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Michael G. Scott

Blaine N. Ouimette

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ENERGY CONSUMPTION OF
HOUSEHOLD CONSUMER PRODUCTS

Michael G. Scott and Blaine N. Quimette
Midwest Research Institute
Kansas City, Missouri

Abstract

This article describes the energy consuming characteristics of the U.S. household both in quantitative and qualitative terms. Alternative household definitions for energy consuming household consumer products are used to illustrate and assess the potential consequences of mandatory energy efficiency and labeling standards.

1. INTRODUCTION

The reduction of residential energy consumption has become a national priority. Recently passed legislation* has mandated that energy conservation standards be established for households. By 1980, energy efficiency and labeling standards are to be established for 14 categories** of energy-consuming household consumer products. The first 13 categories specify major household appliances. The fourteenth category was created to include any other household products consuming over 100 kw-hr annually.

One aspect of the current National Energy Plan for the residential sector concerns providing economic

incentives to improve household energy efficiency, through structural modifications. The other aspect involves the development of energy efficiency and labeling standards for the 14 categories of energy consuming household consumer products. These mandatory energy efficiency standards have not been enacted, for several reasons. As yet, the basic information needed to understand each component of residential energy use and consumption patterns is not precisely understood. This is especially true for those household consumer products to be incorporated into the fourteenth category of the EPCA. The EPCA definition for Category 14 includes all household consumer products whose. . .

* Energy Policy and Conservation Act (EPCA), PL 94-163.

** EPCA 14 categories: (1) refrigerator and refrigerator/freezers, (2) freezers, (3) dishwashers, (4) clothes dryers, (5) water heaters, (6) room air conditioning, (7) home heating equipment, (8) television sets, (9) kitchen ovens and ranges, (10) clothes washers, (11) humidifiers and dehumidifiers, (12) central air conditioning, (13) furnaces, (14) other.

. . ."average annual per household energy use by products of such type is likely to exceed 100 kw-hr (or its Btu equivalent) per year. . .(for) consumer products of such type which are used by households in the United States, divided by the number of such households which use products of such type."

Briefly, the EPCA definition includes all household consumer products consuming in excess of 100 kw-hr annually per household, for households possessing at least one such product.

This article, provides an alternative definition to the EPCA Category 14, to derive two useful types of information. First, the energy consuming characteristics of the U.S. household described and quantified at the micro and macro levels. Second, the alternative definition is used to illustrate and assess the existing EPCA definition's potential consequences. The alternative definition proposed is

"All products whose average annual energy use per average U.S. household is likely to exceed 100 kw-hr (or its Btu equivalent)."

The EPCA definition covers any product that consumes over 100 kw-hr if a household has at least one such product. The "alternative" definition includes only those products consuming over 100 kw-hr per average U.S. household. The slight variation in definition makes a significant impact as to which household consumer products are contained within the EPCA Category 14 and to which products will be subject to energy efficiency and labeling standards. The final definition used has further implications as to the necessary level of federal

regulation over the appliance industry and the types of products used in the American household.

The following discussion is structured to provide answers to three basic questions. How much energy is consumed by small household appliances considered for Category 14? Which household consumer products would be included by each definition? What portion of the residential energy budget is consumed by each EPCA category of household consumer products? To date, few studies have attempted to answer any of the questions. The following information was derived as part of a series of residential energy conservation programs performed by Midwest Research Institute (MRI).*

2. HOUSEHOLD CONSUMER PRODUCT CHARACTERISTICS

Table 1 summarizes power ratings, consumer use patterns and market saturation for 125** household consumer products (mostly appliances). The power ratings and market saturation figures are the result of an extensive literature review of previous similar studies and recent MRI project work compiled in two FEA sponsored studies. Note that two alternative market saturation estimates are provided. The first (the EPCA Definition) shows the number of units per household, for households possessing at least one number of consumer products per household in the United States.

3. ANNUAL ENERGY CONSUMPTION

Table 2 uses the information compiled in Table 1 to compute the annual energy consumption for each consumer product. The first column was derived by multiplying each consumer product's power rating

* Energy Efficiency Program for Appliances, Midwest Research Institute, FEA Contract No. CR-04-60664-00 (unpublished).

Patterns for Energy Use by Electric Appliances, Midwest Research Institute, FEA Contract No. CO-04-50016-00.

** This condensed listing only highlights half of the over 250 consumer products evaluated in the yet unpublished MRI/FEA report "Energy Efficiency Program for Appliances."

by its annual hours of use (Consumer Use Pattern). The second column conforms to the EPCA definition, reflecting annual energy consumed per household having at least one such product. The third column adjusts the annual energy consumption to reflect the average number of consumer products per household nationally.

Using the existing EPCA criteria all manufacturers of electric pressure cookers, for example, would be required to conform to energy efficiency and labeling standards by 1980. Even though pressure cookers consume over 100 kw-hr (i.e., 163.3 kw-hr) for households having at least one such device; pressure cookers on the average consume only 3.2 kw-hr per average U.S. household, when weighted with the market saturation criteria incorporated into the "Alternative Definition." Nationally, pressure cookers consume approximately one-half of one ten-thousandth percent.

Clearly, the selection of candidate household consumer products for inclusion into EPCA Category 14 (i.e., using over 100 kw-hr annually) is greatly dependent on which definition is used. The number of consumer products shown in Table 2 consuming over 100 kw-hr using the EPCA definition (Column 2) is significant when considering that the existing EPCA criteria for energy efficiency and labeling standards may be applied to many household consumer products whose average household energy consumption is significantly below 100 kw-hr. This will also place a large regulatory burden on many manufactures of small volume energy consuming household consumer products (mainly appliances).

3. CONCLUSION

Table 3 and Figure 1 combine the Category 14 information with other MRI residential energy consumption estimates for the remaining 13 EPCA categories using the alternative definition. The

existing EPCA definition for Category 14 consumer products should be altered to include market saturation information, reflecting only the average number of products contained per average U.S. household, not the average number per households having at least one product. If not, a significant number of household consumer products having little significance to national residential energy demand must be needlessly regulated to conform to energy efficiency and labeling regulations and standards.

TABLE 1

HOUSEHOLD CONSUMER PRODUCT CHARACTERISTICS

<u>Household Consumer Product</u>	<u>Characteristics</u>	<u>Power Rating</u> (i.e. Wattage)	<u>Consumer Use Patterns</u> (Annual Hr of Use)	<u>Market Saturation</u>			
				<u>EPCA Definition</u>	<u>Average Number Per Household</u>		
Category 14 "Other"							
<u>Kitchen Appliances</u>							
	Toaster	1,123	34	1.01	0.89		
	Waffle iron	1,116	20	1.01	0.33		
	Griddle	1,350	38	1.00	0.10		
	Skillet (elec. fry pan)	1,198	124	1.05	0.55		
	Mixer--portable	104	} 55	1.00	0.69		
	Mixer--regular	150		1.00	0.34		
	Coffee maker	495	238	1.11	0.74		
	Blender	343	21	1.00	0.64		
	Juicer	160	7	1.01	0.05		
	Can opener	100	3	1.00	0.34		
	Opener/knife sharpener	75	4	1.00	0.37		
	Crock pot	184	693	1.01	0.32		
	Fondue set/wok (elec.)	800	12	1.02	0.05		
	Broiler	1,288	72	} 1.03	} 0.18		
	Roaster	1,379	85				
	Hot trays/plates	1,310	72	1.20	0.18		
	Electric knife/slicer	94	48	1.00	0.39		
	Food grinder/chopper	456	39	1.00	0.04		
	Popcorn popper	550	15	1.01	0.33		
	Ice crusher	475	5	1.00	0.06		
	Ice cream maker	156	3	1.00	0.09		
	Pressure cooker	1,355	117	1.03	0.02		
	Electric clock	2.5	8,760	2.39	2.15		
	Garbage disposal	445	67	1.00	0.06		
	Trash compactor	460	125	1.00	0.00		
	Deep fryer	1,200	57	Market Saturation Data Not Available (N.A.)			
	Egg cooker	533	25	↓			
	Sandwich grill	1,161	28				
	Kettle	1,500	50				
	Rotisserie	1,400	52				
	Baby food warmer	165	131				
	Bottle warmer	575	140				
	Cooker/fryer (dutch oven)	1,200	19				
	Hot tray/dish	140	52				
<u>Living Room</u>							
	Table radio	32	993			1.85	1.52
	Console stereo, hi-fi	40	416	1.22	0.81		
	Amplifier (guitar/organ)	114	260	1.08	0.08		
	Tape deck(s)	23	312	1.24	0.04		

TABLE 1 (Continued)

Household Consumer Product	Characteristics	Power Rating (i.e. Wattage)	Consumer Use Patterns (Annual Hr of Use)	Market Saturation	
				EPCA Definition	Average Number Per Household
<u>Bedroom</u>					
Electric blanket		150	916	1.36	0.37
Vaporizer		50	845	1.06	0.31
Massager/vibrator		28	34	1.07	0.01
Heating pad		60	102	1.03	0.05
<u>Bathroom</u>					
Electric sauna		1,000	156	1.00	0.00
Sun lamp		279	472	1.11	0.08
Shaver		15	69	1.15	0.49
Hot comb		833	33	1.22	0.56
Hairdryer--hand-held		491	38	} 1.10	} 0.57
Hairdryer--nonhand-held		650	125		
Toothbrush		1	8,760	1.08	0.10
Water pic		35	30	1.03	0.08
Curler (hair setter)		375	39	1.02	0.25
Curling iron		39	41	1.03	0.22
Make-up mirror		50	108	Market Saturation Data Not Available (N.A.) ↓	
Hair clippers		10	33		
Shaving cream heater		60	6		
Heat lamp		533	52		
<u>Shop and Hobby</u>					
Lawn mower--hand (elec.)		1,150	16	1.02	0.07
Lawn mower--hand (gas)		5,408	16	N.A.	N.A.
Lawn mower--riding (gas)		10,444	16	N.A.	N.A.
Sewing machine		75	129	1.04	0.71
Garden tools		--	--	1.22	0.31
Chain saw		1,120	24	N.A.	N.A.
Edger/trimmer		346	8	N.A.	N.A.
Shrub trimmer		283	8	N.A.	N.A.
Grass shears		5	12	N.A.	N.A.
Leaf vacuums		5,222	6	N.A.	N.A.
Welder		2,590	12	1.12	0.04
Portable woodworking		--	--	2.56	1.40
Power planer		615	13	N.A.	N.A.
Power saw--circular		1,180	52	N.A.	N.A.
Power saw--sabre		327	52	N.A.	N.A.
Power saw--reciprocating		458	30	N.A.	N.A.
Router		649	43	N.A.	N.A.
Stationary woodworking		--	--	1.37	0.17
Drill press		408	52	N.A.	N.A.
Sander-belt		790	52	N.A.	N.A.
Sander/grinder		1,150	52	N.A.	N.A.

TABLE 1 (Continued)

Characteristics Household Consumer Product	Power Rating (i.e. Wattage)	Consumer Use Patterns (Annual Hr of Use)	Market Saturation	
			EPCA Definition	Average Number Per Household
<u>Shop and Hobby (Concluded)</u>				
Stationary woodworking (concluded)				
Table saw--ban	476	52	N.A.	N.A.
Table saw--jointer	551	52	N.A.	N.A.
Table--miter box	1,200	52	N.A.	N.A.
Table saw--radial	1,263	104	N.A.	N.A.
Portable metalworking	--	--	1.40	0.03
Electric drills	439	17	--	--
Electric engraver	943	52	--	--
Stationary metal working	--	--	1.38	0.19
Bench grinders	439	17	N.A.	N.A.
Sander-polisher	943	52	N.A.	N.A.
Motor tillers	8,263	10	N.A.	N.A.
Shredder/grinder	1,740	4	N.A.	N.A.
Snow throwers	5,480	15	N.A.	N.A.
Soldering gun	179	52	N.A.	N.A.
Outboard motor	9,176	48	N.A.	N.A.
Trolling motors	350	36	N.A.	N.A.
Auto oil-warmer	50	1,008	N.A.	N.A.
Auto battery chargers	118	60	N.A.	N.A.
<u>Miscellaneous</u>				
Portable heater	1,322	130	1.22	0.27
Exhaust fan--attic	370	786	} 1.35	} 0.56
Exhaust fan--circulating	88	489		
Exhaust fan--kitchen	48	546		
Exhaust fan--rollaway	171	807		
Exhaust fan--window	200	850		
Vacuum sweeper	630	73	1.28	1.21
Flood lights	230	1,820	1.90	0.45
Decorative/special lighting	--	--	2.16	0.24
Lawn lights (elec.)	74	3,640	N.A.	N.A.
Lawn lights (gas)	--	8,760	N.A.	N.A.
Nightlights	15	3,285	N.A.	N.A.
Adding machine	37	104	N.A.	N.A.
Burglar alarm	10	3,285	N.A.	N.A.
Calculator (battery)	6	832	N.A.	N.A.
Fireplace	2,050	468	N.A.	N.A.
Garage door opener	3	--	1.08	0.07
Germicidal lamp	20	7,050	N.A.	N.A.
Home intercom	5	30	N.A.	N.A.
Iron	1,054	98	N.A.	N.A.
Lights				
Incandescent	60	2,184	N.A.	N.A.
Fluorescent	--	--	N.A.	N.A.

TABLE 1 (Concluded)

Characteristics <u>Household Consumer Product</u>	Power Rating (i.e. Wattage)	Consumer Use Patterns (Annual Hr of Use)	<u>Market Saturation</u>	
			<u>EPCA Definition</u>	<u>Average Number per Household</u>
<u>Miscellaneous (Concluded)</u>				
Opaque projectors	100	26	N.A.	N.A.
Pencil sharpener	100	61	N.A.	N.A.
Photographic equipment	--	--	N.A.	N.A.
Portable steam press	500	26	N.A.	N.A.
Scissors (elec.)	90	13	N.A.	N.A.
Slide/movie projector	203	52	N.A.	N.A.
Smoke/fume detector	3	8,760	N.A.	N.A.
Snowblower	7,500	100	N.A.	N.A.
Typewriter (elec.)	50	156	N.A.	N.A.
Water pump	1,334	244	N.A.	N.A.
Whirlpool	360	156	N.A.	N.A.
Air cleaner	49	4,320	N.A.	N.A.
Floor polisher	305	15	N.A.	N.A.

TABLE 2

ANNUAL ENERGY CONSUMPTION

<u>Household Consumer Product</u>	<u>Energy Consumption</u> <u>Per Household</u> <u>Consumer</u> <u>Product</u>	<u>Per Household</u> <u>Using</u> <u>EPCA</u> <u>Definition</u>	<u>Per Average</u> <u>U.S.</u> <u>Household</u>
Category 14 "Other"			
<u>Kitchen Appliances</u>			
Toaster	38.5	38.9	34.3
Waffle iron	22.0	22.2	7.3
Griddle	163.8*	163.8*	16.4
Skillet (elec. fry pan)	148.3*	155.7*	81.6
Mixer--portable	5.7	5.7	3.9
Mixer--regular	2.0	2.0	0.7
Coffee maker	118.0*	131.1*	87.3
Blender	7.2	7.2	4.6
Juicer	1.1	1.1	0.1
Can opener	3.2	3.2	1.1
Opener/knife sharpener	3.2	3.2	1.1
Crock pot	127.5*	128.7*	40.8
Fondue set/wok (elec.)	9.2	9.4	0.5
Broiler	116.6*	121.0*	21.0
Roaster	93.0	93.0	19.5
Hot trays/plates	101.8*	122.2*	21.4
Electric knife/slicer	4.4	4.4	1.7
Food grinder/chopper	17.7	17.7	0.7
Popcorn popper	8.3	8.4	2.7
Ice crusher	2.4	2.4	0.1
Ice cream maker	0.5	0.5	0.0
Pressure cooker	158.5*	163.3*	3.2
Electric clock	19.6	46.8	42.1
Garbage disposal	30.0	30.0	1.8
Trash compactor	53.7	53.7	0.0
Deep fryer	75.9	---	---
Egg cooker	13.4	---	---
Sandwich grill	33.0	---	---
Kettle	75.0	---	---
Rotisserie	73.0	---	---
Baby food warmer	21.6	---	---
Bottle warmer	80.5	---	---
Cooker/fryer (dutch oven)	27.8	---	---
Hot tray/dish	72.8	---	---
<u>Living Room</u>			
Table radio	70.5	130.4*	107.2*
Console stereo, hi-fi	16.6	20.3	13.4
Amplifier (guitar/organ)	29.6	32.0	2.4
Tape decks(s)	7.2	8.9	0.3

TABLE 2 (Continued)

<u>Household Consumer Product</u>	<u>Energy Consumption</u> <u>Per Household</u> <u>Consumer</u> <u>Product</u>	<u>Per Household</u> <u>Using</u> <u>EPCA Definition</u>	<u>Per Average</u> <u>U.S.</u> <u>Household</u>
<u>Bedroom</u>			
Electric blanket	138.5*	188.4*	51.2
Vaporizer	42.2	44.7	13.1
Massager/vibrator	0.9	1.0	0.0
Heating pad	8.4	14.0	0.7
<u>Bathroom</u>			
Electric sauna	156.0*	156.0*	0.0
Sun lamp	450.5*	500.1*	36.0
Shaver	1.0	1.2	0.5
Hot comb	27.3	33.3	15.3
Hairdryer--hand-held	18.3	---	---
Hairdryer--nonhand-held	81.3	---	---
Toothbrush	11.4	12.3	1.1
Water pic	1.1	1.1	0.1
Curler (hair setter)	14.6	14.9	3.7
Curling iron	1.6	1.6	0.4
Make-up mirror	5.4	---	---
Hair clippers	0.3	---	---
Shaving cream heater	0.4	---	---
Heat lamp	25.6	---	---
<u>Shop and Hobby</u>			
Lawn mower--hand (elec.)	18.4	---	---
Lawn mower--hand (gas)	86.5	---	---
Lawn mower--riding (gas)	167.1*	---	---
Sewing machine	122.8*	---	---
Garden tools			
Chain saw	26.9	---	---
Edger/trimmer	2.8	---	---
Shrub trimmer	2.3	---	---
Grass shears	0.1	---	---
Leaf vacuums	31.3	---	---
Welder	31.1	34.8	1.2
Portable woodworking			
Power planer	8.0	---	---
Power saw--circular	61.4	---	---
Power saw--sabre	17.0	---	---
Power saw--reciprocating	13.7	---	---
Router	27.9	---	---
Stationary woodworking			
Drill press	21.2	---	---
Sander-belt	41.1	---	---
Sander/grinder	59.8	---	---
Table saw--ban	24.8	---	---
Table saw--jointer	28.7	---	---
Table saw--miter box	62.4	---	---

TABLE 2 (Continued)

<u>Household Consumer Product</u>	<u>Energy Consumption</u>	<u>Per Household Consumer Product</u>	<u>Per Household Using EPCA Definition</u>	<u>Per Average U.S. Household</u>
<u>Shop and Hobby (Concluded)</u>				
Table saw--radial		131.3*	---	---
Portable metalworking				
Electric drills		27.6	---	---
Electric engraver		0.1	---	---
Stationary metalworking				
Bench grinders		7.6	---	---
Sander-polisher		49.0	---	---
Motor tillers		80.3	---	---
Shredder/grinder		7.0	---	---
Snow throwers		81.1	---	---
Soldering gun		9.3	---	---
Outboard motor		440.5*	---	---
Trolling motors		12.6	---	---
Auto oil-warmer		50.4	---	---
Auto battery chargers		7.1	---	---
<u>Miscellaneous</u>				
Portable heater		171.9		
			(Item Probably Incorporated in EPCA Category 7)	
Exhaust fan--attic		290.5*	---	---
Exhaust fan--circulating		43.0	---	---
Exhaust fan--kitchen		26.3	---	---
Exhaust fan--rollaway		138.0*	---	---
Exhaust fan--window		157.5*	---	---
Vacuum sweeper		44.6	57.1	54.0
Flood lights		418.6*	795.3*	188.4*
Decorative/special lighting				
Lawn lights (elec.)		269.4*	---	---
Lawn lights (gas)		3,600.0*	---	---
Nightlights		49.3	---	---
Adding machine		3.8	---	---
Burglar alarm		32.8	---	---
Calculator (battery)		5.0	---	---
Fireplace		959.4*		
			(Item Probably Incorporated in EPCA Category 7)	
Garage door opener		29.8	31.8	2.1
Germicidal lamp		141.0*	---	---
Home intercom		0.2	---	---
Iron		103.4*	---	---
Lights				
Incandescent		1,870.0*	---	---
Fluorescent		260.0*	---	---
Opaque projectors		2.6	---	---
Pencil sharpener		6.1	---	---
Photographic equipment		---	---	---

TABLE 2 (Concluded)

<u>Household Consumer Product</u>	<u>Energy Consumption</u>	<u>Per Household Consumer Product</u>	<u>Per Household Using EPCA Definition</u>	<u>Per Average U.S. Household</u>
<u>Miscellaneous (Concluded)</u>				
Portable steam press		13.0	---	---
Scissors (elec.)		1.2	---	---
Slide/movie projector		10.6	---	---
Smoke/fume detector		28.0	---	---
Snowblower		75.0	---	---
Typewriter (elec.)		7.8	---	---
Water pump		244.1*	---*	---
Whirlpool		56.2	---	---
Air cleaner		216.0*	---*	---
Floor polisher		15.0	---	---

TABLE 3

NATIONAL SUMMARY ENERGY CONSUMPTION--RESIDENTIAL SECTOR

Consumer Product Category	MRI Estimate	
	10 ¹² Btu	%
1. Refrigerator and Refrigerator/Freezers	289	2.5
2. Freezers	132	1.1
3. Dishwashers	33	0.3
4. Clothes dryers	194	1.7
5. Water heaters	1,926	16.8
6. Room air conditioning	234	2.0
7. Home heating equipment	N.A. ^{a/}	---
8. Television sets	175	1.5
9. Kitchen ovens and ranges	602	5.2
10. Clothes washers	18	0.2
11. Humidifiers and dehumidifiers	21	0.2
12. Central air conditioning	81	0.7
13. Furnaces	7,000	60.8
14. Other	345	3.0
Kitchen Appliances	94	0.8
Living Room	29	0.3
Bedroom	16	0.1
Bathroom	20	0.2
Shop and Hobby	93	0.8
Other	93	0.8
Lighting	465	4.0
	<u>11,515</u>	<u>100.0%</u>

N.A. (Not Available)

a/ Included in Category 13 totals.

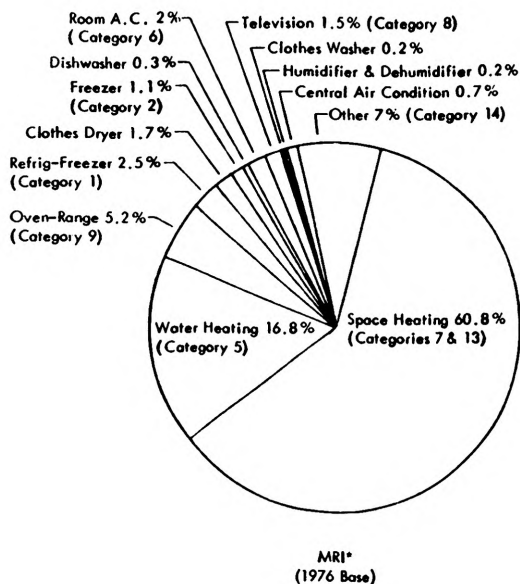


Figure 1 - Residential Energy Consumption Estimates