Emerging Miscellaneous Uses of Electricity in Homes

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Introduction

In an earlier paper, we described and quantified 35 miscellaneous uses of electricity in homes (Meier, Rainer, and Greenberg 1992). These uses, including water bed heaters, fans, de-humidifiers, and pumps, together represent only about 20% of residential electricity use--but may be the largest single use of electricity in a particular home. Trends suggest that the fraction, and possibly the amount, will rise.

New Miscellaneous Uses of Electricity

We investigated several more miscellaneous energy uses which we felt may become more significant or are interesting in other aspects. Not all of them have obvious opportunities for conservation, but their electricity use may be confused with the standard end uses. In addition, some end uses are likely to grow because they are associated with relatively new appliances.

Low-Voltage Transformers

A large fraction of new consumer electronic equipment operates on 5 to 15-volt power transformed from standard 120 volt supplies. These appliances include almost all telephone-related equipment, portable vacuum cleaners, battery chargers (along with appliances having rechargeable batteries, such as flashlights), and computer equipment. We are principally concerned with the standby power requirements rather than energy consumed during operation. We estimate that the average home now contains at least three external transformers, that is, over 300 million low-voltage transformers are presently in use in the United States. An informal nationwide survey of upper middle class homes found an average of 8 low-voltage transformers per home, with several homes reporting more than twelve. Tens of millions more transformers are built in to appliances, some of which operate continuously.

No comprehensive survey of the transformers' energy use has been undertaken. Our measurements of a limited sample (Table 1) suggest that transformers in standby mode (but still connected to their load, i.e., charging fully-charged batteries, etc.) draw 1 - 9 W. We estimate that the average is about 4 W. The rated power of a transformer is not a reliable indicator of actual energy use, even for peak loads. Nameplate ratings overestimate standby (average) consumption, in this case by about 2-5 times.

Cable TV Converter Boxes

There are roughly fifty million cable TV converter boxes in U.S. homes. These boxes draw from 10 - 25 watts continuously. The savings from "cable-ready" TVs and VCRs are being offset by the growth in use of addressable boxes. Together, these boxes consume about 1 percent of residential electricity.

Electricity Usage of Gas Appliances

Electricity plays a key role in an increasing number of new energy-efficient gas appliances. The principal functions are fans and as ignitors. The stock of these appliances remains relatively small but will increase rapidly as older units are replaced.

Electric ignitors are commonly used in place of pilot lights. In response to the federal energy efficiency standards, stove manufacturers have replaced pilot lights with electric ignition in over 90% of all new gas stoves manufactured since 1987. In gas ovens, the ignitor remains energized for the entire time the burner is on. (To maintain 400°F, the burner is on about 40% of the time.) Since the ignitor is rated at 400 W, it represents a significant load; indeed, a gas oven may require more electricity to cook small items than a microwave oven. Based on the DOE test procedure, this ignitor contributes 60 kWh/year in the average home (assuming about 180 hours of baking per year). In homes where the oven is frequently used, the ignitor consumes considerable electricity. If federal efficiency standards are not quickly revised to prohibit this technique--non-continuous ignitors are available--this totally avoidable end use will eventually consume almost 0.4% of total residential electricity.

Table 1. Measurements of Low-Voltage Transformers

Item	Rated Input	Rated Output	Standby Power (W) No Load	Standby Power (W) As Connected	Other
Telephone equipment					
Cordless phone	6w	2.4W	n.a.	2.7	charging handset
Answering machine/ phone combination	12w	6W	0.9	4.0	
Answering machine	17w	8.4W	1.0	3.3	play 5-6W
Laptop computer transformers					
Old (mid-'80s)	27w	13.5W	0.7	8-9	13-15W w/comp. on
Newer (late-'80s)	15w	9.9W	0.8	4-5	6-7W w/comp. on
286 notebook	70-96VA	27W	2.6	14-15	charging (comp. off)
386 notebook	58-115VA	15.5W	2.5	5	fully charged (comp. off)
Macintosh notebook	30-40VA	15W	0.6-0.9	18	charging or on
Plug-in battery charger	0.09A	n.a.	0.7	3.0	for small lead-acid batteries
Battery charger for drill	35W	14W	0.9	0.9	fully charged battery
AC/DC converter	5w	1.2W	0.8	n.a.	unknown usage
Model (2400 baud)	30w	14VA	1.6	1.6	10 w/modem on
External floppy drive	15W	6W	1.8	2.1	

Line Losses on the Customer Side of the Meter

Distribution losses are rarely considered inside the home but may represent a significant end use of electricity. Many older houses have electrical demands considerably higher than designed for in the original circuits. Additional electrical appliances, such as microwave ovens, toaster ovens, portable resistance heaters, intensive lights, etc., often overload particular circuits. We estimated the distribution losses, based on a range of loads, power factors, and other conditions. Lightly loaded circuits probably have low (about 1%) losses. However, losses can exceed 5% for a circuit that is overloaded or has a poor power factor (due to presence of microwave ovens, CFLs, computers, etc.) The typical older house probably experiences about 2% line losses.

Electric Lawn Mowers

Electric lawn mowers have traditionally been a tiny part of the lawn mower market (about 6%) (Appliance Magazine 1991). New air pollution regulations, however, will restrict the use of gasoline-powered lawn mowers in Southern California. As a result, a large fraction of new mowers in Southern California will be electrically powered. We expect that other areas with dirty air may copy this policy, so energy use of electric mowers will increase. A typical mower draws 1.5 kW and is used 1 hour per week; thus, annual electricity consumption is around 75 kWh.

Conclusions

The results of this study are summarized in Table 2. The end uses described here account for a total of almost 3% of total residential electricity use. This, combined with the our earlier estimates, suggests that over 20% of residential electricity is consumed by miscellaneous appliances. None of the miscellaneous uses of electricity identified in this or our previous study represent a significant aggregate amount of electricity. However, in a single home, one miscellaneous use may be the largest single use of electricity. Even when not the largest, the pattern of consumption for miscellaneous uses can be mistaken for other appliances. This may lead to overestimates of energy use and savings for conservation measures.

Table 2. Additional Miscellaneous Uses of Appliances

Appliance	Stock (Millions)	Unit Energy Consumption (kWh/year)	Total Energy Use (GWh/year)	Fraction of 1990 Residential Use (%)
Low voltage transformers	300	30	9000	1.1
Cable TV converter boxes	50	160	8000	1.0
Wire losses	20	160	3200	0.4
In-house medical equipment	0.5	400	2000	0.2
Electric ignitors in gas ovens	10	60	600	0.07
Induced draft fans for furnaces	3	50	150	0.02
Electric lawn mowers	2	75	150	0.02
Induced draft fans for gas water heaters	15	0.2	3	0.0004

Finally, some of the miscellaneous use--such as the electric ignitors--can be easily reduced or eliminated.

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