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- “Your computer system consumes half of its energy when you aren’t using it.”

These kinds of statements—together with showing households brief summaries of the data we collected during the meter removal process—were sufficient to attract the attention of the households. When we discussed possible energy-saving strategies, few households asked what their financial savings would be. While they might still mentally connect saving energy with saving money, they seemed willing to take action—or indicate that they would—based on the knowledge that certain actions would be effective energy-saving strategies. It is possible that financial savings information is less important to customers for no- and low-cost energy-saving steps than they are for measures that come with a significant financial cost. Consequently, we think that program materials should emphasize—or at least include—messages about reducing energy waste. Statements such as “Did you know that 75 percent of the electricity used by the average desktop computer is consumed when no one is in front of it?” could be powerful attention-getters and motivators.

### **Seeing usage numbers unlocks behavioral potential**

The feedback we provided to study participants about their devices’ energy consumption probably played a role in the households’ positive inclinations to implement some energy-saving opportunities. Showing our “removal log sheet” to households became a routine part of our interviews because it was an effective way to initiate a conversation about energy-saving opportunities the household had and what they might or might not consider doing. At the same time, households seemed interested in hearing about the highlights of what we found, so we ended up providing useful, credible, and house-specific feedback to the study participants. This feedback became part of the information on which households based their comments about their likely practices and level of interest in various energy-saving actions.

Replicating the feedback we gave households after month-long metering would be difficult for a program to accomplish cost effectively, but some proxy of this feedback would most likely enhance program efforts. The interviews and past research suggest that utilities are seen as credible information sources, and data from our study could be cited to assure program audiences that the information is based on field research in Minnesota. The challenge is to provide information that each household will perceive as pertaining to its home and its devices. For devices with narrow ranges of standby and active mode consumption, broad statements, such as “desktop computers use between 50 and 100 watts of electricity (excluding the monitor) when left running” and “recent research found that two-thirds of computers are left on for long periods of time” may be effective. On the other hand, broad statements lose their usefulness for devices like televisions, whose standby and active mode usage varies widely. Program designers would need to find other methods to provide sufficient household-specific information.

One other challenge for programs is to provide the right amount of context for specific energy savings. Because our study was concerned with plugged-in devices, we focused households’ attention on these devices in our discussions. As such, we could point to the most energy-using plugged-in devices that we metered. The reference point for audit-driven residential programs, however, is likely to be the entire house, which may make comparisons of individual plugged in devices seem smaller. At the same time, some plug loads (especially computer power management) can offer significant savings painlessly: this could provide early program credibility and motivation for households to pursue other opportunities that require a more significant time and financial investment.

**Convenience—and start-up time—matters**

Not surprisingly, convenience matters, and perceived convenience affects people's willingness to change their practices. Avoiding the long start-up time for computers is a major reason some households leave their desktops running for extended periods. Power management offers a much faster alternative to the slow start-up process of many computers after they have been completely powered down. Having a computer take just a few seconds to wake up from sleep—or a bit longer from hibernate—may be fast enough for those who leave computers running simply to avoid a slow start-up. This aspect of power management provides an element of convenience that we think has appeal and is worth mentioning in program materials.

On the other hand, convenience is also a barrier to some technically feasible energy-saving opportunities that we identified. Nearly all households with cable or satellite television set-top boxes left these boxes running continuously. Even when we pointed to continuous power usages as high as 50 watts, most households seemed reluctant to manage these devices actively, because of the time required to recover when power is restored to the device. In these cases, convenience trumps energy savings. At best, programs can offer work-arounds that maintain convenience, such as encouraging households to put their set-top boxes on a timer that cuts power during hours when they rarely watch or record television programming.

**Awareness spurs computer power management**

The fact that a significant proportion of households immediately enabled power management during the interviews came as a surprise to us that seemed to point us to the missing elements that had prevented households from enabling power management previously. Based on these interactions with study participants, we think that educational campaigns about power management should inform households of the following:

- Desktop computers consume a substantial amount of electricity while operating.
- A substantial share of computer energy usage occurs unnecessarily when no one is using the computer.
- A desktop CPU may still be operating in full-power mode even if the monitor is blank or turned off.
- Both Windows and Mac operating systems offer a feature that puts the computer into a low-power setting while it is not being actively used.
- Computers awake from the low-power sleep mode within seconds.

We found that households reacted well to messages that simply highlight energy waste or the share of energy that is used unnecessarily (as in “your computer uses x% of its power when it isn't being used”). We did not usually translate savings into dollar terms, because the amounts to be saved may seem small to some individuals—and we found good traction with messages centered on waste. Pilot programs could experiment with messages that feature waste, cost, or both.

Telling households how to enable power management is complicated by the differences among operating systems and the varying levels of computer skills among desktop owners. Households would need to be given instructions or assistance to enable power management as part of any program. Program designers could develop their own material or reference existing tools available on the Internet. As noted earlier,

newer desktop computers tend to be shipped with power management fully enabled, so messaging should primarily target desktops (and operating systems such as Windows XP) that pre-date 2007.

We found several tools that already help people enable power management. The first is the Climate Savers Computing Initiative, which provides instructions on how to enable power management on most operating systems.<sup>26</sup> Their assortment of screen shots and instructions—or something similar—should allow most desktop owners to enable power management.

The remaining tools are a number of gadgets and applications that set a computer's power management settings for the user. One of these is the Google Energy Saving Gadget. This application sets a computer's power management settings to EPA recommended standards. The gadget also displays how much energy a computer is saving individually as well as collective energy savings of everyone using the gadget. Google desktop does need to be installed and running in order for the Energy Saving gadget to work and requires either a Windows XP or later platform. The need for the Google desktop to be running is a potential barrier to its use, however.

At least two power management applications are available for free download. One – the EZ Wizard – is available on the Energy Star website.<sup>27</sup> It is a relatively simple application that provides the user a choice of three levels of power management with the click of a button. Once run, it requires a reboot of the computer. The other, Edison, is available from Verdiem.<sup>28</sup> It provides a more sophisticated user interface and a larger number of choices, all with some feedback on energy saved.<sup>29</sup> This application takes much more memory, however, requires user registration, and launches a window at every start-up.

### **Unplugging is a common sense strategy to many**

We anticipated that few households would consider energy-saving strategies that require them to unplug devices, but we were surprised to find that unplugging is already a regular practice for some households on some devices. Up to 20 percent of the households in our fieldwork deliberately unplugged at least one metered device during our month-long monitoring period, and about eight percent of devices were unplugged at the time of our initial visit. Our interviews suggest that about half of households would seriously consider unplugging a plugged-in device we metered to save energy. To make this strategy more convenient and appealing to households, programs could be designed to promote the use of switched power strips as a way of cutting power to devices that have a high standby load.

One other approach to getting households to unplug rarely used devices would be to encourage them to unplug electronics that will not lose essential settings during storms and whenever they go on vacation.

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<sup>26</sup> [www.climatesaverscomputing.org](http://www.climatesaverscomputing.org)

<sup>27</sup> [http://www.energystar.gov/index.cfm?c=power\\_mgt.pr\\_power\\_mgt\\_ez\\_wiz](http://www.energystar.gov/index.cfm?c=power_mgt.pr_power_mgt_ez_wiz)

<sup>28</sup> <http://www.verdiem.com/edison.aspx>

<sup>29</sup> The feedback is not computer- or user-specific, however. The savings estimate appears to be a computation of energy that would be saved by a generic computer that is left running continuously.

An add-on message could suggest that they just leave rarely used devices unplugged upon their return because electronic devices and power supplies can use energy when plugged in. This way, households can be educated about standby load while also being encouraged to unplug devices at a time that would probably make sense to many who aren't necessarily motivated by the energy savings.

## REFERENCES

Chetty, Marshini, A. Bernheim Bush, B Meyers, and Paul Jones. 2009 "It's Not Easy Being Green," Proceedings of the 27th International Conference on Human Factors in Computing Systems, Boston, MA.

Meier, A., L. Rainer and S. Greenburg. 1992. "Miscellaneous Electrical Energy Use in Homes." *Energy* 17(5): 509-518.

Meier, Alan. 1993. "Leaking Electricity," *Home Energy*, December 1993.

Porter, S., L. Moorfield and P May-Ostendorp (Ecos Consulting). 2005. *Final Field Research Report*. Prepared for the California Energy Commission.

## APPENDIX A — SAMPLE DESIGN, WEIGHTING AND RESPONSE RATES

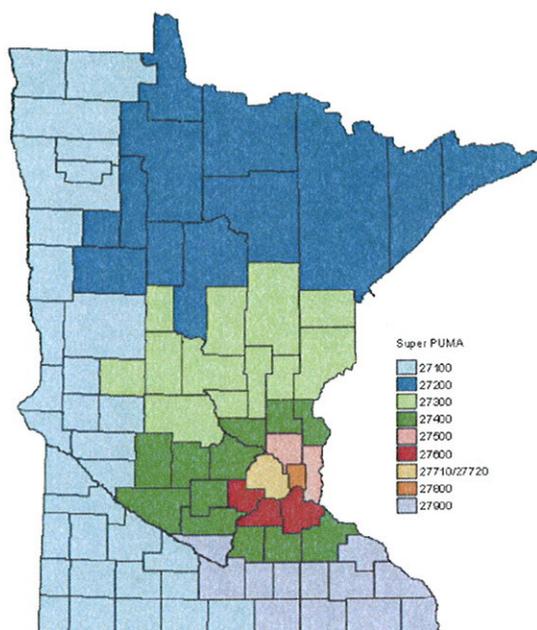
### SAMPLE DESIGN

Our intent with sample design was to ensure that our samples were geographically and demographically representative of the population of Minnesota households. We also felt it was important that the metering data be seasonally balanced as well.

Geographically, we stratified the state into nine regions defined by the Census Bureau’s Public Use Microdata Areas (Figure 9). There are actually 10 so-called “Super-PUMA” regions—each comprises about 10 percent of the population—but we combined two central Twin Cities regions (27710 and 27720) into one for our purposes.

Demographically, we divided the population of occupied households into four groups, maintaining a distinction between homeowners and renters. Table 9 shows the statewide distribution of households across these strata.

**FIGURE 9, CENSUS BUREAU SUPER PUMA REGIONS FOR MINNESOTA.**



**TABLE 9, STATEWIDE PERCENT OF OCCUPIED MINNESOTA HOUSEHOLDS BY DEMOGRAPHIC GROUP AND TENURE.**

Group	Definition	Renters	Owners	Total
1	Single person household (not senior)	7.9%	9.2%	17.1%
2	Adult-only household (not all senior)	5.8%	24.4%	30.1%
3	Children present in household	6.6%	30.1%	36.7%
4	Senior (age 65+) household	4.5%	11.6%	16.1%
Total		24.7%	75.3%	100.0%

Source: Census 2000 PUMS data.

For seasonal balance, we implemented all three levels of data collection in four rounds: one for each season. For each round, we collected data for about a quarter of our target sample in the core Twin Cities region (Super Pumas 27400 through 27800) and one of the four outlying regions (Super Pumas 27100, 27200, 27300 and 27900), as shown in Table 10.

**TABLE 10, DATA COLLECTION TIME PERIOD AND COMPLETIONS BY ROUND.**

	Round 1	Round 2	Round 3	Round 4
Outlying region covered	27900	27200	27300	27100
<b>Telephone survey</b>				
Time period	11/24 – 12/09	03/26 – 04/09	05/28 – 06/08	08/11 – 08/21
Completions				
Core Twin Cities	150	150	149	153
Outlying	100	100	111	100
Total	250	250	160	153
<b>Appliance survey</b>				
Time period	01/7 – 01/23	04/20 – 05/01	06/10 – 06/22	08/27 – 09/10
Completions				
Core Twin Cities	27	47	42	29
Outlying	23	22	34	36
Total	50	69	76	65
<b>On-site</b>				
Time period	02/11 – 03/28	05/11 – 06/15	07/08 – 08/14	09/23 – 10/28
Completions				
Core Twin Cities	7	9	7	8
Outlying	5	4	6	4
Total	12	13	13	12

**SURVEY RESPONSE DISPOSITIONS**

**TABLE 11, SURVEY DISPOSITIONS BY ROUND.**

	Round 1	Round 2	Round 3	Round 4
<b>Telephone survey</b>				
Total sampled	1,687	4,192	7,083	4,567
Out of scope (incl. quota full)	226	460	990	575
Language barrier	25	43	19	36
Not reached	902	3,020	5,213	3,292
Refused	270	382	519	359
Terminated	6	7	25	7
Unknown	8	30	57	45
Completed	250	250	260	253
<b>Appliance survey</b>				
Total mailed	89	120	133	120
Completed	50	69	76	65
owner-occupied	44	52	62	51
rental	6	17	14	14

**CASE WEIGHTS**

We applied the Census 2000 PUMS distribution of households by demographic group and tenures to 2008 estimates of Minnesota owner- and renter-occupied households (by Super PUMA) from the American Community Survey to obtain the estimated total households shown in Table 12. These estimates form the initial basis for case weights applied to each stratum for each level of data collection.

**TABLE 12, ESTIMATED 2008 MINNESOTA OCCUPIED HOUSING UNITS, BY GEOGRAPHIC REGION, TENURE AND DEMOGRAPHIC GROUP.**

Tenure	Demographic Group				Total
	Group 1	Group 2	Group 3	Group 4	
Super-PUMA					
Owners					
27100	14,631	45,207	53,827	37,893	151,558
27200	17,086	44,199	45,251	27,135	133,671
27300	15,760	47,065	56,646	28,380	147,851
27400	16,669	55,381	76,678	23,463	172,191
27500	19,521	57,973	80,432	14,251	172,177
27600	20,213	59,959	87,766	15,641	183,579
27710/27720	50,235	105,803	116,904	45,309	318,251
27800	19,830	42,918	48,672	20,989	132,409
27900	16,322	46,123	58,418	27,384	148,247
Subtotal (owners)	190,267	504,628	624,594	240,445	1,559,934
Renters					
27100	12,342	8,445	12,253	13,184	46,224
27200	11,789	8,116	11,568	10,536	42,009
27300	11,717	10,329	11,671	10,119	43,836
27400	9,496	7,719	11,513	8,824	37,552
27500	8,995	6,756	10,837	5,764	32,352
27600	11,890	10,739	12,698	6,095	41,422
27710/27720	57,466	41,201	34,651	19,929	153,247
27800	25,221	16,144	18,944	10,165	70,474
27900	14,549	10,678	11,821	8,257	45,305
Subtotal (renters)	163,465	120,127	135,956	92,873	512,421
Total households	353,732	624,755	760,550	333,318	2,072,355

However, we found that our final samples differed from the Census in two important ways: (1) they were more likely to be older; and (2) they were more likely to have a college degree. We therefore implemented a more complex weighting scheme that stratified the samples along these dimensions (in addition to the geographic, demographic and housing tenure dimensions above), and used case weights to correct for these biases. Our age stratification variable was a simple binary indicator for whether the original survey respondent was over the age of 40. Similarly, our education variable was whether that survey respondent had a college degree. To develop population estimates of these proportions, we randomly sampled an adult in each household from the 5-percent PUMS data.

For the telephone survey, we had nearly enough cases to fill all 128 strata (9 geographic regions, by owner versus renter, by 4 original demographic strata, by over or under 40 years old, and by college degree attainment or not), but had to collapse a few strata due to a lack of respondents.<sup>30</sup> For the appliance survey and (especially) the on-site samples, we collapsed the geographic stratification to a simpler core Twin Cities (Super Pumas 27400 through 27800) versus outlying region (Super Pumas 27100, 27200, 27300 and 27900) to reduce the number of strata—but we still needed to collapse across some demographic strata due to some unfilled cells. Our general principle in collapsing across strata was to first ensure that the final weights exactly matched the Census data on the original demographic group and housing tenure. We then attempted to preserve college-degree proportions, followed in priority by over/under age 40 proportions and finally geographic representativeness. Table 13 shows the range of final case weights; i.e. the number of MN households represented by each household in the study sample.

As Table 14 shows, the final weighted samples match the Census data well in terms of college degree, and reasonably well in terms of age-of-respondent. These matches come at the expense of some distortion in geographic representation at the Super-PUMA level, though the weights do a good job of maintaining the proportions for core Twin Cities versus outlying region households.

**TABLE 13, FINAL CASE WEIGHTS, BY SAMPLE.**

	Telephone Sample	Appliance Sample	On-site Sample
Minimum	245	1,188	2,730
Median	1,617	6,396	20,517
Maximum	22,076	41,672	170,793

<sup>30</sup> Note that Group 4 (seniors), by definition contains no under-40 household members.

**TABLE 14, CENSUS AND (WEIGHTED) STUDY SAMPLE PROPORTIONS FOR EDUCATION, AGE OF RESPONDENT AND GEOGRAPHIC DISTRIBUTION.**

	Owners				Renters		
	Census 2000	Telephone Sample	Appliance Sample	On-Site Sample	Census 2000	Telephone Sample	Appliance Sample
College degree	28%	28%	28%	28%	22%	22%	22%
Under 40 yrs old	35%	35%	29%	25%	56%	53%	49%
Core region	63%	63%	64%	62%	65%	65%	57%
Outlying region	37%	37%	36%	38%	35%	35%	43%
Super-PUMA							
27100	10%	10%	8%	3%	9%	11%	15%
27200	9%	9%	6%	4%	8%	5%	7%
27300	9%	10%	9%	15%	9%	9%	13%
27400	11%	12%	18%	3%	7%	11%	8%
27500	11%	11%	12%	18%	6%	13%	15%
27600	12%	11%	8%	12%	8%	8%	12%
27700	20%	19%	18%	15%	30%	19%	6%
27800	8%	9%	8%	14%	14%	15%	16%
27900	10%	8%	13%	15%	9%	8%	8%

## APPENDIX B — METERING DETAILS

We relied primarily on Watts Up? Pro and Pro ES meters for the metering portion of the study ([www.wattsupmeters.com](http://www.wattsupmeters.com)). The two models have the same features, but the Pro ES has four times more onboard data storage, which we used to increase the time resolution of the recorded data for selected devices (particularly computers and monitors). We employed about 200 meters, of which about 25 were the Pro ES model.

The meters were configured to record the following data at a six-minute interval (90 seconds for the Pro ES):

- Accumulated watt-hours of electricity use
- Maximum watts during interval
- Minimum watts during the interval
- Accumulated average duty cycle, relative to a fixed 15-watt “on” threshold (we did not make use of this data, and relied instead on duty cycles calculated for device-specific wattage thresholds, as described below).
- Incremental flag for loss of power to the meter

The Pro models stored 6,515 data points under this configuration, or 27.1 days of data. The Pro ES models stored 26,176 records, or 27.3 days worth of data. All meters were configured to simply stop recording when their memory was filled.

The Watts Up? meters do not have an onboard real-time clock. We recorded the date/time of deployment and retrieval, and used these to time-stamp the individual data records. In some cases this was not possible: if the meter lost power more than once during the monitoring period, the recorded data between the two power outages could not be time-stamped. Fortunately, this affected only about four percent of the data.

We also encountered cases where device start-up transients corrupted the meters and caused subsequent data to be erroneous (until the meter was power-cycled). These events tended to occur with refrigerators, dehumidifiers, microwaves and other devices with high start-up transients. These corruptions generally resulted in extremely high indicated electricity use (3,000 or more watts), and were thus easy to flag and remove from the data. Such corruptions affected about three percent of the data gathered in the study, though they affected a much higher proportion of the aforementioned types of devices. (After the first round of metering revealed the problem, we instituted a policy of also installing the Kill A Watt meters described below on these devices as back-up insurance.)

We also employed about 25 Kill A Watt meters (Model P4460) for recording electricity use for low-priority devices and for devices that had a tendency to corrupt the Watts Up? meters. These meters do not store time-series data, but simply log accumulated kWh and hours.

Subsequent to the fieldwork, we checked the accuracy of all of the meters against a reference meter (Dent Elite Pro 1200) that was itself checked out against a recently calibrated utility revenue meter. We found

the large majority of the study meters to be accurate to within a few percent, though a handful had noticeable errors that exceeded 10 percent. Errors for the Watts Up? meters were almost all of the percent-of-reading variety, meaning that indicated wattage was in error by a relatively fixed percentage of actual wattage. The Kill A Watt meters (and a few Watts Up? meters) also displayed offset errors: i.e., an error component that was a fixed number of watts regardless of the indicated wattage level. We developed and applied individual correction factors for each meter: thus corrected, we estimate that the metering data are accurate to within about 2 percent.

Post retrieval review and processing consisted of reviewing the full time-series trace for each meter for signs of data corruption, and to establish a device-specific wattage threshold between active and standby power consumption. In many cases, the distinction between the two was quite obvious, but in some cases it was difficult to tell. Some devices drew a constant amount of power throughout the monitoring period, necessitating a judgment call as to whether the device was in active or standby mode the entire time. Other devices (particularly printers) were active for only brief periods even within the 6-minute data interval we used. A few devices showed multiple distinct power draw levels, requiring a judgment as to differences between standby, active-idle and active states of operation.

Nonetheless, we did assign a threshold for active vs. standby usage for all devices in the study. We then developed algorithms to estimate duty cycle (i.e. the fraction of the time in active mode) within each data interval. The algorithms made use of the assigned threshold, the average wattage for the interval and the minimum and maximum recorded in the interval. Most (98.5%) of the recorded data was classified as either fully standby (or off) or fully active; only 1.5 percent of the data required interpolation of an intermediate duty cycle within a data interval.

In addition to device electricity metering, we also employed occupancy sensors and light sensors in the study. We used the occupancy sensor to assess whether people were at a computer that we were metering for electricity consumption, and we used the light sensors to log ambient light levels for selected metered televisions.

The occupancy sensors were modified Radio Shack Model 49-426 occupancy sensors in which we replaced the speaker with a resistor and capacitor in parallel (RC circuit).<sup>31</sup> Whenever the sensor detected motion, it briefly applied about 8.6V to the RC circuit, thus charging the capacitor, which then gradually discharged through the resistor. By logging this voltage (using a Hobo H8 4-channel data logger) every 90 seconds, and knowing the discharge curve for the RC circuit, we could determine whether an occupancy trigger had occurred in the previous 90 seconds.<sup>32</sup> The occupancy sensors were mounted on small flexible tripods to facilitate locating them to point directly at the spot where a person would sit when using the computer. We also taped off part of the sensor's field of view to mitigate the incidence of extraneous triggers. We deployed 13 occupancy sensors, and sought to log occupancy for one desktop

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<sup>31</sup> See [http://arch.ced.berkeley.edu/vitalsigns/equip/occ\\_doc.html](http://arch.ced.berkeley.edu/vitalsigns/equip/occ_doc.html) for a similar design.

<sup>32</sup> A potential problem with this method is the gradual voltage drop of the occupancy sensor's battery over time. We addressed this by using Lithium 9-volt batteries with high capacity and a much flatter voltage curve than conventional 9-volt batteries. We also used a fresh battery each time the sensor was deployed, and checked the discharge characteristics of each sensor before and after each deployment.

computer in each home, though in some cases this was not possible. We made extensive use of these data to assess computer electricity use when not being used and potential savings from power management.

The light sensors were Hobo H8 light loggers (Model H08-004-02) that recorded ambient lumens per square foot every six minutes in the direction faced by the television on which they were mounted. We deployed 13 of these as well, and sought to monitor ambient light levels for the main television in each home. We made very limited use of these data, mainly to assess electricity consumption for two televisions in the study with automatic brightness control.

**APPENDIX C — SUMMARY OF DEVICE SATURATION AND METERING DATA**

**TABLE 15, ON-SITE DEVICE SATURATION AND METERING SUMMARY (WEIGHTED DATA).**

Device	Avg. # per home	# metered	Avg. kWh/yr	Avg. active watts	Avg. standby watts	Avg. hrs/day active	Active mode % of kWh
<b><u>TVs</u></b>	<b><u>3.17</u></b>						
TV, CRT, <18"	0.62	22	39.3	45.5	3.7	1.1	30.4%
TV, CRT, 18-25"	0.76	18	64.2	53.7	1.7	2.8	79.5%
TV, CRT, <26-31"	0.43	18	137.2	80.2	4.6	3.9	74.9%
TV, CRT, 32"+	0.35	13	139.6	79.9	5.3	4.8	79.9%
TV, LCD, <18"	0.05	6	29.5	39.1	0.6	1.8	82.1%
TV, LCD, 18-25"	0.13	7	35.7	43.2	0.3	3.1	92.4%
TV, LCD, <26-31"	0.13	6	329.7	75.7	1.9	10.8	95.4%
TV, LCD, 32"+	0.31	11	451.0	122.8	1.3	11.4	97.5%
TV, plasma, 32"+	0.13	7	610.0	328.5	0.0	4.5	98.7%
TV, projection	0.05	1	55.2				
TV, rear projection, 32"+	0.06	1	352.7	146.4	5.6	5.9	88.6%
<b><u>TV peripherals</u></b>	<b><u>3.85</u></b>						
Cable box	0.11	5	199.9	26.3	0.5	23.9	100.0%
Satellite box	0.84	24	208.1	25.5	0.4	22.0	99.8%
DVD player	0.93	37	23.9	7.9	0.4	8.2	89.1%
DVD/CD player	0.02	1	1.4				
DVD/VCR player	0.51	12	27.6	17.4	2.5	1.1	21.2%
DVDR	0.01	1	93.2	11.0	1.0	23.1	99.7%
DVR	0.04	1	240.4	27.4		24.0	100.0%
VCR	0.49	13	34.0	6.6	1.2	4.1	47.6%
Gaming system, dance mat	0.11	0					
Gaming system, game cube	0.05	1	4.7				
Gaming system, nintendo	0.04	1	12.9				
Gaming system, nintendo 64	0.02	1	6.1				
Gaming system, ps2	0.04	3	0.9	26.9	0.0	0.7	94.4%
Gaming system, wii	0.17	5	16.9	16.4	1.5	1.2	25.7%
Gaming system, xbox	0.04	0					
Gaming system, xbox 360	0.02	2	45.3	151.2	1.7	0.5	65.9%
Antenna, TV	0.11	3	11.8	1.3		24.0	100.0%
Digital converter box	0.28	8	8.9	4.9	0.2	4.7	83.2%
<b><u>Computers</u></b>	<b><u>1.44</u></b>						
Desktop computer	1.03	42	262.3	68.9	2.4	11.2	96.3%
Laptop computer	0.40	17	113.0	29.7	0.7	10.4	97.1%

Device	Avg. # per home	# metered	Avg. kWh/yr	Avg. active watts	Avg. standby watts	Avg. hrs/day active	Active mode % of kWh
<b>Computer peripherals</b>	<b>3.76</b>						
Monitor	1.03	43	52.2	43.3	1.2	5.3	84.3%
Access point	0.01	1	12.1	1.4		24.0	100.0%
Cable modem	0.05	0					
DSL modem	0.14	5	31.3	4.2	0.1	23.9	99.9%
Hub	0.02	0					
Modem	0.31	12	36.6	5.3	1.5	20.9	95.4%
Router	0.23	8	30.4	4.3		24.0	100.0%
Satellite Internet box	0.05	1	40.0	4.6		24.0	100.0%
Unknown	0.03	0					
Usb hub	0.01	0					
Wireless Booster	0.02	0					
Wireless internet receiver	0.09	3	33.2	4.7	0.9	23.9	99.9%
Wireless router	0.21	5	36.0	4.3	1.8	24.0	100.0%
Printer	1.19	45	40.3	12.5	4.3	0.9	8.5%
External hard drive	0.06	2	17.4	1.2		24.0	100.0%
Print server	0.01	1	47.7	5.4		24.0	100.0%
Scanner	0.10	3	0.8	10.0	1.5	0.4	48.1%
Speakers	0.18	6	35.4	4.3		24.0	100.0%
UPS	0.01	0					
Usb hub	0.01	0					
<b>Audio</b>	<b>3.69</b>						
Compact stereo	0.58	15	64.0	31.6	4.3	6.8	64.5%
Receiver	0.61	19	36.0	40.3	0.8	2.5	84.7%
Radio	0.76	13	9.2	4.3	1.6	1.7	22.4%
Weather radio	0.04	1	14.0	1.6		24.0	100.0%
CD player	0.45	13	17.7	13.2	1.6	1.8	18.2%
DVD/CD player	0.02	0					
Amplifier	0.03	2	3.0	75.9	0.0	0.3	98.0%
Audio interface	0.02	1	4.4	9.7	0.0	5.0	99.8%
Boombox	0.11	3	27.4	5.1	2.5	5.4	32.3%
Cassette tape deck	0.21	4	14.9	75.9	0.0	0.3	98.0%
Home theater system	0.04	1	0.5	21.5	0.0	0.1	98.8%
Ipod dock	0.12	0					
Jukebox	0.02	1	35.4				
Karaoke machine	0.05	1	14.8				
Phono Preamp	0.01	1	20.4				
Sound machine	0.02	1	6.5				
Sound system	0.02	1	45.4	96.2	0.0	1.3	98.2%
Speakers	0.32	9	14.6	3.4	0.4	18.7	94.0%
Stereo/cube	0.04	1	167.8				
Subwoofer	0.11	5	57.7	9.5	5.9	2.5	19.4%
Turntable	0.05	2	0.0	32.6	0.0	0.1	85.3%

Device	Avg. # per home	# metered	Avg. kWh/yr	Avg. active watts	Avg. standby watts	Avg. hrs/day active	Active mode % of kWh
White noise machine	0.01	0					
Wireless headphones	0.05	0					
<b>Telephone</b>	<b>2.96</b>						
Cordless phone base station	1.18	9	12.1	1.9	0.5	19.3	94.6%
Charger, phone handset	1.07	7	11.6	2.3	1.1	20.0	82.4%
Answering machine	0.04	1	14.4	1.6		24.0	100.0%
Caller ID unit	0.02	0					
Charger, blackberry	0.01	0					
Charger, bluetooth	0.01	0					
Charger, cell phone	0.47	4	1.1	4.0	0.1	0.3	19.8%
Charger, pager	0.01	0					
Fax machine	0.01	1	45.6	6.5	5.2	0.4	2.0%
Phone router	<0.01	0					
Telephone	0.09	1	1.7				
VOIP modem	0.04	1	36.1	4.1		24.0	100.0%
<b>Plug-in HVAC</b>	<b>3.14</b>						
Space heater	0.82	8	313.9	1319.8	0.6	1.6	95.4%
Dehumidifier	0.45	14	456.9	449.3	3.2	5.7	85.9%
Air conditioner	0.36	2	100.4	572.7	0.0	2.4	98.9%
Fan	1.05	14	22.0	45.8	0.2	9.4	99.1%
Humidifier	0.18	4	85.2	33.9	0.0	12.9	99.7%
Air cleaner	0.20	4	54.7	4.2	0.0	23.7	100.0%
Auxiliary pump	0.01	0					
Condensate pump	0.02	0					
Propane meter	0.02	0					
Radon fan	0.02	0					
<b>Kitchen appliances</b>	<b>2.83</b>						
Coffeemaker	0.76	7	159.9	331.6	1.6	5.6	75.5%
Microwave	0.67	7	38.6	758.8	1.9	0.2	38.9%
Blender	0.13	0					
Can opener	0.09	0					
Coffee grinder	0.07	1	0.6	26.9	0.0	0.0	26.9%
Countertop oven	0.08	2	47.2	1151.0	0.0	0.1	88.6%
Espresso machine	0.02	0					
Juicer	0.02	0					
Mixer	0.16	1	11.3				
Shrink wrapper	0.01	0					
Slow cooker	0.01	1	160.4				
Toaster	0.65	2	32.4				
Toaster oven	0.17	1	53.9	1051.0	0.0	0.1	71.2%

Device	Avg. # per home	# metered	Avg. kWh/yr	Avg. active watts	Avg. standby watts	Avg. hrs/day active	Active mode % of kWh
<b>Utility/</b>	<b>3.57</b>						
<b>Household</b>							
Baby monitor	0.20	4	4.4	0.6	0.0	23.3	100.0%
CO detector	0.23	0					
Doorbell	0.01	0					
Garage door opener	0.22	0					
Intercom	0.03	0					
Lawn sprinkler controller	0.01	1	32.0	10.6	3.7	0.0	0.1%
Security system	0.02	0					
Sump pump	0.11	0					
Sump pump backup system	0.01	0					
Swimming pool pump	0.04	0					
Water softener	0.30	4	13.1	4.4	1.5	0.1	1.5%
Broom	0.02	1	38.0				
Central vacuum	0.04	1	30.7	1414.6	1.7	0.0	36.2%
Iron	0.17	1	30.6				
Sewing machine	0.31	5	0.9	13.3	0.1	0.1	39.1%
Shoe dryer	0.01	1	714.3				
Vacuum	0.16	3	55.1	542.4	0.0	0.1	60.5%
Alarm clock	0.37	1	1.8	0.2		24.0	100.0%
Clock	0.21	1	8.3	1.0		24.0	100.0%
Clock radio	1.09	5	17.8	2.1	1.0	21.1	94.0%
<b>Other Chargers</b>	<b>0.83</b>						
Charger, battery	0.31	6	16.2	7.4	2.6	1.0	12.8%
Charger, blackberry	0.01	1	0.1	4.0	0.0	0.1	96.3%
Charger, camcorder	0.01	0					
Charger, camera	0.07	2	11.4	2.0		24.0	100.0%
Charger, flashlight	0.06	1	39.5				
Charger, ipod	0.02	0					
Charger, lawnmower	0.03	1	8.3	1.7	0.9	1.0	7.2%
Charger, mini-vac	0.02	0					
Charger, tool	0.18	7	37.6	12.9	4.2	0.2	2.2%
Charger, trouble-light	0.04	0					
Charger, vacuum	0.03	2	28.5				
Charger, walkie talkie	0.01	1	5.8				
Charger, wii	0.04	1	0.3	2.9	0.0	0.3	89.7%
<b>Other</b>	<b>3.00</b>						
Adding machine	0.07	0					
Air compressor	0.15	1	96.5				
Aquarium equipment	0.10	3	152.6	23.8	0.0	17.9	99.9%

Device	Avg. # per home	# metered	Avg. kWh/yr	Avg. active watts	Avg. standby watts	Avg. hrs/day active	Active mode % of kWh
Baby wipe warmer	0.01	0					
Bed, "Sleep Number"	0.07	1	6.7				
Bench grinder	0.02	0					
Blanket	0.12	0					
Blood pressure monitor	0.02	0					
Breast pump	0.01	0					
Curling iron	0.11	1	2.4	92.8	0.2	0.0	37.4%
Dart board	0.01	1	35.9	5.7	0.2	17.1	98.5%
Decorative table	0.02	1	13.5	60.3	1.4	0.1	8.5%
Desiccant device	0.04	0					
Digital photo frame	0.17	4	6.5	3.1	0.0	13.1	100.0%
Disco ball light	0.01	0					
Elliptical machine	0.03	1	0.1	1.5	0.0	0.1	91.7%
Fountain	0.08	1	16.4	12.7	0.2	3.1	89.4%
Guitar amp	0.07	0					
Hair dryer	0.08	1	3.5	172.8	0.0	0.1	100.0%
Hair straightener	0.01	1	0.5	20.9	0.0	0.1	88.1%
Heat lamp	0.04	1	1309.4	504.3	0.0	7.1	99.7%
Heating pad	0.02	1	8.1	55.0	0.2	0.3	47.1%
Hole punch	0.01	1	4.7				
Lava lamp	0.12	0					
Lawn mower	0.06	1	1.4	5.9	0.0	0.6	92.6%
Mattress pad	0.04	1	44.2				
Moving picture	0.04	0					
Organ	0.02	1	0.0				
Pencil Sharpener	0.10	2	4.4	8.3	0.0	2.5	100.0%
Piano	0.06	2	0.1	16.2	0.0	0.1	93.2%
Plant growlights	0.01	1	164.7	36.3	0.0	12.4	99.9%
Plug-in scent	0.08	1	8.3				
Power tools, various	0.22	0					
Razor	0.03	0					
Sander	0.02	0					
Saw	0.06	0					
Scoreboard	0.02	0					
Shaver	0.02	0					
Shredder	0.41	8	6.1	904.7	0.2	1.4	74.7%
Sofa	0.01	0					
Stairlift	0.04	1	19.2	25.9	2.0	0.2	8.2%
Stapler	0.01	0					
Toothbrush	0.18	1	10.0				
Toy aquarium	<0.01	0					
Treadmill	0.12	4	56.5	307.0	5.6	0.1	16.5%
Trimmer	0.02	0					
Video tape rewinder	0.01	1	5.5				

Device	Avg. # per home	# metered	Avg. kWh/yr	Avg. active watts	Avg. standby watts	Avg. hrs/day active	Active mode % of kWh
Water pick	0.04	0					

## **APPENDIX D — IMPUTATION AND CONFIDENCE INTERVALS**

### **IMPUTATION OF USAGE**

Despite having more than 200 meters at our disposal, we could not meter all devices in the dozen or so homes encountered in each round of the study. We therefore developed an imputation procedure to estimate the electricity use and savings opportunities associated with devices that we inventoried during the initial walk-throughs but did not subsequently meter.

We used a procedure akin to hot-deck imputation to match unmetered devices with similar metered devices, and assign the metering results from the matched metered device to the unmetered device. The matching was hierarchical, according to the following criteria (which are explained in more detail below):

- Category of device
- Device description / type
- Device size (applies to televisions only)
- Device location or usage level (for televisions and computers)
- Household demographic group

In other words, for each device for which we wish to impute usage, we first look for other metered devices that match all of the criteria above. If more than one such device is found, we randomly sample one of these. If one matching device is found, we use it as a match. If no matching devices are found, we drop the bottom matching criterion, and repeat the process.

Additional details about the various levels of matching criteria are as follows.

### **CATEGORY OF DEVICE**

We classified all devices into 21 categories:

- audio
- chargers
- clock
- computer
- computer peripherals
- exercise

- gaming
- grooming
- household
- HVAC
- kitchen
- musical
- networking
- office
- sleeping
- telephone
- tools
- TV
- TV peripherals
- utility
- other

#### **DEVICE DESCRIPTION, TYPE AND SIZE**

We listed 184 unique device descriptions among the 1,653 devices that we recorded. Examples are “DVD player,” “printer” and “coffeemaker.” For televisions, computer monitors and gaming systems, we further assigned devices to sub-types (e.g. LCD and CRT computer monitors). We further sub-divided televisions into four size categories:

- 17 inches or less
- 18-24 inches
- 25-31 inches
- 32 inches or more

### **Device Location or Self-Reported Usage Level**

For televisions and computers, we made use of the mail survey data (where it could be matched with our on-site device inventories) to match on usage level or location within the home. We classified televisions according to approximate quartiles of self-reported hours used per week:

- 5 or fewer hours per week
- 6-15 hours per week
- 16-28 hours per week
- 29 or more hours per week

If we were lacking self-reported hours-of-use, we used a secondary criterion of matching by location: bedroom, kitchen and other.

Similarly, we classified computers as low or high self-reported usage depending on whether the survey respondent indicated the computer was used for 10+ hours per day or fewer than 10 hours per day.

### **Household Demographic Group**

We used the four demographic groups described in Table 9 in Appendix A, though we excluded clocks, telephones, computer networking equipment, and set-top boxes from this matching, given that usage for these devices typically does not vary much by household.

### **Assigned usage**

We felt that some idiosyncratic devices that could only be matched at the very top level (device category) were not well-estimated by any matching procedure. For example, we encountered a single blood-pressure monitor in the study that was assigned to the “other” category, which also contained devices such as aquarium pumps, digital photo frames, and a disco ball light. For devices such as this, we assigned typical usage using our best judgment. Fortunately only 76 devices representing about 3.5 percent of total estimated electricity use fell into this category.

The table below summarizes these imputation results.

**TABLE 16, SUMMARY OF USAGE IMPUTATION.**

	Percent of devices (n=1,653)	Percent of estimated annual kWh
Metered Usage	42.4%	58.7%
Imputed Usage		
Matched at highest level (5 criteria)	37.6%	27.6%
Matched on 4 criteria	11.2%	8.3%
Matched on 3 criteria	0.8%	0.5%
Matched on 2 criteria	2.7%	0.8%
Matched at lowest level (device category)	0.7%	0.6%
Not matched; usage assigned	4.6%	3.5%
All imputed devices	57.6%	41.3%

**IMPUTATION OF SAVINGS OPPORTUNITIES**

Imputing savings opportunities among unmetered devices followed a similar procedure to imputing electricity usage. In fact, in most cases, the imputation of savings opportunities flowed directly from the usage imputation procedure: if the usage imputation procedure resulted in matching an unmetered device with a metered device that had a technical savings opportunity associated with it, we assigned the same savings opportunity to the unmetered device. Thus savings opportunities were generally extrapolated to unmetered devices at about the same rate that they occurred among metered devices.

Smart power strips presented a more complicated situation, since the savings here are dependent on the type and number of attached peripherals. To impute smart power strip opportunities among unmetered devices, we first compiled a list of all TV, computer and audio centers with a primary device and one or more peripherals that could potentially be controlled by a smart power strip. We then calculated the incidence rate of smart power strip opportunities among metered centers (by type of center), and randomly imputed opportunities among unmetered centers at the same incidence rate. We then randomly assigned a metered-center opportunity to each imputed unmetered opportunity (by type of center and number of attached peripherals), and applied the percentage savings from the former to the imputed usage for the latter to get an imputed annual kWh savings estimate for the unmetered center.

The behavioral adjustments to technical savings tend to be more associated with the household than the device. To assign behavioral probabilities to imputed savings opportunities, we used the following hierarchy: (1) use the behavioral probabilities for the same type of opportunity in the same home if any; otherwise, (2) use the overall behavioral probability from all opportunities for the same home; otherwise, (3) use the overall average behavioral probability for the type of opportunity across all households.

### **CALCULATION OF STATISTICAL UNCERTAINTY**

We used a bootstrap procedure to estimate the uncertainty in our estimates of usage and savings from two key sources: (1) sampling uncertainty inherent in the 50-household on-site sample; and, (2) uncertainty from the imputation procedure described above. The procedure begins by re-sampling (with replacement) 50 households from the 50-household study group. The purpose of this step is to empirically simulate the sample-to-sample variation that we would see if we repeated the study many times with 50-household samples.<sup>33</sup> For each re-sampled iteration, we then implemented the imputation procedures above for usage and savings opportunities. After iterating many times (we repeated the process 1,000 times), we can examine the distribution of estimated usage or savings, and use these to gauge the uncertainty arising from these two sources of error.

Note that while this procedure accounts for two major sources of uncertainty in the study, it does not account for other sources, such as uncertainty in extrapolating from monthly electricity usage to annual, or uncertainty in our estimated behavioral probabilities.

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<sup>33</sup> To maintain demographic balance, we implemented the re-sampling within the four demographic groups outlined in Appendix A, and re-calculated case weights with each iteration.

## APPENDIX E — TELEPHONE SURVEY INSTRUMENT

(This version of the instrument includes minor adjustments made after early rounds.)

Hello, my name is \_\_\_\_\_ from The Blackstone Group, a Midwestern research firm. We are working on a study funded by the Minnesota Department of Commerce on a couple of important issues that affect Minnesota. I'm not selling anything; I'd just like to talk with an adult member of your household and get their input on some important issues. All responses are completely confidential. Are you 18 years or older?

- 1 Yes
- 2 No → May I speak with an adult member of the household? Repeat introduction if necessary.

(IF ASKED) This will take about 10 minutes.

QA) Did I reach you at your primary residence?

- 1) YES
- 2) NO / VACATION HOME ==> TERMINATE
- 8) DON'T KNOW ==> TERMINATE
- 9) REFUSED ==> TERMINATE

Q1) First, I have a couple of questions about your household. Do you own or rent this residence?

- 1) OWN / BUYING
- 2) RENT / LEASE
- 3) OTHER ==>TERMINATE
- 8) DON'T KNOW ==> TERMINATE
- 9) REFUSED ==> TERMINATE

Q2) Including yourself, how many people live in your household who are: [ALLOW RANGE 0-10]

- a) Below the age of 18 [RECORD WHOLE NUMBER]
- b) Between 18 and 64 [RECORD WHOLE NUMBER]
- c) 65 or more [RECORD WHOLE NUMBER]

Q2D) And in which of the following ranges does your age fall? [CHECK QUOTAS]

- a) Below the age of 18 ==> TERMINATE
- b) 18 to 34
- c) 35 to 64
- d) 65 and above
- 9) REFUSED ==> TERMINATE

Q3) Next, I am going to read a list of issues. Please indicate whether you are not at all concerned, slightly concerned, somewhat concerned, or very concerned about each issue. How concerned are you about...

[ROTATE]

- a) The economy
- b) National security
- c) Climate change
- d) Health care
- e) The environment
- f) Energy
- g) Education
- h) Immigration
- i) Crime

- 1) Not at all concerned
- 2) Slightly concerned
- 3) Somewhat concerned
- 4) Very concerned
- 8) DON'T KNOW
- 9) REFUSED

Q4) There has been much news about the economy lately. Would you describe your own household's economic condition as better than a year ago, about the same, or worse?

- 1) Better
- 2) Same
- 3) Worse
- 8) DON'T KNOW
- 9) REFUSED

Q5) How does the amount you are spending for the following compare to a year ago? Are you spending a lot more, a little more, the same, a little less, or a lot less on...

[ROTATE]

- a) Food
- b) Housing costs
- c) Health care, including health insurance
- d) Transportation, including gasoline
- e) Energy used in your home

- 1) A lot more
- 2) A little more
- 3) Same
- 4) A little less
- 5) A lot less
- 8) DON'T KNOW
- 9) REFUSED

Q6) Next, I want to ask about how easy or difficult it would be to reduce your household's expenses in each of these areas. Do you think you could reduce expenses for ... easily, with some minor adjustments, with some major adjustments, or not at all?

[ROTATE – SAME ORDER AS Q5]

- a) Food
- b) Housing costs
- c) Health care
- d) Transportation
- e) Energy used in your home

- 1) Easily
- 2) Minor adjustments
- 3) Major adjustments
- 4) Not at all
- 8) DON'T KNOW
- 9) REFUSED

Q7) Have you done anything already to try to reduce your costs in any of these areas in the past year?

- 1) Yes
- 2) No ==> SKIP TO Q10
- 8) DON'T KNOW ==> SKIP TO Q10
- 9) REFUSED ==> SKIP TO Q10

Q8) Which costs have you tried to reduce? [MULTIPLE RESPONSE; READ LIST IF NEEDED]

- 1) Food
- 2) Housing
- 3) Health care
- 4) Transportation
- 5) Energy in the home

[IF Q8-5 (energy in the home) NOT mentioned ==> SKIP TO Q10]

Q9) In a sentence or so, can you describe the main thing or things you have done to reduce your costs in these areas? [RECORD VERBATIM. PROBE AND CLARIFY.]

Q10) Do you take any personal actions to try to protect the environment?

- 1) Yes
- 2) No ==> SKIP TO Q11b
- 8) DON'T KNOW ==> SKIP TO Q11b
- 9) REFUSED ==> SKIP TO Q11b

Q11) What kinds of things do you do? [DO NOT READ. RECORD FIRST THREE MENTIONS.]

- 1) BUY/USE RENEWABLE ENERGY
- 2) PURCHASE DECISIONS (BUY LESS, WATCH PACKAGING, BUY LOCAL, ETC.)
- 3) RECYCLE
- 4) REDUCE ENERGY USE – GENERAL
- 5) REDUCE ENERGY USE IN THE HOME (TURN THINGS OFF, MORE EFFICIENT LIGHTS/APPLIANCES, TURN THERMOSTAT UP/DOWN, ETC.)
- 6) REDUCE TRANSPORTATION ENERGY (CARPOOL, DRIVE LESS, WALK/BIKE MORE, FUEL EFFICIENT CAR)
- 7) STAY INFORMED
- 8) SUPPORT ENVIRONMENTAL ORGANIZATIONS
- 9) TALK ABOUT ISSUES / POLITICAL ACTION (VOTE, WRITE TO ELECTED OFFICIALS, ETC.)
- 10) OTHER [SPECIFY] \_\_\_\_\_
- 98) DON'T KNOW
- 99) REFUSED

Q11b) How many refrigerators do you have in your home? [RECORD]

\_\_\_\_\_

Q11c) How many stand-alone freezers do you have? [RECORD]

\_\_\_\_\_

Q12) How many desktop computers would you say get used in your home in a typical week? [RECORD RESPONSE]

- \_\_\_\_\_
- 98) DON'T KNOW
  - 99) REFUSED

Q13) How many laptops would you say get used in your home in a typical week? [RECORD RESPONSE]

- \_\_\_\_\_
- 98) DON'T KNOW
  - 99) REFUSED

[IF Q12=0 AND Q13=0 ==> SKIP TO Q15]

Q14) On a typical weekday, about how many hours is there a computer on in your home?

- 1) 3 hours or less
- 2) 4 – 7 hours
- 3) 8 – 12 hours
- 4) More than 12 hours
- 5) OTHER – RECORD \_\_\_\_\_
- 8) DON'T KNOW
- 9) REFUSED

Q15) Do you have an Internet connection in the home?

- 1) Yes
- 2) No ==> SKIP TO Q17
- 8) DON'T KNOW ==> SKIP TO Q17
- 9) REFUSED ==> SKIP TO Q17

Q16) What kind of Internet connection is this? [READ IF NECESSARY. PICK THE PRIMARY CONNECTION IF THERE IS MORE THAN ONE IN THE HOUSE.]

- 1) Dial-up
- 2) DSL
- 3) Cable
- 4) Other
- 8) DON'T KNOW
- 9) REFUSED

Q17) How many television sets do you have in your home? [RECORD RESPONSE]

- 8) DON'T KNOW
- 9) REFUSED

[IF Q17 = 0 ==> SKIP TO Q24]

Q18) Do you have a gaming system, such as Playstation, Xbox, Wii, or something similar?

- 1) Yes
- 2) No
- 8) DON'T KNOW
- 9) REFUSED

[IF Q17 = DK / REF ==> SKIP TO Q24]

Q19) Do you subscribe to cable television?

- 1) Yes
- 2) No
- 8) DON'T KNOW
- 9) REFUSED

Q20) Do you subscribe to satellite television?

- 1) Yes
- 2) No
- 8) DON'T KNOW
- 9) REFUSED

THERE IS NO Q21.

Q22) Do you have a digital converter box that allows you to receive local digital television transmissions off the air using an antenna and view them on an analog television set?

- 1) Yes
- 2) No
- 8) DON'T KNOW
- 9) REFUSED

Q23) On a typical weekday, about how many hours would you say there is a television set on in your house? Please include all uses of televisions, including watching broadcast TV, watching movies, playing video games, or just having a set on in the background.

- 1) 0 – 3 hours
- 2) 4 – 7 hours
- 3) 8 – 12 hours
- 4) More than 12 hours
- 8) DON'T KNOW
- 9) REFUSED

Q24) Do you know about how much you paid for electricity last month?

- 1) Yes
- 2) No ==> SKIP TO Q26
- 9) REFUSED ==> SKIP TO Q28

Q25) About how much was it? [RECORD]

\_\_\_\_\_

Q26) What share of your typical monthly costs for electricity do you think goes to running your computers, televisions, and related equipment like printers, DVDs, gaming systems, and so forth? [IF RESPONDENT HESITATES, SELECT DON'T KNOW AND MOVE TO FOLLOW-UP QUESTION]

RECORD (INDICATE WHETHER % OR \$): \_\_\_\_\_ ==> SKIP TO Q28

- 8) DON'T KNOW
- 9) REFUSED

Q27) Do you think it is closest to 1 percent, 5 percent, 10 percent, 25 percent, or 50 percent?

- 1) 1 percent
- 2) 5 percent
- 3) 10 percent
- 4) 25 percent
- 5) 50 percent
- 8) DON'T KNOW
- 9) REFUSED

Q28) Next, I will read some statements. For each one, please tell me whether you strongly agree, agree, disagree, or strongly disagree with the statement.

When we [IF Q2A+Q2B+Q2C=1, USE ALTERNATE WORDING: I] get a new electronic device, I usually need someone else to set it up or show me how to use it.

- 1) Strongly agree
- 2) Agree
- 3) NEITHER AGREE NOR DISAGREE
- 4) Disagree ==> SKIP TO Q30
- 5) Strongly disagree ==> SKIP TO Q30
- 8) DON'T KNOW
- 9) REFUSED

[IF Q2A+Q2B+Q2C = 1 ==> SKIP TO Q30]

Q29) Someone in the household can usually get new electronic devices set up and working the way we want fairly easily.

- 1) Strongly agree
- 2) Agree
- 3) NEITHER AGREE NOR DISAGREE
- 4) Disagree
- 5) Strongly disagree
- 8) DON'T KNOW
- 9) REFUSED

Q30) Overall, computers and technology in our homes give us more control over our lives than we would have without those things.

- 1) Strongly agree
- 2) Agree
- 3) NEITHER AGREE NOR DISAGREE
- 4) Disagree
- 5) Strongly disagree
- 8) DON'T KNOW
- 9) REFUSED

Q31) It would be hard to live with fewer electronic gadgets.

- 1) Strongly agree

- 2) Agree
- 3) NEITHER AGREE NOR DISAGREE
- 4) Disagree
- 5) Strongly disagree
- 8) DON'T KNOW
- 9) REFUSED

Q32) We would like to send you an appliance-related survey in the mail. The survey will ask for a more details about appliances you have plugged in in your house and how you use them. This will help the State of Minnesota and the state's utilities better serve customers. If you mail back the completed survey, we will send you a \$10 Visa gift card. May we send you the survey?

- 1) Yes
- 2) No

[IF Q1 <> 1 AND Q32 = 2 ==> SKIP TO Q40]  
[IF Q1 <> 1 AND Q32 <> 2 ==> SKIP TO Q34]

Q33) We are also looking for households for an in-home study of how much electricity various appliances use. Households selected for this study will receive a \$100 Visa gift card. Participating households will have small portable meters plugged into various appliances for a month and participate in an interview. Would you be willing to participate in this study if the research team needs additional households in your part of the state?

[IF ASKED: The meters are about the size of a hard-cover book. We will install 15 to 20 per household. The installation and removal time will be about 2 hours each.]

- 1) Yes
- 2) No
- 3) NEED MORE INFORMATION; HAVE A RESEARCH TEAM MEMBER CALL [DO NOT PROMISE THAT WE WILL CALL, BUT SAY YOU WILL CHECK WHETHER SOMEONE FROM THE RESEARCH TEAM CAN CALL THEM]

[IF Q32 = 2 AND Q33 = 2 ==> SKIP TO Q40]  
[IF Q33=3 AND Q32 <>1 ==> SKIP TO Q36]

Q34) GET & RECORD NAME. VERIFY SPELLING!

Q35) GET & RECORD MAILING ADDRESS. VERIFY SPELLING!

[IF Q33 = 2 ==> SKIP TO Q38]

Q36) Is this the best telephone number to reach you if needed?

- 1) Yes ==> SKIP TO Q38
- 2) No
- 3) OFFERING AN ADDITIONAL NUMBER

Q37) What would be a good telephone number to reach you? [RECORD]

[IF Q32 = 1 AND Q33<>1]

Q38) Thank you. Our research team will send you the appliance survey in the next few weeks. Look for an envelope labeled "Minnesota Appliance Survey."

1) CONTINUE ==> SKIP TO Q40

[IF Q33=1 AND Q32<>1]

Q39) Thank you. Our research team will contact you within the next few months about this study.

1) CONTINUE ==> SKIP TO Q40

[IF Q32=1 AND Q33=1]

Q39b) Thank you. Our research team will send you the appliance survey in the next few weeks. Look for an envelope labeled "Minnesota Appliance Survey." We would also contact you [insert approximate timeframe] if needed for the in-home part of the study.

Q40) I have just a few more questions for classification purposes. What company provides your electricity?

- 1) ALLIANT ENERGY
- 2) ANOKA ELECTRIC COOP
- 3) DAKOTA ELECTRIC ASSOCIATION
- 4) MINNESOTA POWER (ALLETE)
- 5) OTTER TAIL POWER
- 6) XCEL ENERGY (NORTHERN STATES POWER, NSP)
- 7) OTHER (SPECIFY) \_\_\_\_\_
- 8) DON'T KNOW
- 9) REFUSE

Q41) Is your home a...?

- 1) Single-family home ==> SKIP TO Q43
- 2) Row or townhouse ==> SKIP TO Q43
- 3) A unit in a multi-family structure
- 4) A mobile home or house trailer ==> SKIP TO Q43
- 5) Something else ==> SKIP TO Q43
- 8) DON'T KNOW ==> SKIP TO Q43
- 9) REFUSED ==> SKIP TO Q43

Q42) How many units are there in this building?

- 1) 2
- 2) 3-4
- 3) 5-9
- 4) 10-19
- 5) 20-49
- 6) 50 or more
- 8) DON'T KNOW
- 9) REFUSED

Q43) How many bedrooms does your home have?

- 8) DON'T KNOW
- 9) REFUSED

Q44) What year were you born? [ENTER LAST TWO DIGITS OF YEAR]

- 99) REFUSED

Q45) What is the highest level of education you have completed? [READ LIST.]

- 1) Some high school or less
- 2) High school graduate
- 3) Some technical school or college
- 4) Technical school graduate (Associates degree)
- 5) College graduate (Bachelors degree)
- 6) Advanced degree (Masters degree or higher)
- 8) DON'T KNOW
- 9) REFUSED

Q46) Which of the following income categories best describes your total annual household income in 2007, before taxes? Please stop me when I get to the right category. [READ LIST.]

- 1) Less than \$25,000
- 2) \$25,000 to less than \$50,000
- 3) \$50,000 to less than \$75,000
- 4) \$75,000 to less than \$100,000
- 5) \$100,000 or more
- 8) DON'T KNOW
- 9) REFUSED

Q47) [RECORD GENDER]

- 1) Male
- 2) Female
- 3) Not sure

[THANK AND END INTERVIEW]

## **APPENDIX F — APPLIANCE SURVEY INSTRUMENT**

The appliance saturation survey was formatted as a 12-page booklet. The attached version includes minor changes made after the first round of data collection.

# Minnesota Appliance Survey



Respondent # \_\_\_\_\_

Thank you for agreeing to complete this survey about Minnesotan household appliances. Please return this booklet in the self-addressed, stamped envelope when completed. We will send you a \$10 Visa gift card if we receive your survey **before [insert date]**.

Your responses are confidential. We will not share any household-specific data or personal information provided in your survey with anyone outside our research team.

**1. How long have you lived at this residence?**

- less than 1 year
- 1 – 2 years
- 3 – 5 years
- 6 – 10 years
- more than 10 years

**2. How large is your home?** \_\_\_\_\_ finished square feet

**3. Do you maintain a home office for any of the following purposes?** *(Check all that apply.)*

- no home office
- home-based business
- work from home as part of a job

## Televisions

**4. Which of the following best describes your *primary* television set?** *(If you do not have any television sets in your home, check here  and skip to question 15a.)*

traditional television set



flat-screen television



==> Is it a ...?

- plasma TV
- LCD TV
- rear-projection TV
- other
- don't know

other ==> Please describe:

5. What is your primary TV's screen size? (Please approximate if you don't know.)

- 20 inches or less
- 21 – 30 inches
- 31 – 40 inches
- 41 – 50 inches
- more than 50 inches

6. What shape is this TV's screen?

- |       |
|-------|
| 4 x 3 |
|-------|
- |        |
|--------|
| 16 x 9 |
|--------|

7. How does this television set receive broadcast signals? (Please check all that apply and answer the questions to the right of the applicable pictures.)

cable

satellite

local broadcasts



- with a digital converter box
- no digital converter box

8. Please check any of the following that apply to this TV.

- high-definition (HD) capable
- built-in digital video recorder (DVR)
- built-in digital video player (DVD)
- built-in video cassette recorder (VCR)
- have adjusted brightness or other picture settings since purchase
- have had unit professionally calibrated since purchase

9. About how many hours per week is this TV turned on? (max: 168 hours): \_\_\_\_\_

**10. Into what kind of AC power source do you keep this TV plugged in?**

- |  |                                  |                                      |
|--|----------------------------------|--------------------------------------|
| <input type="radio"/> wall outlet =====> | Is it plugged in...?             | <input type="radio"/> always         |
|  |                                  | <input type="radio"/> usually        |
|  |                                  | <input type="radio"/> only when used |
| <input type="radio"/> power strip =====> | Is the power strip turned on...? | <input type="radio"/> always         |
|  |                                  | <input type="radio"/> usually        |
|  |                                  | <input type="radio"/> only when used |
| <input type="radio"/> other              |                                  |                                      |

**11. Would a power outage cause you to lose any settings in your primary TV that require user intervention or reprogramming?** *(Answer no if you lose only settings you don't use, such as a clock you don't set anyway.)*

- yes
- no
- don't know

**12. What other devices are connected to your primary TV?** *(Please count any single device only once in the table below.)*

	connected to TV	requires user intervention after power failure
<i>Please check if applicable.</i>		
Set-top boxes for cable, satellite, and digital conversion		
cable <i>with recording capability</i>	<input type="checkbox"/>	<input type="checkbox"/>
cable <i>without recording capability</i>	<input type="checkbox"/>	<input type="checkbox"/>
satellite <i>with recording capability</i>	<input type="checkbox"/>	<input type="checkbox"/>
satellite <i>without recording capability</i>	<input type="checkbox"/>	<input type="checkbox"/>
digital converter box for broadcast TV	<input type="checkbox"/>	<input type="checkbox"/>
<i>Please indicate number of each.</i>		
Other devices		
TiVo, DVR, or other digital recording device	_____	_____
VCR	_____	_____
DVD player	_____	_____
gaming system	_____	_____
separate audio system (surround-sound, stereo)	_____	_____
other – please describe:	_____	_____

**13. Please answer the following questions about any *additional* television sets in your home.**  
*(If you have more than four additional television sets, please answer for the four most-used sets.*  
*If you do not have any additional television sets, please check here ○ and skip to question 14.)*

	TV #2	TV #3	TV #4	TV #5
<b>a) What kind of TV is this?</b>				
traditional TV .....	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
flat-screen TV	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
plasma	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
LCD	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
rear-projection	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
other/don't know	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
other .....	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
don't know .....	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
<b>b) What is the TV's screen size?</b>				
20 inches or less	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
21 – 30 inches	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
31 – 40 inches	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
41 – 50 inches	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
more than 50 inches	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
<b>c) What shape is this TV's screen?</b>				
<input type="checkbox"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
<input type="checkbox"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
<b>d) Is this TV high definition (HD) capable? <i>(Please mark the circle if it is.)</i></b>				
	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
<b>e) During a typical week, how many hours is this TV turned on? <i>(A week has 168 hours.)</i></b>				
	_____	_____	_____	_____
<b>f) Are any set-top boxes connected to this TV?</b>				
cable	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
satellite	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
digital converter box for broadcast TV	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<b>g) How many of the following devices are connected to this TV? <i>(Please count any single device only once.)</i></b>				
VCR	_____	_____	_____	_____
DVD player	_____	_____	_____	_____
gaming system	_____	_____	_____	_____
other	_____	_____	_____	_____

## Gaming Systems

14. Please complete the table below for your gaming system(s). (If you do not have any gaming systems, check here  and skip to question 15a.)

		Number of Systems	Hours turned on per week (max 168)
Sony PlayStation	PS1	_____	_____
	PS2	_____	_____
	PS3	_____	_____
Nintendo	64	_____	_____
	Game Cube	_____	_____
	Wii	_____	_____
Microsoft	Xbox	_____	_____
	Xbox 360	_____	_____
Other		_____	_____

## Audio Entertainment

15a. Do you have any multi-component audio systems? (Please include only systems with two or more separate devices. We will ask about all-in-one stereo systems in a subsequent question.)

- yes ==> How many? \_\_\_\_\_  
 no ==> Skip to question 16.

15b. Please complete the table below for your multi-component audio systems. (If you have more than three, please answer for the most commonly used three systems.)

	Audio System		
	#1	#2	#3
tuner / receiver	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
amplifier	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
mixer	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
CD player	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
cassette player	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
turntable	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
speakers with their own AC power	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
connected to a TV / video system	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
connected to a computer	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

16. How many of the following stand-alone audio devices do you usually keep plugged in?

- \_\_\_\_\_ table-top / under-cabinet radios
- \_\_\_\_\_ portable radios
- \_\_\_\_\_ boom boxes / mini-stereos
- \_\_\_\_\_ clock radios
- \_\_\_\_\_ satellite radios
- \_\_\_\_\_ Wifi / Internet radios
- \_\_\_\_\_ MP3 docking station
- \_\_\_\_\_ other radios or audio devices

### Telecommunications Devices & Internet

17. How many of the following telecommunications devices do you usually keep plugged in?

- \_\_\_\_\_ cordless telephone base
- \_\_\_\_\_ cordless telephone handset charger
- \_\_\_\_\_ answering machine (stand-alone only)
- \_\_\_\_\_ caller ID unit (stand-alone only)
- \_\_\_\_\_ fax machine (stand-alone only)
- \_\_\_\_\_ cellular telephone chargers

18. What kind of Internet connection(s) do you have in your home? (Check all that apply.)

- none ==> Skip to question 21.
- dial-up
- DSL
- cable
- other ==> please describe: \_\_\_\_\_

19. What do you usually do with your Internet connection when not actively online?

- leave Internet connection on all the time
- sometimes turn off Internet connection
- always turn off Internet connection

20. Other than computers, do any devices in your home connect to the Internet at least monthly?

- yes ==>
  - television or home theater system
  - digital video recorder (DVR) or TiVo
  - audio system
  - gaming system
  - other ==> please describe: \_\_\_\_\_
- no

## Desktop Computers

21. How many desktop computers were plugged in during the past month in your home?  
\_\_\_\_\_ (if zero, please skip to question 23)

22. Please complete the table below for your three most-used desktop computers.

	Desktop 1	Desktop 2	Desktop 3
<b>a) What operating system does it run?</b>			
Windows XP	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Windows Vista	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Windows 2000 or ME	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Mac OS or Mac OS X	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Other	_____	_____	_____
<b>b) How many monitors of each type shown below are typically used with this computer?</b>			
CRT 	_____	_____	_____
LCD 	_____	_____	_____
Other	_____	_____	_____
<b>c) How many people regularly use this computer?</b>			
	_____	_____	_____
<b>d) On a typical day, how many hours is the computer...</b>			
turned on and actively used	_____	_____	_____
left on, but not actively used	_____	_____	_____
<b>e) How do you use this computer? (Check all frequent uses.)</b>			
word processing / spreadsheets	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
e-mail / web browsing	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
audio / video streaming / telephony	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
games	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
other	_____	_____	_____
<b>f) How does this computer connect to the Internet?</b>			
Wirelessly	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
via network cable	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
via dial-up	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
not at all	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

## Notebook Computers

23. How many notebook computers were plugged in during the past month in your home?  
\_\_\_\_\_ (if zero, please skip to question 25)

24. Please complete the table below for your three most-used notebook computers.

	Notebook 1	Notebook 2	Notebook 3
<b>a) What operating system does it run?</b>			
Windows XP	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Windows Vista	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Windows 2000 or ME	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Mac OS or Mac OS X	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Other	_____	_____	_____
<b>b) How many people regularly use this notebook?</b>	_____	_____	_____
<b>c) Where is this computer operated regularly?</b>			
in a single location in the home	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
multiple locations in the home	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
in & outside the home	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
<b>d) On a typical day, how many hours is the computer...</b>			
turned on and actively used	_____	_____	_____
left on, but not actively used	_____	_____	_____
<b>e) Please check here if you regularly use an external monitor with this computer.</b>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<b>f) Where in your home do you plug this computer into an AC power source?</b>			
a single location in the home	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
multiple locations in the home	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
outside the home only	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
<b>g) Check all frequent uses for this computer.</b>			
word processing / spreadsheets	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
e-mail / web browsing	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
audio / video streaming / telephony	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
games	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
other	_____	_____	_____
<b>h) How does this computer connect to the Internet?</b>			
wirelessly	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
via network cable	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
via dial-up	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
not at all	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

## Computer Peripherals

25. Into what kind of AC power source do you keep your primary computer plugged in?

- wall outlet ==>  plugged in all the time  unplugged when not in use  
 power strip that is ==>  turned on all the time  turned off when equipment is off  
 other -- Please describe: \_\_\_\_\_

26. How many of the following computer-related devices do you have in your home?

- \_\_\_\_\_ Inkjet printer  
 \_\_\_\_\_ Deskjet printer  
 \_\_\_\_\_ Other printer  
 \_\_\_\_\_ Scanner (stand-alone, not part of a printer or other device)  
 \_\_\_\_\_ Modem  
 \_\_\_\_\_ Router / Network hub / Access Point  
 \_\_\_\_\_ External hard drive  
 \_\_\_\_\_ External computer speakers (with their own power supply)  
 \_\_\_\_\_ Uninterruptible Power Supply (UPS)  
 \_\_\_\_\_ Laptop Docking Station  
 \_\_\_\_\_ PDA cradle

27. Do you have any other computer devices that have their own AC power adapter?

- yes -- Please list:  
 no

## Major Appliances – Food

28. How many refrigerators and stand-alone freezers do you have plugged in? Please write the number on the applicable lines in the table below.

	Location			
	kitchen	other heated living space	garage	unheated basement
<b>Refrigerators</b>				
top-freezer	_____	_____	_____	_____
side-by-side	_____	_____	_____	_____
bottom freezer	_____	_____	_____	_____
mini-refrigerator	_____	_____	_____	_____
<b>Stand-alone freezers</b>				
chest freezer	_____	_____	_____	_____
upright freezer	_____	_____	_____	_____

- 29. Is your stove-top?**
- electric
  - natural gas or propane

- 30. Is your oven?**
- electric
  - natural gas or propane

## Heating, Cooling, and Related Equipment

- 31. What fuels do you use to heat your home?**
- natural gas ==> Is this a  forced air furnace,  boiler, or  something else?
  - propane ==> Is this a  forced air furnace,  boiler, or  something else?
  - electricity
  - fuel oil
  - wood
  - other: \_\_\_\_\_

- 32. What fuel does your water heater use?**
- natural gas / propane
  - electricity
  - other / don't know

- 33. Do you use portable electric space heaters during winter?**
- often
  - sometimes
  - infrequently
  - not at all

- 34. What kind(s) of fireplace(s) do you use in your home?**
- none
  - wood
  - natural gas / propane
  - electric

- 35. What kind(s) of air conditioning do you have in your home?**
- none
  - central A/C
  - room A/Cs ==> How many units? \_\_\_\_\_
  - other ==> Please describe: \_\_\_\_\_

- 36. Do you use any dehumidifiers?**
- not at all
  - part of the year ==> How many dehumidifiers? \_\_\_\_\_
  - all year ==> How many dehumidifiers? \_\_\_\_\_

37. Do you regularly use any of the following in your home? (Please check all that apply.)

- whole house fan (blows warm air out through the attic)
- heat lamp
- air cleaner ==>  part of heating system  stand-alone
- humidifier ==>  part of heating system  stand-alone
- heated waterbed ==> How many? \_\_\_\_\_
- electric blanket ==> How many? \_\_\_\_\_

## Other Appliances

38. What kind of laundry equipment do you have?

- |                                     |   |
|-------------------------------------|---|
| clothes washer                      | clothes dryer                             |
| <input type="radio"/> none          | <input type="radio"/> none                |
| <input type="radio"/> top-loading   | <input type="radio"/> electric            |
| <input type="radio"/> front-loading | <input type="radio"/> natural gas/propane |

39. Which of the following do you regularly have plugged in? (Please check all that apply.)

- chargers for cordless tools, cordless lawn mower
- medical equipment
- aquarium
- pet fence
- growing lamp

40. Which of the following have you used in your home within the past year? (Please check all that apply.)

- engine block heater
- spa/hot tub
- electric sauna

41. Do you use any compact fluorescent light bulbs in your home?

- |  |                                       |
|--|---------------------------------------|
| <input type="radio"/> yes ==> What share of your bulbs are compact fluorescents? | <input type="radio"/> less than ¼     |
| <input type="radio"/> no   | <input type="radio"/> between ¼ and ¾ |
|  | <input type="radio"/> more than ¾     |

42. Do you have any other devices that could use a substantial amount of electricity?

(e.g., water cooler, swimming pool, spa/hot tub, sauna, welding equipment, kiln, etc.)

- yes – Please list: \_\_\_\_\_
- no

43. How do you think your household's energy usage compares to ...?

- |                     | I/we use less         | about the same        | I/we use more         |
|---------------------|-----------------------|-----------------------|-----------------------|
| Your neighbors      | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| Minnesotans overall | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |

## Household Energy Usage & Demographics

44. The value of the information you have provided will be enhanced if we can also obtain information on your actual energy usage in recent months. We can obtain this information directly from your electric and/or natural gas utility, but only with your written permission below. Please choose from the two options below.

**Yes, I agree to allow my electricity provider release my energy consumption records for the confidential research purposes of this study.** *(Please complete the information below.)*

I hereby authorize my electric and/or natural gas utility to release to the Energy Center of Wisconsin monthly electric usage for the service address listed below. This authorization applies to usage beginning January 2007 and ending December 2009. I understand that the Energy Center requests this data for confidential research purposes only and that this request applies only to energy usage and not to billing or payment-related information.

Electric Utility: \_\_\_\_\_ Account Number: \_\_\_\_\_

Natural Gas Utility: \_\_\_\_\_ Account Number: \_\_\_\_\_

Service Address: [insert respondent street address]  
[insert respondent city, state, zip code]

Name of Authorizing Customer: \_\_\_\_\_

Signature: \_\_\_\_\_

Date: \_\_\_\_ / \_\_\_\_ /2009

**No, I do not wish my energy consumption records to be released for this study.**

*(optional)* Please provide your e-mail address to facilitate scheduling if your home is selected for the in-home portion of the study. (For more information, visit [www.ecw.org/mnenergystudy](http://www.ecw.org/mnenergystudy). We will not share your e-mail address or contact you for any other reason.)

e-mail address: \_\_\_\_\_

**Thank you!**

Please return your completed survey in the envelope we provided or mail it to:

Minnesota Appliance Survey  
Energy Center of Wisconsin  
455 Science Drive #200  
Madison, WI 53711

## APPENDIX F — ON-SITE INTERVIEW GUIDE

(This version of the instrument includes minor adjustments made after early interviews.)

### MN Plugging Into Savings Interview Guide

SITE \_\_\_\_\_ DATE \_\_\_\_\_ TIME \_\_\_\_\_

#### Interview Intro:

- Meters will tell us about the energy use, interview is to better understand what people are interested in & what they might do reduce use.
- Interview is key to creating services and offerings that will be useful.
- We want your candid thoughts.
- Your household responses are anonymous.

#### Interview topics

1. How concerned are you about energy? NOT, SLIGHTLY, SOMEWHAT OR VERY  
  
What is it about energy that concerns you ?
2. How closely do you pay attention to energy saving information, programs, incentives, offerings?
3. Where can local people go for help to reduce energy usage?
4. Have you done anything specific to reduce energy use in past year? (Credibility check)  
WHAT WAS IT?  
WHAT MOTIVATED YOU?  
WHERE DID IDEA TO DO IT COME FROM?
5. If you wanted to reduce further, what else could/might you do?
6. What would it take for you to try any of these things?  
example: How much in cost savings?
7. We are looking at 4 ways to help people reduce home energy use. We can:
  - Encourage energy efficient HABITS of turning things off or unplugging them when not in use.
  - PROVIDE INFORMATION on how much energy various devices use; chart of average use, or card re: use at different settings
  - Encourage people to CHANGE SETTINGS so a device works more efficiently, such as computer power management
  - Promote purchase of TECHNOLOGY/TECHNICAL AIDS that helps to turn things off such as Smart Power Strip or Remote Outlet control

Would any of these work in your household?

Can you tell me a little bit more about that?

8. What would you think about a feedback DEVICE such as this which shows WHOLE-HOUSE energy-usage?

(If positive) 1) What is appealing about it? 2) How would you use it? 3) If offered at low/no cost would you get one?

9. If a utility or other group went door to door in your neighborhood offering to take an instant meter reading of various appliances and provide specific feedback on their use would you participate?

Do you think your neighbors would get such an appliance audit?

10. Is turning Internet modem/cable box/connection off at night or when gone practical/possible?

11. {If not talked about earlier} Do you know there are energy savings settings on your computer? Is changing those power settings something you would consider?

12. Which is your primary TV? (Did you know about brightness?)

13. Looking at your results for 2 things: how much electricity they use when they're not being used. And ones that use a lot on a monthly basis.

Any Questions? Surprises in metering results?

14. Interviewer to identify 3 main opportunities strategies and obtain household reactions.

Opportunity	Strategy/Options	Interest/Barrier/Reactions
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1.

2.

3

Which of these things might you do? What might get in your way?

{for low probability items, follow up} What (anything specific) might keep you from trying \_\_\_?

15. Given that we are looking at ways we could help people to save energy, do you any other thoughts to share with us?

16. interviewer impression