

The Manufacturing Energy Consumption Survey (MECS)

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Robert Adler (202) 586-1134

Robert.Adler@eia.doe.gov

Tom Lorenz (202) 586-3442

Thomas.Lorenz@eia.doe.gov

What is EIA?

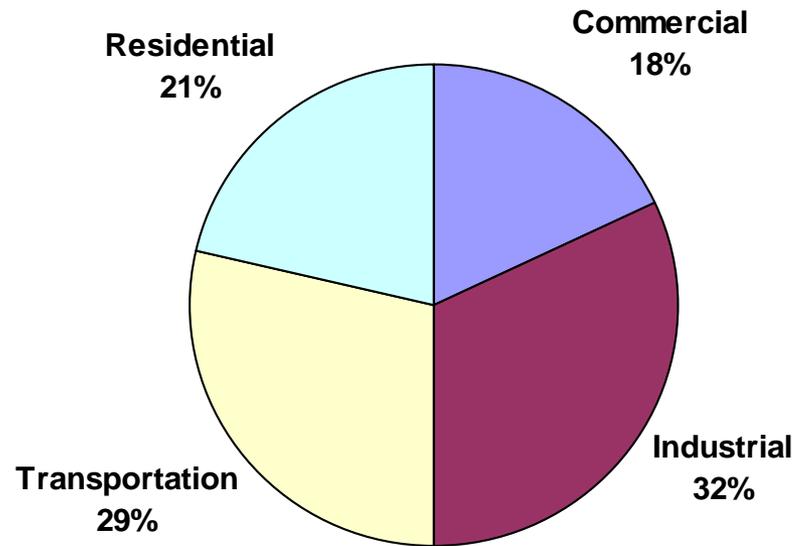
- EIA is the Energy Information Administration
- Statistical arm of the Department of Energy (DOE)
- Collects energy data on over 70 surveys
- Provides energy statistics and analysis from the surveys:
 - EIA supplies daily, weekly, monthly and yearly energy quantity and price data
 - Forecasting and analysis of both domestic and international energy markets

Energy Consumption Surveys

- Three main surveys in EIA that are demand-based:
 - Residential Energy Consumption Survey (RECS)
 - Commercial Buildings Energy Consumption Survey (CBECS)
 - Manufacturing Energy Consumption Survey (MECS)
 - missing are agriculture, construction, and mining
- No longer collect energy consumption data for Transportation sector (RTECS)

Energy Consumption by Sector

Industrial Sector uses One-Third of the Energy in the U.S., 2007



Source: EIA Annual Energy Review, 2007

Note: The percentages are based upon supplier surveys rather than consumption.

MECS in Brief

- Is a sample survey fielded every 4 years (used to be 3)
- Mandatory by federal law
- Designed and sponsored by EIA; the U.S. Census Bureau conducts the data collection
- By Using Census Bureau, data are confidential by Title 13 of the U.S. Code

MECS in Brief (continued)

- Uses the North American Industry Classification System (NAICS) to classify industry types and establishments
- Statistical sample from list frame (15,500 sample cases in 2002 and 2006)
- Self-administered questionnaire through the Internet (electronically based) and mail

Why Have a MECS?

- Specifically mandated by U.S. law
- Only survey on energy consumption for the U.S. manufacturing sector that is both statistically reliable and comprehensive
- Provides the baseline energy consumption data for the U.S. manufacturing sector

Some Uses for the Data

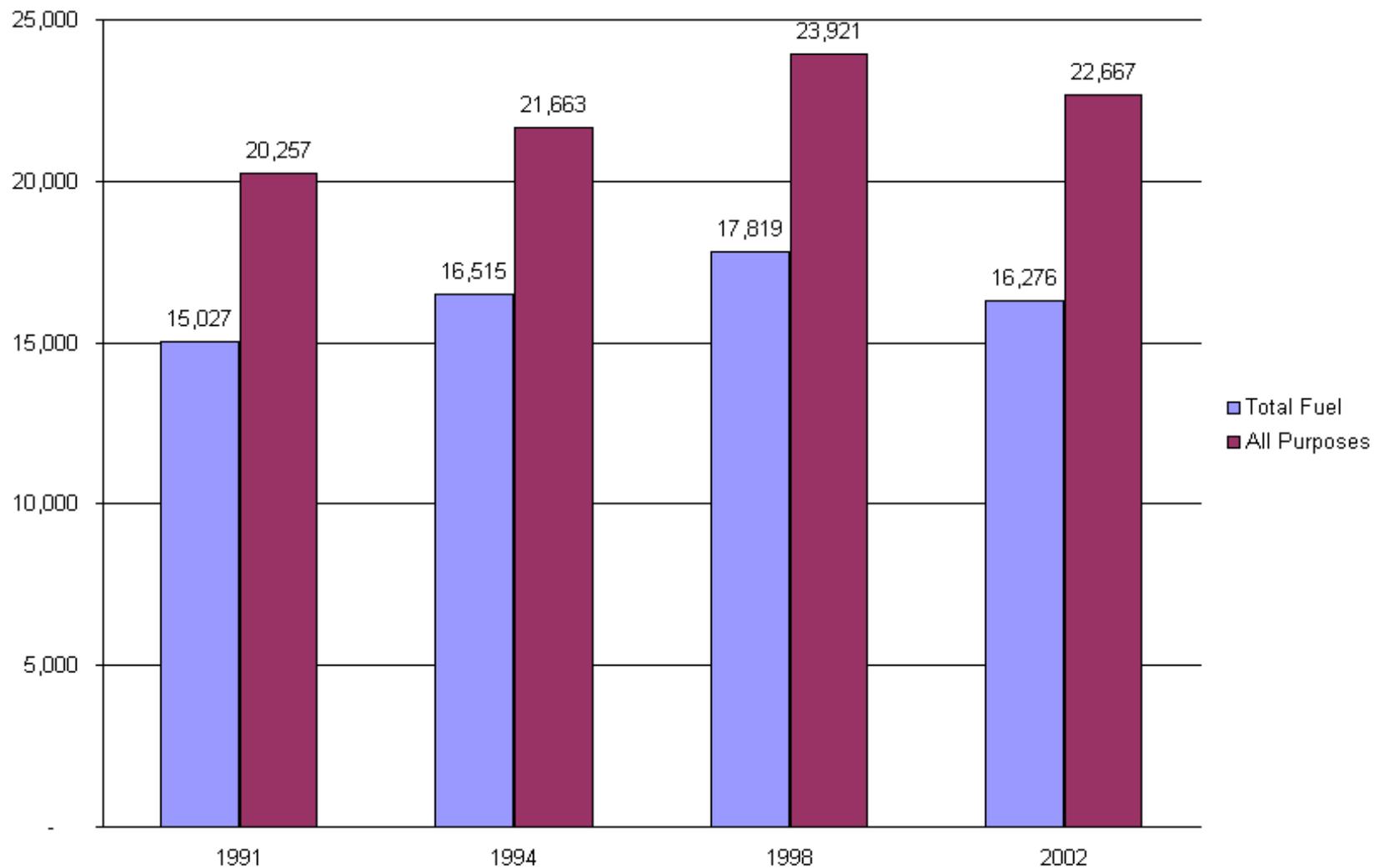
- EIA's Office of Integrated Analysis and Forecasting uses the data extensively as input to National Energy Modeling System (NEMS) industrial models
- Other EIA data and analysis projects use MECS for:
 - estimates on renewable resources
 - submissions to the International Energy Agency
 - and inventories of greenhouse gases

Some More Uses for the Data

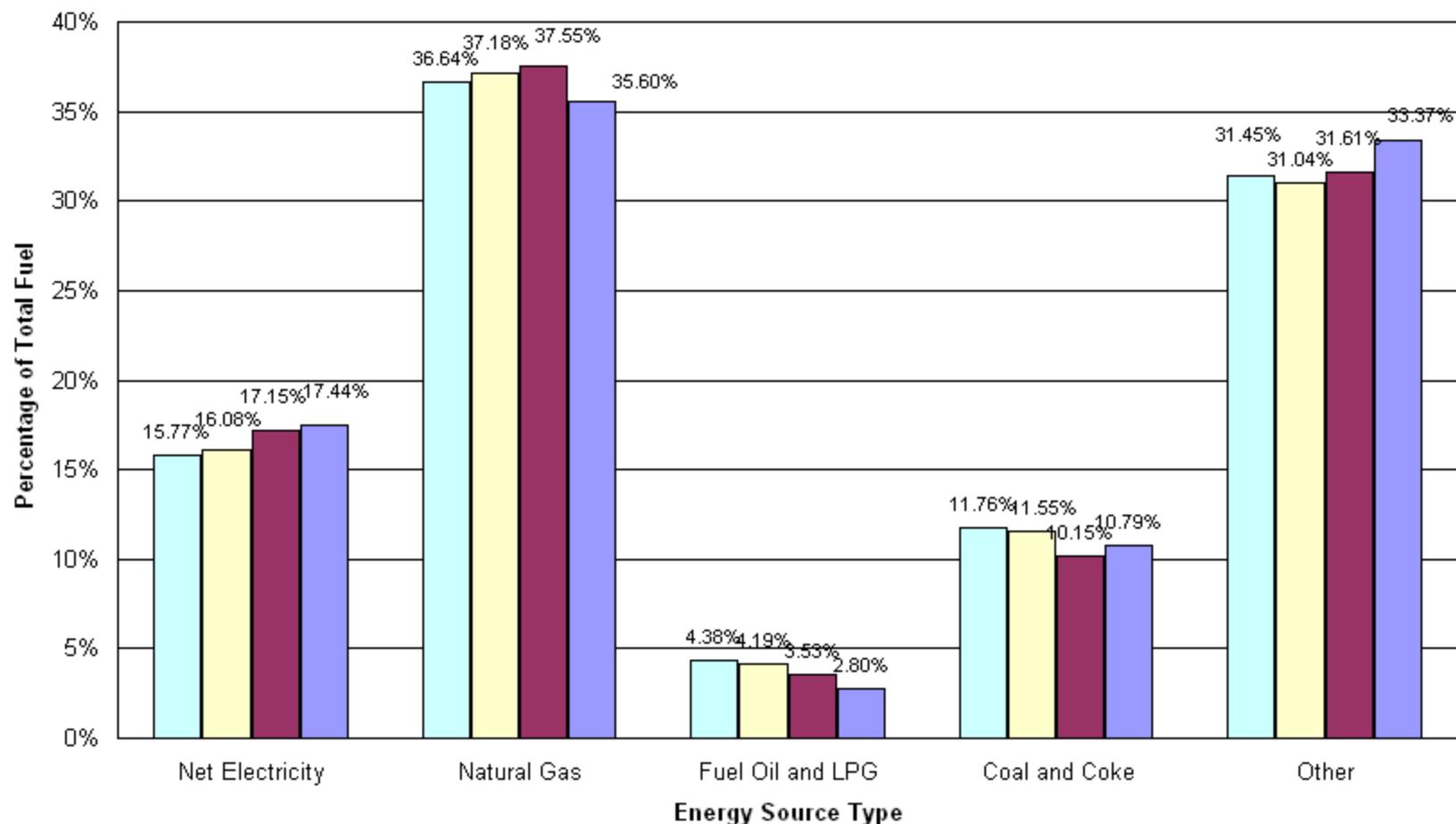
- The DOE Industry Technologies Program (ITP) uses the MECS end-use data in QuickPEP, and will use the 2006 data to examine the penetration in industry of their energy management programs
- The Bureau of Economic Analysis uses the MECS to prepare the industry inputs for their benchmark and annual input-output accounts, which are in turn used in the computation of gross domestic product

Manufacturing Consumption of Energy for Fuel and All Purposes, 1991 to 2002

Trillion Btu

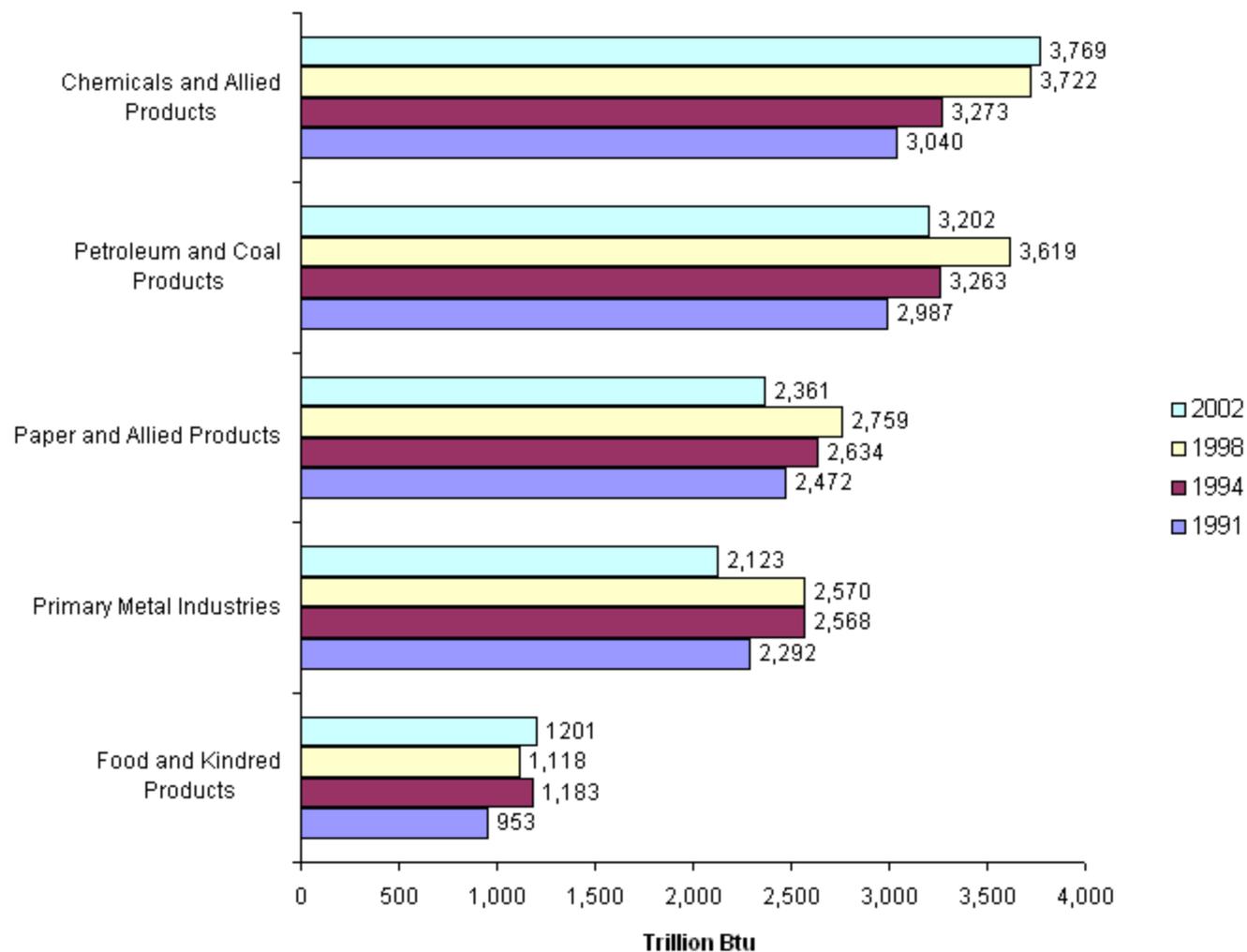


Shares of Fuel Consumption by Energy Source Type, 1998 and 2002



■ 1991
 ■ 1994
 ■ 1998
 ■ 2002

Fuel Consumption in Most Energy Consumptive Industries, 1991-2002



How the MECS is Designed

- EIA is responsible for the design and content of the survey
- Some data questions mandated through the law
- Others arise through our continuing understanding of the survey and the manufacturing population (e.g., energy source shipments, and breakouts of specific energy sources)
- We meet with our users regularly, especially before a new survey, to understand their needs

Who Conducts the Survey?

- The U.S. Census Bureau is responsible for the mailing, data collection, and processing all with input from EIA
- By using Census we benefit from:
 - Larger staff and resources
 - Well-maintained comprehensive survey frame
 - Strongest confidentiality protection

What is Collected?

- For all burnable energy sources:
 - Purchases and Expenditures
 - Transfers in (or receipts coming from other than purchases)
 - Onsite Production
 - How much used as a fuel
 - How much used as a nonfuel or feedstock
 - For some energy sources: how much shipped offsite
 - For fuel oils and gasoline: storage capacity

What is Collected? (cont.)

- For electricity, steam, and other boiler output (hot water):
 - Purchases and Expenditures
 - Transfers in
 - Onsite Generation (CHP and conventional generation (electricity only) and generation from renewable sources (hydropower, solar, wind, geothermal))
 - Sold or transferred out

What is Collected? (cont. 2)

- For most widely used energy sources, breakouts of end-uses (e.g., boiler fuel, process heat, building HVAC)
- Fuel-switching capacity
- Energy management program participation
- Technologies

What is Collected? (cont. 3)

- Building number and square-footage
- Also uses data collected by Census and present on the frame data records:
 - Value of shipments
 - Total employment
 - Value added (Basically, shipments minus costs)

The Sampling Frame

- The sampling frame (or list of units) is from the mail file of the Economic Census—Manufacturing (ECM)
- The mail file has only 60 percent of the manufacturing establishments in the U.S.
- However, it covers 97 to 98% of U.S. manufacturing payroll and is estimated to contain at least that much energy consumption

The Sampling Frame (cont.)

- The frame has names, addresses, activity information, but also ECM data that are used to construct a Measure of Size (MOS)
- The MOS is a way of determining the relative importance of an establishment site in an industry
- The MOS is constructed from the cost of fuels and electric energy data, from the ECM

Sample Methods

- The MECS sample is a form of probability proportion to size (PPS)
- Establishments with greater MOS have a greater chance of being included in the sample
- Sample sizes were assigned to each industry to ensure small errors due to sampling

Sample Methods (cont.)

- Sample was selected so as to have reliable estimates for industry type, and in 2002 geographical area
- In some industries, we took all the available establishments in the frame:
 - those industries with 100 or fewer establishments;
 - those with heavy feedstock use
- Some industries were chosen for their special use of energy (wood and agricultural waste)

Editing and Data Processing

- MECS data are collected and stored on a database called **StEPS** (i.e., **Standard Economic Processing System**)
- In StEPS the data can be reviewed and edited with procedures used in other surveys known to the analysts
- Included are price checks, balance checks, and referral to past data

Editing and Data Processing (cont.)

- Data are easily “flagged” for analyst correction, rare imputation, or computer batch correction
- StEPS also houses many derived variables (i.e., values formed from other reported values) which form the backbone of the MECS estimates

Importance of Derived Values

- Manufacturing has complicated energy flows:
 - Fuel and feedstock use
 - Energy that can be produced onsite from both energy and nonenergy sources
 - Shipments offsite
- When trying to determine “total energy consumption,” double-counting can be a problem

Preparation of Tables

- Tables are prepared using the sample weights, reported and derived values
- Examined at cell level for cycle-to cycle consistency and compared to economic data
- Typically, row “stubs” are industry and geographic breakouts with energy source types forming the column headers
- Because we use the ECM frame, we also have access to data that are collected by Census
- We can therefore show tables -broken out by value of shipments and employment size categories without actually collecting that data as part of the MECS

Example of MECS Table

Table 1.1 First Use of Energy for All Purposes (Fuel and Nonfuel), 2002:
Level: National and Regional Data;
Row: NAICS Codes; Column: Energy Sources and Shipments;
Unit: Physical Units or Btu.

NAICS Code(a)	Subsector and Industry	Total(b) (trillion Btu)	Net Electricity(c) (million kWh)	Residual Fuel Oil (million bbl)	Distillate Fuel Oil(d) (million bb)	Natural Gas(e) (billion cu ft)	LPG and NGL(f) (million bbl)	Coal (million short tons)	Coke and Breeze (million short tons)	Other(g) (trillion Btu)	Shipments of Energy Sources Produced Onsite(h) (trillion Btu)	RSE Row Factors
Total United States												
	RSE Column Factors:	0.9	1	1.2	1.8	1	1.5	0.8	0.9	1.2	0.4	
311	Food	1,123	67,521	2	3	567	1	8	*	89	0	6.8
311221	Wet Corn Milling	217	6,951	*	*	59	*	5	0	11	0	1.1
31131	Sugar	112	725	*	*	22	*	2	0	46	0	0.9
311421	Fruit and Vegetable Canning	47	1,960	*	*	35	*	0	0	1	0	1.1
312	Beverage and Tobacco Products	105	7,639	*	*	45	*	1	0	11	0	4
3121	Beverages	85	6,426	*	*	41	*	1	0	10	0	5.4
3122	Tobacco	20	1,213	*	*	4	*	0	0	1	0	0.9
313	Textile Mills	207	25,271	1	0	73	*	1	0	15	0	14.3
314	Textile Product Mills	60	4,875	0	0	28	*	0	0	0	0	20.2
315	Apparel	30	3,588	*	*	16	*	0	0	0	0	21.4
316	Leather and Allied Products	7	716	*	*	4	*	0	0	0	0	7.8
321	Wood Products	377	20,985	*	2	56	1	0	0	228	0	4.1
321113	Sawmills	127	5,845	*	1	10	*	0	0	91	0	4.7
3212	Veneer, Plywood, and Engineered Woods	167	9,619	*	*	32	*	0	0	95	0	4.7
3219	Other Wood Products	73	5,282	*	*	11	0	0	0	40	0	8.2
322	Paper	2,363	65,503	16	2	490	2	11	*	1,276	0	1.8
322110	Pulp Mills	224	15,579	0	1	23	0	0	0	175	0	0.9
322121	Paper Mills, except Newsprint	1,002	22,831	8	1	201	6	6	*	523	0	1.7
322122	Newsprint Mills	94	11,174	0	0	15	0	0	0	27	0	0.9
322130	Paperboard Mills	308	16,369	5	1	183	0	5	0	542	0	2.2
323	Printing and Related Support	98	14,714	*	*	45	*	0	0	1	0	10.6
324	Petroleum and Coal Products	6,799	37,186	4	3	854	6	0	0	5,520	83	3.5
324110	Petroleum Refineries	6,391	35,478	1	1	799	5	*	*	5,404	0	3
324199	Other Petroleum and Coal Products	0	-533	0	0	4	0	0	0	108	81	1.3
325	Chemicals	6,465	153,104	13	2	2,246	839	16	*	687	504	5.4
325110	Petrochemicals	889	0	0	0	204	260	0	0	80	368	1.2
325120	Industrial Gases	204	0	0	0	0	0	0	0	0	0	3.1
325181	Alkalies and Chlorine	191	12,354	0	0	0	0	1	0	15	0	1.3
325182	Carbon Black	88	605	9	*	19	*	0	0	9	0	0.8
325188	Other Basic Inorganic Chemicals	218	25,904	*	*	75	3	1	*	17	0	1.8
325192	Cyclic Crudes and Intermediates	99	3,443	*	*	42	5	*	0	24	0	0.9
325193	Ethyl Alcohol	60	0	0	0	29	0	1	0	7	0	4.7
325199	Other Basic Organic Chemicals	1,833	22,917	0	0	572	199	0	0	370	98	6.9
325211	Plastics Materials and Resins	1,821	21,495	*	*	404	362	1	*	54	34	4.5
325212	Synthetic Rubber	57	1,878	*	*	28	1	*	0	12	0	4.3
325222	Noncellulosic Organic Fibers	63	0	0	0	31	0	0	0	5	0	1.5
325311	Nitrogenous Fertilizers	497	3,486	0	0	471	0	0	0	1	0	0.9
325312	Phosphoric Fertilizers	38	1,025	0	0	30	0	0	0	1	0	0.9
3254	Pharmaceuticals and Medicines	119	10,715	0	0	60	0	0	0	7	0	4.7
325412	Pharmaceutical Preparation	84	8,312	0	0	39	0	0	0	4	0	5.5
325992	Photographic Film, Paper, Plate, and Chemicals	29	0	0	0	7	0	0	0	0	0	5.8
326	Plastics and Rubber Products	351	53,181	1	0	125	2	0	0	5	0	9.8
327	Nonmetallic Mineral Products	1,059	41,393	6	6	411	1	14	*	136	0	3.6
3272	Glass and Glass Products	201	12,233	0	0	149	0	0	0	5	0	2.1
327211	Flat Glass	63	1,842	0	0	51	0	0	0	3	0	0.9
327213	Glass Containers	66	3,932	0	0	51	0	0	0	0	0	0.8
327310	Cements	409	12,471	1	0	21	0	11	0	95	0	1.8
327410	Lime	106	1,353	0	0	2	0	26	0	2	0	0.9
327993	Mineral Wool	52	3,750	0	0	35	0	0	0	0	0	2.4
331	Primary Metals	2,120	144,502	3	3	686	1	20	14	178	143	1.8
331111	Iron and Steel Mills	1,308	53,915	0	0	406	19	13	0	23	143	2
331112	Electrometallurgical Ferroalloy Products	27	3,555	0	0	7	0	0	0	2	0	3.4
3312	Steel Products from Purchased Steel	45	4,611	0	0	23	0	0	0	0	0	9.5
3313	Alumina and Aluminum	473	56,673	0	0	132	0	0	0	143	0	1.6
331312	Primary Aluminum	325	0	0	0	19	0	0	0	0	0	0.9
3314	Nonferrous Metals, except Aluminum	101	9,855	0	0	42	0	0	0	5	0	3.7
3315	Foundries	165	15,893	0	0	75	0	0	1	1	0	3
331511	Iron Foundries	87	8,211	0	0	27	0	0	0	1	0	3.5
331521	Aluminum Die-Casting Foundries	23	1,897	0	0	16	0	0	0	0	0	2.2
331524	Aluminum Foundries, except Die-Casting	19	1,350	0	0	14	0	0	0	0	0	4.3
332	Fabricated Metal Products	388	47,123	0	1	204	1	0	0	3	0	15.3
333	Machinery	177	24,563	0	0	80	1	4	0	0	0	10.2
334	Computer and Electronic Products	201	38,352	0	0	64	0	0	0	3	0	15.7
334413	Semiconductors and Related Devices	67	13,001	0	0	21	0	0	0	1	0	4.7
335	Electrical Equip., Appliances, and Components	172	13,901	0	0	80	0	52	0	70	0	8.2
336	Transportation Equipment	429	50,508	1	1	198	1	0	0	30	0	5.1
336112	Light Trucks and Utility Vehicles	57	0	0	0	35	0	0	0	3	0	0.9
337	Furniture and Related Products	64	7,062	0	0	24	0	0	0	11	0	9.5
339	Miscellaneous	71	10,374	0	0	31	0	0	0	2	0	8.3
	Total	22,666	832,061	41	26	6,298	857	84	16	8,271	730	

Example of a MECS End-Use Table

Table 5.2 End Uses of Fuel Consumption, 2002;
Level: National Data;
Row: End Uses within NAICS Codes;
Column: Energy Sources, including Net Electricity;
Unit: Trillion Btu.

NAICS Code(a)	End Use	Total	Net Electricity(b)	Residual Fuel Oil	Distillate Fuel Oil and Diesel Fuel(c)	Natural Gas(d)	LPG and NGL(e)	Coal (excluding Coal Coke and Breeze)	Other(f)	RSE Row Factors
Total United States										
311 - 339	ALL MANUFACTURING INDUSTRIES									
	RSE Column Factors:	0.3	1	1	2.4	1.1	1.3	1	NF	
	TOTAL FUEL CONSUMPTION	16,273	2,840	208	141	5,794	103	1,182	6,006	3.3
	Indirect Uses-Boiler Fuel	—	12	127	25	2,162	8	776	—	5.5
	Conventional Boiler Use	—	9	76	25	1,306	8	255	—	5.6
	CHP and/or Cogeneration Process	—	4	51	10	857	*	521	—	3.7
	Direct Uses-Total Process	—	2,218	60	43	2,956	64	381	—	2.9
	Process Heating	—	343	58	24	2,742	60	368	—	3.2
	Process Cooling and Refrigeration	—	194	*	2	45	*	*	—	3.7
	Machine Drive	—	1,426	2	16	109	4	5	—	4.8
	Electro-Chemical Processes	—	242	—	—	—	—	—	—	1
	Other Process Use	—	13	*	1	60	*	7	—	5.3
	Direct Uses-Total Nonprocess	—	514	4	50	513	24	19	—	4.6
	Facility HVAC (g)	—	262	3	5	417	5	5	—	6.6
	Facility Lighting	—	196	—	—	—	—	—	—	1.1
	Other Facility Support	—	48	*	1	30	*	*	—	9.7
	Onsite Transportation	—	4	—	35	2	18	—	—	3.1
	Conventional Electricity Generation	—	—	1	Q	55	*	14	—	1.7
	Other Nonprocess Use	—	3	*	Q	10	*	0	—	8.8
	End Use Not Reported	6,306	96	17	12	162	6	6	6,006	8.7



Confidentiality and Disclosure Analysis

- All MECS data are strictly confidential in accordance with Title 13 of the U.S. Code
- Micro data can only be viewed at the Census Bureau and associated Data Centers by Census Staff and those with special sworn status
- Even tabular data are subject to confidentiality testing

Confidentiality and Disclosure Analysis (cont.)

- If data cells are mostly attributable to a small number of companies, then that cell must be suppressed, indicated in our case with a “W”
- Other cells would then have to be withheld as complimentary suppressions so that the original cell cannot be obtained through arithmetic

Current Enhancements

- MECS is a necessary and complicated survey. It has faced declining response rates as well as timeliness problems. That could in turn effect our relevance and budgets. To help with those problems we instituted a few changes:
 - The 2006 MECS, currently being processed and edited, is mostly Internet-based (electronic)

Current Enhancements (cont.)

- The electronic questionnaire has built in edit warnings and automatic computations. This could aid in having an initially cleaner dataset
- We have a “business help site” which has information about the survey including instructions and FAQ’s
- If respondent prefers written form, they can download PDF’s
- “Short” form is mailed to smaller establishments if requested

Click Here for More Information

- MECS Home Page:
<http://www.eia.doe.gov/emeu/mecs/contents.html>

- Recent data:
 - Data tables:
<http://www.eia.doe.gov/emeu/mecs/mecs2002/data02/shelltables.html>
 - Summary of findings:
http://www.eia.doe.gov/emeu/mecs/special_topics/energy_use_manufacturing/energyuse98_02/98energyuse02.html

Click Here for More Information (cont.)

- Methodology:
http://www.eia.doe.gov/emeu/mecs/mecs2002/methodology_02/meth_02.html
- MECS Questionnaires (blank):
http://www.eia.doe.gov/emeu/mecs/mecs2002/forms2002/mecs_forms.html
- Email or call one of us:
 - Robert.Adler@eia.doe.gov or (202) 586-1134
 - Thomas.Lorenz@eia.doe.gov or (202) 586-3442