TOTAL MINING	1	8.9	6.8		54.5				70.1
TOTAL INDUSTRY	1	570.2	830.1		1962.2	16.8	2.8	526.1	3908.2

DIRECT HEAT - (INTERMEDIATE)

SERVICE SECTOR #2

INT DN 11 1974 SERVICE DEMANDS FOR OLD TECHNOLOGIES (10x12 BTUS)

		COAL	RESID.	LF6	NAT GAS	OTH GAS	ELEC	HEC EN	TOTAL
OD	201			14.3		53.5			67.8
PACCO	211					1.3	2.8		4.1
XTILES	221			3.6		9.4			13.0
PANEL	231					2.4	13.3		15.7
WDER, WOOD	241					11.0	5.7		16.8
FURNITURE	251			0.4		5.2			5.6
PRINTING, PUBLISH.	271			1.5		10.6			12.0
CHEMICALS	281						31.2		31.2
WDER, MISC, PLAS	301			9.9					9.9
OTHER	311			1.1			4.4		5.5
EEL	3311			11.4		29.3			40.7
ORINON	33341			4.2		34.5			38.7
WDER FRI, METALS	3341			15.5		63.2	24.1		102.8
PRICATED METALS	341					35.1			35.1
CLOTHING (ELEC.)	351					27.3			27.3
EC, MACHINERY	361					15.8			15.8
TRANSPORT, EQUIP.	371					18.0			18.0
ASURING EQUIP.	381					2.6			2.6
SC MANUFACTURING	391					3.3			3.3
TAL MANUFACTURING	1			61.9		322.5	81.5		465.9
OPS	011			3.2	19.0	8.3	2.3		32.9
VESTOCK	021					6.7			6.7
TAL AGRICULTURE	1			3.2	19.0	15.0	2.3		39.5
TAL MINING	101			1.6		39.9			41.4
MMETAL MINING	141			15.2		22.6	6.9		44.7
TAL MINING	1			14.8		62.4	6.9		84.1
TAL INDUSTRY	1			81.8	19.0	400.0	90.7		591.6

DIRECT HEAT - (DIRTY)

SERVICE SECTOR #3

DTY DH 11 1974 SERVICE DEMANDS FOR OLD TECHNOLOGIES (10**12 BTUS)

	COAL	RESID.	LPG	NAT GAS	OTH GAS	ELEC	NEC EH	TOTAL
201	1.2	3.6						4.8
211		1.0						1.0
261		20.7		52.6				73.3
3311	8.8	33.4		0.5				42.7
33341	1.8	1.6				6.6		10.1
3341		3.6						3.6
1	11.8	64.0		53.1		6.6		135.6
1	11.8	64.0		53.1		6.6		135.6

INDIRECT HEAT - (COAL CAPABLE)

SERVICE SECTOR #4

INDR HT 11 1974 SERVICE DEMANDS FOR OLD TECHNOLOGIES (10**12 BTUS)

	COAL	RESID.	LPG	NAT GAS	OTH GAS	ELEC	NEC EH	TOTAL
201		61.1		117.8				178.9
291	3.3	238.3		455.5				697.0
1	3.3	299.3		573.3				875.9
1	3.3	299.3		573.3				875.9

MACHINE DRIVE
SERVICE SECTOR #5

MCH-DR 11 1974 SERVICE DEMANDS FOR OLD TECHNOLOGIES (10**12 BTUS)

	COAL	RESID.	LFG	HOT GAS	OTH GAS	ELEC	MEC EN	TOTAL
DD	201					99.3		99.3
RTILES	221					53.3		53.3
PANEL	231	1.5				15.0		17.3
MBER, WOOD	241	1.3				42.4		43.7
CHITURE	251	1.0				15.0		16.0
PER, ALLIED PROD	261					245.5		245.5
CHTING, PUBLISH.	271					36.4		36.4
ENICALS	281	5.0		29.5		317.9		352.4
COLEUM REFINING	291	2.5		11.9		94.0		108.3
DER, MISC. PLAS	301					62.9		62.9
CG, CONCRETE	321	6.2				125.4		131.7
EEL	3311					124.4		124.4
ONITION	33341			0.3		18.5		18.8
IER FRI, METALS	3341	0.7		63.2		100.0		163.9
ERICATED METALS	341					93.5		93.5
CHINERY (~ELEC.)	351					95.5		95.5
EC, MACHINERY	361					87.0		87.0
ANSPORT, EQUIP.	371					95.9		95.9
ASURING EQUIP.	381					16.0		16.0
IC MANUFACTURING	391					14.9		14.9
AL MANUFACTURING	1	19.0		104.9		1753.5		1877.4
IFS	011			40.5		63.0		103.5
ESTOCK	021					22.7		22.7
AL AGRICULTURE	1			40.5		85.7		126.2
AL MINING	101	9.8		0.4		47.5		57.8
IMETAL MINING	141	22.5		0.5		19.2		42.2
AL MINING	1	32.3		0.9		66.7		99.9
AL INDUSTRY	1	51.3		146.4		1905.8		2103.5

ELECTROLYTIC
SERVICE SECTOR #6

ELTTIC 11 1974 SERVICE DEMANDS FOR OLD TECHNOLOGIES (10**12 BTUS)

	COAL	RESID.	LPG	NAT GAS	OTH GAS	ELEC	HEC EN	TOTAL
CHEMICALS 201						126.8		126.8
STEEL 3311						64.7		64.7
ALUMINUM 33341						260.0		260.0
OTHER FRY, METALS 3341						15.0		15.0
TOTAL MANUFACTURING 1						466.5		466.5
TOTAL INDUSTRY 1						466.5		466.5

LIQUID FEEDSTOCK
SERVICE SECTOR #7

LIO FD 11 1974 SERVICE DEMANDS FOR OLD TECHNOLOGIES (10**12 BTUS)

	COAL	RESID.	LPG	NAT GAS	OTH GAS	ELEC	HEC EN	TOTAL
CHEMICALS 201			771.1					771.1
ALUMINUM 33341			82.3					82.3
TOTAL MANUFACTURING 1			853.4					853.4
TOTAL INDUSTRY 1			853.4					853.4

NATURAL GAS FEEDSTOCK

SERVICE SECTOR #8

NGAS FD 11 1974 SERVICE DEMANDS FOR OLD TECHNOLOGIES (10**12 BTUS)

	COAL	RESID.	LPG	NAT GAS	OTH GAS	ELEC	REC EN	TOTAL
CHEMICALS			281					485.7
TOTAL MANUFACTURING			1					485.7
TOTAL INDUSTRY			1					485.7

LPG FEEDSTOCK

SERVICE SECTOR #9

LPG FD 11 1974 SERVICE DEMANDS FOR OLD TECHNOLOGIES (10**12 BTUS)

	COAL	RESID.	LPG	NAT GAS	OTH GAS	ELEC	REC EN	TOTAL
CHEMICALS			281					1074.4
AL MANUFACTURING			1					1074.4
AL INDUSTRY			1					1074.4

METALLURGICAL COAL

SERVICE SECTOR #10

NET CL 11 1974 SERVICE DEMANDS FOR OLD TECHNOLOGIES (10**12 BTUS)

	COAL	RESID.	LPG	NAT GAS	OTH GAS	ELEC	MISC EN	TOTAL
EEL	3311	2363.1						2363.1
TAL MANUFACTURING	1	2363.1						2363.1
TAL INDUSTRY	1	2363.1						2363.1

MISCELLANEOUS ENERGY AND LUBES

SERVICE SECTOR #11

MISC EN 11 1974 SERVICE DEMANDS FOR OLD TECHNOLOGIES (10**12 BTUS)

	COAL	RESID.	LPG	NAT GAS	OTH GAS	ELEC	MISC EN	TOTAL
OP	201					7.3		7.3
RTILES	221					40.2		40.2
MINIUM	33341			1.9				1.9
TAL MANUFACTURING	1			1.9		47.5		49.4
OPS	011	22.4				1.0		23.4
VESTOCK	021	48.5						48.5
TAL AGRICULTURE	1	70.9				1.0		71.9
TAL INDUSTRY	1	70.9		1.9		48.5		121.3

SPACE HEAT
SERVICE SECTOR #12

SFC HT 11 1974 SERVICE DEMANDS FOR OLD TECHNOLOGIES (10**12 BTUS)

		COAL	RESID.	LPG	NAT GAS	OTH GAS	ELEC	HEC EH	TOTAL
OP	201	2.2	4.8		14.3				21.4
PACCO	211	0.4							0.4
RTILES	221	0.8	2.9		2.8		1.3		7.8
FAREL	231	0.5	2.8						3.2
MBER, WOOD	241		9.3						9.3
ENITURE	251		2.4						2.4
FER, ALLIED PROD	261		6.9		18.1				25.0
INTING, PUBLISHED	271	0.1	0.5		1.3				1.9
EMICALS	281	2.7	7.2						9.9
MBER, MISC. PLAS	301	1.0			3.1				4.1
ATHER	311		0.2						0.3
C, G, CONCRETE	321		2.1		4.8		13.8		20.8
EEL	3311				26.9				26.9
HER FRI, METALS	3341	2.6							2.6
BRICATED METALS	341	3.2	13.3		25.5				42.0
CHINERY (ELEC.)	351		3.6		14.0				17.6
EC, MACHINERY	361	0.9	8.5		17.7				27.1
ANSFORT, EQUIP.	371	11.0	15.3		21.4				47.7
ASURING EQUIP.	381				6.0				6.0
SC MANUFACTURING	391		0.5						0.5
TAL MANUFACTURING	1	25.4	80.3		156.0		15.1		276.7
VESTOCK	021				4.2		1.8		6.1
TAL AGRICULTURE	1				4.2		1.8		6.1
TAL INDUSTRY	1	25.4	80.3		160.3		16.9		282.8

INDIRECT HEAT - (NOT COAL CAPABLE)

SERVICE SECTOR #13

INDR SC11 1974 SERVICE DEMANDS FOR OLD TECHNOLOGIES (10**12 BTUS)

	COAL	RESID.	LFG	HAT GAS	OTH GAS	ELEC	HEC EH	TOTAL
CHEMICALS	281			177.7				177.7
PETROLEUM REFINING	291	139.4		556.7				696.0
STEEL MANUFACTURING	1	139.4		734.4				873.8
STEEL INDUSTRY	1	139.4		734.4				873.8

CALCINING

SERVICE SECTOR #14

CALCT 11 1974 SERVICE DEMANDS FOR OLD TECHNOLOGIES (10**12 BTUS)

	COAL	RESID.	LFG	HAT GAS	OTH GAS	ELEC	HEC EH	TOTAL
CEMENT, CONCRETE	321	68.7	26.8	121.9				217.4
STEEL MANUFACTURING	1	68.7	26.8	121.9				217.4
STEEL INDUSTRY	1	68.7	26.8	121.9				217.4

GLASS MELTING
SERVICE SECTOR #15

GL MELT || 1974 SERVICE DEMANDS FOR OLD TECHNOLOGIES (10**12 BTUS)
COAL | RESID. | LPG | NAT GAS | OTH GAS | ELEC | NEC EN | TOTAL

6, CONCRETE	321		9.5		57.0		13.0		79.5
AL MANUFACTURING	1		9.5		57.0		13.0		79.5
AL INDUSTRY	1		9.5		57.0		13.0		79.5

BRICK AND CLAY FIRING
SERVICE SECTOR #16

FIRING || 1974 SERVICE DEMANDS FOR OLD TECHNOLOGIES (10**12 BTUS)
COAL | RESID. | LPG | NAT GAS | OTH GAS | ELEC | NEC EN | TOTAL

6, CONCRETE	321	0.8	1.1		21.3		1.7		24.9
L MANUFACTURING	1	0.8	1.1		21.3		1.7		24.9
L INDUSTRY	1	0.8	1.1		21.3		1.7		24.9

IRONMAKING
SERVICE SECTOR #17

IRH MAR 11 1974 SERVICE DEMANDS FOR OLD TECHNOLOGIES (10**12 BTUS)
COAL RESID, LPG NAT GAS OTH GAS ELEC NEC EN TOTAL

	COAL	RESID,	LPG	NAT GAS	OTH GAS	ELEC	NEC EN	TOTAL
EL 3311		24.3		15.6		6.4		
AL MANUFACTURING		24.3		15.6		6.4		46.3
AL INDUSTRY		24.3		15.6		6.4		46.3
								46.3

STEEL REHEATING
SERVICE SECTOR #19

STL REH 11 1974 SERVICE DEMANDS FOR OLD TECHNOLOGIES (10**12 BTUS)
COAL RESID, LPG NAT GAS OTH GAS ELEC NEC EN TOTAL

	COAL	RESID,	LPG	NAT GAS	OTH GAS	ELEC	NEC EN	TOTAL
EL 3311		6.9		96.6	68.4	4.0		175.9
AL MANUFACTURING		6.9		96.6	68.4	4.0		175.9
AL INDUSTRY		6.9		96.6	68.4	4.0		175.9

APPENDIX III-2

INDUSTRY BY INDUSTRY ANALYSIS

This appendix describes in detail how ECDB energy consumption was mapped into ISTUM service sectors. It gives detailed tables describing this mapping for each ISTUM industry.

Tables I and II summarize the ECDB to ISTUM translation. Table I lists the amount of fuel consumed by SICs for each service sector in 1974. For example, it shows that the transportation equipment industries consumed 60 trillion Btus in the direct heat (intermediate) service sector.

Table II lists the service demands consumed by each SIC. Service sectors 20 and 21 show no consumption because they are not final uses of energy. Fuel used for internal generation is later used again by firms in the form of electricity. The captive electricity service sector exists only to avoid double-counting; since service demands include only the fuels actually used for a service sector, no double-counting of service demands exists.

The rest of this appendix describes the sources and quantities of ISTUM service demand and fuel consumption estimates for each SIC-service sector combination. It briefly describes the sources of data on each industry, and gives tables describing the industry's demand base.

A partial look at the paper industry tables will show how each industry's tables work. Table III shows the primary and secondary service sectors for some ECDB functional use-fuel cells. When all of the ECDB consumption in a cell

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TABLE I

TOTAL 1STUM FUEL CONSUMPTION BY SIC (10E12 BTUS) 1974

[illegible]

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TABLE I continued

	INDR HT	CALCINE	BRICK	IRON	STEEL	STEEL	INTERNAL	CAPTIVE	CAP DIR	COKE	TOTALS
	13	14	15	16	17	18	19	20	21	22	23
CCO	201							27.2	-9.0		934.6
ILES	221										19.0
REL	231							3.9	-1.3		316.7
ER, WOOD	241										64.0
TTURE	251										253.3
R, ALLIED PROD	261										59.0
TING, PUBLISH.	271							234.0	-122.4		2223.0
ICALS	281	286.7									89.1
OLEUM REFINING	291	1122.7						192.7	-63.5	3.2	5211.0
ER, MISC. FLAS	301							48.2	-15.2		3073.2
NER	311										250.0
G, CONCRETE	321		724.4	237.0	80.3			4.4	-2.0		21.9
L	3311					141.0	115.0	570.0	120.9	-36.6	1301.3
IRON	33341									-409.0	3420.5
S PRI, METALS	3341							170.5	-67.0		624.2
ICATED METALS	341										756.2
THERY (ELEC.)	351										407.2
, MACHINERY	361										361.0
SPORT, EQUIP.	371										246.7
ORTING EQUIP.	381										370.3
MANUFACTURING	391										50.5
MANUFACTURING	1409.3	724.4	237.0	80.3	141.0	115.0	570.0	019.0	-317.6	-409.0	20105.6
STOCK	011										333.6
AGRICULTURE	021										118.0
MINING	101										451.6
ETAL MINING	141							20.3	-10.7		172.0
MINING	1										305.4
INDUSTRY	1409.3	724.4	237.0	80.3	141.0	115.0	570.0	040.1	-328.3	-409.0	21034.6

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TABLE II

TOTAL ISTUM SERVICE DEMANDS BY SIC (10E12 BTUS) 1974

	STEAM	DIE HT	DIE HT	INDR HT	MACHINE	ELEC-	LIQUID	NAT GAS	LPG	NET	MISC EN	SPACE	
	1	INTER	BIRTY	COAL	DRIVE	LYTIC	FEED	FEED	FEED	9 COAL	10 LUBE	11 HEAT	12
	201	356.1	67.8	4.8		99.3					7.3	21.4	
ACCOC	211	4.9	4.1	1.0								0.4	
COLES	221	106.6	13.0			53.3					40.2	7.8	
GREL	231	11.7	15.7			17.3						3.2	
DER, WOOD	241	92.6	16.8			43.7						9.3	
ATURE	251	10.3	5.6			16.8						2.4	
ER, ALLIED PROD	261	1018.1		73.3		245.5						25.0	
TING, PUBLISH.	271	5.9	12.0			36.4						1.9	
ICALS	281	1059.4	31.2		178.9	352.4	126.8	771.1	485.7	1074.4		9.9	
POLYMER REFINING	291	452.8			697.0	108.3						4.1	
DER, MISC. FLAS	301	101.5	9.9			62.9						0.3	
OTHER	311	8.8	5.5									20.8	
G, CONCRETE	321	35.1				131.7						26.9	
EL	3311	180.1	40.7	42.7		124.4	64.7			2363.1		2.6	
IRON	3341		38.7	10.1		18.8	260.0	82.3			1.9	41.9	
ER FRI, METALS	3341	34.0	102.8	3.6		163.9	15.0					17.6	
RICATED METALS	341	90.2	35.1			93.5						27.1	
INERY (-ELEC.)	351	97.3	27.3			95.5						6.0	
, MACHINERY	361	43.5	15.8			87.0						0.5	
SUPPORT, EQUIP.	371	94.5	18.0			95.9						23.4	
URING EQUIP.	381	10.8	2.6			16.0						6.1	
MANUFACTURING	391	16.2	3.3			14.9						0.2	
MANUFACTURING	401	3830.6	465.2	135.6	875.9	1877.4	466.5	853.4	485.7	1074.4	2363.1	49.4	276.7
STOCK	411		32.9			103.5						23.4	
AGRICULTURE	421	7.5	6.7			22.7						48.5	6.1
MINING	431	7.5	39.5			126.2						71.9	6.1
ETAL MINING	441	2.0	41.4			57.8						0.2	
INDUSTRY	451	68.1	44.7			42.2							
	461	70.1	86.1			99.9							
	471	3908.2	591.6	135.6	875.9	2103.5	466.5	853.4	485.7	1074.4	2363.1	121.5	282.8

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TABLE II continued

	IRON	HT	CALCINE	GLASS	BRICK	IRON	STEEL	STEEL	INTERNAL	CAPTIVE	CAP	DIA	COKE	TOTALS
	13	14	15	16	17	18	19	20	21	22	23	24	25	
	201													556.6
CO	211													10.4
LES	221													221.0
EL	231													47.9
ER, WOOD	241													162.3
TURE	251													35.1
E, ALLIED PROD	261													1361.9
ING, PUBLISH	271													56.2
ICALS	281	177.7										1.0		4268.4
OLEUM REFINING	291	696.0												1954.2
ER, MISC, PLAS	301													178.3
ER	311													14.6
S, CONCRETE	321		217.3	79.5	24.9							8.0		517.3
	3311					46.3	34.5	175.9			-146.9	-160.9		2791.6
CHUM	33341													411.8
E PRI, METALS	3341											19.7		341.8
COATED METALS	341											0.7		261.3
EMERY (W/ELEC.)	351											1.4		239.1
MACHINERY	361											0.2		173.6
SPORT, EQUIP.	371											0.9		257.1
URING EQUIP.	381													35.3
MANUFACTURING	391													34.9
L MANUFACTURING	401	873.8	217.3	79.5	24.9	46.3	34.5	175.9			-146.9	-128.9		13931.0
S	011													159.8
STOCK	021													91.4
L AGRICULTURE	1													251.2
L MINING	101													101.4
ETAL MINING	141													155.0
L MINING	1													256.4
L INDUSTRY	1	873.8	217.3	79.5	24.9	46.3	34.5	175.9			-146.9	-128.9		14438.6

is mapped to a single service sector, no secondary service sector is printed. For example, all of the consumption in the steam-coal cell is mapped into the steam service sector. If a cell has no consumption at all, as with the steam-electricity cell, no service sector mapping is printed.

TABLE III

Industry: Paper SIC Code: 26 Primary Service Sectors

<u>Functional Use</u>	<u>Coal</u>	<u>Residual</u>	<u>Natural Gas</u>	<u>Electricity</u>
Process Steam:	Steam	Steam	Steam	
Electricity: Generation	Internal Generation	Internal Generation	Internal Generation	Captive Electricity

Secondary Service Sectors

<u>Functional Use</u>	<u>Coal</u>	<u>Residual</u>	<u>Natural Gas</u>	<u>Electricity</u>
Process Steam		Space Heat		
Electricity Generation				

Table IV lists the fraction of the fuel consumption in a cell that is mapped into the primary service sector. When a cell has only a primary service sector, that fraction is one. The fraction of consumption allocated to the secondary service sector is 1 minus the listed number. For example, 3 percent of the steam-residual oil cell is mapped into the space heat service sector.

TABLE IV

Industry: Paper SIC Code: 26 Fraction Allocated To Primary Service Sectors

<u>Functional Use</u>	<u>Coal</u>	<u>Residual</u>	<u>Natural Gas</u>	<u>Electricity</u>
Process Steam	1.0	.97	1.0	
Electricity Generation	1.0	1.0	1.0	1.0

Table V lists the efficiency of converting the fuel consumption of each ECDB cell to ISTUM service demands. For example the efficiency of converting natural gas consumption to steam is .7.

TABLE V

Industry: Paper SIC Code: 26		Efficiencies (Fuel To Primary Service Sectors)		
<u>Functional Use</u>	<u>Coal</u>	<u>Residual</u>	<u>Natural Gas</u>	<u>Electricity</u>
Process Steam	.7	.7	.7	
Electricity Generation	1.0	1.0	1.0	1.0

Efficiencies to Secondary Service Sectors

<u>Functional Use</u>	<u>Coal</u>	<u>Residual</u>	<u>Natural Gas</u>	<u>Electricity</u>
Process Steam		.7		
Electricity Generation				

Finally Table VI lists the total fuel consumption in each ECDB cell. When a cell has a negative consumption estimate, that number was calculated to offset double-counting

of consumption. For example firms burn some fuel to generate electricity. They then use the electricity for other purposes. A negative number is put in the electricity generation-electricity cell to show how much electricity was produced in 1974, and then used for other functional uses.

TABLE VI

Industry: Paper SIC Code: 26 Fuel Consumption (Trillion Btus)

<u>Functional Use</u>	<u>Coal</u>	<u>Residual</u>	<u>Natural Gas</u>	<u>Electricity</u>
Process Steam	161.8	330.4	209.2	
Electricity Generation	42.5	81.4	77.9	-111.7

1. Food - SIC 20

SIC 20 includes 47 different 4 digit SIC food industries ranging from meat packers to bakeries to distilleries. Nearly all of these industries consume substantial amounts of energy, primarily steam. The ECDB shows the industry consuming 935 trillion Btus of energy in 1974, and more than half was for steam production. The ITC and Battelle reports both study a variety of food processes and determine the fuel consumption for each. All three estimates of food industry fuel consumption depend on the Annual Survey of Manufacturers.

Fuel consumption was allocated to service sectors according to information from several different sources. The ECDB, using an Energy Efficiency Improvement Target report from the FEA, allocated 85 percent of industry energy consumption to its 15 functional uses. The ITC and Battelle analyses generally supported the ECDB breakdowns for uses of fuels. The ECDB left 170 trillion Btus of consumption as functional use unspecified. The NSK use category included 35 trillion Btus of food waste, which firms generally burn for clean direct heat. The remainder of the ECDB NSK use consumption was allocated according to the type of fuel used: small food firms use electricity for machine drive, and other fuels for heating and steam production.

INDUSTRY: FOOD SIC CODE: 20 PRIMARY SERVICE SECTORS

FUNCTIONAL USE	COAL	COKE-BR	DISTIL	RESID	MISCFET	LFG	NAT GAS	OTH GAS	HYDRO	ELEC	NEC EN
SPACE HEATING	SFC HT		SFC HT	SFC HT			SFC HT				
SPACE COOLING										MISC EN	
LIGHTING										MISC EN	
DIRECT HT (600F)											
DIR HT 600-1000											
DIR HT1000-1500											
DIRECT HT >1500											
DIRECT HEAT HSK			INT DH	DTY DH			INT DH				
RAW MATERIAL											
PROCESS STEAM	STEAM		STEAM	STEAM			STEAM				
ELECTRICITY GEN	INT GEN		INT GEN	INT GEN			INT GEN			CAF EL	
COKE PRODUCTION											
MACHINE DRIVE										MCH DR	
ELECTROLYTIC											
OTHER USES HSK	STEAM		DTY DH	STEAM	STEAM		INT DH			MCH DR	INT DH

SECONDARY SERVICE SECTORS

FUNCTIONAL USE	COAL	COKE-BR	DISTIL	RESID	MISCFET	LFG	NAT GAS	OTH GAS	HYDRO	ELEC	NEC EN
SPACE HEATING											
SPACE COOLING											
LIGHTING											
DIRECT HT (600F)											
DIR HT 600-1000											
DIR HT1000-1500											
DIRECT HT >1500											
DIRECT HEAT HSK											
RAW MATERIAL											
PROCESS STEAM											
ELECTRICITY GEN											
COKE PRODUCTION											
MACHINE DRIVE											
ELECTROLYTIC											
OTHER USES HSK			INT DH	DTY DH							

INDUSTRY: FOOD SIC CODE: 20 FRACTION ALLOCATED TO PRIMARY SERVICE SECTOR

FUNCTIONAL USE	COAL	COKE-BR	DISTIL	RESID	MISCFET	LFG	NAT GAS	OTH GAS	HYDRO	ELEC	NEC EN
SPACE HEATING	1.00		1.00	1.00			1.00				
SPACE COOLING										1.00	
LIGHTING										1.00	
DIRECT HT (600F)											
DIR HT 600-1000											
DIR HT1000-1500											
DIRECT HT >1500											
DIRECT HEAT HSK			1.00	1.00			1.00				
RAW MATERIAL											
PROCESS STEAM	1.00		1.00	1.00			1.00				
ELECTRICITY GEN	1.00		1.00	1.00			1.00			1.00	
COKE PRODUCTION											
MACHINE DRIVE										1.00	
ELECTROLYTIC											
OTHER USES HSK	1.00	1.00	0.80	0.80			1.00			1.00	1.00

INDUSTRY: FOOD

SIC CODE: 20

EFFICIENCIES(FUEL TO PRIMARY SERVICE SECTOR)

FUNCTIONAL USE | COAL | COKE-BR | DISTIL. | RESID. | MISCPET | LPG | NAT GAS | OTH GAS | HYDRO | ELEC | NEC EN |

FACE HEATING	0.65		0.75	0.70			0.70				
FACE COOLING										0.30	
IGHTING										0.20	
IRECT HT (600F)											
IR HT 600-1000											
IR HT 1000-1500											
IRECT HT >1500											
IRECT HEAT NSK			0.30	0.30			0.30				
AW MATERIAL											
PROCESS STEAM	0.70		0.75	0.70			0.70				
ELECTRICITY GEN	1.00		1.00	1.00			1.00			1.00	
KE PRODUCTION											
ACHINE DRIVE										0.95	
ELECTROLYTIC											
HER USES NSK	0.70	0.30	0.75	0.70			0.30			0.95	0.30

EFFICIENCIES TO SECONDARY SERVICE SECTORS

FUNCTIONAL USE | COAL | COKE-BR | DISTIL. | RESID. | MISCPET | LPG | NAT GAS | OTH GAS | HYDRO | ELEC | NEC EN |

FACE HEATING											
FACE COOLING											
IGHTING											
IRECT HT (600F)											
IR HT 600-1000											
IR HT 1000-1500											
IRECT HT >1500											
IRECT HEAT NSK											
AW MATERIAL											
PROCESS STEAM											
ELECTRICITY GEN											
KE PRODUCTION											
ACHINE DRIVE											
ELECTROLYTIC											
HER USES NSK			0.30	0.30							

INDUSTRY: FOOD

SIC CODE: 20

FUEL CONSUMPTION (10**12 BTUS)

FUNCTIONAL USE	COAL	COKE-BR	DISTIL	RESID	MISC PET	LPG	NAT GAS	OTH GAS	HYDRO	ELEC	REC EN	TOTAL
SPACE HEATING	3.4		3.5	3.1			20.5					30.5
SPACE COOLING										3.4		3.4
LIGHTING										31.2		31.2
DIRECT HT (600F)												
DIR HT 600-1000												
DIR HT 1000-1500												
DIRECT HT >1500												
DIRECT HEAT HSK			9.5	9.3			75.3					94.1
RAW MATERIAL												
PROCESS STEAM	47.4		44.8	45.5			320.1					477.8
ELECTRICITY GEN	3.0		2.7	2.6			18.9			78.8		18.4
COKE PRODUCTION												
MACHINE DRIVE										98.7		98.7
ELECTROLYTIC												
OTHER USES HSK	3.8	4.1	16.0	12.7			103.1			5.8	35.0	180.5
TOTAL FUNC USES	77.6	4.1	76.5	73.2			537.9			130.3	35.0	934.6

2. Tobacco - SIC 21

The tobacco industry consumed only 19 trillion Btus in 1974, so it was not examined closely for the ISTUM model. The Annual Survey of Manufacturers provided raw fuel consumption data, and the ITC report studied processes. Consumption of each fuel was allocated to an ISTUM service sector on the basis of those sources. The NEDS file showed that the industry uses 7 percent of its steam production for space heat, so fuel consumption was allocated to the steam and space heat service sectors in a 14:1 ratio.

INDUSTRY: TOBACCO

SIC CODE: 21

PRIMARY SERVICE SECTORS

FUNCTIONAL USE	COAL	COKE-BR	DISTIL.	RESID.	MISCPET	LPG	NAT GAS	OTH GAS	HYDRO	ELEC	HEC EH
FACE HEATING											
FACE COOLING											
IGHTING											
RECT HT (600F)											
R HT 600-1000											
R HT1000-1500											
RECT HT >1500											
RECT HEAT HSK											
W MATERIAL											
CESS STEAM											
ELECTRICITY GEN											
KE PRODUCTION											
CHINE DRIVE											
ELECTROLYTIC											
HER USES HSK	STEAM		DTY DH	DTY DH			INT DH			INT DH	DTY DH

SECONDARY SERVICE SECTORS

FUNCTIONAL USE	COAL	COKE-BR	DISTIL.	RESID.	MISCPET	LPG	NAT GAS	OTH GAS	HYDRO	ELEC	HEC EH
FACE HEATING											
FACE COOLING											
IGHTING											
RECT HT (600F)											
R HT 600-1000											
R HT1000-1500											
RECT HT >1500											
RECT HEAT HSK											
W MATERIAL											
CESS STEAM											
ELECTRICITY GEN											
KE PRODUCTION											
CHINE DRIVE											
ELECTROLYTIC											
HER USES HSK	SFC HT			STEAM							

INDUSTRY: TOBACCO

SIC CODE: 21

FRACTION ALLOCATED TO PRIMARY SERVICE SECTOR

FUNCTIONAL USE	COAL	COKE-BR	DISTIL.	RESID.	MISCPET	LPG	NAT GAS	OTH GAS	HYDRO	ELEC	HEC EH
FACE HEATING											
FACE COOLING											
IGHTING											
RECT HT (600F)											
R HT 600-1000											
R HT1000-1500											
RECT HT >1500											
RECT HEAT HSK											
W MATERIAL											
CESS STEAM											
ELECTRICITY GEN											
KE PRODUCTION											
CHINE DRIVE											
ELECTROLYTIC											
HER USES HSK	0.90		1.00	0.50							

INDUSTRY: TOBACCO

SIC CODE: 21

EFFICIENCIES(FUEL TO PRIMARY SERVICE SECTOR)

FUNCTIONAL USE	COAL	COKE-DR	DISTIL.	RESID.	MISCPET	LPG	NAT GAS	OTH GAS	HYDRO	ELEC	HEC EN
----------------	------	---------	---------	--------	---------	-----	---------	---------	-------	------	--------

SPACE HEATING											
SPACE COOLING											
LIGHTING											
DIRECT HT (600F)											
IR HT 600-1000											
IR HT1000-1500											
DIRECT HT >1500											
DIRECT HEAT HSK											
RAW MATERIAL											
PROCESS STEAM											
ELECTRICITY GEN											
ORE PRODUCTION											
MACHINE DRIVE											
ELECTROLYTIC											
OTHER USES HSK	0.70		0.30	0.30			0.30			0.80	0.30

EFFICIENCIES TO SECONDARY SERVICE SECTORS

FUNCTIONAL USE	COAL	COKE-DR	DISTIL.	RESID.	MISCPET	LPG	NAT GAS	OTH GAS	HYDRO	ELEC	HEC EN
----------------	------	---------	---------	--------	---------	-----	---------	---------	-------	------	--------

SPACE HEATING											
SPACE COOLING											
LIGHTING											
DIRECT HT (600F)											
IR HT 600-1000											
IR HT1000-1500											
DIRECT HT >1500											
DIRECT HEAT HSK											
RAW MATERIAL											
PROCESS STEAM											
ELECTRICITY GEN											
ORE PRODUCTION											
MACHINE DRIVE											
ELECTROLYTIC											
OTHER USES HSK	0.65			0.70							

STRY: TOBACCO

SIC CODE: 21

FUEL CONSUMPTION (10**12 BTUS)

TIONAL USE | COAL | COKE-DR | DISTIL | RESID | MISCPET | LPG | NAT GAS | OTH GAS | HYDRO | ELEC | REC EN | TOTAL |

E HEATING												
E COOLING												
TING												
CT HT (600F												
HT 600-1000												
HT 1000-1500												
CT HT >1500												
CT HEAT HSK												
MATERIAL												
ESS STEAM												
TRICITY GEN												
PRODUCTION												
INE DRIVE												
YDOLYTIC												
R USES HSK	5.5	1.1	4.1			4.5			3.5	0.3	19.0	
... FUEL USES	5.5	1.1	4.1			4.5			3.5	0.3	19.0	

3. Textiles - SIC 22

The textile industry consumed 317 trillion Btus of fuel in 1974. The ECDB studied fuel consumption in the industry quite thoroughly, relying on the Annual Survey of Manufacturers and the Energy Efficiency Improvement Target Report^{1/} for its fuel consumption by functional use estimates. These estimates were used in its development of the ISTUM demand base.

The industry used nearly 40 percent of its energy for steam production, with direct heat (intermediate) and machine drive the other major energy users the ECDB shows that textile firms use nearly 10 percent of their steam production for space heating, so ISTUM shows the textile industry consuming 10 trillion Btus of fuel for space heating.

The ECDB specified the functional use for more than 85 percent of the industry's fuel consumption. Service sectors were specified for the remainder according to the type of fuel. For each fuel, the ISTUM model generally assumed that firms use the unspecified functional use energy for the same purposes that they use other energy.

^{1/} SCS Engineers, Inc. Energy Efficiency Improvement Target in the Textile Mill Products Industry SIC 22. Prepared for the FEA, June 1976.

INDUSTRY: TEXTILES

SIC CODE: 22

EFFICIENCIES(FUEL TO PRIMARY SERVICE SECTOR)

FUNCTIONAL USE	COAL	COKE-BR	DISTIL.	RESID.	MISCPET	LPG	NAT GAS	OTH GAS	HYDRO	ELEC	REC EN
HEATING	0.65		0.75	0.70			0.70			0.90	
COOLING										0.90	
TING										0.20	
CT HT (600F)											
HT 600-1000											
HT1000-1500											
CT HT >1500											
CT HEAT RSK							0.30				
MATERIAL											
ESS STEAM	0.70		0.75	0.70			0.70				
TRICITY GEN	1.00		1.00	1.00			1.00			1.00	
PRODUCTION											
INE DRIVE										0.95	
TROLYTIC											
R USES RSK	0.70		0.75	0.70			0.30			0.95	0.30

EFFICIENCIES TO SECONDARY SERVICE SECTORS

FUNCTIONAL USE	COAL	COKE-BR	DISTIL.	RESID.	MISCPET	LPG	NAT GAS	OTH GAS	HYDRO	ELEC	REC EN
HEATING											
COOLING											
TING											
CT HT (600F)											
HT 600-1000											
HT1000-1500											
CT HT >1500											
CT HEAT RSK											
MATERIAL											
ESS STEAM											
TRICITY GEN											
PRODUCTION											
INE DRIVE											
TROLYTIC											
R USES RSK	0.70						0.70			0.90	

INDUSTRY: TEXTILES SIC CODE: 22 FUEL CONSUMPTION (10**12 BTUS)

FUNCTIONAL USE	COAL	COKE-BR	DISTIL.	RESID.	MISC PET	LFG	NAT GAS	OTH GAS	HYDRO	ELEC	REC EN	TOTAL
SPACE HEATING	1.2		1.7	2.3			4.0			1.4		10.6
SPACE COOLING										30.3		30.3
LIGHTING										11.1		11.1
RECT HT (600F)												
R HT 600-1000												
R HT 1000-1500												
RECT HT >1500												
RECT HEAT HSK							26.0					26.0
W MATERIAL												
PROCESS STEAM	20.0		23.3	32.9			68.1					144.3
ELECTRICITY GEN	0.5		0.5	0.8			2.1			1.3		2.6
RE PRODUCTION												
CHINE DRIVE										44.2		44.2
ELECTROLYTIC												
OTHER USES HSK	0.4		1.9	1.7			7.7			23.9	12.0	47.6
TOTAL FUND USES	22.1		27.4	37.7			107.9			109.6	12.0	316.7

4. Apparel - SIC 23

The apparel industry consumed less than 65 trillion Btus of fuel in 1974, so the ECDB did not study industry functional uses. The Annual Survey of Manufacturers provided raw fuel consumption data. Small firms consumed most of the unspecified fuels, and that energy was allocated to fuels in proportion to reported consumption. Most fuel was burned in boilers, and NEDS provided service sector breakdowns for boiler fuel consumption -- 75 percent process steam, 25 percent space heat, and virtually no electricity generation.

PRIMARY SERVICE SECTORS

FUNCTIONAL USE	COAL	COKE-BR	DISTIL.	RESID.	MISCPET	LPG	NAT GAS	OTH GAS	HYDRO	ELEC	HEC EN
FACE HEATING											
FACE COOLING											
LIGHTING											
IRECT HT (400F											
IR HT 400-1000											
IR HT1000-1500											
IRECT HT >1500											
IRECT HEAT HSK											
AW MATERIAL											
PROCESS STEAM											
ELECTRICITY GEN											
ORE PRODUCTION											
ACHINE DRIVE											
ELECTROLYTIC											
OTHER USES HSK	STEAM	STEAM	STEAM				STEAM			INT DR	MCH BR

SECONDARY SERVICE SECTORS

FUNCTIONAL USE	COAL	COKE-DR	DISTIL	RESID	MISCPET	LPG	NAT GAS	OTH GAS	HYDRO	ELEC	HEC-EN
FACE HEATING											
FACE COOLING											
LIGHTING											
DIRECT HT (600F)											
DIRECT HT 600-1000											
DIRECT HT 1000-1500											
DIRECT HT >1500											
DIRECT HEAT USK											
RAW MATERIAL											
PROCESS STEAM											
ELECTRICITY GEN											
PIKE PRODUCTION											
ENGINE DRIVE											
ELECTROLYTIC											
OTHER USES USK	SPEC HT		SPEC HT	SPEC HT			INT DR			MCH DR	

FRACTION ALLOCATED TO PRIMARY SERVICE SECTOR

[illegible]

INDUSTRY: APPAREL

SIC CODE: 23

EFFICIENCIES(FUEL TO PRIMARY SERVICE SECTOR)

ADDITIONAL USE | COAL | COKE-BR | DISTIL. | RESID. | MISCFET | LPG | NAT GAS | OTH GAS | HYDRO | ELEC | REC EN |

HEATING											
COOLING											
ATING											
CT HT (600F)											
HT 600-1000											
HT1000-1500											
CT HT >1500											
CT HEAT HSR											
MATERIAL											
ESS STEAM											
TRICITY GEN											
PRODUCTION											
INE DRIVE											
ETROLYTIC											
R USES HSR	0.70		0.75	0.70			0.70		0.80	0.60	

EFFICIENCIES TO SECONDARY SERVICE SECTORS

ADDITIONAL USE | COAL | COKE-BR | DISTIL. | RESID. | MISCFET | LPG | NAT GAS | OTH GAS | HYDRO | ELEC | REC EN |

HEATING											
COOLING											
ATING											
CT HT (600F)											
HT 600-1000											
HT1000-1500											
CT HT >1500											
CT HEAT HSR											
MATERIAL											
ESS STEAM											
TRICITY GEN											
PRODUCTION											
INE DRIVE											
ETROLYTIC											
R USES HSR	0.65		0.75	0.70			0.30		0.95		

INDUSTRY: APPAREL

SIC CODE: 23

FUEL CONSUMPTION (10**12 BTUS)

FUNCTIONAL USE	COAL	CORE-PR	DISTIL.	RESID.	MISCFT	LPG	NAT GAS	OTH GAS	HYDRO	ELEC	REC EN	TOTAL
----------------	------	---------	---------	--------	--------	-----	---------	---------	-------	------	--------	-------

SPACE HEATING												
---------------	--	--	--	--	--	--	--	--	--	--	--	--

SPACE COOLING												
---------------	--	--	--	--	--	--	--	--	--	--	--	--

LIGHTING												
----------	--	--	--	--	--	--	--	--	--	--	--	--

DIRECT HT <600F												
-----------------	--	--	--	--	--	--	--	--	--	--	--	--

DIR HT 600-1000												
-----------------	--	--	--	--	--	--	--	--	--	--	--	--

DIR HT1000-1500												
-----------------	--	--	--	--	--	--	--	--	--	--	--	--

DIRECT HT >1500												
-----------------	--	--	--	--	--	--	--	--	--	--	--	--

DIRECT HEAT HSK												
-----------------	--	--	--	--	--	--	--	--	--	--	--	--

RAW MATERIAL												
--------------	--	--	--	--	--	--	--	--	--	--	--	--

PROCESS STEAM												
---------------	--	--	--	--	--	--	--	--	--	--	--	--

ELECTRICITY GEN												
-----------------	--	--	--	--	--	--	--	--	--	--	--	--

CORE PRODUCTION												
-----------------	--	--	--	--	--	--	--	--	--	--	--	--

MACHINE DRIVE												
---------------	--	--	--	--	--	--	--	--	--	--	--	--

ELECTROLYTIC												
--------------	--	--	--	--	--	--	--	--	--	--	--	--

OTHER USES HSK	1.4		5.6	1.9			20.2			33.2	2.5	64.0
----------------	-----	--	-----	-----	--	--	------	--	--	------	-----	------

TOTAL FUNC USES	1.4		5.6	1.9			20.2			33.2	2.5	64.0
-----------------	-----	--	-----	-----	--	--	------	--	--	------	-----	------

5. Lumber and Wood - SIC 24

The ECDB provides no functional use data for SIC 24. The industry consumed over 250 trillion Btus in 1974, so most other reports do study SIC 24 energy consumption processes. The Battelle, ITC, and coal conversion reports all calculate that the industry consumes most fuel for steam production. Specifically industries within SIC 24 have the following primary uses for fuel consumption:

<u>SIC</u>		<u>Primary Service Sector</u>	<u>Secondary Ser- vice Sector</u>	<u>1974 trillion Btus consumed</u>
241	Logging	Machine Drive		17
242	Sawmills	Direct Heat (Intermediate)	Machine Drive	92
243	Mills and Wood- work	Steam		108
	Other SIC 24	Steam	Machine Drive	36
TOTAL				253

SIC 24 fuel consumption was allocated on the basis of the above chart and NEDS space heat information. Some ECDB NSK fuels were allocated among fossil fuels, leaving a substantial residual of wood waste. Since mills usually burn wood waste to heat boilers, NEC fuel consumption was translated into the steam service sector.

INDUSTRY: LUMBER, WOOD

SIC CODE: 24

PRIMARY SERVICE SECTORS

FUNCTIONAL USE	COAL	CORE-DR	DISTIL	RESID	MISCPET	LPG	NAT GAS	OTH GAS	HYDRO	ELEC	NEC EN
SPACE HEATING											
SPACE COOLING											
LIGHTING											
DIRECT HT (600F)											
DIR HT 600-1000											
DIR HT1000-1500											
DIRECT HT >1500											
DIRECT HEAT HSK											
RAW MATERIAL											
PROCESS STEAM											
ELECTRICITY GEN											
COKE PRODUCTION											
MACHINE DRIVE											
ELECTROLYTIC											
OTHER USES HSK	STEAM		STEAM	STEAM			STEAM			MCH DR	STEAM

SECONDARY SERVICE SECTORS

FUNCTIONAL USE	COAL	CORE-DR	DISTIL	RESID	MISCPET	LPG	NAT GAS	OTH GAS	HYDRO	ELEC	NEC EN
SPACE HEATING											
SPACE COOLING											
LIGHTING											
DIRECT HT (600F)											
DIR HT 600-1000											
DIR HT1000-1500											
DIRECT HT >1500											
DIRECT HEAT HSK											
RAW MATERIAL											
PROCESS STEAM											
ELECTRICITY GEN											
COKE PRODUCTION											
MACHINE DRIVE											
ELECTROLYTIC											
OTHER USES HSK			MCH DR	SPC HT			INT DU			INT DU	SPC HT

INDUSTRY: LUMBER, WOOD

SIC CODE: 24

FRACTION ALLOCATED TO PRIMARY SERVICE SECTOR

FUNCTIONAL USE	COAL	CORE-DR	DISTIL	RESID	MISCPET	LPG	NAT GAS	OTH GAS	HYDRO	ELEC	NEC EN
SPACE HEATING											
SPACE COOLING											
LIGHTING											
DIRECT HT (600F)											
DIR HT 600-1000											
DIR HT1000-1500											
DIRECT HT >1500											
DIRECT HEAT HSK											
RAW MATERIAL											
PROCESS STEAM											
ELECTRICITY GEN											
COKE PRODUCTION											
MACHINE DRIVE											
ELECTROLYTIC											
OTHER USES HSK	1.00		0.90	0.50			0.60			0.70	0.77

1 LUMBER, WOOD SIC CODE: 24 EFFICIENCIES (FUEL TO PRIMARY SERVICE SECTOR)

AL USE | COAL | CORE-DR | DISTIL. | RESID. | MISCPET | LPG | NAT GAS | OTH GAS | HYDRO | ELEC | NEC EN |

	COAL	CORE-DR	DISTIL.	RESID.	MISCPET	LPG	NAT GAS	OTH GAS	HYDRO	ELEC	NEC EN
HEATING											
COOLING											
5											
600-1000											
1000-1500											
1500											
HEAT HSR											
ERIAL											
STEAM											
CITY GEN											
DUCTION											
DRIVE											
TTIC											
ES HSR	0.70		0.75	0.70			0.70			0.95	0.60

EFFICIENCIES TO SECONDARY SERVICE SECTORS

AL USE | COAL | CORE-DR | DISTIL. | RESID. | MISCPET | LPG | NAT GAS | OTH GAS | HYDRO | ELEC | NEC EN |

	COAL	CORE-DR	DISTIL.	RESID.	MISCPET	LPG	NAT GAS	OTH GAS	HYDRO	ELEC	NEC EN
HEATING											
COOLING											
5											
600-1000											
1000-1500											
1500											
HEAT HSR											
ERIAL											
STEAM											
CITY GEN											
DUCTION											
DRIVE											
TTIC											
ES HSR			0.30	0.70			0.30			0.30	0.60

STRT: LUMBER, WOOD

SIC CODE: 24

FUEL CONSUMPTION (10A12 BTUS)

ADDITIONAL USE | COAL | CORE-DR | DISTIL | RESID. | MISCPET | LPG | NAT GAS | OTH GAS | HYDRO | ELEC | NEC EN | TOTAL |

HEATING											
COOLING											
WATER											
BT BT (400F)											
BT 400-1000											
BT 1000-1500											
BT BT >1500											
BT HEAT USE											
MATERIAL											
ESS STEAM											
TRICITY GEN											
PRODUCTION											
ME DRIVE											
ELECTRIC											
USES USE	3.5	43.0	10.5			91.9		63.7	40.7	253.3	
FUNG USES	3.5	43.0	10.5			91.9		63.7	40.7	253.3	

6. Furniture - SIC 25

The ECDB shows that the furniture industry consumed 59.1 trillion Btus of fuel in 1974, however it does not give functional use data. The ITC report does study the industry's energy consuming processes, so fuel consumption was allocated to service sectors according to that report. ITC shows that the industry uses fuel for direct heat, steam, and machine drive. The NEDS file supplied space heat data on the industry.

INDUSTRY: FURNITURE SIC CODE: 25 PRIMARY SERVICE SECTORS

FUNCTIONAL USE	COAL	COKE-OR	DISTIL	RESID	MISCPET	LPG	NAT GAS	OTH GAS	HYDRO	ELEC	REC EN
SPACE HEATING											
SPACE COOLING											
LIGHTING											
DIRECT HT <600F											
DIR HT 600-1000											
DIR HT1000-1500											
DIRECT HT >1500											
DIRECT HEAT HSK											
RAW MATERIAL											
PROCESS STEAM											
ELECTRICITY GEN											
COKE PRODUCTION											
MACHINE DRIVE											
ELECTROLYTIC											
OTHER USES HSK	STEAM		MCH DR	INT DH			INT DH			MCH DR	SFC HT

SECONDARY SERVICE SECTORS

FUNCTIONAL USE	COAL	COKE-OR	DISTIL	RESID	MISCPET	LPG	NAT GAS	OTH GAS	HYDRO	ELEC	REC EN
SPACE HEATING											
SPACE COOLING											
LIGHTING											
DIRECT HT <600F											
DIR HT 600-1000											
DIR HT1000-1500											
DIRECT HT >1500											
DIRECT HEAT HSK											
RAW MATERIAL											
PROCESS STEAM											
ELECTRICITY GEN											
COKE PRODUCTION											
MACHINE DRIVE											
ELECTROLYTIC											
OTHER USES HSK				SFC HT			STEAM				

INDUSTRY: FURNITURE SIC CODE: 25 FRACTION ALLOCATED TO PRIMARY SERVICE SECTOR

FUNCTIONAL USE	COAL	COKE-OR	DISTIL	RESID	MISCPET	LPG	NAT GAS	OTH GAS	HYDRO	ELEC	REC EN
SPACE HEATING											
SPACE COOLING											
LIGHTING											
DIRECT HT <600F											
DIR HT 600-1000											
DIR HT1000-1500											
DIRECT HT >1500											
DIRECT HEAT HSK											
RAW MATERIAL											
PROCESS STEAM											
ELECTRICITY GEN											
COKE PRODUCTION											
MACHINE DRIVE											
ELECTROLYTIC											
OTHER USES HSK	1.00		1.00	0.50			0.60			1.00	1.00

INDUSTRY: FURNITURE

SIC CODE: 25

EFFICIENCIES(FUEL TO PRIMARY SERVICE SECTOR)

FUNCTIONAL USE | COAL | COKE-BR | DISTIL. | RESID. | MISCFET | LPG | NAT GAS | OTH GAS | HYDRO | ELEC | NEC EN |

SPACE HEATING											
SPACE COOLING											
LIGHTING											
DIRECT HT (600F)											
DIR HT 600-1000											
DIR HT 1000-1500											
DIRECT HT >1500											
DIRECT HEAT HSK											
RAW MATERIAL											
PROCESS STEAM											
ELECTRICITY GEN											
CORE PRODUCTION											
MACHINE DRIVE											
ELECTROLYTIC											
OTHER USES HSK	0.70		0.30	0.30		0.30			0.95	0.60	

EFFICIENCIES TO SECONDARY SERVICE SECTORS

FUNCTIONAL USE | COAL | COKE-BR | DISTIL. | RESID. | MISCFET | LPG | NAT GAS | OTH GAS | HYDRO | ELEC | NEC EN |

SPACE HEATING											
SPACE COOLING											
LIGHTING											
DIRECT HT (600F)											
DIR HT 600-1000											
DIR HT 1000-1500											
DIRECT HT >1500											
DIRECT HEAT HSK											
RAW MATERIAL											
PROCESS STEAM											
ELECTRICITY GEN											
CORE PRODUCTION											
MACHINE DRIVE											
ELECTROLYTIC											
OTHER USES HSK			0.70			0.70					

STRY: FURNITURE

SIC CODE: 25

FUEL CONSUMPTION (10**12 BTUS)

TIONAL USE | COAL | COKE-ER | DISTIL. | RESID. | MISCPET | LPG | NAT GAS | OTH GAS | HYDRO | ELEC | REC EN | TOTAL |

E HEATING												
E COOLING												
TING												
CT HT <600F												
HT 600-1000												
HT 1000-1500												
CT HT >1500												
CT HEAT HSK												
MATERIAL												
ESS STEAM												
TRICITY GEN												
PRODUCTION												
INE DRIVE												
ELECTRIC												
R USES HSK	3.3	6.0	3.0				28.7		15.8	2.2	59.0	
L FUSE USES	3.3	6.0	3.0				28.7		15.8	2.2	59.0	

7. Paper - SIC 26

The paper industry consumed over 2.2 quads of fuel in 1974, so the ECDB studies the industry intensively. The ECDB determines functional uses for more than 90 percent of that consumption, and shows that paper firms use most energy for steam production. The ITC and Battelle reports study industry energy consumption processes and determine that firms use steam for paper drying as well as many other processes. Both reports concur with the ECDB allocation of fuel consumption to functional uses.

The ECDB relies on Patterns of Fuel and Energy Consumption in the U.S. Pulp and Paper Industry for most of its functional use data^{1/}. With the advice of the ECDB authors, those functional use breakdowns were translated into ISTUM service sectors. The ECDB specifies functional uses for all pulp, paper, paper board, and building paper industries, leaving converting mill energy consumption in an unspecified functional use category. The ITC report shows the uses of energy in that industry, so EEA used that report to allocate ECDB NSK use energy consumption into ISTUM service sectors. The NEDS file shows that SIC 26 uses small amounts of residual oil and natural gas for space heating.

The paper industry consumes large amounts of fuel that the ECDB does not specify by fuel type. This fuel is generally spent liquor, used for steam production. To describe these spent liquor boilers in the ISTUM demand base, 845 trillion Btus of SIC 26 NEC fuels was allocated to the steam service sector.

^{1/} Jeffrey M. Duke. Patterns of Fuel and Energy Consumption in the U.S. Pulp and Paper Industry. (New York: American Paper Institute, 1973).

PRIMARY SERVICE SECTORS

FUNCTIONAL USE	COAL	COKE-DR	DISTIL	RESID	MISCFET	LPG	NAT GAS	OTH GAS	HYDRO	ELEC	REC EN
ICE HEATING							SPC HT				
ICE COOLING											
HEATING											
ELECT HT (600F)											
ELECT HT 600-1000											
ELECT HT 1000-1500											
ELECT HT >1500											
ELECT HEAT HSK				DTY DH			DTY DH				
MATERIAL											
CESS STEAM	STEAM		STEAM	STEAM			STEAM				STEAM
ELECTRICITY GEN	INT GEN		INT GEN	INT GEN			INT GEN		CAP EL	CAP EL	INT GEN
E PRODUCTION											
WINE DRIVE									MCH DR	MCH DR	
ELECTROLYTIC											
ER USES HSK	STEAM		STEAM	STEAM		DTY DH	DTY DH			MCH DR	STEAM

SECONDARY SERVICE SECTORS

OPTIONAL USE	COAL	COKE-SR	DISTIL	RESID	MISCPET	LPG	NAT GAS	OTH GAS	HYDRO	ELEC	REC EN
CE HEATING											
CE COOLING											
HTING											
ECT HT (600F											
HT 600-1000											
HT1000-1500											
ECT HT >1500											
ECT HEAT HSK											
MATERIAL											
CESS STEAM				SFC HT							
CTRICITY GEN											
E PRODUCTION											
INE DRIVE											
CTROLYTIC											
ER USES HSK				DTY DH			SFC HT				

FRACTION ALLOCATED TO PRIMARY SERVICE SECTOR

[illegible]

INDUSTRY: PAPER(TOTAL) SIC CODE: 26 EFFICIENCIES(FUEL TO PRIMARY SERVICE SECTOR)

FUNCTIONAL USE	COAL	COKE-BR	DISTIL	RESID	MISC PET	LPG	NAT GAS	OTH GAS	HYDRO	ELEC	HEC EN
E HEATING							0.70				
E COOLING											
TING											
CT HT (600F)											
HT 600-1000											
HT 1000-1500											
CT HT >1500											
CT HEAT HSK				0.30			0.30				
MATERIAL											
ESS STEAM	0.70		0.75	0.70			0.70				0.50
TRICITY GEN	1.00		1.00	1.00			1.00		1.00	1.00	1.00
PRODUCTION											
INE DRIVE								0.95	0.95		
YDOLYTIC											
E USES HSK	0.70		0.75	0.70		0.30	0.30			0.95	0.50

EFFICIENCIES TO SECONDARY SERVICE SECTORS

FUNCTIONAL USE	COAL	COKE-BR	DISTIL	RESID	MISC PET	LPG	NAT GAS	OTH GAS	HYDRO	ELEC	HEC EN
E HEATING											
E COOLING											
TING											
CT HT (600F)											
HT 600-1000											
HT 1000-1500											
CT HT >1500											
CT HEAT HSK											
MATERIAL											
ESS STEAM				0.70							
TRICITY GEN											
PRODUCTION											
INE DRIVE											
YDOLYTIC											
E USES HSK				0.30			0.70				

INDUSTRY: PAPER(TOTAL) SIC CODE: 26 FUEL CONSUMPTION (10**12 BTUS)

FUNCTIONAL USE | COAL | COKE-PR | DISTIL. | RESID. | MISCPET | LPG | NAT GAS | QTH GAS | HYDRO | ELEC | REC EN | TOTAL |

ICE HEATING						8.3						8.3
ICE COOLING												
HEATING												
ELECT HT (600F)												
HT 600-1000												
HT 1000-1500												
ELECT HT >1500												
ELECT HEAT HSK			66.9			79.5						146.4
MATERIAL												
CESS STEAM	161.8	11.9	330.4			209.2				836.5		1549.8
ELECTRICITY GEN	42.5	3.5	81.4			77.9				28.7		111.6
E PRODUCTION												
INE DRIVE												
CTROLYTIC												
EN USES HSK	5.0	10.9	11.0			69.6	43.8			32.4	9.0	181.7
AL FUNC USES	209.3	26.3	489.7			69.6	418.7			136.0	874.2	2223.8

8. Printing and Publishing - SIC 27

The printing and publishing industries consumed less than 100 trillion Btus of energy in 1974. It uses electricity as its main fuel, primarily for the large presses and other machines in printing and publishing plants. NEDS shows that firms use a substantial portion of boiler output for space heat.

INDUSTRY: PRINT PUBL, SIC CODE: 27 PRIMARY SERVICE SECTORS

FUNCTIONAL USE	COAL	COKE-BR	DISTIL	RESID	MISC PET	LPG	NAT GAS	OTH GAS	HYDRO	ELEC	NEC EN
ICE HEATING											
ICE COOLING											
HEATING											
HEAT HT (600F)											
HT 600-1000											
HT 1000-1500											
HEAT HT >1500											
HEAT HT NSK											
MATERIAL											
CESS STEAM											
TRICITY GEN											
E PRODUCTION											
INE DRIVE											
CTROLYTIC											
ER USES NSK	STEAM		STEAM	STEAM			INT GH			MCH DR	INT DH

SECONDARY SERVICE SECTORS

FUNCTIONAL USE	COAL	COKE-BR	DISTIL	RESID	MISC PET	LPG	NAT GAS	OTH GAS	HYDRO	ELEC	NEC EN
ICE HEATING											
ICE COOLING											
HEATING											
HEAT HT (600F)											
HT 600-1000											
HT 1000-1500											
HEAT HT >1500											
HEAT HT NSK											
MATERIAL											
CESS STEAM											
TRICITY GEN											
E PRODUCTION											
INE DRIVE											
CTROLYTIC											
ER USES NSK	SFC HT			SFC HT			SFC HT				

INDUSTRY: PRINTING, PUBL, SIC CODE: 27 FRACTION ALLOCATED TO PRIMARY SERVICE SECTOR

FUNCTIONAL USE	COAL	COKE-BR	DISTIL	RESID	MISC PET	LPG	NAT GAS	OTH GAS	HYDRO	ELEC	NEC EN
ICE HEATING											
ICE COOLING											
HEATING											
HEAT HT (600F)											
HT 600-1000											
HT 1000-1500											
HEAT HT >1500											
HEAT HT NSK											
MATERIAL											
CESS STEAM											
TRICITY GEN											
E PRODUCTION											
INE DRIVE											
CTROLYTIC											
ER USES NSK	0.70		1.00	0.70							

INDUSTRY; PRINTING, PUBL. SIC CODE; 27 EFFICIENCIES(FUEL TO PRIMARY SERVICE SECTOR)

FUNCTIONAL USE	COAL	COKE-BR	DISTIL.	RESID.	MISC PET	LPG	NAT GAS	OTH GAS	HYDRO	ELEC	REC EN
FACE HEATING											
FACE COOLING											
LIGHTING											
DIRECT HT <600F											
IR HT 600-1000											
IR HT 1000-1500											
DIRECT HT >1500											
DIRECT HEAT HSK											
RAW MATERIAL											
PROCESS STEAM											
ELECTRICITY GEN											
PIKE PRODUCTION											
MACHINE DRIVE											
ELECTROLYTIC											
OTHER USES HSK	0.70		0.75	0.70			0.30			0.95	0.30

EFFICIENCIES TO SECONDARY SERVICE SECTORS

FUNCTIONAL USE	COAL	COKE-BR	DISTIL.	RESID.	MISC PET	LPG	NAT GAS	OTH GAS	HYDRO	ELEC	REC EN
FACE HEATING											
FACE COOLING											
LIGHTING											
DIRECT HT <600F											
IR HT 600-1000											
IR HT 1000-1500											
DIRECT HT >1500											
DIRECT HEAT HSK											
RAW MATERIAL											
PROCESS STEAM											
ELECTRICITY GEN											
PIKE PRODUCTION											
MACHINE DRIVE											
ELECTROLYTIC											
OTHER USES HSK	0.65			0.70			0.70				

STRT; PRINTING, FUEL, SIC CODE: 27 FUEL CONSUMPTION (10**12 BTUS)

ATIONAL USE | COAL | COKE-BR | DISTIL. | RESID. | MISC PET | LPG | NAT GAS | OTH GAS | HYDRO | ELEC | REC EN | TOTAL |

HEATING												
COOLING												
TING												
CT HT (500F)												
HT 500-1000												
HT 1000-1500												
CT HT >1500												
CT HEAT USK												
MATERIAL												
ESS STEAM												
FRICITY GEN												
PRODUCTION												
ME DRIVE												
EOLYTIC												
USES NSK	0.4	6.0	2.4			37.1			38.3	4.9	89.1	
FUNC USES	0.4	6.0	2.4			37.1			38.3	4.9	89.1	

9. Chemicals - SIC 28

The chemical industry consumed over 5 quads of fuel in 1974. According to DRI, the industry also has a higher growth rate than any other SIC, so that its demand for energy will be 40 percent of total industrial demand by the year 2000. Because of the relative importance of energy consumption in the industry, the industry was examined quite carefully for the ISTUM model.

The ECDB, Battelle, ITC and coal conversion studies all present thorough descriptions of energy consumption in the chemical industry. The ECDB and coal conversion studies both disaggregate the industry by process. They calculate total consumption by multiplying the energy required to produce one pound of each chemical by the number of pounds of that chemical actually produced.

The different sources agree in their conclusions about the ways that the chemical industry uses its fuels: for feedstocks, steam and indirect heat. The ISTUM demand base for SIC 28 relies primarily on the ECDB, since the ECDB supplies by far the best data on fuel consumption for feedstocks, internal generation, and machine drive.

Chemical industry processes were examined to determine if the industry's fuel consumption should be disaggregated into more service sectors. The analysis included the three service sectors the industry uses most steam, feedstocks, and indirect heat.

The industry converted 1.5 quads of fuel into steam in 1974. Since the industry used the same 'process' - boilers - to produce all of this steam, the steam service sector was not disaggregated.

Processes to create feedstocks vary considerably. Firms convert heavy liquids such as benzene and toluene into some feedstocks, natural gas into others, and LPG into still others. The feedstock service sector was disaggregated by the type of fuel used: liquid feedstocks, natural gas feedstocks, and LPG feedstocks.

Chemical industry indirect heat processes were also studied. The processes fall into two general categories -- coal capable and not coal capable. Firms can use coal in most chemical industry processes. There are three major exceptions: ammonia, methanol and ethylene production. Ammonia and methanol processes consumed 281 trillion Btus of natural gas in 1974. Ethylene production consumed another 200 trillion Btus, but the ethylene process produces as much energy as it consumes. But ammonia and methanol process energy consumption were put into a separate indirect heat - coal incapable service sector. The ISTUM demand base allocates direct heat fuel consumption in other chemical processes to an indirect heat-coal capable service sector. Table VII shows how energy consumption for indirect heat was disaggregated in the chemical industry.

TABLE VII
INDIRECT HEAT USED IN CHEMICAL PROCESSES
(1974 Trillion Btu's)

Fuel					
Chemical	Distillate Oil	Residual Oil	Natural Gas	Total for Service Sectors	
Ammonia			251.9	281.3	Indirect heat not coal capable
Methanol			29.4		
Other	43.4	54.5	203.4	302.4	Indirect heat coal capable
Total*	43.4	54.4	485.8	583.7	

* Totals from ECDB Chemical energy consumption in 1973 from coal conversion study. 1973-1974 growth rates used to calculate 1974 energy consumption. Growth rates taken from Chemical & Engineering News, May 5, 1975, Volume 53, No. 18, p. 31. "Chemical & Engineering News ranks the fiftieth largest volume chemicals and the fiftieth largest chemical producers in the U.S."

INDUSTRY: CHEMICALS-TOTAL SIC CODE: 28

PRIMARY SERVICE SECTORS

FUNCTIONAL USE	COAL	COKE-BR	DISTIL	RESID.	MISCPET	LPG	NAT GAS	OTH GAS	HYDRO	ELEC	NEC EN
SPACE HEATING											
SPACE COOLING											
LIGHTING											
DIRECT HT (600F)			INDR HT	INDR HT			INDR HT				
DIR HT 600-1000							INDR HT				
DIR HT 1000-1500			INDR HT	INDR HT			INDR HT			INT DH	INDR HT
DIRECT HT >1500			INDR HT	INDR HT			INDR AC			INT DH	
DIRECT HEAT HSK											
RAW MATERIAL						LIG FD	LPG FD	NGAS FD			LIG FD
PROCESS STEAM	STEAM		STEAM	STEAM			STEAM				STEAM
ELECTRICITY GEN	INT GEN		INT GEN	INT GEN			INT GEN			CAP EL	INT GEN
COKE PRODUCTION											
MACHINE DRIVE			MCH DR	MCH DR			MCH DR			MCH DR	
ELECTROLYTIC										ELYTIC	
OTHER USES HSK	STEAM	COK CON	STEAM	STEAM			STEAM				

SECONDARY SERVICE SECTORS

FUNCTIONAL USE	COAL	COKE-BR	DISTIL	RESID.	MISCPET	LPG	NAT GAS	OTH GAS	HYDRO	ELEC	NEC EN
SPACE HEATING											
SPACE COOLING											
LIGHTING											
DIRECT HT (600F)											
DIR HT 600-1000											
DIR HT 1000-1500							INDR AC				
DIRECT HT >1500											
DIRECT HEAT HSK											
RAW MATERIAL											
PROCESS STEAM			SFC HT	SFC HT							
ELECTRICITY GEN											
COKE PRODUCTION											
MACHINE DRIVE											
ELECTROLYTIC											
OTHER USES HSK	SFC HT		INDR HT	INDR HT			INDR HT				

INDUSTRY: CHEMICALS-TOTAL SIC CODE: 28

FRACTION ALLOCATED TO PRIMARY SERVICE SECTOR

FUNCTIONAL USE	COAL	COKE-BR	DISTIL	RESID.	MISCPET	LPG	NAT GAS	OTH GAS	HYDRO	ELEC	NEC EN
SPACE HEATING											
SPACE COOLING											
LIGHTING											
DIRECT HT (600F)			1.00	1.00			1.00				
DIR HT 600-1000							1.00				
DIR HT 1000-1500			1.00	1.00			0.20			1.00	1.00
DIRECT HT >1500			1.00	1.00			1.00			1.00	
DIRECT HEAT HSK											
RAW MATERIAL					1.00	1.00	1.00				1.00
PROCESS STEAM	1.00		0.95	0.90			1.00				1.00
ELECTRICITY GEN	1.00		1.00	1.00			1.00			1.00	1.00
COKE PRODUCTION											
MACHINE DRIVE			1.00	1.00			1.00			1.00	
ELECTROLYTIC										1.00	
OTHER USES HSK	0.95	1.00	0.50	0.70			0.70				

INDUSTRY: CHEMICALS-TOTAL SIC CODE: 28

EFFICIENCIES(FUEL TO PRIMARY SERVICE SECTOR)

FUNCTIONAL USE | COAL | COKE-BR | DISTIL | RESID | MISCPET | LFG | NAT GAS | OTH GAS | HYDRO | ELEC | NEC EN |

SPACE HEATING											
SPACE COOLING											
LIGHTING											
DIRECT HT (600F)			0.62	0.62			0.62				
DIR HT 600-1000							0.62				
DIR HT 1000-1500			0.62	0.62			0.62		0.80		
DIRECT HT >1500			0.62	0.62			0.62		0.80	0.62	
DIRECT HEAT HSK											
RAW MATERIAL					1.00	1.00	1.00				1.00
PROCESS STEAM	0.70		0.75	0.70			0.70				0.60
ELECTRICITY GEN	1.00		1.00	1.00			1.00		1.00	1.00	
COKE PRODUCTION											
MACHINE DRIVE			0.30	0.30			0.30		0.95		
ELECTROLYTIC									1.00		
OTHER USES HSK	0.70	0.30	0.75	0.70			0.70				

EFFICIENCIES TO SECONDARY SERVICE SECTORS

FUNCTIONAL USE | COAL | COKE-BR | DISTIL | RESID | MISCPET | LFG | NAT GAS | OTH GAS | HYDRO | ELEC | NEC EN |

SPACE HEATING											
SPACE COOLING											
LIGHTING											
DIRECT HT (600F)											
DIR HT 600-1000											
DIR HT 1000-1500							0.62				
DIRECT HT >1500											
DIRECT HEAT HSK											
RAW MATERIAL											
PROCESS STEAM			0.75	0.70							
ELECTRICITY GEN											
COKE PRODUCTION											
MACHINE DRIVE											
ELECTROLYTIC											
OTHER USES HSK	0.65		0.62	0.62			0.62				

INDUSTRY: CHEMICALS-TOTAL SIC CODE: 28 FUEL CONSUMPTION (10**12 BTUS)

FUNCTIONAL USE	COAL	COKE-ER	DISTIL.	RESID.	MISCPET	LPG	NAT GAS	OTH GAS	HYDRO	ELEC	NEC EN	TOTAL
SPACE HEATING												
SPACE COOLING												
LIGHTING												
DIRECT HT (500F)		11.2	14.6				87.1					112.9
DIR HT 600-1000							27.8					27.8
DIR HT 1000-1500		7.6	10.6				194.7			36.0	20.6	269.5
DIRECT HT >1500		12.5	16.7				130.9			3.0		163.1
DIRECT HEAT HSK												
RAW MATERIAL					725.8	1074.4	485.7				45.3	2331.2
PROCESS STEAM	230.4	49.4	76.3				872.3				93.8	1322.2
ELECTRICITY GEN	27.0	4.7	7.7				136.9			763.5	16.4	129.2
COKE PRODUCTION												
MACHINE DRIVE		7.1	9.5				98.4			334.6		449.6
ELECTROLYTIC										126.8		126.8
OTHER USES HSK	82.2	3.2	34.9	37.7			120.7					278.7
TOTAL FUNC USES	339.6	3.2	127.4	173.1	725.8	1074.4	2154.5			436.9	176.1	5211.0

10. Petroleum Refining - SIC 29

The petroleum refining industry consumed over 3 quads of fuel in 1974. Because refineries are large and the industry consumes so much energy, analysts have examined refinery energy consumption quite thoroughly. The ECDB, Battelle, ITC, and coal conversion studies all describe SIC 29 energy use. The ECDB determines functional uses for almost 99 percent of that energy consumption. The ISTUM model translates those functional uses into ISTUM service sectors.

The petroleum refining industry consumes almost three-fourths of its fuel in tube-still heaters. In these heaters the flame does not actually touch the product being heated, so tube-still fuels were mapped into the indirect heat service sectors. The coal conversion study analyses consumption in the industry's indirect heat processes, and determines the energy used and heating requirements for each.

As in the chemical industry, petroleum industry energy consumption was best described by translating ECDB direct heat into two service sectors: indirect heat - (coal capable) and indirect heat - (coal incapable). Each petroleum industry indirect heat process was allocated to one of these service sectors. Table VIII shows the processes, classifications, and energy consumption for each.

TABLE VIII
OIL AND GASEOUS FUEL CONSUMPTION
IN DIRECT HEAT PROCESS APPLICATIONS
(1974 Data)

<u>Process</u>	<u>Consumption of Selected Processes</u>	
	<u>Direct Heat (10¹² Btu)</u>	<u>Indirect Heat Service Sector</u>
Catalytic Reforming	378	Coal Capable
Atmospheric Crude Distillation	353	Coal Capable
Alkylation	175	Coal Capable
Hydrocracking	170	Not Coal Capable
Hydrotreating	133	Not Coal Capable
Vacuum Distillation	132	Not Coal Capable
Hydrorefining	81	Coal Capable
Hydrogen Manufacture	60	Not Coal Capable
Delayed Coking	45	Not Coal Capable
Visbreaking	15	Not Coal Capable
Thermal Cracking	40	Not Coal Capable
Other Processes	4	Not Coal Capable (Obsolete)
Not Accounted For ^{2/}	222	
	<hr/> 1808	

1/ Source: Coal Conversion study

2/ Energy in this category may include oil and gaseous fuel used in the eleven processes in Table I since "typical" process configurations were used to derive this table. See Appendix A for the derivation of the table.

PRIMARY SERVICE SECTORS

FUNCTIONAL USE	COAL	COKE-RR	DISTIL.	RESID.	MISC-PET	LFG	NAT GAS	OTH GAS	HYDRO	ELEC	REC EN
CE HEATING											
CE COOLING											
HTING											
ECT HT (600F			INDR HT	INDR HT		INDR HT	INDR HT	INDR HT			
HT 600-1000			INDR HT	INDR HT		INDR HT	INDR HT	INDR HT			
HT 1000-1500					INDR HT	INDR HT	INDR HT	INDR HT			
ECT HT >1500											
ECT HEAT HSK											
MATERIAL											
CESS STEAM			STEAM	STEAM		STEAM	STEAM	STEAM			STEAM
TRICITY GEN			INT GEN	INT GEN	INT GEN	INT GEN	INT GEN	INT GEN		CAP EL	
E PRODUCTION											
INE DRIVE			MCH DR	MCH DR	MCH DR	MCH DR	MCH DR	MCH DR		MCH DR	
ETROLYTIC											
ER USES HSK	INDR HT						INDR HT	INDR HT			

SECONDARY SERVICE SECTORS

FUNCTIONAL USE	COAL	COKE-BR	DISTIL	RESID	MISCPET	LPG	NAT GAS	OTH GAS	HYDRO	ELEC	REC EN
HE HEATING											
HE COOLING											
HEATING											
ECT HT (600F)			INDR AC			INDR AC	INDR AC	INDR AC			
HT 600-1000			INDR AC			INDR AC	INDR AC	INDR AC			
HT 1000-1500					INDR AC	INDR AC	INDR AC	INDR AC			
ECT HT >1500											
ECT HEAT NSK											
MATERIAL											
ESS STEAM											
TRICITY GEN											
RODUCTION											
INE DRIVE											
ETROLYTIC											
ER USES NSK							INDR AC	INDR AC			

FRACTION ALLOCATED TO PRIMARY SERVICE SECTOR

[illegible]

INDUSTRY: PETRO, REFINING SIC CODE: 29

EFFICIENCIES (FUEL TO PRIMARY SERVICE SECTOR)

FUNCTIONAL USE | COAL | COKE-BR | DISTIL. | RESID. | MISCFET | LPG | NAT GAS | OTH GAS | HYDRO | ELEC | NEC EN |

CE HEATING											
CE COOLING											
HEATING											
ECT HT (600F)		0.62	0.62			0.62	0.62	0.62			
HT 600-1000		0.62	0.62			0.62	0.62	0.62			
HT1000-1500				0.62		0.62	0.62	0.62			
ECT HT >1500											
ECT HEAT MSK											
MATERIAL											
CESS STEAM		0.75	0.70			0.70	0.70	0.70			0.60
ELECTRICITY GEN		1.00	1.00	1.00	1.00	1.00	1.00		1.00		
E PRODUCTION											
INE DRIVE		0.30	0.30	0.30	0.30	0.30	0.30		0.95		
ETROLYTIC											
ER USES MSK	0.62					0.62	0.62				

EFFICIENCIES TO SECONDARY SERVICE SECTORS

FUNCTIONAL USE | COAL | COKE-BR | DISTIL. | RESID. | MISCFET | LPG | NAT GAS | OTH GAS | HYDRO | ELEC | NEC EN |

CE HEATING											
CE COOLING											
HEATING											
ECT HT (600F)		0.62				0.62	0.62	0.62			
HT 600-1000		0.62				0.62	0.62	0.62			
HT1000-1500				0.62		0.62	0.62	0.62			
ECT HT >1500											
ECT HEAT MSK											
MATERIAL											
CESS STEAM											
ELECTRICITY GEN											
E PRODUCTION											
INE DRIVE											
ETROLYTIC											
ER USES MSK						0.62	0.62				

RY] PETRO, REFINING SIC CODE] 29 FUEL CONSUMPTION (100012 BTUS)

ADONAL USE | COAL | COKE-BR | DISTIL | RESID | MISCPET | LPG | NAT GAS | OTH GAS | HYDRO | ELEC | NEC EN | TOTAL |

HEATING											
COOLING											
ENG											
HT (600F)	7.7	42.2			5.9	169.4	150.9				384.1
600-1000	28.9	158.2			21.2	609.1	558.5				1375.9
1000-1500			372.1		1.4	39.6	37.6				450.7
HT >1500											
HEAT HSK											
MATERIAL											
SS STEAM	11.8	70.5			9.8	276.5	274.9		3.0		646.5
RICITY GEN	0.9	4.9	0.8		0.7	22.1	18.8	-15.2			33.0
PRODUCTION											
IE DRIVE	1.0	6.2	1.1		0.6	20.0	19.0	98.9			146.8
OLYTIC											
USES HSK	5.3					15.0	15.9				36.2
FUNC USES	5.3	50.3	282.0	374.0	39.6	1151.7	1083.6	83.7	3.0		3073.2

11. Rubber and Miscellaneous Plastics - SIC 30

The rubber industry consumed 251 trillion Btus of energy in 1974. The ECDB contains no functional use data on the industry, so the ISTUM demand base relied on other sources. The Annual Survey of Manufacturers provided raw energy consumption data, and both the ITC and Battelle reports determine the ways the industry uses that energy.

The tire and tube industry is the biggest energy-consumer in SIC 30. It uses saturated steam to heat tire molds and for a variety of other industry processes. The synthetic rubber industry uses most of SIC 30's electricity consumption for large machines such as bale cutters, cracking rolls, plasticators, and strainers. The miscellaneous plastics industries convert fuel to direct heat in order to shape plastic containers. Considering these three industries, SIC 30 energy consumption was allocated to steam, machine drive, and direct heat - intermediate service sectors. The NEDS file shows that firms use about 3 percent of their steam production for space heating, so the steam and space heat service sectors were determined accordingly.

INDUSTRY: RUBBERAMISC, FL SIC CODE: 30

PRIMARY SERVICE SECTORS

FUNCTIONAL USE	COAL	CORE-BR	DISTIL	RESID	MISCPET	LPG	NAT GAS	OTH GAS	HYDRO	ELEC	REC EN
SPACE HEATING											
SPACE COOLING											
LIGHTING											
DIRECT HT (600F)											
DIR HT 600-1000											
DIR HT1000-1500											
DIRECT HT >1500											
DIRECT HEAT HSK											
RAW MATERIAL											
PROCESS STEAM											
ELECTRICITY GEN											
CORE PRODUCTION											
MACHINE DRIVE											
ELECTROLYTIC											
OTHER USES HSK	STEAM		INT DH	INT OH			STEAM			MCH DR	INT DH

SECONDARY SERVICE SECTORS

FUNCTIONAL USE	COAL	CORE-BR	DISTIL	RESID	MISCPET	LPG	NAT GAS	OTH GAS	HYDRO	ELEC	REC EN
SPACE HEATING											
SPACE COOLING											
LIGHTING											
DIRECT HT (600F)											
DIR HT 600-1000											
DIR HT1000-1500											
DIRECT HT >1500											
DIRECT HEAT HSK											
RAW MATERIAL											
PROCESS STEAM											
ELECTRICITY GEN											
CORE PRODUCTION											
MACHINE DRIVE											
ELECTROLYTIC											
OTHER USES HSK	SFC HT		STEAM	STEAM			SFC HT				STEAM

INDUSTRY: RUBBERAMISC, FL SIC CODE: 30

FRACTION ALLOCATED TO PRIMARY SERVICE SECTOR

FUNCTIONAL USE	COAL	CORE-BR	DISTIL	RESID	MISCPET	LPG	NAT GAS	OTH GAS	HYDRO	ELEC	REC EN
SPACE HEATING											
SPACE COOLING											
LIGHTING											
DIRECT HT (600F)											
DIR HT 600-1000											
DIR HT1000-1500											
DIRECT HT >1500											
DIRECT HEAT HSK											
RAW MATERIAL											
PROCESS STEAM											
ELECTRICITY GEN											
CORE PRODUCTION											
MACHINE DRIVE											
ELECTROLYTIC											
OTHER USES HSK	0.95		0.50	0.50			0.95			1.00	0.50

INDUSTRY: RUBBER/MISC. PL SIC CODE: 30

EFFICIENCIES (FUEL TO PRIMARY SERVICE SECTOR)

FUNCTIONAL USE	COAL	COKE-DR	DISTIL.	RESID.	MISC/PET	LPG	HAT GAS	OTH GAS	HYDRO	ELEC	HEC EN
HEATING											
COOLING											
ATING											
CT HT (200F)											
HT 200-1000											
HT 1000-1500											
CT HT >1500											
CT HEAT USE											
MATERIAL											
ESS STEAM											
TRICITY GEN											
PRODUCTION											
INE DRIVE											
ROLYTIC											
USE USE	0.70		0.30	0.30			0.70			0.95	0.30

EFFICIENCIES TO SECONDARY SERVICE SECTORS

FUNCTIONAL USE	COAL	COKE-DR	DISTIL.	RESID.	MISC/PET	LPG	HAT GAS	OTH GAS	HYDRO	ELEC	HEC EN
HEATING											
COOLING											
ATING											
CT HT (200F)											
HT 200-1000											
HT 1000-1500											
CT HT >1500											
CT HEAT USE											
MATERIAL											
ESS STEAM											
TRICITY GEN											
PRODUCTION											
INE DRIVE											
ROLYTIC											
USE USE	0.45		0.75	0.70			0.70				0.60

STRT; RUBBERAMISC, FL SIC CODE; 20 FUEL CONSUMPTION (10AA12 BTUS)

ADDITIONAL USE | COAL | CORE-PR | DISTIL | RESID | MISCFET | LPG | NAT GAS | OTH GAS | HYDRO | ELEC | MEC EN | TOTAL |

HEATING												
COOLING												
ING												
BT BT (200F)												
BT 200-1000												
BT 1000-1500												
BT BT >1500												
BT HEAT USE												
MATERIAL												
SS STEAM												
RICITY GEN												
PRODUCTION												
RE DRIVE												
ELECTRIC												
USES HSK	30.3		18.7	24.3			88.6			44.2	20.7	250.8
FUNG USES	30.3		18.7	24.3			88.6			44.2	20.7	250.8

12. Leather - SIC 31

The leather industry consumed 22 trillion Btus of energy in 1974. The Annual Survey of Manufacturers provides energy consumption data on the industry, but none of the ISTUM data sources described the uses of that energy. Leather firms generally use fuel for steam production, and the NEDS file shows that the industry uses 3 percent of that steam for space heating.

INDUSTRY: LEATHER

SIC CODE: 31

PRIMARY SERVICE SECTORS

FUNCTIONAL USE	COAL	COKE-BR	DISTIL	RESID	MISCPET	LPG	NAT GAS	OTH GAS	HYDRO	ELEC	HEC	EN
ACE HEATING												
ACE COOLING												
IGHTING												
ECT HT (600F												
R HT 600-1000												
R HT1000-1500												
RECT HT >1500												
RECT HEAT HSK												
V MATERIAL												
CESS STEAM												
ELECTRICITY GEN												
E PRODUCTION												
INE DRIVE												
ELECTROLYTIC												
ER USES HSK	STEAM		STEAM	STEAM			STEAM			INT BH	INT BH	

SECONDARY SERVICE SECTORS

FUNCTIONAL USE	COAL	COKE-BR	DISTIL	RESID	MISCPET	LPG	NAT GAS	OTH GAS	HYDRO	ELEC	HEC	EN
ACE HEATING												
ACE COOLING												
IGHTING												
ECT HT (600F												
HT 600-1000												
HT1000-1500												
ECT HT >1500												
ECT HEAT HSK												
MATERIAL												
CESS STEAM												
CTRICITY GEN												
E PRODUCTION												
INE DRIVE												
CTROLYTIC												
ER USES HSK	SFC HT			SFC HT			SFC HT					

INDUSTRY: LEATHER

SIC CODE: 31

FRACTION ALLOCATED TO PRIMARY SERVICE SECTOR

FUNCTIONAL USE	COAL	COKE-BR	DISTIL	RESID	MISCPET	LPG	NAT GAS	OTH GAS	HYDRO	ELEC	HEC	EN
ACE HEATING												
ACE COOLING												
HTING												
ECT HT (600F												
HT 600-1000												
HT1000-1500												
ECT HT >1500												
ECT HEAT HSK												
MATERIAL												
CESS STEAM												
ELECTRICITY GEN												
E PRODUCTION												
INE DRIVE												
ETROL												
ER USES HSK	0.97		1.00	0.90			0.00					

INDUSTRY: LEATHER

SIC CODE: 31

EFFICIENCIES (FUEL TO PRIMARY SERVICE SECTOR)

ADDITIONAL USE | COAL | COKE-OR | DISTIL. | RESID. | MISCPET | LPG | NAT GAS | OTH GAS | HYDRO | ELEC | REC EN |

CE HEATING											
CE COOLING											
HEATING											
ECT HT (600F)											
HT 600-1000											
HT 1000-1500											
ECT HT >1500											
ECT HEAT HSK											
MATERIAL											
CESS STEAM											
ELECTRICITY GEN											
E PRODUCTION											
LINE DRIVE											
ELECTROLYTIC											
ER USES HSK	0.70		0.75	0.70			0.70		0.80	0.30	

EFFICIENCIES TO SECONDARY SERVICE SECTORS

ADDITIONAL USE | COAL | COKE-OR | DISTIL. | RESID. | MISCPET | LPG | NAT GAS | OTH GAS | HYDRO | ELEC | REC EN |

CE HEATING											
CE COOLING											
HEATING											
ECT HT (600F)											
HT 600-1000											
HT 1000-1500											
ECT HT >1500											
ECT HEAT HSK											
MATERIAL											
CESS STEAM											
ELECTRICITY GEN											
E PRODUCTION											
LINE DRIVE											
ELECTROLYTIC											
ER USES HSK	0.65		0.70				0.70				

INDUSTRY: LEATHER

SIC CODE: 31

FUEL CONSUMPTION (10**12 BTUS)

FUNCTIONAL USE: COAL CORE-BR DISTIL RESID MISC PET LFG NAT GAS OTH GAS HYDRO ELEC MEC EN TOTAL

HEATING								
COOLING								
TYING								
ACT HT (600F)								
HT 600-1000								
HT 1000-1500								
ACT HT >1500								
ACT HEAT NSR								
MATERIAL								
ESS STEAM								
TRICITY GEN								
PRODUCTION								
INE DRIVE								
TEOLYTIC								
R USES NSR	1.3	3.0	3.3	5.2	5.5	3.6	21.9	
L FURC USES	1.3	3.0	3.3	5.2	5.5	3.6	21.9	

13. Stone, Clay, Glass and Concrete Products - SIC 32

The Stone, Clay, and Glass (SCG) SIC code includes several industries with different energy needs: cement, glass, lime, brick, clay refractories, gypsum, and others. The SCG industries consumed more than 1.3 quads of energy in 1974. According to the ECDB, the industries used 80 percent of that energy as direct heat.

Because of the large quantities of direct heat consumed in the SCG industries, the SIC 32 direct heat processes were allocated to three separate service sectors: calcining, glass melting, and brick firing. Table IX lists the fuels used to supply energy for each of these processes.

The cement, lime, and smaller SCG industries calcine raw materials in kilns -- usually rotary kilns. The cement industry consumed more energy than any other industry in SCG -- 414 trillion Btu's for calcining alone. It calcines stone exclusively in rotary kilns -- cylindrical steel chambers tilted to allow material to flow through slowly. Lime, concrete, and gypsum kilns are similar, but slightly smaller. They consumed about 243 trillion Btu's in 1974.

Glass industry direct requirements differ greatly from other industries in SIC 32. Generally, regenerative furnaces are used to melt the glass. These furnaces send long smooth flames over shallow tanks of raw materials to create glass. Most regenerative furnaces use natural gas as fuel, but they could be converted for pulverized coal use. The other major furnace used to melt glass is the unit melter. Unit melters are long narrow chutes; flames from above heat materials as they flow through the chute. As with regenerative furnaces, most unit melters presently

TABLE IX

FUELS USED FOR STONE, CLAY, AND GLASS PROCESSES - 1974

(Trillion Btu's)

(parentheses indicate subtotals)

	<u>Oil</u>	<u>Gas</u>	<u>Coal</u>	<u>Electricity</u>	<u>Total</u>
Clay and Brick Firing	<u>3.8</u>	<u>71.8</u>	<u>2.6</u>	<u>2.1</u>	<u>80.3</u>
Clay Refractories	(.9)	(14.0)	--	(.6)	(15.5)
Brick	(2.9)	(57.8)	(2.6)	(1.5)	(64.8)
Glass Melting	<u>31.7</u>	<u>189.9</u>	---	<u>16.2</u>	<u>237.8</u>
Calcining ^{1/}	89.2	406.2	<u>229.0</u>	0	724.4
Cement	(42.6)	(205.1)	(167.1)	0	(414.8)
Other Cal- cining (in- cludes con- crete, gypsum, plaster, and others)	(46.6)	(201.1)	(61.9)	0	(309.6)
TOTAL	<u>124.7</u>	<u>667.9</u>	<u>231.6</u>	<u>18.3</u>	<u>1042.5</u>

SOURCES: ECDB and Coal Conversion Study.

^{1/} Small industry direct heat fuel use was assumed to use the calcining process.

use natural gas for fuel. Glass melters consumed 237.8 trillion Btu's of fuel in 1974 -- 189.9 trillion being natural gas.

The building brick and clay refractory industries both fire raw materials in tunnel kilns. Kiln exhaust gases dry processed and shaped clay, which is then fired in the kiln. The kiln is a long refractory lined chamber with temperatures varying along its length. Presently, most tunnel kilns use natural gas for fuel, but oil and coal could be used. The main difference between heating brick and heating clay refractories is that higher temperatures are used in the latter process.

The standard method of setting up the ISTUM demand base does not allow ECDB functional use to be translated to more than two service sectors. Because of the three different SCG direct heat processes, this method was inadequate for the SIC 32 direct heat functional use. The ECDB cell's mapped into more than two service sectors were inputted separately into the ISTUM demand base. Table X lists each of those cells and the service sectors, efficiencies, and fuel consumptions actually inputted.

The data for the SCG demand base comes from three basic sources: the ECDB, the coal conversion study, and the NEDS file. The ECDB give gross consumption data and functional use data for the space heat, machine drive, internal generation, and coke consumption service sectors. The coal conversion study lists fuel consumption data for each of the SCG direct heat processes. And the NEDS file gives information on steam production in these industries.

TABLE X

ISTUM DEMAND BASE FOR ECDB CELLS MAPPED
 INTO AT LEAST THREE SERVICE SECTORS

(SIC 32)

(ECDB DIRECT HEAT/NSK FUNCTIONAL USE)

<u>ISTUM Category</u>	<u>ECDB FUELS</u>		
	<u>Distillate</u>	<u>Residual</u>	<u>Natural Gas</u>
1. Service Sector	Calcining	Calcining	Calcining
Efficiency	.3	.3	.3
Consumption (10^{12} Btus)	24.9	19.5	406.2
2. Service Sector	Glass Melting	Glass Melting	Glass Melting
Efficiency	.3	.3	.3
Consumption (10^{12} Btus)	16.7	15.0	189.9
3. Service Sector	Brick Firing	Brick Firing	Brick Firing
Efficiency	.3	.3	.3
Consumption (10^{12} Btus)	2.0	1.8	71.8
4. Service Sector	Steam	Steam	
Efficiency	.75	.70	
Consumption (10^{12} Btus)	10.2	10.2	

INDUSTRY: 5, , CONCRE SIC CODE: 32 PRIMARY SERVICE SECTORS

FUNCTIONAL USE	COAL	COKE-BR	DISTIL.	RESID.	MISCFET	LPG	NAT GAS	OTH GAS	HYDRO	ELEC	NEC EN
SPACE HEATING			SPC HT	SPC HT			SPC HT			SPC HT	
SPACE COOLING											
LIGHTING											
DIRECT HT (600F)											
IR HT 600-1000											
IR HT1000-1500											
DIRECT HT >1500											
DIRECT HEAT HSK	FIRING		STEAM	STEAM			CALCI			FIRING	
RAW MATERIAL											
PROCESS STEAM											
ELECTRICITY GEN	INT GEN		INT GEN	INT GEN			INT GEN			CAP EL	
COKE PRODUCTION											
MACHINE DRIVE			MCH DR								
ELECTROLYTIC											
OTHER USES HSK		COK CON		CALCI			STEAM			SPC HT	CALCI

SECONDARY SERVICE SECTORS

FUNCTIONAL USE	COAL	COKE-BR	DISTIL.	RESID.	MISCFET	LPG	NAT GAS	OTH GAS	HYDRO	ELEC	NEC EN
SPACE HEATING											
SPACE COOLING											
LIGHTING											
DIRECT HT (600F)											
IR HT 600-1000											
IR HT1000-1500											
DIRECT HT >1500											
DIRECT HEAT HSK	CALCI		FIRING	GL MELT			GL MELT			GL MELT	
RAW MATERIAL											
PROCESS STEAM											
ELECTRICITY GEN											
COKE PRODUCTION											
MACHINE DRIVE											
ELECTROLYTIC											
OTHER USES HSK										MCH DR	

INDUSTRY: 5, C, G, CONCRE SIC CODE: 32 FRACTION ALLOCATED TO PRIMARY SERVICE SECTOR

FUNCTIONAL USE	COAL	COKE-BR	DISTIL.	RESID.	MISCFET	LPG	NAT GAS	OTH GAS	HYDRO	ELEC	NEC EN
SPACE HEATING			1.00	1.00			1.00			1.00	
SPACE COOLING											
LIGHTING											
DIRECT HT (600F)											
IR HT 600-1000											
IR HT1000-1500											
DIRECT HT >1500											
DIRECT HEAT HSK	0.01		0.19	0.22			0.70			0.11	
RAW MATERIAL											
PROCESS STEAM											
ELECTRICITY GEN	1.00		1.00	1.00			1.00			1.00	
COKE PRODUCTION											
MACHINE DRIVE			1.00								
ELECTROLYTIC											
OTHER USES HSK		1.00		1.00			1.00			0.10	1.00

EFFICIENCIES (FUEL TO PRIMARY SERVICE SECTOR)

DESCRIPTION	0.75	0.70	0.70	0.90
EATING				
DOOLING				
5				
IT (400F)				
600-1000				
000-1500				
IT >1500				
HEAT HSK	0.30	0.75	0.70	0.30
SERIAL				0.80
STEAM				
CITY GEN	1.00	1.00	1.00	1.00
DUCTION				
DRIVE		0.30		
TTIC				
ES HSK	0.30	0.30	0.70	0.90
				0.30

AL USE	COAL	COKE-PR	DISTIL	RESID	MISCFT	LPG	NAT GAS	OTH GAS	HYDRO	ELEC	HEC EN
--------	------	---------	--------	-------	--------	-----	---------	---------	-------	------	--------

ATING						
OLING						
T (200F)						
00-1000						
00-1500						
T 1500						
FEAT HSR	0.30	0.30	0.30	0.30	0.80	
FEAL						
STEAM						
ITY GEN						
DUCTION						
DRIVE						
TTIC						
ES HSR					0.25	

TRY: S, C, G, CONCRE SIC CODE: 32

FUEL CONSUMPTION (10**12 BTUS)

ADDITIONAL USE	COAL	COKE-BR	DISTIL.	RESID.	MISC PET	LPG	HAT GAS	OTH GAS	HYDRO	ELEC	HEC EH	TOTAL
HEATING			1.0	2.0			4.9			0.7		10.6
COOLING												
HT (600F												
600-1000												
1000-1500												
HT (1500												
HEAT WSK	231.6		53.8	46.5			667.9			18.3		1018.1
MATERIAL												
AS STEAM												
ELECTRICITY GEN	1.4		0.5	0.3			4.2			2.0		4.4
PRODUCTION												
IE DRIVE			20.8									20.8
ELECTRIC												
USES WSK		26.8		0.8			29.0			146.7	44.0	247.3
FOOD USES	233.0	26.8	76.1	49.6			708.0			163.7	44.0	1301.2

14. Steel - SIC 331

The steel industry consumed 3.4 quads of energy in 1974. Metallurgical coal supplied two-thirds of the fuel used, since it is needed to produce coke. Fossil fuels and electricity provided the other quad of energy to the steel industry, and primarily for direct heat processes.

The industry used 1.1 quads of energy for direct heat in 1974, including .3 quads of off-gases from coke-ovens and blast furnaces. The ISTUM model disaggregates this energy consumption by the type of direct heat process involved: ironmaking, steelmaking, steel reheating, other direct heat (intermediate), and other direct heat (dirty).

Ironmaking: The iron making process uses direct heat in blast furnaces. A blast furnace is a vertical shaft in the form of a truncated cone lined with heat resistant brick. The charge -- iron ore, scrap, coke, and some less important materials -- is dumped down the shaft. Hot gases rising from a blast furnace stove heat the charge. Blast air, heated by injected fossil fuels, ignites the coke at the bottom of the shaft. Finally, the burning coke converts the rest of the charge into molten iron.

Blast furnaces use all types of fuels to melt iron. Coke and breeze are the main fuels, but other fossil fuels heat the blast air and are used in the blast furnace stoves. Oil and gas provided 120 trillion Btu's of energy in 1974 for ironmaking (See Table XI). Tar and pitch and electricity provided another 30 trillion Btu's. The ironmaking process recycles 200 trillion Btu's of its fuel consumption by capturing hot gases rising from the shaft and using it in other processes.

TABLE XI

NET ENERGY CONSUMPTION IN THE IRON AND STEEL INDUSTRY IN 1974

(trillion Btu's)
(parentheses indicate subtotals)

Direct Heat Process	Oil	Natural Gas	Electric	Coal not including met-coal	Coke and Breeze	Tar and Pitch	Met Coal Gas	Coke Oven Gas	Blast Furn. Gas	Total
Ironmaking (blast furnaces)	<u>81</u>	<u>43</u>	<u>8</u>	0	<u>1469</u>	<u>21</u>	0	<u>9</u>	<u>-199</u>	<u>1432</u>
Steelmaking	<u>49</u>	<u>60</u>	<u>65</u>	<u>0</u>	<u>0</u>	<u>19</u>	<u>0</u>	<u>6</u>	<u>0</u>	<u>199</u>
Open Hearth Furnaces	(49)	(41)	(2)			(19)		(6)		(117)
Basic Oxygen Furnaces		(16)	(8)							(25)
Electric Arc Furnaces		(3)	(55)							(58)
Steel Reheating	<u>23</u>	<u>322</u>	<u>5</u>	<u>0</u>	0	<u>0</u>	<u>0</u>	<u>113</u>	<u>115</u>	578
Slab/Bloom Reheat Furnace	(7)	(216)	(1)					(68)		292
Billet Reheat Furnace	(11)	(32)						(16)		(59)
Annealing and other Heat Treating	(5)	(57)	(4)					(4)	(15)	(85)
Soaking Pits		(17)						(25)	(100)	(142)
Other Steel	112	257	131	183	-1430	-93	2126	-158	84	1212
TOTAL	265	682	209	183	39	-53	2126	-30	--	3421

SOURCE: EEA report on potential for coal conversion (not yet published)

Steelmaking: Steelmaking furnaces convert molten iron and scrap into steel. The U.S. Steel industry now has three types of furnaces: basic oxygen, electric arc, and open hearth. The basic oxygen furnace produced 56 percent of the U.S. - made steel in 1974. It injects oxygen into the molten charge and scrap to create steel without the use of other fuels. The basic oxygen furnace burns fossil fuels only to maintain furnace temperature between firings, burn in refractory linings, and preheat ladles.

Electric arc furnaces produced 20 percent of the steel made in the U.S. in 1974. They melt scrap and convert it into steel by sending a current through it. Electricity supplies nearly all of the energy consumed.

Open hearth furnaces produced 24 percent of the 1974 U.S. steel output. Fossil fuel energy melt a long bath of scrap, which is then covered with molten charge. Oxygen is fed into the bath expediting the creation of steel. Fossil fuels supply most of the heat required.

The open hearth process consumed 90 trillion Btu's of oil and gas in 1974, while the other steelmaking processes consumed very little. The Electric Arc Process consumed 55 trillion Btu's of electricity, which was the other major energy input for steelmaking.

TABLE XII
ENERGY CONSUMED IN STEELMAKING PER TON

Fuel Process	Oil	Natural Gas	Electric	Tar & Pitch	Coke Oven Gas	Total
Open Hearth	1.35	1.15	.05	.59	.17	3.26
BOF		.20	.10			.30
Electric Arc		.10	1.85			

Table XII lists the energy required to make a ton of steel by each of the processes. The open hearth process consumes much more energy per ton than the other two. Since the steel industry is phasing out that process, the steelmaking process will show a decrease in the energy required to produce a ton of steel.

Steel reheating: The steel reheating process heats newly made steel, which is then shaped and annealed. The newly made steel is placed in soaking pits, where it is soaked in a thermal bath. Then the steel is reheated and shaped in one of two types of furnaces. Batch furnaces heat stationary steel piles to high temperatures, while continuous furnaces slowly heat steel as it moves along conveyors. Both types of reheat furnaces burn fossil fuels. Steel is annealed and tempered in heat treating furnaces. The furnaces usually burn gaseous fuels.

Gaseous fuels supplied nearly all of the energy used by the steel forming and finishing process in 1974. The process consumed 578 trillion Btu's. Purchased natural gas provided 70 percent of this energy, and internally produced coke oven gas supplied most of the remainder.

As in SIC 32, the additional steel industry direct heat processes caused some ECDB direct heat functional uses to be mapped into more than two service sectors. Table XIII lists the fuels, service sectors, efficiencies, and consumption of these ECDB functional use cells.

Service sector allocations and energy consumption estimates on the steel industry taken from two general sources: the ECDB and the coal conversion study. The ECDB provided consumption data on all service sectors not involving direct heat processes. The coal conversion study provided information on those processes.

TABLE XIII

ISTUM DEMAND BASE FOR ECDB CELLS MAPPED INTO AT
LEAST THREE SERVICE SECTORS (SIC 331)

(ECDB Direct Heat/WSK Functional Uses)

(Consumption is in trillion Btus)

<u>ISTUM category</u>	<u>ECDB Fuels</u>			
	<u>Residual</u>	<u>Natural Gas</u>	<u>Other Gas</u>	<u>Electricity</u>
1. Service Sector	Iron Making	Iron Making	Iron Making	Iron Making
Efficiency	.3	.3	.3	.8
Consumption	81	43	9	8
2. Service Sector	Direct Heat Dirty	Direct Heat Dirty	Direct Heat Dirty	Electrolytic
Efficiency	.3	.3	.3	1.0
Consumption	55.1	63.3	33.0	65
3. Service Sector	Steel Reheating	Steel Reheating	Steel Reheating	Steel Reheating
Efficiency	.3	.3	.3	.8
Consumption	23	322	228	5
4. Service Sector	Steel Making	Steel Making	Steel Making	
Efficiency	.3	.3	.3	
Consumption	49	60	6	

The two sources above give different estimates of total direct heat process use in the steel industry. Several sources were consulted to resolve this discrepancy, most important of them being D. Larson's "A Projection of Energy Demand by the Iron and Steel Industry"¹. Generally, the differences were resolved by increasing ECDB consumption estimates for the steam and internal generation service sectors.

^{1/} D. Larson, "A Projection of Energy Demand By the Iron and Steel Industry" from Energy Conservation Through Effective Energy Utilization. National Bureau of Standards Special Publication 409, 1976. pp. 121-152.

INDUSTRY: STEEL

SIC CODE: 331

PRIMARY SERVICE SECTORS

FUNCTIONAL USE	COAL	COKE-BR	DISTIL	RESID	MISCFET	LPG	NAT GAS	OTH GAS	HYDRO	ELEC	NEC EN
FACE HEATING											
FACE COOLING											
LIGHTING											
DIRECT HT <600F											
IR HT 600-1000											
IR HT1000-1500											
DIRECT HT >1500											
DIRECT HEAT HSK		DTY DH	DTY DH	DTY DH			INT DH	INT DH	INT DH	ELYTIC	INT DH
RAW MATERIAL		COK CON									
PROCESS STEAM	STEAM	STEAM						STEAM			
ELECTRICITY GEN	INT GEN	INT GEN						INT GEN		CAP EL	
COKE PRODUCTION	MET CL	COK CON	DTY DH				DTY DH	CAP DHT		MCH DR	CAP DHT
MACHINE DRIVE											
ELECTROLYTIC											
OTHER USES HSK	STEAM	COK CON	DTY DH	DTY DH			INT DH	SFC HT	CAP DHT	MCH DR	INT DH

SECONDARY SERVICE SECTORS

FUNCTIONAL USE	COAL	COKE-BR	DISTIL	RESID	MISCFET	LPG	NAT GAS	OTH GAS	HYDRO	ELEC	NEC EN
FACE HEATING											
FACE COOLING											
LIGHTING											
DIRECT HT <600F											
IR HT 600-1000											
IR HT1000-1500											
DIRECT HT >1500											
DIRECT HEAT HSK				IRN MAK			STL REN	STL REN		IRN MAK	
RAW MATERIAL											
PROCESS STEAM											
ELECTRICITY GEN											
COKE PRODUCTION											
MACHINE DRIVE											
ELECTROLYTIC											
OTHER USES HSK							STEAM				

INDUSTRY: STEEL

SIC CODE: 331

FRACTION ALLOCATED TO PRIMARY SERVICE SECTOR

FUNCTIONAL USE	COAL	COKE-BR	DISTIL	RESID	MISCFET	LPG	NAT GAS	OTH GAS	HYDRO	ELEC	NEC EN
FACE HEATING											
FACE COOLING											
LIGHTING											
DIRECT HT <600F											
IR HT 600-1000											
IR HT1000-1500											
DIRECT HT >1500											
DIRECT HEAT HSK		1.00	1.00	0.26		1.00	0.13	0.12		0.83	1.00
RAW MATERIAL		1.00									
PROCESS STEAM	1.00	1.00						1.00			
ELECTRICITY GEN	1.00	1.00						1.00		1.00	
COKE PRODUCTION	1.00	1.00	1.00				1.00	1.00		1.00	1.00
MACHINE DRIVE											
ELECTROLYTIC											
OTHER USES HSK	1.00	1.00	1.00	1.00		1.00	0.20	1.00		1.00	1.00

INDUSTRY: STEEL

SIC CODE: 331

EFFICIENCIES(FUEL TO PRIMARY SERVICE SECTOR)

FUNCTIONAL USE | COAL | COKE-BR | DISTIL. | RESID. | MISCFET | LPG | NAT GAS | OTH GAS | HYDRO | ELEC | REC EN |

SPACE HEATING											
SPACE COOLING											
LIGHTING											
DIRECT HT <600F											
DIR HT 600-1000											
DIR HT 1000-1500											
DIRECT HT >1500											
DIRECT HEAT NSK		0.30	0.30	0.30		0.30	0.30	0.30		1.00	0.30
RAW MATERIAL		1.00									
PROCESS STEAM	0.70	0.60						0.70			
ELECTRICITY GEN	1.00	1.00						1.00		1.00	
COKE PRODUCTION	1.00	1.00	0.40				0.40	0.30		0.95	0.30
MACHINE DRIVE											
ELECTROLYTIC											
OTHER USES NSK	0.70	0.30	0.30	0.30		0.30	0.70	0.30		0.95	0.30

EFFICIENCIES TO SECONDARY SERVICE SECTORS

FUNCTIONAL USE | COAL | COKE-BR | DISTIL. | RESID. | MISCFET | LPG | NAT GAS | OTH GAS | HYDRO | ELEC | REC EN |

SPACE HEATING											
SPACE COOLING											
LIGHTING											
DIRECT HT <600F											
DIR HT 600-1000											
DIR HT 1000-1500											
DIRECT HT >1500											
DIRECT HEAT NSK			0.30				0.30	0.30		0.80	
RAW MATERIAL											
PROCESS STEAM											
ELECTRICITY GEN											
COKE PRODUCTION											
MACHINE DRIVE											
ELECTROLYTIC											
OTHER USES NSK							0.70				

INDUSTRY: STEEL

SIC CODE: 331

FUEL CONSUMPTION (10**12 BTUS)

FUNCTIONAL USE	COAL	COKE-BR	DISTIL	RESID	MISCPET	LPG	NAT GAS	OTH GAS	HYDRO	ELEC	REC EN	TOTAL	
SPACE HEATING													
SPACE COOLING													
LIGHTING													
DIRECT HT (600F)													
DIR HT 600-1000													
DIR HT1000-1500													
DIRECT HT >1500													
DIRECT HEAT NSK		29.4	9.4	208.1			0.5	488.3	276.0		78.0	35.9	1125.6
RAW MATERIAL		1462.5											1462.5
PROCESS STEAM	65.2	1.9						24.0					91.1
ELECTRICITY GEN	92.5	2.4						34.0		-36.6			92.3
COKE PRODUCTION	2363.1	-1629.2	3.4				1.2	-268.1		7.0	-125.1		352.3
MACHINE DRIVE													
ELECTROLYTIC													
OTHER USES NSK	12.6	19.4	1.9	41.5			0.6	192.4	-96.6		123.9	2.0	297.7
TOTAL FUNC USES	2533.4	-113.6	14.7	249.6			1.1	681.9	-30.7		172.3	-87.2	3421.5

15. Aluminum - SIC 3334

The ISTUM model aluminum industry includes only primary aluminum production, not secondary production or the conversion of bauxite to alumina. Primary production involves the conversion of alumina to aluminum, and very little else.

Aluminum companies usually convert alumina to aluminum via the Hall/Heroult process. Molten alumina is spread over a bed of cathodes. An electric current is then passed through the alumina to smelt it. This process consumes anodes quickly, so anode paste is usually baked into new anodes prior to the electrolytic smelting. The aluminum industry uses primarily the electrolytic and direct heat service sectors in the ISTUM demand base.

The ECDB provides the ISTUM consumption data on the Aluminum industry; it also provides most of the service sector breakdowns. The Aluminum Association publishes the uses of energy in its member firms. The ECDB converts these Aluminum Association estimates into functional use consumption estimates, which were later translated into ISTUM service sectors. The Battelle report and an Arthur D. Little report on energy conservation in the industry generally supported the service sector allocations according to ECDB functional uses.^{1/}

^{1/} Environmental Considerations of Selected Energy Conserving Manufacturing Process Options, Volume III, Alumina/Aluminum Report. A.D. Little, Inc.

CELLS IN THIS SIC ARE MAPPED INTO AT MOST ONE SERVICE SECTOR

TRY: ALUMINUM SIC CODE: 3334 PRIMARY SERVICE SECTORS

FUNCTIONAL USE	COAL	COKE-DR	DISTIL.	RESID.	MISCFET	LPG	NAT GAS	OTH GAS	HYDRO	ELEC	HEC EN
HEATING											
COOLING											
ING											
T HT (600F											
T 600-1000											
T 1000-1500											
T HT >1500											
T HEAT HSK	DTY DH		INT DH	DTY DH	INT DH	MISC EN	INT DH		DTY DH	DTY DH	
MATERIAL					LIG FD						
SS STEAM											
RICITY GEN	INT GEN			INT GEN			INT GEN		CAP EL	CAP EL	
PRODUCTION											
ME DRIVE									MCH DR	MCH DR	
ELECTRIC									ELYTIC	ELYTIC	
USES HSK						MCH DR			MCH DR		

TRY: ALUMINUM SIC CODE: 3334 FRACTION ALLOCATED TO PRIMARY SERVICE SECTOR

FUNCTIONAL USE	COAL	COKE-DR	DISTIL.	RESID.	MISCFET	LPG	NAT GAS	OTH GAS	HYDRO	ELEC	HEC EN
HEATING											
COOLING											
ING											
T HT (600F											
T 600-1000											
T 1000-1500											
T HT >1500											
T HEAT HSK	1.00		1.00	1.00	1.00	1.00	1.00		1.00	1.00	
MATERIAL					1.00						
SS STEAM											
RICITY GEN	1.00			1.00			1.00		1.00	1.00	
PRODUCTION											
ME DRIVE									1.00	1.00	
ELECTRIC									1.00	1.00	
USES HSK						1.00				1.00	

B CELLS IN THIS SIC ARE MAPPED INTO AT MOST ONE SERVICE SECTOR

INDUSTRY: ALUMINUM		SIC CODE: 3334		EFFICIENCIES(FUEL TO PRIMARY SERVICE SECTOR)									
OPTIONAL USE		COAL	COKE-BR	DISTIL.	RESID.	MISCPET	LPG	NAT GAS	OTH GAS	HYDRO	ELEC	HEC EN	

CE HEATING													
CE COOLING													
HTING													
ECT HT (600F)													
HT 600-1000													
HT1000-1500													
ECT HT >1500													
ECT HEAT HSK		0.30		0.30	0.30	0.30	1.00	0.30		0.80	0.80		
MATERIAL						1.00							
CESS STEAM													
TRICITY GEN		1.00			1.00			1.00		1.00	1.00		
E PRODUCTION													
INE DRIVE										0.95	0.95		
CTROLYTIC										1.00	1.00		
ER USES HSK						0.30					0.95		

STRY: ALUMINUM

SIC CODE: 3334

FUEL CONSUMPTION (10**12 BTUS)

ADITIONAL USE | COAL | CORE-BR | DISTIL. | RESID. | MISCPET | LPG | NAT GAS | OTH GAS | HYDRO | ELEC | REC EN | TOTAL |

E HEATING												
E COOLING												
TING												
ET HT (600F)												
ET 600-1000												
ET 1000-1500												
ET HT >1500												
ET HEAT USK	6.0	4.0	5.5	10.1	1.9	114.9		0.4	7.9			150.7
MATERIAL				82.3								82.3
ESS STEAM												
TRICITY GEN	61.1		2.6			114.8		14.4	53.4			110.7
PRODUCTION												
INE DRIVE								1.0	18.1			19.1
ROLYTIC								13.0	247.0			260.0
R USES USK					1.0				0.4			1.4
L FINE USES	67.1	4.0	8.1	92.4	2.9	229.7			220.0			624.2

16. Other Primary Metals - SIC 334^{1/}

The SIC 334 industries are a heterogeneous group: primary and secondary copper, lead and zinc; secondary aluminum; iron and steel foundries; and a variety of other metal industries. The ECDB provides gross consumption data on the industries from the Annual Survey of Manufacturers, but no functional use data. Because the industries consumed more than 3/4 of a quad of energy in 1974, consumption patterns were examined quite closely for the ISTUM demand base.

The primary copper industry consumed over 100 trillion Btus in 1974. The Battelle and ITC reports both analyze this consumption. The industry used energy for roasting, reverberatory furnaces, converting, fire refining, and electrolytic refining. So consumption is translated to the direct heat and electrolytic service sectors. According to the ITC report, the primary lead and zinc industries use similar processes for the same service sectors.

None of the standard data sources studies energy consumption in the secondary metals or iron foundries industries. These uses of this energy were studied in two ways. First, firms and industry associations were called and asked about the ways they use energy. Second, engineers made their best estimates of the quantities of energy used for each service sector. In general, the secondary metals and iron foundries industries use most of their energy in the machine drive service sector.

^{1/} This SIC number is a surrogate number for SICs 332, 333 except 3334, and 334-339.

SIC 334 had one ECDB functional use-fuel cell that ISTUM maps to three service sectors: other uses NSK/Electricity. Table XIV lists the service sectors, efficiencies, and fuel consumption for that ECDB cell.

TABLE XIV

ISTUM DEMAND BASE FOR ECDB CELLS MAPPED INTO AT
LEAST THREE SERVICE SECTORS (SIC 334)

(ECDB Other use/NSK functional use; electricity as fuel)

<u>Service Sector</u>	<u>Efficiency</u>	<u>Fuel Consumption</u>
1. Machine Drive	.95	30.1
2. Direct Heat (Intermediate)	.8	105.3
3. Electrolytic	1.0	15.0

INDUSTRY: OTHER PRIM, MET SIC CODE: 334 PRIMARY SERVICE SECTORS

FUNCTIONAL USE	COAL	COKE-DR	DISTIL	RESID	MISCFET	LPG	NAT GAS	OTH GAS	HYDRO	ELEC	MEC EN
SPACE HEATING											
SPACE COOLING											
LIGHTING											
DIRECT HT (600F)											
DIR HT 600-1000											
DIR HT1000-1500											
DIRECT HT >1500											
DIRECT HEAT HSK											
RAW MATERIAL											
PROCESS STEAM											
ELECTRICITY GEN											
COKE PRODUCTION											
MACHINE DRIVE											
ELECTROLYTIC											
OTHER USES HSK	STEAM	COK CON	INT DH	PTY DH			INT DH			MCH DR	INT DH

SECONDARY SERVICE SECTORS

FUNCTIONAL USE	COAL	COKE-DR	DISTIL	RESID	MISCFET	LPG	NAT GAS	OTH GAS	HYDRO	ELEC	MEC EN
SPACE HEATING											
SPACE COOLING											
LIGHTING											
DIRECT HT (600F)											
DIR HT 600-1000											
DIR HT1000-1500											
DIRECT HT >1500											
DIRECT HEAT HSK											
RAW MATERIAL											
PROCESS STEAM											
ELECTRICITY GEN											
COKE PRODUCTION											
MACHINE DRIVE											
ELECTROLYTIC											
OTHER USES HSK	SFC HT		MCH DR	STEAM			MCH DR			INT DH	

INDUSTRY: OTHER PRIM, MET SIC CODE: 334 FRACTION ALLOCATED TO PRIMARY SERVICE SECTOR

FUNCTIONAL USE	COAL	COKE-DR	DISTIL	RESID	MISCFET	LPG	NAT GAS	OTH GAS	HYDRO	ELEC	MEC EN
SPACE HEATING											
SPACE COOLING											
LIGHTING											
DIRECT HT (600F)											
DIR HT 600-1000											
DIR HT1000-1500											
DIRECT HT >1500											
DIRECT HEAT HSK											
RAW MATERIAL											
PROCESS STEAM											
ELECTRICITY GEN											
COKE PRODUCTION											
MACHINE DRIVE											
ELECTROLYTIC											
OTHER USES HSK	0.90	1.00	0.90	0.50			0.50			0.70	1.00

OTHER PRIM. NET SIC CODE: 334

EFFICIENCIES(FUEL TO PRIMARY SERVICE SECTOR)

FINAL USE	COAL	CORE-PR	DISTIL.	RESID.	MISC-FET	LPG	NAT GAS	OTH GAS	HYDRO	ELEC	REC EN
-----------	------	---------	---------	--------	----------	-----	---------	---------	-------	------	--------

HEATING											
COOLING											
WATER											
WATER (400F)											
400-1000											
1000-1500											
WATER >1500											
HEAT HSK											
MATERIAL											
STEAM											
CITY GEN											
PRODUCTION											
DRIVE											
ELECTRIC											
USES HSK	0.70	0.20	0.30	0.30			0.30			0.95	0.30

EFFICIENCIES TO SECONDARY SERVICE SECTORS

FINAL USE	COAL	CORE-PR	DISTIL.	RESID.	MISC-FET	LPG	NAT GAS	OTH GAS	HYDRO	ELEC	REC EN
-----------	------	---------	---------	--------	----------	-----	---------	---------	-------	------	--------

HEATING											
COOLING											
WATER											
WATER (400F)											
400-1000											
1000-1500											
WATER >1500											
HEAT HSK											
MATERIAL											
STEAM											
CITY GEN											
PRODUCTION											
DRIVE											
ELECTRIC											
USES HSK	0.65		0.30	0.70			0.30			0.80	

TRY: OTHER PRIM, NET SIC CODE: 334 FUEL CONSUMPTION (10A12 BTUS)

TIONAL USE | COAL | COKE-BR | DISTIL. | RESID. | MISCPET | LPG | NAT GAS | OTH GAS | HYDRO | ELEC | NEC EN | TOTAL |

HEATING												
COOLING												
ING												
T HT (200F)												
T 200-1000												
T 1000-1500												
T HT >1500												
T HEAT RSR												
ATERIAL												
SS STEAM												
RICITY GEN												
PRODUCTION												
NE DRIVE												
ELECTRIC												
USES RSR	40.7	45.8	23.0	24.0			421.6		150.4	31.0	756.5	
FOUC USES	40.7	45.8	23.0	24.0			421.6		150.4	31.0	756.5	

17. Fabricated Metals - SIC 34

The fabricated metals SIC includes a variety of metal-working industries: metal forgings, cutlery, hand tools, hardware, cans, ordnance, boilers, metal services, and others. The ECDB shows that the industry consumed over 400 trillion Btus of energy in 1974, but provides no functional use data on that consumption. Nor do the ITC or Battelle reports analyze the industry. So the ISTUM SIC 34 demand base was developed from the Annual Survey of Manufacturers, interviews, and engineering estimates rather than the usual textbook data sources.

The Annual Survey of Manufacturers provides energy consumption estimates for four digit SICs. In the primary metals industries, four digit SIC information shows which types of industries consume which fuels. This data makes it easier to determine how much of the consumption of each fuel should be allocated to different service sectors. For example, the metal forgings industry used 65 trillion Btus of natural gas in 1974. Since that industry has large amounts of direct heat, the ISTUM model allocates some natural gas consumption to the direct heat service sector. Table XV lists some of the fuels consumed by different fabricated metals industries.

In addition firms and industry associations suggested ways that firms use energy. The Can Manufacturers Association suggested that canners use steam and direct heat. Metal finishers use machine drive, space heat, and some direct heat. And footwear manufacturers use direct heat and machine drive.

The NEDS file also provided information about service sectors in the fabricated metals industries. The file shows

TABLE XV

FUEL CONSUMPTION IN FABRICATED METALS INDUSTRIES

(10¹² Btus)

<u>Industry</u>	<u>Coal</u>	<u>Natural Gas</u>	<u>Distillate Oil</u>	<u>Residual Oil</u>	<u>Electricity</u>
Metal forgings and stampings	7	65	10	8	20
Cutlery, Handtools, Hardware	2	13	2	5	6
Cans		26			
Structural Metal Products		40			
Metal Services NEC		18	2		10
Ordnance and accessories		12	2	5	
Miscellaneous valves and pipefittings		27			
Boilers			4		21

Source: Annual Survey of Manufacturers - 1974

how much of the steam production from each fuel is used for space heating. This information generally guided allocations to the steam and space heat service sectors.

The fabricated metals SIC has one ECDB cell that ISTUM maps to three service sectors. Other uses/NSK-natural gas. Table XVI lists the service sectors, efficiencies, and fuel consumption for that ECDB cell.

TABLE XVI
ISTUM DEMAND BASE FOR ECDB CELLS MAPPED INTO AT
LEAST THREE SERVICE SECTORS (SIC 34)

(ECDB other use/NSK functional use; natural gas as fuel)

<u>Service Sector</u>	<u>Efficiency</u>	<u>1974 Fuel Consumption (10¹² Btus)</u>
Direct Heat --	.3	116.3
Intermediate		
Steam	.7	80
Space Heat	.7	36.3

INDUSTRY: FERR METALS

SIC CODE: 34

PRIMARY SERVICE SECTORS

FUNCTIONAL USE	COAL	COKE-BR	DISTIL.	RESID.	MISC PET	LPG	NAT GAS	OTH GAS	HYDRO	ELEC	HEC EN
SPACE HEATING											
SPACE COOLING											
LIGHTING											
DIRECT HT <600F											
DIR HT 600-1000											
DIR HT 1000-1500											
DIRECT HT >1500											
DIRECT HEAT HSK											
RAW MATERIAL											
PROCESS STEAM											
ELECTRICITY GEN											
COKE PRODUCTION											
MACHINE DRIVE											
ELECTROLYTIC											
OTHER USES HSK	STEAM	COKE CON	STEAM	STEAM			INT DH			MCH DR	STEAM

SECONDARY SERVICE SECTORS

FUNCTIONAL USE	COAL	COKE-BR	DISTIL.	RESID.	MISC PET	LPG	NAT GAS	OTH GAS	HYDRO	ELEC	HEC EN
SPACE HEATING											
SPACE COOLING											
LIGHTING											
DIRECT HT <600F											
DIR HT 600-1000											
DIR HT 1000-1500											
DIRECT HT >1500											
DIRECT HEAT HSK											
RAW MATERIAL											
PROCESS STEAM											
ELECTRICITY GEN											
COKE PRODUCTION											
MACHINE DRIVE											
ELECTROLYTIC											
OTHER USES HSK	SFC HT		SFC HT	SFC HT			STEAM				

INDUSTRY: FERRIC METALS

SIC CODE: 34

FRACTION ALLOCATED TO PRIMARY SERVICE SECTOR

FUNCTIONAL USE	COAL	COKE-BR	DISTIL.	RESID.	MISC PET	LPG	NAT GAS	OTH GAS	HYDRO	ELEC	HEC EN
SPACE HEATING											
SPACE COOLING											
LIGHTING											
DIRECT HT <600F											
DIR HT 600-1000											
DIR HT 1000-1500											
DIRECT HT >1500											
DIRECT HEAT HSK											
RAW MATERIAL											
PROCESS STEAM											
ELECTRICITY GEN											
COKE PRODUCTION											
MACHINE DRIVE											
ELECTROLYTIC											
OTHER USES HSK	0.60	1.00	0.70	0.40			0.50			1.00	1.00

STRY: FABRIC METALS SIC CODE: 34 EFFICIENCIES (FUEL TO PRIMARY SERVICE SECTOR)

ADITIONAL USE	COAL	COKE-OR	DISTIL.	RESID.	MISCPET	LPG	HAT GAS	OTH GAS	HYDRO	ELEC	REC EN
HEATING											
COOLING											
TING											
ET HT <600F											
ET 600-1000											
ET 1000-1500											
ET HT >1500											
ET HEAT HSK											
MATERIAL											
SS STEAM											
RICITY GEN											
PRODUCTION											
NE DRIVE											
ROLYTIC											
USES HSK	0.70	0.30	0.75	0.70			0.30			0.95	0.60

EFFICIENCIES TO SECONDARY SERVICE SECTORS

ADITIONAL USE	COAL	COKE-OR	DISTIL.	RESID.	MISCPET	LPG	HAT GAS	OTH GAS	HYDRO	ELEC	REC EN
HEATING											
COOLING											
TING											
ET HT <600F											
ET 600-1000											
ET 1000-1500											
ET HT >1500											
ET HEAT HSK											
MATERIAL											
SS STEAM											
RICITY GEN											
PRODUCTION											
NE DRIVE											
ROLYTIC											
USES HSK	0.65		0.75	0.70			0.70				

INDUSTRY: FABRIC METALS SIC CODE: 34 FUEL CONSUMPTION (100012 BTUS)

ADDITIONAL USE | COAL | COKE-DR | DISTIL. | RESID. | MISCPET | LPG | NAT GAS | OTH GAS | HYDRO | ELEC | DEC EN | TOTAL |

HEATING												
COOLING												
ATING												
ELECT HT (400F)												
HT 400-1000												
HT 1000-1500												
ELECT HT >1500												
ELECT HEAT HSK												
MATERIAL												
CESS STEAM												
ELECTRICITY GEN												
PRODUCTION												
LINE DRIVE												
ELECTROLYTIC												
SK USES HSK	12.3	2.2	25.7	17.9		233.9			98.4	16.8	407.2	
AL FUND USES	12.3	2.2	25.7	17.9		233.9			98.4	16.8	407.2	

18. Machinery - SIC 35

The ECDB provided energy consumption data on SIC 35, but neither the ECDB, the Battelle study, or the ITC study supplied any information about the uses of that energy. The ISTUM model generally assumes that the industry uses energy for the same purposes as the Electrical Machinery industry -- SIC 36. The method for determining SIC 36 consumption patterns will be discussed in the next section.

The major difference between energy use in the two machinery industries is in the uses of steam. The NEDS file shows that the machinery industry normally uses steam in processes, while the electrical machinery industry has much more space heating. ISTUM steam and space heat consumption estimates were adjusted to reflect this difference.

This SIC also has an ECDB cell that ISTUM maps to three service sectors: Other uses/NSK - natural gas. Table XVII lists the service sectors, efficiencies, and fuel consumption for that mapping.

TABLE XVII

ISTUM DEMAND BASE FOR ECDB CELLS MAPPED INTO AT
LEAST THREE SERVICE SECTORS (SIC 35)

(ECDB other use/NSK functional use; natural gas as fuel)

<u>Service Sector</u>	<u>Efficiency</u>	<u>Fuel Consumption (10^{12} Btus - 1974)</u>
Direct Heat --	.3	91
Intermediate		
Space Heat	.7	20
Steam	.7	71

PRIMARY SERVICE SECTORS

FUNCTIONAL USE	COAL	COKE OR DISTIL.	RESID.	MISC PET	LPG	NAT GAS	OTH GAS	HYDRO	ELEC	HEC EN
SPACE HEATING										
SPACE COOLING										
LIGHTING										
DIRECT HT (600F)										
DIR HT 600-1000										
DIR HT 1000-1500										
DIRECT HT >1500										
DIRECT HEAT HSK										
RAW MATERIAL										
PROCESS STEAM										
ELECTRICITY GEN										
COKE PRODUCTION										
MACHINE DRIVE										
ELECTROLYTIC										
OTHER USES HSK	STEAM	COKE OR STEAM	STEAM			INT BR			MCH DR	STEAM

SECONDARY SERVICE SECTORS

FUNCTIONAL USE	COAL	COKE-DR	DISTIL	RESID	MISC PET	LPG	NAT GAS	OTH GAS	HYDRO	ELEC	REC EN
SPACE HEATING											
SPACE COOLING											
LIGHTING											
DIRECT HT (600F)											
DIR HT 600-1000											
DIR HT 1000-1500											
DIRECT HT >1500											
DIRECT HEAT HSK											
RAW MATERIAL											
PROCESS STEAM											
ELECTRICITY GEN											
COKE PRODUCTION											
MACHINE DRIVE											
ELECTROLYTIC											
OTHER USES HSK			SFC HT	SFC HT			STEAM				SFC HT

FRACTION ALLOCATED TO PRIMARY SERVICE SECTOR

[illegible]

INDUSTRY: MACHINERY

SIC CODE: 35

EFFICIENCIES(FUEL TO PRIMARY SERVICE SECTOR)

FUNCTIONAL USE | COAL | COKE-DR | DISTIL. | RESID. | MISCFET | LPG | NAT GAS | OTH GAS | HYDRO | ELEC | NEC EN |

ICE HEATING											
ICE COOLING											
HEATING											
RECT HT (600F)											
HT 600-1000											
HT 1000-1500											
RECT HT >1500											
RECT HEAT HSK											
J MATERIAL											
CESS STEAM											
ELECTRICITY GEN											
RE PRODUCTION											
INE DRIVE											
CTROLYTIC											
ER USES HSK	0.70	0.30	0.75	0.70			0.30			0.95	0.60

EFFICIENCIES TO SECONDARY SERVICE SECTORS

FUNCTIONAL USE | COAL | COKE-DR | DISTIL. | RESID. | MISCFET | LPG | NAT GAS | OTH GAS | HYDRO | ELEC | NEC EN |

ICE HEATING											
ICE COOLING											
HEATING											
RECT HT (600F)											
HT 600-1000											
HT 1000-1500											
RECT HT >1500											
RECT HEAT HSK											
MATERIAL											
CESS STEAM											
ELECTRICITY GEN											
RE PRODUCTION											
INE DRIVE											
CTROLYTIC											
ER USES HSK			0.75	0.70			0.70				0.60

INDUSTRY: MACHINERY

SIC CODE: 35

FUEL CONSUMPTION (10AA12 BTUS)

FUNCTIONAL USE	COAL	COKE-DR	DISTIL	RESID	MISC PET	LPG	NAT GAS	OTH GAS	HYDRO	ELEC	REC EN	TOTAL
SPACE HEATING												
SPACE COOLING												
LIGHTING												
DIRECT HT (600F)												
HT 600-1000												
HT 1000-1500												
DIRECT HT >1500												
DIRECT HEAT RSK												
MATERIAL												
PROCESS STEAM												
ELECTRICITY GEN												
PRODUCED												
ENGINE DRIVE												
ELECTROLYTIC												
OTHER USES RSK	22.3	4.8	18.8	18.3			182.0			100.5	14.4	361.1
ALL FUEL USES	22.3	4.8	18.8	18.3			182.0			100.5	14.4	361.1

19. Electrical Machinery - SIC 36

The ECDB provides energy consumption estimates on SIC 36, but has no information of functional uses. The ITC report contains some data on direct heat processes in the transformer (SIC 3612) and motor (SIC 3621) manufacturing industries, but these industries did not consume much energy. Because of the scarcity of functional use data, ISTUM service sector allocations were derived from the coal conversion study and the NEDS file.

The coal conversion study states that SIC 36 uses coal almost exclusively for steam production. Firms usually use natural gas for direct heat processes such as forging and heat treating. And assembly operations depend heavily on electricity as a fuel.

The NEDS file shows firms use a third of their steam production for space heating. Natural gas boilers are usually used for space heating rather than process steam.

This SIC also has an ECDB cell that ISTUM maps to three service sectors: other uses/NSK -- natural gas. Table XVIII lists the service sectors, efficiencies, and fuel consumption for that mapping.

TABLE XVIII

ISTUM DEMAND BASE FOR ECDB CELLS MAPPED INTO AT
LEAST THREE SERVICE SECTORS
(SIC 36)

(ECDB other use/NSK-functional use; natural gas as fuel)

<u>Service Sector</u>	<u>Efficiency</u>	<u>Fuel Consumption (10^{12} Btus - 1974)</u>
Direct Heat -- Intermediate	.3	52.7
Steam	.7	17.7
Space Heat	.7	35

FUNCTIONAL USE		CORE-DR	DISTIL	RESID.	MISC/PET	LFG	NAT GAS	OTH GAS	HYDRO	ELEC	REC EN
ACE HEATING	STEAM										
ACE COOLING											
CHTING											
RECT HT (600F)											
R HT 600-1000											
R HT1000-1500											
RECT HT >1500											
RECT HEAT HSK											
W MATERIAL											
CESS STEAM											
ELECTRICITY GEN											
KE PRODUCTION											
CHINE DRIVE											
ELECTROLYTIC											
HEK USES HSK	STEAM	COK CON	STEAM	STEAM			INT EN			MCH DR	STEAM

FUNCTIONAL USE	COAL	COKE-BR	DISTIL	RESID	MISCPET	LEG	NAT GAS	OTH GAS	HYDRO	ELEC	REC EN
ACE HEATING											
ACE COOLING											
CHYING											
RECT HT (600F)											
R HT 600-1000											
R HT1000-1500											
RECT HT >1500											
RECT HEAT HSK											
W MATERIAL											
CESS STEAM											
ELECTRICITY GEN											
RE PRODUCTION											
CHINE DRIVE											
ELECTROLYTIC											
HER USES HSK	SFC HT		SFC HT	SFC HT			SFC HT				

FUNCTIONAL USE	COAL	CORE-EX	DISTIL	RESID.	MISC PET	LPG	NAT GAS	OTH GAS	HYDRO	ELEC	REC EN
ICE HEATING	1.00										
ICE COOLING											
SHTING											
RECT HT <600F											
RECT HT 600-1000											
RECT HT 1000-1500											
RECT HT >1500											
RECT HEAT HSK											
Q MATERIAL											
PROCESS STEAM											
ELECTRICITY GEN											
ICE PRODUCTION											
CHINE DRIVE											
ELECTROLYTIC											
WATER USES HSK	0.90	1.00	0.90	0.90			0.50			1.00	1.00

INDUSTRY: ELEC MACH

SIC CODE: 36

EFFICIENCIES(FUEL TO PRIMARY SERVICE SECTOR)

ADDITIONAL USE | COAL | COKE-DR | DISTIL. | RESID. | MISCPET | LPG | NAT GAS | OTH GAS | HYDRO | ELEC | REC EN |

HEATING											
COOLING											
TING											
CT HT (400F)											
HT 400-1000											
HT 1000-1500											
CT HT >1500											
CT HEAT HSK											
MATERIAL											
ESS STEAM											
RICITY GEN											
PRODUCTION											
INE DRIVE											
ROLYTIC											
R USES HSK	0.70	0.30	0.75	0.70			0.30		0.95	0.60	

EFFICIENCIES TO SECONDARY SERVICE SECTORS

ADDITIONAL USE | COAL | COKE-DR | DISTIL. | RESID. | MISCPET | LPG | NAT GAS | OTH GAS | HYDRO | ELEC | REC EN |

HEATING											
COOLING											
TING											
CT HT (400F)											
HT 400-1000											
HT 1000-1500											
CT HT >1500											
CT HEAT HSK											
MATERIAL											
ESS STEAM											
RICITY GEN											
PRODUCTION											
INE DRIVE											
ROLYTIC											
R USES HSK	0.45		0.75	0.70			0.70				

STRY: ELEC MACH

SIC CODE: 36

FUEL CONSUMPTION (10AA12 BTUS)

ADITIONAL USE | COAL | CORE-PR | DISTIL. | RESID. | MISCFET | LPG | NAT GAS | OTH GAS | HYDRO | ELEC | DEC EN | TOTAL |

E HEATING												
E COOLING												
ING												
ET HT (600F												
ET 600-1000												
ET 1000-1500												
ET HT >1500												
ET HEAT HSK												
MATERIAL												
ESS STEAM												
RICITY GEN												
PRODUCTION												
NE DRIVE												
ROLYTIC												
USES HSK	14.4	0.7	12.1	11.2			105.4		91.6	11.3	246.7	
FOHC USES	14.4	0.7	12.1	11.2			105.4		91.6	11.3	246.7	

20. Transportation Equipment - SIC 37

SIC 37 includes manufacturers of cars, trucks, aircraft, ships, missiles, railroad cars, motorcycles and bicycles. These industries consumed 370 trillion Btus in 1974, with the automotive industry consuming more than half of that energy.

The ECDB supplies energy consumption data on this SIC but no functional use data. However both the ITC and Battelle reports study direct heat processes in the automotive industry. Both reports show that paint drying is the main direct heat process in the industry, and that the industry only consumed about 46 trillion Btus of fuel for direct heat in 1974.

The SIC 37 demand base was developed with the a priori assumption that the industry uses large amounts of machine drive, space heat, and steam. The prevalence of assembly lines and the need to move heavy equipment make machine drive necessary; 27 percent of the SIC's 1974 fuel consumption was electricity. The NEDS file shows that the industry uses a substantial number of boilers, and that almost 40 percent of the steam production is used for space heating.

This SIC also has an ECDB cell that ISTUM maps to three service sectors: other uses/NSK - natural gas. Table XIX lists the service sectors, efficiencies, and fuel consumption for that mapping.

TABLE XIX

ISTUM DEMAND BASE FOR ECDB CELLS MAPPED INTO AT
LEAST THREE SERVICE SECTORS (SIC 37)

(ECDB other use/NSK functional use; natural gas and fuel)

<u>Service Sector</u>	<u>Efficiency</u>	<u>Fuel Consumption</u>
Direct Heat -- Intermediate	.3	60
Steam	.7	59.4
Space Heat	.7	30.6

INDUSTRY: TRANSPORT EQUIP SIC CODE: 37

PRIMARY SERVICE SECTORS

FUNCTIONAL USE	COAL	COKE-BR	DISTIL	RESID	MISCFET	LPG	NAT GAS	OTH GAS	HYDRO	ELEC	NEC EN
FACE HEATING											
FACE COOLING											
LIGHTING											
DIRECT HT (600F)											
IR HT 600-1000											
IR HT1000-1500											
DIRECT HT >1500											
DIRECT HEAT HSK											
RAW MATERIAL											
PROCESS STEAM											
ELECTRICITY GEN											
COKE PRODUCTION											
MACHINE DRIVE											
ELECTROLYTIC											
OTHER USES HSK	STEAM	COKE CON	STEAM	STEAM			INT BU			MCH DR	STEAM

SECONDARY SERVICE SECTORS

FUNCTIONAL USE	COAL	COKE-BR	DISTIL	RESID	MISCFET	LPG	NAT GAS	OTH GAS	HYDRO	ELEC	NEC EN
FACE HEATING											
FACE COOLING											
LIGHTING											
DIRECT HT (600F)											
IR HT 600-1000											
IR HT1000-1500											
DIRECT HT >1500											
DIRECT HEAT HSK											
RAW MATERIAL											
PROCESS STEAM											
ELECTRICITY GEN											
COKE PRODUCTION											
MACHINE DRIVE											
ELECTROLYTIC											
OTHER USES HSK	SPC HT		SPC HT	SPC HT			STEAM				SPC HT

INDUSTRY: TRANSPORT EQUIP SIC CODE: 37

FRACTION ALLOCATED TO PRIMARY SERVICE SECTOR

FUNCTIONAL USE	COAL	COKE-BR	DISTIL	RESID	MISCFET	LPG	NAT GAS	OTH GAS	HYDRO	ELEC	NEC EN
FACE HEATING											
FACE COOLING											
LIGHTING											
DIRECT HT (600F)											
IR HT 600-1000											
IR HT1000-1500											
DIRECT HT >1500											
DIRECT HEAT HSK											
RAW MATERIAL											
PROCESS STEAM											
ELECTRICITY GEN											
COKE PRODUCTION											
MACHINE DRIVE											
ELECTROLYTIC											
OTHER USES HSK											

TRK: TRANSPORT EQUIP SIC CODE: 37

EFFICIENCIES(FUEL TO PRIMARY SERVICE SECTOR)

ADITIONAL USE | COAL | COKE-OR | DISTIL. | RESID. | MISCPET | LPG | NAT GAS | OTH GAS | HYDRO | ELEC | REC EH |

HEATING											
COOLING											
ING											
T OT (400F)											
T 600-1000											
T 1000-1500											
T OT >1500											
T HEAT HSK											
ATERIAL											
SS STEAM											
RICITY GEN											
RODUCTION											
IE DRIVE											
OLYTIC											
USES HSK	0.70	0.30	0.75	0.70		0.30			0.95	0.40	

EFFICIENCIES TO SECONDARY SERVICE SECTORS

ADITIONAL USE | COAL | COKE-OR | DISTIL. | RESID. | MISCPET | LPG | NAT GAS | OTH GAS | HYDRO | ELEC | REC EH |

HEATING											
COOLING											
ING											
T OT (400F)											
T 600-1000											
T 1000-1500											
T OT >1500											
T HEAT HSK											
ATERIAL											
SS STEAM											
RICITY GEN											
RODUCTION											
IE DRIVE											
OLYTIC											
USES HSK	0.65		0.75	0.70		0.70				0.40	

Y: TRANSPORT EQUIP SIC CODE: 37 FUEL CONSUMPTION (10AA12 BTUS)

AL USE	COAL	COKE-PR	DISTIL.	RESID.	MISCPET	LPG	NAT GAS	OTH GAS	HYDRO	ELEC	REC EN	TOTAL
HEATING												
COOLING												
...												
IT (400F)												
800-1000												
000-1500												
OT 1500												
HEAT USE												
SERIAL												
STEAM												
CITY GEN												
DUCTION												
DRIVE												
LYTIC												
GES USE	49.6	3.1	17.4	24.8			150.0			101.0	24.4	370.3
MC USE	49.6	3.1	17.4	24.8			150.0			101.0	24.4	370.3

21. Measuring Equipment - SIC 38

According to the ECDB the Measuring Equipment industries consumed 50 trillion Btus of energy in 1974. The ECDB, the Battelle study, and the ITC study do not study the uses of energy in the industry, so fuel consumption was allocated to service sectors according to engineering estimates. Generally it was assumed that firms burn oil in boilers; use electricity for machine drive, and use natural gas for space heating and direct heat. The NEDS file gives data on the use of steam production from each fuel for space heating and process steam.

INDUSTRY: MEASURING EQ SIC CODE: 38 PRIMARY SERVICE SECTORS

FUNCTIONAL USE	COAL	COKE-BR	DISTIL.	RESID.	MISCPET	LPG	NAT GAS	OTH GAS	HYDRO	ELEC	REC EN
FACE HEATING											
FACE COOLING											
LIGHTING											
DIRECT HT (600F)											
IR HT 600-1000											
IR HT1000-1500											
DIRECT HT >1500											
DIRECT HEAT HSK											
RAW MATERIAL											
PROCESS STEAM											
ELECTRICITY GEN											
ORE PRODUCTION											
MACHINE DRIVE											
ELECTROLYTIC											
OTHER USES HSK			STEAM	STEAM			INT DR			MCH DR	STEAM

SECONDARY SERVICE SECTORS

FUNCTIONAL USE	COAL	COKE-BR	DISTIL.	RESID.	MISCPET	LPG	NAT GAS	OTH GAS	HYDRO	ELEC	REC EN
FACE HEATING											
FACE COOLING											
LIGHTING											
DIRECT HT (600F)											
IR HT 600-1000											
IR HT1000-1500											
DIRECT HT >1500											
DIRECT HEAT HSK											
RAW MATERIAL											
PROCESS STEAM											
ELECTRICITY GEN											
ORE PRODUCTION											
MACHINE DRIVE											
ELECTROLYTIC											
OTHER USES HSK				SFC HT			SFC HT				

INDUSTRY: MEASURING EQ SIC CODE: 38 FRACTION ALLOCATED TO PRIMARY SERVICE SECTOR

FUNCTIONAL USE	COAL	COKE-BR	DISTIL.	RESID.	MISCPET	LPG	NAT GAS	OTH GAS	HYDRO	ELEC	REC EN
FACE HEATING											
FACE COOLING											
LIGHTING											
DIRECT HT (600F)											
IR HT 600-1000											
IR HT1000-1500											
DIRECT HT >1500											
DIRECT HEAT HSK											
RAW MATERIAL											
PROCESS STEAM											
ELECTRICITY GEN											
ORE PRODUCTION											
MACHINE DRIVE											
ELECTROLYTIC											
OTHER USES HSK			1.00	0.90			0.50			1.00	1.00

NET MEASURING EQ SIC CODE: 30 EFFICIENCIES(FUEL TO PRIMARY SERVICE SECTOR)

TOTAL USE	COAL	COKE-BR	DISTIL	RESID	MISC PET	LPG	NAT GAS	OTH GAS	HYDRO	ELEC	HEC EN
HEATING											
COOLING											
WGS											
HT (200F)											
400-1000											
1000-1500											
HT >1500											
HEAT HSK											
ATERIAL											
IS STEAM											
ICITY GEN											
RODUCTION											
E DRIVE											
OLYTIC											
USES HSK		0.75	0.70				0.30			0.95	0.60

EFFICIENCIES TO SECONDARY SERVICE SECTORS

TOTAL USE	COAL	COKE-BR	DISTIL	RESID	MISC PET	LPG	NAT GAS	OTH GAS	HYDRO	ELEC	HEC EN
HEATING											
COOLING											
WGS											
HT (200F)											
400-1000											
1000-1500											
HT >1500											
HEAT HSK											
ATERIAL											
S STEAM											
ICITY GEN											
RODUCTION											
E DRIVE											
OLYTIC											
USES HSK							0.70				

TEST; MEASURING EQ SIC CODE: 38 FUEL CONSUMPTION (100012 BTUS)

TOTAL USE	COAL	CORE-DR	DISTIL	RESID	MISC PET	LPG	NAT GAS	OTH GAS	HYDRO	ELEC	HEC EN	TOTAL
HEATING												
COOLING												
DRYING												
TEMP HT (600F)												
600-1000												
1000-1500												
HT > 1500												
HEAT USE												
MATERIAL												
AS STEAM												
ELECTRICITY GEN												
PRODUCTION												
DRIVE												
ELECTRIC												
USES USE												
FOOD USES												
		3.6	10.1				17.1			16.8	2.9	50.5
		3.6	10.1				17.1			16.8	2.9	50.5

22. Miscellaneous Manufacturing - SIC 39

The ECDB shows that the SIC 39 industries consumed 50 trillion Btus of energy in 1974. None of the standard ISTUM data sources provide functional use data on these industries, so fuel consumption was allocated to service sectors according to engineering estimates. Generally they assumed firms burn coal and oil in boilers, use electricity for machine drive and use natural gas for direct heat and steam production. The NEDS file gives data on the use of steam production from each fuel for space heating and process steam.

INDUSTRY: MISC MANUFAC, SIC CODE: 39 PRIMARY SERVICE SECTORS

FUNCTIONAL USE	COAL	COKE-BR	DISTIL	RESID	MISCPET	LPG	NAT GAS	OTH GAS	HYDRO	ELEC	NEC EN
SPACE HEATING											
SPACE COOLING											
LIGHTING											
DIRECT HT (600F)											
DIR HT 600-1000											
DIR HT1000-1500											
DIRECT HT >1500											
DIRECT HEAT RSK											
RAW MATERIAL											
PROCESS STEAM											
ELECTRICITY GEN											
COKE PRODUCTION											
MACHINE DRIVE											
ELECTROLYTIC											
OTHER USES RSK	STEAM		STEAM	STEAM			INT DH			MCH DR	STEAM

SECONDARY SERVICE SECTORS

FUNCTIONAL USE	COAL	COKE-BR	DISTIL	RESID	MISCPET	LPG	NAT GAS	OTH GAS	HYDRO	ELEC	NEC EN
SPACE HEATING											
SPACE COOLING											
LIGHTING											
DIRECT HT (600F)											
DIR HT 600-1000											
DIR HT1000-1500											
DIRECT HT >1500											
DIRECT HEAT RSK											
RAW MATERIAL											
PROCESS STEAM											
ELECTRICITY GEN											
COKE PRODUCTION											
MACHINE DRIVE											
ELECTROLYTIC											
OTHER USES RSK				SFC HT			STEAM				

INDUSTRY: MISC MANUFAC, SIC CODE: 39 FRACTION ALLOCATED TO PRIMARY SERVICE SECTOR

FUNCTIONAL USE	COAL	COKE-BR	DISTIL	RESID	MISCPET	LPG	NAT GAS	OTH GAS	HYDRO	ELEC	NEC EN
SPACE HEATING											
SPACE COOLING											
LIGHTING											
DIRECT HT (600F)											
DIR HT 600-1000											
DIR HT1000-1500											
DIRECT HT >1500											
DIRECT HEAT RSK											
RAW MATERIAL											
PROCESS STEAM											
ELECTRICITY GEN											
COKE PRODUCTION											
MACHINE DRIVE											
ELECTROLYTIC											
OTHER USES RSK											

INDUSTRY: MISC MANUFAC, SIC CODE: 39 EFFICIENCIES(FUEL TO PRIMARY SERVICE SECTOR)

ADDITIONAL USE | COAL | COKE-DR | DISTIL | RESID | MISCPET | LPG | NAT GAS | OTH GAS | HYDRO | ELEC | REC EN |

HEATING											
COOLING											
TING											
CT HT (600F)											
HT 600-1000											
HT 1000-1500											
CT HT >1500											
CT HEAT HSK											
MATERIAL											
ESS STEAM											
TRICITY GEN											
PRODUCTION											
INE DRIVE											
TEOLYTIC											
R USES HSK	0.70		0.75	0.70			0.30		0.95	0.60	

EFFICIENCIES TO SECONDARY SERVICE SECTORS

ADDITIONAL USE | COAL | COKE-DR | DISTIL | RESID | MISCPET | LPG | NAT GAS | OTH GAS | HYDRO | ELEC | REC EN |

HEATING											
COOLING											
TING											
CT HT (600F)											
HT 600-1000											
HT 1000-1500											
CT HT >1500											
CT HEAT HSK											
MATERIAL											
ESS STEAM											
TRICITY GEN											
PRODUCTION											
INE DRIVE											
TEOLYTIC											
R USES HSK			0.70				0.70				

STRT: MISC MANUFAC, SIC CODE: 39 FUEL CONSUMPTION (10X12 BTUS)

FICTIONAL USE | COAL | COKE-PR | DISTIL. | RESID. | MISCPET | LPG | NAT GAS | OTH GAS | HYDRO | ELEC | DEC EN | TOTAL |

HEATING												
COOLING												
WTR												
HT HT (400F)												
HT 400-1000												
HT 1000-1500												
HT HT >1500												
HT HEAT USR												
MATERIAL												
SS STEAM												
RICITY GEN												
PRODUCTION												
HE PRIVE												
ROLYTIC												
USES USR	0.9	5.2	4.8				22.1		15.7	1.8	50.5	
FDIC USES	0.9	5.2	4.8				22.1		15.7	1.8	50.5	

23. Crops - SIC Code 01

24. Livestock - SIC Code 02

The ISTUM model depends on the same data sources for its two agricultural SICs. In mid-1976 the Economic Research Service of the U.S. Department of Agriculture published estimates of the amounts of fuel the agriculture industry used for different purposes.^{1/} The ECDB relies on this data exclusively for its energy consumption estimates for these SICs.

Table I shows the Economic Research Service's energy consumption estimates. Allocating these estimates to ISTUM service sectors required three steps:

1. Convert physical units of fuels to Btus
2. Delete fuel consumption inappropriate to ISTUM model.
3. Determine service sectors for the remaining fuel consumption.

The ECDB uses Bureau of Mines conversion factors to convert physical fuel units into Btus. These conversion factors were listed in Table III-3.

The ISTUM model does not include fuels consumed in motor vehicles. For that reason, the model does not include consumption described in the first two columns of Table XX. Agricultural firms use gasoline and diesel fuel almost exclusively as motor vehicle fuels.

"Determining service sectors for the remaining fuel consumption was straightforward. Each ECDB functional use was

^{1/} Energy and U.S. Agriculture Data Base". Federal Energy Administration and U.S. Department of Agriculture. September, 1976.

mapped into one or two ISTUM service sectors. For example, grain drying was mapped into direct heat (intermediate), and waterheating was mapped into the steam service sector. The agriculture printouts give a complete description of the functional use to service sector mappings.

TABLE XX
UNITED STATES

ENERGY AND AGRICULTURE, 1974 DATA BASE. SUMMARY BY OPERATION A/

OPERATIONS-CROPS	GALS OF GASOLINE (1000)	GALS OF DIESEL (1000)	GALS OF FUEL OIL (1000)	GALS OF LP GAS (1000)	CU FT OF NAT GAS (MILLION)	TONS OF COAL	KWH'S OF ELECT (MILLION)	INVESTED BTU'S (BILLION)	BTU TOTAL (BILLION)
PREPLANT	61424	923331	-	22719	-	-	-	-	139103
PLANT	25591	242400	-	9461	-	-	-	-	33044
CULTIVATE	21476	280368	-	9053	-	-	-	-	43174
FERTILIZER APPLIC	27023	64044	-	9995	-	-	-	-	13274
FERTILIZERS	-	-	-	-	-	-	-	621181	621151
PESTICIDE APPLIC	32711	74754	-	12079	-	-	-	-	15764
PESTICIDES	-	-	-	-	-	-	-	95272	95272
IRRIGATION	70553	177144	-	236331	132318	-	19264	-	250732
FROST PROTECTION	46443	39326	218549	1458	-	-	200	-	92729
HARVEST	493052	443729	-	103102	-	-	-	-	141358
FARM TRUCK	539495	5605	-	-	-	-	-	-	55083
GRAIN HANDLING	15314	-	-	-	-	-	33	-	2153
CROP DRYING	-	-	76564	664440	27182	-	858	-	133311
FARM PICKUP	1036304	1058	-	-	-	-	-	-	120535
FARM AUTO	442722	-	-	-	-	-	-	-	55343
ELECT OVERHEAD	-	-	-	-	-	-	1705	-	5213
MISCELLANEOUS	64293	35354	-	-	-	-	-	-	12955
TOTAL-CROPS	2881276	2286539	295112	1148657	159500	-	22050	716452	1739931
OPERATIONS-LIVESTOCK	GALS OF GASOLINE (1000)	GALS OF DIESEL (1000)	GALS OF FUEL OIL (1000)	GALS OF LP GAS (1000)	CU FT OF NAT GAS (MILLION)	TONS OF COAL	KWH'S OF ELECT (MILLION)	INVESTED BTU'S (BILLION)	BTU TOTAL (BILLION)
LIGHTING	-	-	-	-	-	-	1553	N/A	5541
FEED HANDLING	149633	195283	-	-	-	-	1073	N/A	43765
WASTE DISPOSAL	98036	44645	688	6754	435	-	123	N/A	25120
WATER SUPPLY	-	25511	-	-	-	-	1503	N/A	9049
LIVESTOCK-HANDLING	19391	1033	-	-	-	-	-	N/A	2558
SPACE HEATING	-	1	-	55957	10	-	174	N/A	3520
VENTILATION	-	-	-	-	-	-	2014	N/A	5371
WATER HEATING	-	-	-	70737	-	-	975	N/A	10047
MILKING	-	-	-	-	-	-	620	N/A	2300
MILK COOLING	-	-	-	-	-	-	1344	N/A	4527
EGG HANDLING	-	-	-	-	-	-	31	N/A	107
BROODING	-	-	8129	108120	4181	32725	-	N/A	21250
FARM VEHICLES	233310	69330	-	469	-	-	-	N/A	35514
FARM AUTO	199417	-	-	-	-	-	-	N/A	21332
OTHER	118578	15613	-	10848	-	-	215	N/A	13513
TOTAL-LIVESTOCK	817355	352416	9817	332835	4525	32725	10029	N/A	224231
TOTAL-AGRICULTURE	3598631	2638955	303929	1481542	164125	32725	32089	716452	2014222

NOTES: PRELIMINARY DATA DEVELOPED BY THE ECONOMIC RESEARCH SERVICE, U.S. DEPARTMENT OF AGRICULTURE, WASHINGTON, D.C. 20250, UNDER A JOINTLY FUNDED COOPERATIVE AGREEMENT WITH THE FEDERAL ENERGY ADMINISTRATION. (A) DATA INCLUDE ALL ENERGY USED DIRECTLY ON THE FARM FOR CROP AND LIVESTOCK PRODUCTION. NUMBERS MAY NOT ADD UP EXACTLY DUE TO ROUNDING. (B) INVESTED ENERGY INCLUDES THE ENERGY REQUIRED TO MANUFACTURE FERTILIZERS AND PESTICIDES (INCLUDING CARRIER SOLUTION).

ECDD CELLS IN THIS SIC ARE MAPPED INTO AT MOST ONE SERVICE SECTOR

INDUSTRY: CROPS		SIC CODE: 1		PRIMARY SERVICE SECTORS				
FUNCTIONAL USE	COAL	GASOLIN	DIST	LUBRICA	LPG	NAT GAS	ELECTRI	REC EN
SFC HTG/GRN DRY			INT DH		INT DH	INT DH	INT DH	
SPACE COOLING								
WATERHEATING								
LIGHTING							MISC EN	
REFRIGERATION								
MACH, DR/IRRIGA				MISC EN		MCH DR	MCH DR	
FARM VEHICLES				MISC EN				
MISC, USES				MISC EN				

INDUSTRY: CROPS		SIC CODE: 1		FRACTION TO PRIMARY SERVICE SECTOR				
FUNCTIONAL USE	COAL	GASOLIN	DIST	LUBRICA	LPG	NAT GAS	ELECTRI	REC EN
SFC HTG/GRN DRY			1.00		1.00	1.00	1.00	
SPACE COOLING								
WATERHEATING								
LIGHTING							1.00	
REFRIGERATION								
MACH, DR/IRRIGA				1.00		1.00	1.00	
FARM VEHICLES				1.00				
MISC, USES				1.00				

ECDE CELLS IN THIS SIC ARE MAPPED INTO AT MOST ONE SERVICE SECTOR

INDUSTRY: CROPS		SIC CODE: 1		EFFICIENCIES					
FUNCTIONAL USE		COAL	GASOLIN	DIST	LUBRICA	LPG	HAT GAS	ELECTRI	REC EN
SPC HTG/GRN DRY			0.30			0.30	0.30	0.80	
SPACE COOLING									
WATERHEATING									
LIGHTING								0.20	
REFRIGERATION									
MACH, DR/IRRIGA				1.00			0.30	0.95	
FARM VEHICLES				1.00					
MISC, USES				1.00					

INDUSTRY: CROPS

SIC CODE: 1

FUEL CONSUMPTION (10**12 BTUS)

FUNCTIONAL USE	COAL	GASOLIN	DIST	LUBRICA	LPG	NAT GAS	ELECTRI	REC EN	TOTAL
SFC HTG/GEN DRY	10.6			63.4		27.8	2.9		104.7
SPACE COOLING									
WATERHEATING									
LIGHTING							5.1		5.1
REFRIGERATION									
MACH, DR/IRRIGA			1.1			135.1	66.3		202.5
FARM VEHICLES			20.5						20.5
MISC, USES			0.8						0.8
TOTAL FUNC USES	10.6		22.4		63.4	162.9	74.3		333.6

INDUSTRY: LIVESTOCK

SIC CODE: 2

PRIMARY SERVICE SECTORS

FUNCTIONAL USE	COAL	GASOLIN	DIST	LUBRICA	LPG	NAT GAS	ELECTRI	NEC EN
SFC HTG/GRN DRY				MISC EN	SFC HT		SFC HT	
SPACE COOLING								
WATERHEATING					STEAM		STEAM	
LIGHTING							SFC HT	
REFRIGERATION							MCH DR	
MACH, DR/IRRIGA				MISC EN			MCH DR	
FARM VEHICLES				MISC EN				
MISC, USES				MISC EN	INT DH	INT DH		

SECONDARY SERVICE SECTORS

FUNCTIONAL USE	COAL	GASOLIN	DIST	LUBRICA	LPG	NAT GAS	ELECTRI	NEC EN
SFC HTG/GRN DRY								
SPACE COOLING								
WATERHEATING								
LIGHTING								
REFRIGERATION								
MACH, DR/IRRIGA								
FARM VEHICLES								
MISC, USES						SFC HT		

INDUSTRY: LIVESTOCK

SIC CODE: 2

FRACTION TO PRIMARY SERVICE SECTOR

FUNCTIONAL USE	COAL	GASOLIN	DIST	LUBRICA	LPG	NAT GAS	ELECTRI	NEC EN
SFC HTG/GRN DRY				1.00	1.00		1.00	
SPACE COOLING								
WATERHEATING					1.00		1.00	
LIGHTING							1.00	
REFRIGERATION							1.00	
MACH, DR/IRRIGA				1.00			1.00	
FARM VEHICLES				1.00				
MISC, USES				1.00	1.00-	0.75		

INDUSTRY: LIVESTOCK

SIC CODE: 2

EFFICIENCIES

FUNCTIONAL USE | COAL | GASOLIN | DIST | LUBRICA | LPG | NAT GAS | ELECTRI | REC EN |

SFC HTG/GRN DRY			1.00	0.70		0.90		
SPACE COOLING								
WATERHEATING				0.70		0.85		
LIGHTING						0.20		
REFRIGERATION						0.95		
MACH, DR/IRRIGA			1.00			0.95		
FARM VEHICLES			1.00					
MISC, USES			1.00	0.30	0.30			

EFFICIENCIES TO SECONDARY SERVICE SECTORS

FUNCTIONAL USE | COAL | GASOLIN | DIST | LUBRICA | LPG | NAT GAS | ELECTRI | REC EN |

SFC HTG/GRN DRY								
SPACE COOLING								
WATERHEATING								
LIGHTING								
REFRIGERATION								
MACH, DR/IRRIGA								
FARM VEHICLES								
MISC, USES						0.50		

INDUSTRY: LIVESTOCK

SIC CODE: 2

FUEL CONSUMPTION (10**12 BTUS)

FUNCTIONAL USE	COAL	GASOLIN	DIST	LUBRICA	LPG	NAT GAS	ELECTRI	NEC EN	TOTAL
SFC HTG/GRH DRY		43.4		5.3		0.6			49.3
SPACE COOLING									
WATERHEATING			6.7			3.3			10.0
LIGHTING						6.4			6.4
REFRIGERATION						4.6			4.6
MACH, DR/IRRIGA		2.3				19.3			21.6
FARM VEHICLES		2.2							2.2
MISC, USES		0.6	19.0		4.3				23.9
TOTAL FUNC USES		48.5	31.0		4.3	34.2			118.0

25. Metal Mining - SIC 10

The ECDB shows that the metal mining industries consumed about 175 trillion Btus in 1974. It contains excellent functional use data on the industries, and these functional uses could easily be converted into ISTUM service sectors. The ECDB allocates nearly all of the industry's fuel consumption to its direct heat, steam, and machine drive functional uses, each of which has a corresponding ISTUM service sector.

The ITC report also studies direct heat processes in two metal mining industries: iron ores and copper ores. These two industries consumed about 40 trillion Btus in direct heat applications in 1974 - pelletizings, drying, and roasting. The ITC estimate of metal mining direct heat consumption agrees with the ECDB's estimate of the same consumption.

INDUSTRY: METAL MINING		SIC CODE: 10		PRIMARY SERVICE SECTORS				
FUNCTIONAL USE	COAL	GASOLIN	DIST	LPG	MISCPET	NAT GAS	ELECTRI	NEC EN
DIRECT HT (600F)						INT DH		
DIR HT 600-1000								
DIR HT1000-1500						INT DH		
DIRECT HEAT HSK						INT DH		
PROCESS STEAM						STEAM		STEAM
ELECTRICITY GEN	INT GEN		INT GEN			INT GEN	CAP EL	INT GEN
MACHINE DRIVE			MCH DR		MCH DR		MCH DR	
OTHER USES HSK	INT GEN		MCH DR	INT DH		INT DH	MCH DR	INT DH

SECONDARY SERVICE SECTORS

FUNCTIONAL USE	COAL	GASOLIN	DIST	LPG	MISCPET	NAT GAS	ELECTRI	NEC EN
DIRECT HT (600F)								
DIR HT 600-1000								
DIR HT1000-1500								
DIRECT HEAT HSK								
PROCESS STEAM								
ELECTRICITY GEN								
MACHINE DRIVE								
OTHER USES HSK				MCH DR				MCH DR

INDUSTRY: METAL MINING SIC CODE: 10 FRACTION TO PRIMARY SERVICE SECTOR

FUNCTIONAL USE	COAL	GASOLIN	DIST	LPG	MISCPET	NAT GAS	ELECTRI	NEC EN
DIRECT HT (600F)						1.00		
DIR HT 600-1000						1.00		
DIR HT1000-1500						1.00		
DIRECT HEAT HSK						1.00		
PROCESS STEAM						1.00		1.00
ELECTRICITY GEN	1.00		1.00			1.00	1.00	1.00
MACHINE DRIVE			1.00		1.00		1.00	
OTHER USES HSK	1.00		1.00	0.50		1.00	1.00	0.50

INDUSTRY: METAL MINING

SIC CODE: 10

EFFICIENCIES

FUNCTIONAL USE	COAL	GASOLIN	DIST	LFG	MISCPET	NAT GAS	ELECTRI	REC EN
RECT HT (600F)							0.65	
HT 600-1000							0.65	
HT1000-1500							0.65	
RECT HEAT HSK							0.65	0.60
CESS STEAM							1.00	0.30
ELECTRICITY GEN	0.30		0.30	0.30	0.70			
MINE DRIVE			0.30		0.35		0.95	
ER USES HSK	1.00		0.30		0.30		0.95	0.30

EFFICIENCIES TO SECONDARY SERVICE SECTORS

FUNCTIONAL USE	COAL	GASOLIN	DIST	LFG	MISCPET	NAT GAS	ELECTRI	REC EN
RECT HT (600F)								
HT 600-1000								
HT1000-1500								
RECT HEAT HSK								
CESS STEAM								
ELECTRICITY GEN								
MINE DRIVE								
ER USES HSK				0.35				0.60

INDUSTRY: METAL MINING SIC CODE: 10 FUEL CONSUMPTION (10**12 BTUS)

FUNCTIONAL USE | COAL | GASOLIN | DIST | LPG | MISCPET | NAT GAS | ELECTRI | REC EN | TOTAL |

DIRECT HT (600F)						5.2			5.2
DIR HT 600-1000						46.5			46.5
DIR HT 1000-1500						6.4			6.4
DIRECT HEAT HSK						2.8		0.3	3.1
PROCESS STEAM						9.5	-10.7	0.1	16.8
ELECTRICITY GEN	17.7	0.2				24.3			59.3
MACHINE DRIVE				1.2		7.0	16.2	5.6	34.5
OTHER USES HSK	0.8	0.1	4.8			1.2	77.4	39.3	6.0
TOTAL FUNC USES	18.5	24.6	4.8	1.2					

26. Nonmetal Mining - SIC 14

The ECDB shows that nonmetal mining industry consumed 250 trillion Btus in 1974, but it does not disaggregate that consumption by functional use. The ITC report studies process energy use in the potash, phosphate, and sulphur industries, and served as the main source for allocating fuel consumption to service sectors.

The sulphur industry consumed 60 trillion Btus in 1974. Sulphur is mined by pumping superheated water into wells. The water melts the sulphur, which is forced upwards. The fuel consumption for this process is translated into the steam service sector.

The phosphate and potash industries converted about 15 trillion Btus of fuel into direct heat in 1974. The remaining fuel consumption of the nonmetal mining industries was mapped into the machine drive, direct heat, and steam service sectors.

INDUSTRY: NONMETAL MIN SIC CODE: 14 PRIMARY SERVICE SECTORS

FUNCTIONAL USE	COAL	GASOLIN	DIST	LPG	MISCPET	NAT GAS	ELECTRI	REC EN
DIRECT HT (600F)								
DIR HT 600-1000								
DIR HT1000-1500								
DIRECT HEAT HSK								
PROCESS STEAM								
ELECTRICITY GEN								
MACHINE DRIVE								
OTHER USES HSK	STEAM		MCH DR	STEAM	MCH DR	STEAM	MCH DR	INT DH

SECONDARY SERVICE SECTORS

FUNCTIONAL USE	COAL	GASOLIN	DIST	LPG	MISCPET	NAT GAS	ELECTRI	REC EN
DIRECT HT (600F)								
DIR HT 600-1000								
DIR HT1000-1500								
DIRECT HEAT HSK								
PROCESS STEAM								
ELECTRICITY GEN								
MACHINE DRIVE								
OTHER USES HSK				INT DH		INT DH	INT DH	MCH DR

INDUSTRY: NONMETAL MIN SIC CODE: 14 FRACTION TO PRIMARY SERVICE SECTOR

FUNCTIONAL USE	COAL	GASOLIN	DIST	LPG	MISCPET	NAT GAS	ELECTRI	REC EN
DIRECT HT (600F)								
DIR HT 600-1000								
DIR HT1000-1500								
DIRECT HEAT HSK								
PROCESS STEAM								
ELECTRICITY GEN								
MACHINE DRIVE								
OTHER USES HSK	1.00		1.00	0.50	1.00	0.50	0.70	0.70

INDUSTRY: NONMETAL MIN SIC CODE: 14 EFFICIENCIES

FUNCTIONAL USE | COAL | GASOLIN | DIST | LPG | MISCPET | NAT GAS | ELECTRI | MEC EN |

DIRECT HT (600F) |
DIR HT 600-1000 |
DIR HT 1000-1500 |
DIRECT HEAT NSK |
PROCESS STEAM |
ELECTRICITY GEN |
MACHINE DRIVE |
OTHER USES NSK | 0.70 0.35 0.70 0.30 0.70 0.95 0.30

EFFICIENCIES TO SECONDARY SERVICE SECTORS

FUNCTIONAL USE | COAL | GASOLIN | DIST | LPG | MISCPET | NAT GAS | ELECTRI | MEC EN |

DIRECT HT (600F) |
DIR HT 600-1000 |
DIR HT 1000-1500 |
DIRECT HEAT NSK |
PROCESS STEAM |
ELECTRICITY GEN |
MACHINE DRIVE |
OTHER USES NSK | 0.30 0.30 0.80 0.60

INDUSTRY: NONMETAL MIN SIC CODE: 14 FUEL CONSUMPTION (10**12 BTUS)

FUNCTIONAL USE | COAL | GASOLIN | DIST | LPG | MISCPET | NAT GAS | ELECTRI | REC EN | TOTAL |

DIRECT HT (600F)									
DIR HT 600-1000									
DIR HT 1000-1500									
DIRECT HEAT NSK									
PROCESS STEAM									
ELECTRICITY GEN									
MACHINE DRIVE									
OTHER USES NSK	12.7	33.9	18.8	1.7	150.4	28.8	59.1	305.4	
TOTAL FUNC USES	12.7	33.9	18.8	1.7	150.4	28.8	59.1	305.4	