Residential Customer Characteristics Survey 2009

Seattle City Light

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Seattle City Light

Seattle City Light is a publicly owned utility dedicated to exceeding our customer expectations by producing and delivering low cost, reliable power in an environmentally responsible and safe way. We are committed to delivering the best customer service experience of any utility in the nation.

Conservation Resources

Bringing energy efficiency into every home and business in Seattle.
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Introduction

Overview

*Residential Customer Characteristics Survey*

Seattle City Light has conducted a Residential Customer Characteristics Survey (RCCS) on a periodic basis since 1978. The purpose of the survey is to gain a better understanding of how residential customers use electricity.

The last major study of this kind was completed in 1990, and an abbreviated version was completed in 2000. Previous studies were descriptive in nature, used mainly for rate analysis, and to project future demand for power. They were used to a lesser extent for developing conservation programs, and for integrated resource planning.

Several influences drove the current study. The five-year plan of Seattle City Light’s Conservation Resources Division\(^1\) calls for a revitalization of its planning, research and evaluation infrastructure. In order to continue to pursue energy conservation as an alternative to new generation development, the utility needed to update our understanding of current household uses of electricity. Further, data from previous surveys was no longer applicable or useful.

This study was further encouraged by Seattle’s 2005 CLIMATE PROTECTION INITIATIVE, which has the ambitious long-term goal to reduce greenhouse gases in Seattle to 80% below 1990 levels, by 2050.

Due to the proliferation of household electronics over the past two decades, planners believed that basic research on this new topic might provide an important component for resource planning as well as conservation program development.


Method

Because the content of the survey was to be greatly expanded from previous versions, its development followed a series of key informant interviews with 14 managers and analysts at Seattle City Light and Seattle Public Utilities, who represented the needs of several divisions within the City electric and water utilities.

The resulting 20-page customized survey booklet was an ambitious attempt to meet the broad needs of Seattle City Light and to assess household electricity end uses, capturing data at a level of detail that had not routinely been asked of residential customers.

The 2009 Residential Survey was mailed to 5,374 customer households, a 1.5% random sample from the 343,500 households in Seattle City Light’s service area. Survey packets were mailed out at the beginning of April 2009, with repeated mailings over the next two months, along with a brief telephone contact made with non-responding households at the beginning of June. By the end of June 2009, 2,356 completed booklets had been returned to the utility.

The response rate to this survey was 44% of the original mailed sample. A subsample of 600 provides a 4% level of precision on proportions near 50%, with a 95% confidence interval (and a narrower band of precision as proportions move away from 50:50). The Appendix provides a table of precision levels for other subsample sizes.

Data are presented where sample sizes are sufficient to draw conclusions; caveats are presented where sub-sample sizes are small. The Appendix contains one or more tables for each figure, accompanied by Pearson’s chi-square test of statistical significance.
**Major Findings • 1**

**Housing Stock & Occupants**

Some survey items discussed in this section speak to the distribution and representativeness of the sample; reliability of the data; and comparisons with King County Property Assessments, the Seattle City Light Customer Information System (SCL-CIS), and U.S. Census (American Community Survey) databases.

*In addition to providing survey results concerning the housing stock and occupancy of service area residents, the following Figures also address methodological issues: 1, 2, 3, 5, 8, and 22.*

**Dwelling Characteristics**

**Figure 1:** Mailing and Respondents by Community Reporting Area (neighborhood clusters)

Survey booklets were mailed to residents of different neighborhoods in proportion to the number of households in each neighborhood that make up the Seattle City Light service area. For each Community Reporting Area (a cluster of neighborhoods, used for City planning), the preceding chart shows in blue the proportion of the sample who received a survey (Mailed). In gold it shows the proportion of the sample who responded to the survey (Respondents).

For example, North King County residents (living north of the Seattle City limits) comprise 14% of the sample selected for mailing, but they are slightly underrepresented in the final sample, returning 12% of the surveys received.

The following Community Reporting Areas are slightly *under-represented* in the sample: North, Ballard, Downtown, Central, Greater Duwamish, and Delridge.

The following Community Reporting Areas are slightly *over-represented* in the sample: Northwest, Magnolia-Queen Anne, Lake Union, and South King County (beyond the southern Seattle City limits).

No neighborhood is over-represented or under-represented by more than 2% in the Respondent sample.

The Appendix to this report contains a list of 61 neighborhoods making up the 15 Community Reporting Areas in Seattle City Light’s service area, along with the numbers of surveys Mailed and Respondents by neighborhood.

The following comparisons are made to demonstrate the reliability of self-reporting on housing building type, which is used in many analyses throughout this report. These comparisons may also guide future use of information from King County and City of Seattle databases.
Customer descriptions of their type of housing can be compared with data maintained in the King County property assessment records and in the Seattle City Light Customer Information System (SCL-CIS). Use of the term “agreement” here indicates that the survey respondent checked a building type that matches the land-use code specified by King County (see top green chart), or the dwelling type recorded in the SCL-CIS (see middle magenta chart).

Survey respondents who live in a single-family home, apartment or condo show a high degree of correspondence with both King County and SCL-CIS data, with agreement in 95% or more cases.

Agreement between survey responses and the databases is lower for all other categories of housing type. In these cases, with the exception of houseboats, survey responses are in higher agreement with King County data than SCL-CIS data.

In the following context, “agreement” means that the King County land-use code matches the dwelling type recorded in the SCL-CIS (see bottom gold chart).

The SCL-CIS data and King County data are in high agreement (more than 90%) with each other in the case of the following housing types: single family, condominium, apartment, manufactured mobile and houseboats. They agree in about three-quarters of the cases for: apartments, duplex, fourplex and row/townhome. The two databases have poor agreement in categorizing triplex homes.

In the following comparison, U.S. Census data are analyzed for a geographic area approximating Seattle City Light’s service area (the 2008 AMERICAN COMMUNITY SURVEY for three school districts: Seattle, Shoreline, and Highline). Shown as blue bars, the census records state that 51% of housing structures in this area are “1 unit, detached.” The proportion of this group of structures is compared to “single family” homes in the mailed sample and survey respondent group. The 11% of Census structures described as “1 unit, attached,” “2 units,” “3-4 units,” and “mobile home” are compared to “midsize attached (multiplex)” homes from the survey.
The 38% of Census structures in the range from “5 to 9” up to “50 or more” units are equivalent to “multifamily” buildings (apartments plus condominiums), and are shown next to “apartments” from the survey mailing and respondent groups.

Figure 3:  
Housing Building Type: Comparison of Census Distribution with Random Sample, Mailed Sample, and Survey Respondents

The random sample selected from the customer information system (CIS) is described by the “dwelling type” code from that system. This selection is compared to the U.S. Census (2008 American Community Survey). The CIS code appears to identify as single-family homes some residences described by the census as attached multiplex units.

The random sample was subjected to two screens: 1) to ensure that the record was addressed to an individual person, rather than an organization; and 2) to confirm that the service address could be matched by parcel number or address to a record in the King County Property Assessment files. Fewer apartments and condominiums made it through these screens than did single-family detached homes.

The sample prepared for mailing and the survey respondents are compared using the building type (land-use code) reported in the King County Property Assessment records.

The U.S. Census states that 38% of residential units are in multifamily buildings, whereas the SCL-CIS random sample identified 37% in multifamily buildings. Moreover, about 10,000 units in master-metered multifamily buildings are not on residential rates, thus were not included in the sampling frame for the RCCS. These same units would be included in a census count of dwellings. Because of this factor, the RCCS multifamily dwelling percentage would be expected to be about 2 percentage points lower than the comparable census figure.

The SCL-CIS random sampling and screening processes (58%) selected more single-family detached homes than estimated from U.S. Census records (51%) for the Seattle City Light service area. Meanwhile the SCL-CIS identifies 4% of the random sample as midsize attached (multiplex) units. It appears that the Census may identify as “multiplex” (11%) about 7% of homes that the SCL-CIS and King County label “single family.” These findings underscore that the description of housing structures in County and City files does not perfectly match the distribution of types as identified by the U.S. Census.

The comparison of survey response to mailed sample (overall rate 44%) confirms that single-family households responded slightly more (49%) and midsize (multiplex) households less than expected (29%). Condominium (38%) and apartment (46%) households responded in rough proportion to their appearance in the mailed sample.

Figure 4:  
Housing Building Type

0% 20% 40% 60% 80%

Single Family (75%)

Apartment 13%

Condominium 7%

Duplex 2%

Triplex 1%

Fourplex 1%

Row | town home 1%

Mfr’d | mobile 0.3%

Accessory 0.3%

Houseboat 0.2%
Most survey respondents, three quarters of the sample returning booklets, live in single-family detached homes. About one-fifth live in multifamily homes with 5 units or more; both apartment complexes and condominiums are included in this group. About 6% live in midsize attached (multiplex) buildings, with 2 to 4 units, or in other types of dwellings.

Single-family detached homes are over-represented in this sample, and the various types of midsize attached (multiplex) units form only a small portion of the sample.

For this reason, respondents will be grouped into three general building types, and most survey items will be analyzed separately for these three groups. For some presentations, only single-family homes and multifamily units will be compared.

Comparison of self-reports on decade their residence was built with the King County record of year built shows that 73% of respondents report the same decade of construction. Another 12% report the decade just before or after that recorded by the County. The remaining 14% do not know when their dwelling was built, or state another period further removed in time. It is possible that some of these disagreements are due to a remodel, rehabilitation, or rebuild that affected a major portion of the building. The County files reflect rebuilds by a separate date field which was not available for this comparison.

This figure shows the percentage of respondent households by the decade in which the building was constructed. Most of the single-family homes (75%) were built before 1960.

After 1960, the focus of new construction in and around Seattle shifted to multifamily dwellings; 68% of these respondents’ homes were built in 1960-1999. And more recently, midsize attached (multiplex) dwellings have become more common in new construction (with 32% of respondent homes of this type built since 1990). Among midsize buildings, row- or town-home styles became more prevalent during the 1980s and again since 2000 (not shown in the figure).

Note that more than 20% of multifamily and 24% of midsize unit residents could not report the age of their buildings (compared to 3% of single-family residents).
Comparison of self-reports on ranges of living space square footage with the King County records of finished square footage shows that the two sources agree in fewer than half the cases.

The broad bands labeled “Less than KC” and “Much less than KC” indicate that large proportions of survey respondents believe they have less living space, or estimate much less, than King County reports for their homes.

Survey respondents occupying smaller homes, which would include most apartments and condominiums, report a size range closer to that appearing in King County records. King County specifies the square footage for each condominium unit, but only provides the total square footage for apartment buildings. Square footage thus has been estimated for apartments by dividing number of residential units into total building square footage.

Survey respondent estimates agree least with County records for dwellings larger than about 2,000 square feet of finished space.

Few survey respondents disagree with King County records by estimating a larger square footage for their homes. In ranges below about 1,500 square feet, less than 20% of respondents make this claim, and less than 5% do so when estimating more than 2,000 square feet.

Single-family residences are most likely to be between 1250 and 2500 square feet. Multifamily residences, in contrast, are most likely to be between 500 and 1250 square feet. Homes in midsized attached (multiplex) buildings fall in between these two groups in square footage. Often duplex, triplex, fourplex, and row-home or town-home dwellings (with attached side-walls) have similar construction to detached single-family homes. Accessory dwellings, in this group, are often formed by dividing an existing single-family home into two living units.

Survey respondent estimates agree least with County records for dwellings larger than about 2,000 square feet of finished space.
The number of rooms, on average, is greatest in single-family homes (7.38) compared to midsize homes (5.73) or multifamily homes (3.79). Residents usually heat approximately one less room than they have.

Notice the broad distribution of number of rooms in single-family and midsize homes (reflected in the standard deviations), whereas most (81%) of multifamily homes have 2-5 rooms.

This chart, similar to a topographical map, shows the peak patterns of household size in both square footage and number of rooms. The general shape of the plot indicates a close relationship between the number of rooms in the home and the square footage of the home.

The plum sections, like the peaks of a mountain top, show the two most frequent combinations of housing size and number of rooms. One group tends to have 3-4 rooms and 751-1000 square feet; the second group has 6-9 rooms and 1501-2000 square feet.
The graph for midsize and multifamily homes illustrates the more homogeneous sizes of these homes. They are responsible for the “peak incidence” of 3-4 rooms and 751-1000 square feet, seen in the first graph of this series.

Figure 11: Square Feet of Living Space by Number of Rooms in Single-Family Home

The position of this graph indicates single-family homes are responsible for the “peak incidence” of 6-9-room homes with 1501-2000 square feet, seen in the lower right portion of the previous graph. However, the distribution is nearly as broad as that for the entire sample (previous graph).

Figure 12: Square Feet of Living Space by Number of Rooms in Midsize and Multifamily Home

Most households have one kitchen. Respondents from midsize attached (multiplex) homes report a second kitchen in 10% of cases.

Figure 13: Number of Rooms in Home: Kitchens

Most single-family detached homes (79%) have a dining room, as do about half of midsize attached (56%) and multifamily homes (50%).

Figure 14: Number of Rooms in Home: Dining Rooms
Nearly all households have a living room.

About half (47%) of single-family detached homes have a family room or den.

Utility or laundry rooms are most commonly reported among single-family detached homes (64%) and midsize attached homes (39%). About one in five multifamily units has a laundry room.

Two-thirds of single-family homes have more than one bathroom, whereas one-fourth of multifamily units have a second bathroom.
Single-family detached homes most commonly have three bedrooms, whereas two bedrooms are most commonly reported for midsize attached (multiplex) homes, and just one bedroom for multifamily units.

When County records are compared to individual survey responses, less than two-thirds (58%) of respondents in single-family homes report the same number of bedrooms as King County lists. Only 14% state they have more bedrooms, but nearly a third (29%) say they have fewer bedrooms than listed by King County. This difference may reflect the use of “bedrooms”, as defined by the property assessor, for other purposes such as offices, studies, and dens.

Among condominium units, in 84% of cases the survey respondent reports the same number of bedrooms as listed by King County.

A small portion of single-family homes (7%) have an accessory dwelling. Half of these dwellings are freestanding and not attached to the house, another 43% are under or within the house, and an additional 7% are attached to the side of the house.

Survey respondents and County records agree closely in overall proportions for single-family homes: 24-25% with two bedrooms, 42-44% with three bedrooms, 19-23% with four bedrooms, and 5-7% with five or more bedrooms. King County records do not show any dwellings with no bedrooms.

Condominiums (the only multifamily units reported in the King County data), appear to have more bedrooms than multifamily units overall (including apartments), as reported by survey respondents. That is, the largest proportion of survey respondents in multifamily units claims to have one bedroom, whereas the largest proportion of condominiums has two bedrooms, according to King County records.

This figure displays, for comparison with the previous figure, the number of bedrooms in single-family detached homes and condominium units, as stated in the King County Property Assessment data files.
A large majority of Seattle dwellings (84%) house three or fewer residents. Multifamily households have fewer residents (1.52), on average, than both single-family detached (2.44) and midsize attached (2.34) households. All household types combined average 2.26 occupants.

U.S. Census data for a geographic area approximating Seattle City Light’s service area (the 2008 American Community Survey for three school districts: Seattle, Shoreline, and Highline) report the average number of household occupants to be 2.09. Although not available by housing type, the average number of occupants is reported separately for owner-occupied homes (2.35) and rented homes (1.78).

Just over than half of respondents (56%) own their residences with a mortgage, and another 25% own their homes free and clear. One-fifth of the sample (19%) rent their homes, and less than 1% occupy their home without payment of rent. *In further analyses of owners and renters, this last group will be combined with renters.*

Nearly all single-family respondents (94%) own or are buying their homes. In contrast, most multifamily respondents rent their homes (64%). The midsize attached (multiplex) residences are equally divided between owners and renters.
Across the entire sample, renters are under-represented; 81% of respondents are home owners but only 19% are renters. By contrast, census data for a geographic area approximating Seattle City Light’s service area report that 54% of households are owner-occupied and 46% are rented.

The discrepancy of renters is too large to attribute to under-reporting among apartment dwellers alone. Given that single-family homes comprise 68% of the mailing sample and 75% of respondents, it appears that renters are under-represented among single-family detached homes as well as apartments, and possibly also among midsize attached homes.

**Figure 26: Ownership of Home, for Apartments and Condominiums**

<table>
<thead>
<tr>
<th></th>
<th>Apartments</th>
<th>Condominiums</th>
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</thead>
<tbody>
<tr>
<td>Owned with a mortgage or loan</td>
<td>0.4%</td>
<td>62%</td>
</tr>
<tr>
<td>Owned free and clear</td>
<td>1.4%</td>
<td>32%</td>
</tr>
<tr>
<td>Rented from owner or manager</td>
<td>97%</td>
<td>5%</td>
</tr>
<tr>
<td>Occupied without pmt of rent</td>
<td>1.1%</td>
<td>1.3%</td>
</tr>
</tbody>
</table>

Nearly all apartment residents report that they rent their apartments. Two-thirds of condominiums are owned with a mortgage and one-third are owned free and clear. The proportion of condos that are mortgaged (62%) is similar to that for single-family homes. About 5% of condominiums are rented, among this respondent group.

**Figure 27: Annual Period of Home Occupancy**

- Year-round, occupied full-time, 98.0%
- Seasonal or part-time, occupied >6 months/ year, 1.7%
- Vacant >6 months/ year, 0.3%

The vast majority of all homes (98%) are occupied year-round, full-time. Fewer than 2% are occupied seasonally part-time, more than (>6) six months in the year. Less than 1% go vacant more than (>6) six months of the year. These proportions do not vary significantly by type of building.

**Figure 28: Business Operated from Home**

- Daytime Business: Yes, 11%; No, 89%

A business is operated during the day from home in 11% of Seattle residences.

Survey respondents operating a daytime business out of the home more often (68%) report that one or two rooms are used for an office or study, than among homes not operating a business (31%).
The number of years a customer has been a Seattle City Light customer at the same address is greater for single-family respondents than for midsize and multifamily respondents. Most single-family respondents (62%) have lived in the same home for more than 10 years, whereas more than half of multifamily respondents (and about half of midsize respondents) have lived in the same home for five years or less.

The chart indicates that more than half of all respondents, regardless of housing type, have been Seattle City Light customers for more than 10 years, although they may have changed addresses during that time.

Again, the number of years a customer has been a Seattle City Light customer at any address is greater, on average, for single-family respondents than for midsize or multifamily respondents. Most single-family respondents (80%) have lived in the Seattle City Light service area more than 10 years, compared to 58% of midsize respondents and 52% of multifamily respondents.
Figure 31: Household Total Gross Income in 2008

The pie chart indicates the proportion of households with different levels of total gross income. Single-family residents report higher income levels than midsize and multifamily residents.

Figure 32: Respondent Households Eligible for Utility Rate Assistance or Project SHARE

One in five respondent households appear to have been eligible in 2008 for bill or rate assistance, based on their 2008 household income and number of household occupants. Eligibility is defined here as income below 70% of the Washington State median income relative to a given household size (criteria updated March 2008). This is an approximation of the criteria for Seattle City Light’s Project Share and Rate 26 for low-income and elderly/disabled customers (see rate table in Appendix).

Figure 33: Respondent Households Receiving Emergency Bill Payment Help from the City of Seattle in the Past 3 Years

Among all respondents, 2.6% indicate they received emergency bill payment help from the City of Seattle in the past three years. This proportion is higher among multifamily households (6.4%) than single-family or midsize households (1.6%). Energy bill payment assistance is available to customers on an occasional, not ongoing, basis.
Respondents from single-family detached homes are slightly older, on average, than respondents from midsize attached (multiplex) and multifamily homes (who are somewhat more likely to be renters than owners). This difference is noticeable mainly in the 25-34 year age group; fewer in this group live in single-family homes than in other housing types.

**Implications**

**Dwelling Characteristics**

The type of building in which residents live is an important indicator of other key features that have been shown to be related to energy use. Building type is related to size of residence (square footage and number of rooms), number of occupants, age of building, and ownership of the residence.

Just based on these differences, it is reasonable to expect these groups to vary in their potential to conserve energy (size of household, area heated), and their ability (as home owners or renters) to make energy conserving changes to their homes.

An effective energy conservation strategy would address the differences among these groups that might drive their conservation activities.

Although owner-occupied dwellings are over-represented in this sample, as are single-family households, neighborhoods are represented in proportion to their populations within the Seattle City Light service area.

The correspondence of housing type designation between survey responses and both King County and SCL-CIS databases is high (95% or above) for single family, condominium and apartment housing types.

When examining housing types, the differences in correspondence between survey data and each of the existing databases (King County and SCL-CIS data) may be due to different methods of collecting and updating the housing information. The areas of greatest disagreement – duplex, triplex, fourplex, and row-/town-home – may in part be due to differences in definition. A row-/town-home, for example, may be described as a duplex, triplex or fourplex, depending upon the number of homes attached in the same building. Further, the status of a given building may have changed due to remodels, and one database may track these changes more effectively than another. Finally, not all status changes that added residential units may have been permitted, inspected, or recorded by the City or County.

The greater correspondence between survey data and the King County database, compared to the SCL-CIS database, suggests that the King County database may be more up-to-date, or may categorize households in a way more consistent with the ways that residents describe them.

Seattle City Light may want to assess the accuracy of its customer information system data to assist the work of rate forecaster and load analysts. It would be feasible to coordinate data with King County property assessments (using parcel numbers, which are recorded for each premise in the SCL-CIS). This would be most successful for single-family homes and condominium units, each of which has a separate King County property assessment record.

**Occupancy**

The higher proportion of single-family residents who own their homes, compared to midsize (multiplex) and multifamily residents, means that single-family residents may approach home improvements differently than residents of other housing types, where more of the occupants are renters.
Where residents operate a business in the home during the daytime, thermostat settings and energy use may be different from households in which residents leave the home during weekday hours. This would be true also of homes where disabled or elderly residents are present, and where small children are cared for in the home, during daytime hours.

The number of years a customer has been a Seattle City Light customer at any address is an indicator of familiarity with the utility. Further, the number of years a customer has been a Seattle City Light customer at the same address is an indication of stability in the housing market. Long-time Seattle City Light customers will have had opportunities to learn about and participate in prior utility energy-efficiency programs, but those new to the market may not be as aware of the programs and energy concerns.

Household income is a likely determinant of the home improvements residents are willing and able to make to save energy, as well as the types of utility programs that would appeal to residents. The lower income levels of multifamily residents, combined with their more frequent status as renters, make this group a particular challenge for promoting costly energy-saving measures.

Rate Assistance

According to Seattle City Light records, only 5.5% of residential customers are currently on rate assistance: 4.5% on low-income rates and 1.0% on rates for the elderly and disabled. By comparison, 21% of survey respondents appear eligible for rate assistance. This discrepancy implies that up to 15% of all residential customers are eligible but are not taking advantage of the rate assistance program intended to help them afford energy bills. That is, three-fourths of those eligible are not receiving this assistance.

Seattle City Light might want to explore ways to identify and encourage eligible households to apply for rate assistance. When conservation programs contact customers, they should be made aware of this additional opportunity for their households to manage energy costs.

City Light may also want to more aggressively solicit donations from customers who are willing to help their neighbors pay their bills. Current difficult economic times may very likely put upward pressure on the proportion of customers who seek emergency bill payment assistance. In recent years, about 2% of multifamily household respondents sought this kind of help each year (inferred from 6.4% over a three-year span). Emergency assistance was less frequently sought by residents of single-family and midsize households participating in this survey.

Trends over Three Decades of Residential Customer Characteristics Surveys

![Trend Graph]

Over the years, the Residential Customer Characteristics Survey has been consistently fielded by mailing to about 5,000 randomly selected customers.

The greatest number of survey respondents was seen in 1982, when response peaked at 3,747 households. The number responding to the 2009 survey is similar to that for the 1978 and 2000 surveys.

The response rate has varied over the years, averaging about 62% in the 1980s, dropping to 53% in 2000 and 44% in 2009.
Considering the scope of the RCCS 2009 survey booklet (more items and twice the length of any previous RCCS instrument), 44% is a relatively high response rate.

For comparison, the CONSERVATION KIT PROGRAM EVALUATION survey in 2001-2002 attained a response rate of 41% among a 1% random sample of program participants, with a completion rate (useable booklets) of 37%. The instrument for that survey was considerable smaller (8 half-size pages) and had far fewer items than the 20-page RCCS 2009 booklet.

Over the past three decades, residential survey respondents tended to be comprised of 67-69% homeowners and 31-34% renters. In the 2009 survey, 80% of respondents were homeowners and 20% were renters. This findings is consistent with that for single-family versus multifamily residents.

This differential response may have been influenced by the use of the same booklet for both single-family and multifamily homes. Renters or multifamily occupants may have perceived that many questions were outside their range of knowledge, or did not apply to their dwelling, and thus were less motivated to fill out the booklet. In future administrations of the survey, researchers might explore whether the booklet can be streamlined or customized in some other way for renters or multifamily occupants.
The number of household occupants has remained consistent over the past three decades, with a slight shift in 2009 for the midsize attached (multiplex) category. This may be an artifact of the way certain building types were grouped in past years: specifically, manufactured or mobile homes, houseboats, and row-or town-homes. These now appear in the midsize attached (multiplex) housing group.

**Figure 39: Decade Building Constructed: Trends over 3 Decades (stacked)**

This figure shows the distributions of survey respondents over the past three decades of RCCS reporting, in terms of heated rooms in the dwelling. The proportions with each number of rooms are stacked upon one another, adding up to 100% for each RCCS report. For instance, the 2009 report shows that 6% of homes had one room, 8% had two rooms, 10% had three rooms, and so forth.

The number of homes with only one room (a studio apartment) has increased in proportion from 2% in 1979 to 6% in 2009. Meanwhile the proportions of dwellings with three to five rooms declined over the three-decade span: from 15% to 10% (three rooms), from 17% to 13% (four rooms), and from 17% to 14% (five rooms). The number of dwellings with eight rooms increased, from 6% to 9%; and most markedly, the number of dwellings with nine or more rooms increased in share from 7% to 13% of respondents.

These findings suggest that while small studio apartments increased proportionately among respondents, the proportion of larger homes also increased over the past thirty years. This latter finding may reflect on a trend among single-family detached homes to add space or remodel unused areas into newly occupied space.

This upward spike in new home building during the 1980s reflects a housing boom during a period of post-recession growth in the Pacific Northwest.
Major Findings • 2

Home Heating

Main Home Heating System

Figure 41: Main Home Heat Equipment

![Heat Equipment Bar Charts]

- **Single Family**: 75% of homes use a forced air furnace, 9% use baseboard/wall heaters, and 5% use hydronic/radiant systems.
- **Midsize**: 38% use forced air furnaces, 10% use baseboard/wall heaters, and 10% use hydronic/radiant systems.
- **Multifamily**: Only 9% use forced air furnaces, and 9% use hydronic/radiant systems.

The main type of home heat equipment varies by type of residence. The majority of single-family detached homes (75%) use a forced air furnace, whereas most multifamily units (66%) use baseboard heaters. Midsize attached (multiplex) homes are equally divided between forced air (38%) and baseboard heat (40%).

Midsize attached homes and larger multifamily units use two other types of main heat equipment more often than single-family residences. Hydronic radiant heat is the main home heat system for one in ten midsize (10%) and multifamily (9%) homes, but half that many single-family homes (5%) use this type of heat system. Portable heaters or radiators are the main heat system for 5% of midsize and multifamily residences, compared to 2% of single-family residences. In addition, coil or cable radiant heat is the main system for 5% of multifamily residences, but less than 1% of other residences.

Figure 42: Main Home Heat Fuel

- **Single Family**: 58% use natural gas, 22% use electricity, and 17% use fuel oil/petroleum.
- **Midsize**: 42% use natural gas, 54% use electricity, and 0.8% use fuel oil/petroleum.
- **Multifamily**: 85% use natural gas, and 13% use electricity.

Across all households surveyed, 49% use natural gas as the main heating fuel, 36% use electricity, 13% oil, 1% wood or pellets, and 1% a combination of fuels (e.g., electricity and gas).
The main fuel used to heat residences varies by type of residence. Single-family homes are most likely to use natural gas (58%) compared to midsize (42%) and multifamily (13%). Multifamily homes are most likely to use electricity (85%) compared to midsize (54%) and single-family homes (22%).

Fuel oil is used to heat a substantial portion of single-family homes (16%), but less than 1% of other residences. Few residents depend solely on any other type of fuel as their main source of heat.

There appears to be little relationship between the size of home (measured by number of rooms) and home heat fuel, when examined separately for each housing type.

*Following are descriptions of the main heating systems for each major type of housing, organized by prevalence of equipment type within each fuel choice.*

**Single Family Detached Homes**

Among single-family homes, 22.2% of survey respondents use electricity as their main home heating fuel. This heating group is comprised of the following equipment categories: 9.3% baseboards or wall heaters; 7.5% central forced-air furnaces (with ducts); 3.0% central heat pumps (with ducts); 0.8% radiant coils or cables (in ceiling or floor); and 1.6% other equipment, such as radiators or portable heaters, plug-in fireplace, cooking stove or oven.

More single-family homes (58%) use natural gas as the main heating fuel. This heating group is comprised of the following equipment types: 51.6% central forced-air furnaces (with ducts); 5.3% hydronic systems with radiators, baseboards, or in-floor piping; and 1.1% gas fireplaces.

A portion of single-family homes (17.0%) still heats with fuel oil, comprised of: 16.3% central forced-air furnaces (with ducts); and 0.7% radiant hydronic systems with fuel oil boilers.

A small minority of single-family homes (1.0%) heats with wood or burned pellets, mainly used in a woodstove or fireplace with a stove insert (0.9%). Few (0.1%) use a fireplace alone, without an air exchanger.

Another small minority of single-family homes (1.5%) uses both electric and natural gas forced-air furnaces to supply their main home heating. *Solar energy* does not supply the main home heat for any survey respondents.

**Multifamily Homes**

As for multifamily units, most survey respondents (84.8%) state that *electricity* is their main heating fuel. This heating group is comprised of the following equipment categories: 65.8% baseboards or wall heaters; 7.6% central forced-air furnaces (with ducts); 5.0% portable heaters or radiators; 4.5% radiant coils or cables (in ceiling or floor); and 1.9% central heat pumps (with ducts).

Fewer multifamily units (12.8%) use *natural gas* as the main heating fuel. This heating group is comprised of the following equipment types: 8.8% hydronic systems with radiators, baseboards, or in-floor piping; 3.1% gas fireplaces; 0.7% central forced-air furnaces (with ducts); and 0.2% gas cooking stove or oven.

Few multifamily homes (1.2%) are heated with *fuel oil*, using either a radiant hydronic system with a boiler, or a central forced-air furnace.

**Midsize Attached (multiplex) Homes**

Among midsize attached (multiplex) units, the most common *electric* equipment used for main home heat are: electric baseboards or wall heaters (40.0%); electric central forced-air furnaces with ducts (7.5%); and electric portable heaters or radiators (3.3%).

The most common *natural gas* equipment used for main home heat in midsize units are: natural gas forced-air furnaces (29.2%); and natural gas hydronic systems with radiators, baseboards, or in-floor piping (10.0%).

The remaining midsize units (10.0%) have for their main home heat other equipment such as plug-in electric fireplaces, gas fireplaces, or combination of gas and electric forced-air furnaces that serve the building housing the midsize units.
In single-family homes, the main home heating equipment is most commonly 2-10 years old (42%) or 11-20 years old (21%), with 19% older than that.

Reports on the main heating equipment in multifamily buildings are evenly split between these two age groups (about 16% each). Note that one-third of multifamily residents do not know the age of their building or unit’s main heating equipment.

Among midsize homes the profile for age of the main home heating system is similar to that for single-family homes. One-third of these respondents do not know the age of their main home heating system – a proportion that is higher than for single-family but lower than for multifamily respondents.

Heat systems that use different heating fuels were installed and retained in different proportions during the decades of the past century.

For single-family homes, electric systems were more often installed and retained in homes built from 1970-1990, reaching a peak of 62% in the 1980s. Gas was more popular just before this period and has become the fuel of choice in the past two decades, accounting for 89% of heat systems in new construction built since 2000. The installation and retention of oil systems has steadily declined since the 1950s.
For multifamily homes, electric heat systems (mainly baseboard) were broadly used from the 1950s to the 1990s. In the past decade, however, gas systems have increased their market share to one-third of new construction (31%), whereas electric systems have declined from a 95% peak in market share in the 1970s to a two-thirds share (69%) in the last decade.

These findings should be interpreted cautiously due to the overall small sample size for multifamily households with natural gas home heat.

Oil heat, never common in multifamily residences (found in about 5% of units thirty years ago), has been retained to the present time in only 1% of buildings.

A similar figure (not shown) prepared from data reported in the 1984 RCCS, comparing electric with nonelectric heating, is identical for multifamily respondents, and identical for single-family respondents in homes constructed in 1900-1969.

However, single-family respondents in homes built during 1970-1984 showed a profile that had 17% more electric and 17% fewer nonelectric cases than the current 2009 RCCS depicts, for that period of construction. This implies that 17% of homes built during 1970-1984 have subsequently converted their main home heating from electric to nonelectric fuels.

Supplementary Home Heat

Single Family

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<tr>
<th>Equipment</th>
<th>0%</th>
<th>20%</th>
<th>40%</th>
<th>60%</th>
<th>80%</th>
<th>100%</th>
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<tbody>
<tr>
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<td>Hydronic/radiant</td>
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<td>Coil-cable/radiant</td>
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<tr>
<td>Portable heater/radiator</td>
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<td>Fireplace/stove</td>
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<td>Cooking stove/oven</td>
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Midsize

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Multifamily

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</tr>
<tr>
<td>Hydronic/radiant</td>
<td>0.2%</td>
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<tr>
<td>Coil-cable/radiant</td>
<td>0.7%</td>
<td></td>
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</tr>
<tr>
<td>Portable heater/radiator</td>
<td>10%</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>Fireplace/stove</td>
<td>8%</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>Cooking stove/oven</td>
<td>8%</td>
<td></td>
<td></td>
<td></td>
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<td></td>
</tr>
<tr>
<td>Solar/other</td>
<td>2%</td>
<td></td>
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<tr>
<td>Stated “None”</td>
<td>40%</td>
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<tr>
<td>No reply/blank</td>
<td>27%</td>
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</table>

Single-family residences use supplementary heating systems more frequently and in greater variety than midsize or multifamily residences. More than one-third (40%) of multifamily homes use no additional heat system, compared to 31% of midsize homes and 21% of single-family homes.
In particular, single-family residences use fireplaces/woodstoves (24%), portable heaters or radiators (20%), baseboard heaters (11%), and a forced-air furnace (6%) in greater proportion than other residences to supplement their heat.

About 10% of multifamily residences use portable heaters, baseboard heaters, fireplaces and cooking stoves as supplementary heat sources.

Midsize residences fall between single-family and multifamily homes in use of supplementary heating. They most often use a fireplace (18%), portable heater (17%), or cooking stove (13%).

**Figure 46: Additional Home Heat Fuels**

The most frequently used supplementary home heat fuel for all types of residences is electricity. Natural gas is a secondary source for single-family and midsize residences more often than for multifamily residences. Single-family homes burn wood or wood pellets more often than other residences. Natural gas fireplaces seem to be used by a similar proportion of homes (10%) as wood or pellet stoves and fireplaces (10%).

**Figure 47: Additional Home Heat by Main Heat Fuel**

Among homes using *electricity* as the main heating fuel, 12% supplement that with electric portable heaters or radiators, 8% with electric baseboards or wall heaters, and 7% with electric cooking stoves or ovens. Fewer homes supplement with natural gas, via fireplaces (7%) and cooking stoves or ovens (2%).

Among homes using *natural gas* as the main heating fuel, 17% supplement that with electric portable heaters or radiators, 11% with electric baseboards or wall heaters, and 3% with electric cooking stoves or ovens. More of these homes supplement with natural gas, via fireplaces (15%) and cooking stoves or ovens (7%).

Among homes using *fuel oil* as the main heating fuel, a noteworthy 28% supplement that with electric portable heaters or radiators, 11% with electric baseboards or wall heaters, and 2% with electric cooking stoves or ovens. Few of these homes supplement with natural gas, via fireplaces (2%) and cooking stoves or ovens (1%).
Electricity sources (portable heaters or baseboards) are the most frequent sources of additional heating for both homeowners and renters. Natural gas sources (fireplace or cooking stove) are used less often; renters in particular rarely use gas (2%). Baseboard heaters are used equally often by owners and renters.

Renters and those who own their homes free and clear are more likely to use an electric cooking stove, whereas homeowners with a mortgage are more likely to use a gas cooking stove, for supplementary heat. Wood stoves are used more often by home owners than renters.

In general, the more rooms in a home, the more likely residents are to use most kinds of supplementary heat, particularly a natural gas fireplace or electric baseboard heater.

The first chart shows that the use of electric portable heaters and radiators dramatically increases in homes with 4 or more rooms. The use of woodstoves and fireplaces increases in homes with 7 or more rooms.

In contrast, an electric cooking stove or oven is the most likely supplementary heat source in the smallest homes (1-3 rooms).
Larger households, those with three or more residents, are more likely than smaller households to use portable heaters as a supplementary heat source. Larger households also tend to use their natural gas cooking stoves for home heat.

The largest households, with five or more residents, are among the most likely to use all types of supplementary heat. In contrast, households with only one resident are least likely to use baseboards or a natural gas fireplace as a supplementary heat source.

Only 6% of households report a change in their main home heat system over the prior two-year period. Of the households changing main home heat systems since January 2007, 88% were single-family homes. The largest portion (37%) of households that changed switched from a fuel oil forced-air furnace to another system. Two-thirds switched from a forced-air furnace, whether oil, electric, or natural gas.

The numbers of cases described in the next figure are very small (for instance, 42 households switched away from oil forced-air furnaces, and 20 switched from electric forced air furnaces). These are the only groups that showed a pattern of change. Most combinations from one system type to another involved fewer than five households.
The most noticeable change was among households formerly heating with an oil forced-air furnace. Half of these (52%) switched fuels to natural gas. The other half chose a central electric heat pump (12%), portable electric heaters or radiators (14%), or a variety of other solutions.

A smaller group formerly used an electric forced-air furnace, but now heat with either a natural gas forced-air furnace (25%), and electric central heat pump (20%), or a variety of other heating solutions.

The most important reason for changing a home heat system, regardless of household type, was to lower energy bills, followed closely by energy savings.

Multifamily residents are somewhat less motivated than single-family and midsize residents to replace worn out equipment, or to make the home cleaner, but somewhat more motivated by improved home safety.
Figure 54: Number of Thermostat Controls

Single Family

0% 20% 40% 60% 80% 100%
0 1 2 3 4 5+

0 4% 2% 3% 6% 82%
Figure 55: Proportion of Thermostats that are Programmable

Single Family Midsize Multifamily
61% 28% 9%

Single-family homes are most likely to have a programmable thermostat that allows different settings for different times of the day. Almost two-thirds of single-family homes have this programmable feature, but only one-third of midsize homes and fewer still of multifamily homes do.

Figure 56: Time Settings Allowed by Programmable Thermostats

Single Family

Seasons of the year Days of the week Morning, day, evening, night Day and night only
18% 74% 75% 18%

Midsize

Seasons of the year Days of the week Morning, day, evening, night Day and night only
22% 84% 69% 25%

Multifamily

Seasons of the year Days of the week Morning, day, evening, night Day and night only
29% 68% 68% 25%

Single-family homes most often have only one thermostat control for the entire residence (82%), compared to midsize residences (50%) and multifamily residences (31%). Multifamily homes are more likely to have two (28%) or three (21%) thermostats than just one. However, 14% of multifamily residents say they have no thermostat. This reflects the use of heating systems like baseboards or wall heaters, where the control is directly on the equipment.
Programmable thermostats in single-family detached and midsize attached (multiplex) homes more often allow settings for days of the week and time periods during the day than do thermostats installed in multifamily homes.

In most homes, about three-quarters of programmable thermostats allow different settings for days of the week (74%) and for four time periods of the day (75%). These proportions appear to be slightly lower among multifamily homes. Nearly all of the thermostats that do not have four settings per day do allow different day and night settings (19%).

**Figure 57: Thermostat Winter-time Temperature Settings (by four daily time periods)**

For single-family and midsize homes, the most frequent winter-time temperature setting during morning, day and evening hours is 68-69 degrees Fahrenheit. When multifamily residents use their home heat, they also tend to turn on their heat to 68-69 degrees.

Evening winter-time temperatures tend to be the highest for all housing types, with morning temperatures only slightly lower. Night-time temperatures vary greatly, but tend to be lowest.

During the evening hours, the highest use period, 22-23% of residents from all housing types set their home temperature at 70 degrees or above.

Beyond these general trends, some patterns of winter-time temperature settings for different daily time periods vary by housing type. Multifamily residents, for example, often have their heat turned off; 20-27% of these residents turned their heat completely off during all daily periods except evening.

In multifamily home, during the evening hours temperatures spike upward; 21% heat their homes to 68-69 degrees, and an additional 22% heat their homes to 70 degrees or above. A smaller spike occurs during the morning hours; 21% heat their homes to 68-69 degrees and another 13% use a higher setting.
Single-family homes have the highest proportion of morning and evening temperatures at 68-69 degrees (26% and 34%, respectively). However, single-family homes set their temperatures lowest at night. Only 11% of single-family homes have night-time temperatures of 68 degrees or higher, compared to 20% for midsize and 18% for multifamily homes.

Figure 58: Thermostat Winter-time Temperature Settings: Average (mean) by Period of Day

<table>
<thead>
<tr>
<th>Morning (6AM-9AM)</th>
<th>Day (9AM-5PM)</th>
<th>Evening (5PM-10PM)</th>
<th>Night (10PM-6AM)</th>
</tr>
</thead>
<tbody>
<tr>
<td>65.3</td>
<td>63.5</td>
<td>61.9</td>
<td>61.1</td>
</tr>
<tr>
<td>62.0</td>
<td>60.3</td>
<td>64.4</td>
<td>61.7</td>
</tr>
<tr>
<td>67.1</td>
<td>65.7</td>
<td>59.5</td>
<td></td>
</tr>
</tbody>
</table>

Average (mean) thermostat temperature settings vary by housing type, as well as time of day. These settings likely reflect differing underlying sensitivities of these dwellings to changes in external temperature, which must be made up by space heating.

Occupants of single-family homes set the thermostat to 65 degrees Fahrenheit in the morning, on average; 64 degrees during the day; and 67 degrees during the evening. The average setting for midsize homes is 1-2 degrees lower during each period, and the average setting for multifamily homes is 2-4 degrees lower during each period, than that for single-family homes. At night, all household types set the thermostat to 60-61 degrees, on average.

Figure 59: Thermostat Winter-time Temperature Settings by Whether Business is Operated in Home

Single-family residents who operate a business at home are more likely to set their thermostat to 66-67 degrees, and less likely to turn their heat off.

Figure 60: Thermostat Winter-time Temperature Settings: Night-time Set Back in Single Family Homes

In single-family homes, only 20% do not set back the thermostat from the evening level to a lower night-time level. Most setbacks are in the 3-4 and 5-6 degree ranges. Half of all residents surveyed set back the night-time temperatures by 1 to 9 degrees. The average setback is 6 degrees.
Residents with programmable thermostats (86%) more often set back from evening to night-time than residents with manual thermostats (66%).

The average setback remains about 6 degrees, and the proportions setting back 9 or more degrees at night remains about one-quarter of households, regardless of type of thermostat.

**Implications**

**Home Heating**

Housing types differ greatly in both the type of heating system and type of heating fuel they use. Understanding the profile of each housing type is important for planning and targeting programs to customer groups.

**Single Family Detached Homes**

Single-family detached homes are more likely to have a forced air system (75%), and to use natural gas (58%). Electricity is used in fewer single-family homes (22%). Oil heat systems have seen little use in new single-family construction since 1970. Nearly all of the oil-heated homes were built before 1970. Yet, oil heat systems were installed and retained in 16% of single-family homes. Other home heating methods beyond these three are used only rarely.

As the use of fuel oil declined in mid-century, both gas and electric systems were increasingly installed in new construction of the 1960s and 1970s. The age of heating systems in this group suggest that at least 19% of single-family residences may be due for updating their systems.

Although some homes may have had their heating systems changed over the years, the trends in heating fuel reflect the efficiency and popularity of different heat fuels in each decade. This suggests that programs may be targeted to homes built during periods when electricity was installed in greater proportion. For example, single-family homes built with electric heating between 1970 and 1990 may be good targets for energy-efficiency measures and may be due for updating. However, it is important to remember that this group accounts for only 7% of the existing single-family housing stock, whereas 72% of the current housing stock was built before 1960. Older homes with electric heat may be in greater need of energy efficiency measures due to less efficient construction. Programs could be tailored to the different needs of these construction types.

On the other hand, electric heat homes were very likely to have received at least some efficiency measures through Seattle City Light or other utility conservation programs. The City Light weatherization programs in 1981-2006 reached over 80% of existing single-family homes having electric space heat and built prior to 1980 (when the first building energy code was enacted).

**Multifamily Homes**

The relatively large proportion of multifamily units built between 1960 and 2000 (52%), combined with the large proportion of these units that have electric heat (88-95%), make these residences a good target for energy efficiency programs.

Notice, however, that as installation (and retention) of electric home heat has declined in new construction of the past decade, gas heating systems seem to have taken a larger share of the market. This relationship should be assessed further in future studies, due to the small sample size on which the observation is based. This will be a trend to monitor for energy use planning, and to examine further in order to understand the relative advantages of each type of system for multifamily housing.

Multifamily residents (of apartments and condominiums) have less information about their heating systems compared to single-family residents. This makes sense because apartment residents are most often renters and are not involved with the maintenance of their heating systems. Two-thirds of the multifamily survey respondents live in apartments, as opposed to condominiums. As a result, owners and managers would be the likely targets for programs involving equipment decisions.

Electric-heat multifamily buildings were quite likely to have received at least some efficiency measures.
through Seattle City Light or other utility conservation programs. The City Light weatherization programs in 1981-2006 reached over 65% of existing multifamily units having electric space heat and built prior to 1980 (when the first building energy code was enacted).

Midsize Attached (multiplex) Homes

Midsize attached units – in row- or town-homes, or in multiplex buildings with 2-4 units – seemed to fall somewhere between single-family and multifamily homes in their use of different types of heating systems and the fuels used. These findings may reflect the different types of construction included in this single category of homes. Some buildings may have been single-family homes initially, and then divided, whereas others may have been constructed as a small apartment building from the start. These differences may have driven the choices of heating systems and fuel, resulting in a heterogeneous group of buildings that needs to be approached in multiple ways.

Midsize attached (multiplex) buildings were likely to have received at least some efficiency measures through Seattle City Light or other utility conservation programs. The City Light weatherization programs in 1981-2006 reached over 50% of existing multiplex units having electric space heat and built prior to 1980 (when the first building energy code was enacted).

Supplementary Home Heat

The most common fuel used for supplementary heating by all residences is electricity. Even residents of single-family homes, who most often have natural gas as their main source of home heating fuel, use an electric supplementary heat source when required.

When supplementary heat fuel is compared to the main home heat fuel, the outstanding findings are as follows. About half of homes with natural gas main heat supplement home heating with electricity. Nearly two-thirds of homes with electric main heat also supplement home heating with electricity. But an outstanding three-fourths of homes with oil main heat supplement home heating with electricity, primarily in the form of portable heaters or radiators.

Thus it appears that most oil-heat homes have the least satisfactory main heating system, and must rely on supplemental electric heat to meet their needs. These homes (as well as the half of homes having gas main heat but supplementing with electricity) may be most in need of weatherization. They certainly would be appropriate targets for education about efficient electric zonal heating, for example in the form of ductless heat pumps.

Given that single-family residents use supplementary heat more than occupants of other household types, they may be most important to target for education about energy-efficient choices for supplementary heating.

The difference in types of supplementary heat used by owners and renters is similar to the difference between single-family and multifamily residences. In general, this reflects the greater availability of natural gas and fireplaces in single-family homes (where homes are generally larger and most residents are home owners) and the greater dependence on electricity in multifamily buildings (where renters predominate).

In general, the greater the number of rooms in a household the more likely residents are to use additional home heating methods beyond their main heating system.

A large proportion of households augment their home heating with a supplemental system. In larger homes, particularly those with 4 or more rooms, residents more often use supplemental heat options than in smaller homes.

Although they choose different methods to provide extra heat to their homes, the findings suggest that for a substantial proportion of homes, the main heating system alone is unable to meet residents’ needs.

The smallest homes are more likely than larger homes to use cooking stoves for supplemental heat. This is a concern, especially when a gas cooking stove
or oven is used to supply extra heating (due to the potential for carbon monoxide poisoning).

Supplemental home heat supplied by an electric cooking stove is greatest among households with 5 or more residents and also among one-person households. There may be a segment of one- to three-room households that house 4 or more people and use a cooking stove as supplementary heat.

It is unclear from the survey results whether cooking stoves are used deliberately to provide space heating, or whether respondents are simply recognizing the contribution that cooking makes to generating space heat in their homes.

Changes in Home Heat

Changes in heating are consistent with new construction trends away from oil heat and in favor of natural gas and electric heat (chosen equally frequently by households making a change in the home heating system).

Reasons for changes in heat indicate that customers are motivated by what they perceive as the least expensive option, which is subject to changes in the market. In addition, the idea of a cleaner home may motivate a small segment of single family residents, whereas making the home safer may be more effective for multifamily residents.

The strong appeal of saving energy might have an environmental component, but given its high endorsement, residents probably expect energy savings to result in lower bills.

Thermostat Control

Based on the number and type of programmable thermostats reported, more single-family homes are able to control their household temperature settings automatically and have the greatest control over temperature settings at different times of the day. In contrast, due to multiple thermostats, multifamily residents likely have more independent control of heat in different rooms of their homes, but generally operate them manually. Plans for helping residents conserve need to consider these differences in residents’ ability to control their home heat.

In addition, the estimates given by multifamily respondents may be less accurate than by other groups. Because multifamily residents control multiple thermostats independently, it may be difficult to estimate the average temperature setting.

Trends over Three Decades of Residential Customer Characteristics Surveys

Figure 61: Main Home Heating Fuel: Trends over 3 Decades

The proportion of homes with electricity as the main home heat fuel rose over the 1980s, from 34% at the start of that decade up to 43% at its conclusion. By 2009, that proportion was back down to 36%. Meanwhile, the reciprocal pattern happened for nonelectric home heat, declining from 66% to 57% of homes, then rising once more to 64%.

This pattern reflects the shifting prices of natural gas, relative to electricity, over the past three decades. As newer residential buildings are constructed, builders make heating equipment choices based on first cost and projected operating costs. Fewer newly constructed single-family homes, in particular, are built with electricity for space heating, and natural gas has become more prevalent among newly constructed multifamily high-rise dwellings.
The overall trends seen in this figure mirror to some extent those seen in the earlier figure on *Main Home Heat by Decade Building Constructed*. The following figures break down the patterns by building type.

**Figure 62:**  *Main Home Heating Fuel in Single Family Detached Homes: Trends over 3 Decades*

Among single-family detached homes, there has been a steady upward progression over the past three decades in the proportion heating with natural gas, from 30% in 1979 to 58% in 2009. Meanwhile, the proportion heating with fuel oil has declined from 49% in 1979 to 17% in 2009. This pattern reflects continuing conversions of heating systems from fuel oil to natural gas. The proportion of single-family homes heated by electricity over the past three decades has not changed.

**Figure 63:**  *Main Home Heating Fuel in Midsize Attached (multiplex) Homes: Trends over 3 Decades*

In multifamily homes, the use of electricity gained prevalence from 69% in 1979 to 86% in 1990, and remains predominant at 85% in 2009. Natural gas, used by a fourth (25%) of multifamily homes in 1979, declined in use during the following decade (down to 5-7%), but by 2009 has gained in popularity, now reported in 13% of multifamily homes.
Major Findings • 3

Home Cooling

Fans for Summer Cooling

Figure 65: Use of Fans for Summer Cooling, Among All Survey Respondents

Approximately 14% of residences have air conditioning of some kind. This proportion is similar for all three building types.

Note: In this section of the report, air conditioning data for respondents in midsize buildings is not illustrated due to a small overall sample size combined with the small proportion having air-conditioning (only 17 cases).

More than two-thirds of all respondents say they use portable fans for cooling their homes in the summer. Much smaller proportions use ceiling fans, kitchen and bathroom fans, or window fans. Least commonly used for summer cooling are whole house fans and attic fans.

The patterns are similar for each building type, but single-family detached homes tend to use more ceiling fans and whole house fans. Multifamily unit residents are more likely to do without any fans at all (stated “none”).
Among single-family homes, a central heat pump is the most frequent type of air-conditioning (41%), followed by window or wall air-conditioners (30%).

In half of midsize attached (multiplex) and multifamily units (46%), residents report they have window or wall air conditioners.

Portable air conditioner units are popular in one of five homes, regardless of building type.

Nearly half of the air-conditioning units in single-family residences (48%) are three years old or newer, and only 13% are more than 10 years old. In contrast, in multifamily homes, 42% are three years old or newer, and 29% are more than 10 years old.

About 20% of residents who have air-conditioning equipment use their air-conditioning more than 50 days per year. However, multifamily residents appear more likely than single-family residents to do so. In contrast, single-family residents appear more likely than multifamily residents to use air-conditioning 20 days or fewer per year (49% compared to 25%).

These findings are based on a small sample of multifamily respondents per subgroup. They should be both interpreted cautiously and checked for consistency in future studies.
Nearly one-third of respondents report they turn on their air-conditioning when the indoor air temperature is in the range of 74-77°F, and another one-quarter turn on the air-conditioning at 78-81°F. Single-family and multifamily residents show a similar pattern of behavior. Although the differences between the two groups are not statistically significant, more single-family residents seem to wait for higher indoor temperatures before turning on their air conditioners.

Figure 71: Importance of AC in Homes Having Air Conditioning

About one third of all respondents who have air conditioning say they wouldn’t want to do without it in the summer. Some multifamily residents, however, are more committed to their air-conditioners than single-family residents. Single-family residents are more likely to say they could do without their air-conditioner most of the summer, whereas multifamily residents are more likely to say they could do without it for half of the summer.

Figure 72: Plan to Buy New Air Conditioner, Among All Survey Respondents

Only 1 in 20 respondents (5%) have plans to buy an air-conditioning system in the next two years. Most of those who are considering a purchase plan to buy a window or wall unit or do not know what type they would buy.

One-third of those who plan to buy in the next two years already have some form of air conditioning in their home. The type of air conditioning that they will buy does not differ from those specified by respondents currently without air conditioning.
**Implications**

Portable fans are the most common devices residents use to help cool their homes.

Although air conditioning systems are just as common in single-family as multifamily homes, the use of air-conditioning seems to be greater in multifamily residences, in terms of days per year they are used.

The greater age of air-conditioning in multifamily buildings may be further problematic, as older equipment may be less efficient. This presents an opportunity to work with multifamily buildings to upgrade their air-conditioning systems.

These findings suggest that programmatic attention be paid to air-conditioning in multifamily buildings.

In particular, the greater number of days multifamily residents use air conditioning suggests that they may have fewer methods to cool their homes than do single-family residents.

The temperature at which residents turn on their air conditioning is similar for different building types. Temperature preferences do not explain the more frequent use of air-conditioning by multifamily building residents.

The greater frequency of air-conditioning use by multifamily residents may be explained by the differences in the structures themselves. Single-family homes may be able to take advantage of cross-drafts from one end of the home to the other, whereas multifamily units may have limited ability for natural cooling, especially if south- or west-facing.

If the reason for differences in air conditioning use is structural, Seattle City Light may want to work with building managers to make residential units less susceptible to summer temperatures.

About 5% of respondents say they plan to buy an air-conditioner in the next 2 years. Because half of this group was undecided about their type of purchase, the utility may have an opportunity, through educational materials online or at point of purchase, to guide residents toward a more efficient model. To gain savings on both home cooling and home heating, these strategies might emphasis the benefits of ductless heat pumps.

**Trends over Three Decades of Residential Customer Characteristics Surveys**

**Figure 73: Air Conditioner Saturation: Trends over 3 Decades**

The proportion of homes with air conditioning has increased over past decades, from 3% in 1979 and 1990, to 7% in 2000 and to 14% in 2009. This is an added load to Seattle City Light’s electric system. It would be in the utility’s interest to ensure that, if this trend continues, that customers are fully informed about the most efficient heat pump alternatives.
Major Findings ▪ 4

Water Heating

Main Water Heating System

Figure 74: Main Water Heat Equipment

<table>
<thead>
<tr>
<th></th>
<th>Single Family</th>
<th>Midsize</th>
<th>Multifamily</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tank in heated area</td>
<td>56%</td>
<td>38%</td>
<td>60%</td>
</tr>
<tr>
<td>Tank in unheated area</td>
<td>39%</td>
<td>51%</td>
<td>13%</td>
</tr>
<tr>
<td>Tank-less, whole house or floor</td>
<td>3%</td>
<td>5%</td>
<td>0.7%</td>
</tr>
<tr>
<td>Tank-less, point of use</td>
<td>0.2%</td>
<td>0.9%</td>
<td>0.2%</td>
</tr>
<tr>
<td>Central boiler system</td>
<td>2%</td>
<td>3%</td>
<td>24%</td>
</tr>
<tr>
<td>Active solar</td>
<td>0.3%</td>
<td>0.0%</td>
<td>0.0%</td>
</tr>
</tbody>
</table>

Across all households surveyed, 58% use electricity as the main water heating fuel, 38% use natural gas, only 0.2% use solar energy, and the remainder of respondents are unaware of their water heat fuel. The main fuel used to heat water varies by type of residence. Multifamily units are most likely to use electricity (76%), compared to midsize attached homes (60%) and single-family detached homes (54%).

Figure 75: Main Water Heat Fuel

Single Family

- Electricity: 54%
- Natural gas: 46%
- Solar energy: 0.3%
- Unknown fuel: 0.2%
- Stated "None": 0.1%

Midsize

- Electricity: 60%
- Natural gas: 37%
- Solar energy: 3%
- Unknown fuel: 0.9%
- Stated "None": 0.0%

Multifamily

- Electricity: 76%
- Natural gas: 9%
- Solar energy: 0%
- Unknown fuel: 14%
- Stated "None": 1.0%
Natural gas heats the water in a substantial portion of single-family (46%) and midsize homes (37%), but only 9% of multifamily units.

*Following are descriptions of the main water heating systems for each major type of housing, organized by prevalence of equipment type within each fuel choice.*

**Single Family Detached Homes**

Among single-family homes, 53.8% of survey respondents use electricity as their main water heating fuel. This group is comprised of the following equipment categories: 31.2% tanks located inside a heated area; 21.8% tanks in an unheated area; 0.4% tank-less, on-demand, either for a floor or the whole house; and 0.4% central boiler systems.

Another sizeable group of single-family homes (45.6%) uses natural gas as the main water heating fuel. This group is comprised of the following equipment types: 24.4% tanks located inside a heated area; 16.9% tanks in an unheated area; 3.0% tank-less, on-demand, either for a floor or the whole house; 0.2% tank-less, on-demand, at the point of use; and 1.1% central boiler systems.

Solar energy supplies the main water heat for 0.3% of survey respondents. A fraction of cases (0.2%) cited some other water heat system.

**Multifamily Homes**

As for multifamily units, most survey respondents (76.2%) use electricity as their main water heating fuel. This group is comprised of the following equipment categories: 57.7% tanks located inside a heated area; 11.5% tanks in an unheated area; 0.5% tank-less, on-demand, either for a floor or the whole house; and 6.5% central boiler systems.

A smaller group of multifamily units (9.1%) uses natural gas as the main water heating fuel. This group is comprised of the following equipment types: 2.4% tanks located inside a heated area; 1.7% tanks in an unheated area; 0.2% tank-less, on-demand, either for a floor or the whole house; 0.2% tank-less, on-demand, at the point of use; and 4.6% central boiler systems.

Among multifamily residents, 13.2% do not know what fuels their hot water. (Sometimes hot water tanks are located behind secured panels; and a central boiler system may be located in a secured basement or utility room.)

Solar energy does not supply the main water heat for any survey respondents. A fraction of cases (0.5%) cited some other water heat system.

**Midsize Attached (multiplex) Homes**

Among midsize attached (multiplex) units, 59.7% of survey respondents use electricity as their main water heating fuel. This group is comprised of the following equipment categories: 27.2% tanks located inside a heated area; 31.6% tanks in an unheated area; and 0.9% tank-less, on-demand, either for a floor or the whole house. No central boiler systems were mentioned.

Another sizeable group of midsize homes (36.9%) uses natural gas as the main water heating fuel. This group is comprised of the following equipment types: 10.5% tanks located inside a heated area; 19.3% tanks in an unheated area; 4.4% tank-less, on-demand, either for a floor or the whole house; 0.9% tank-less, on-demand, at the point of use; and 1.8% central boiler systems.

Solar energy does not supply the main water heat for any survey respondents. A fraction of cases (1.8%) cited some other water heat system.
heating fuel and electricity for water heat, comprise 11% of midsize attached (multiplex) homes.

The picture is quite different for multifamily homes, of which 71% are all-electric “single fuel” homes, for both main home heating and water heat. About 5% are all-gas “single-fuel” homes, 5% “dual-fuel” homes use natural gas for home heat but electricity for water heat, and 4% have the opposite “dual fuel” combination (electric home heat, gas water heat). Another 12% with electric home heating have a central water heat system but the respondent did not know the fuel source.

In summary, natural gas water heat is seen almost exclusively in single-family detached and midsize attached households that also have natural gas for their main home heating fuel. In single-family homes where the main home heating fuel is natural gas, however, one-third use electricity for water heat.

**Figure 77: Main Water Heat System Age**

Nearly all single-family residents having electricity as the main home heating fuel also heat their water with electricity; this “single fuel” group represents 19% of all single-family homes. Most single-family residents having natural gas as the main home heating fuel also heat their water with natural gas; this “single-fuel” group represents 41% of all single-family homes.

The two “dual fuel” groups have natural gas as the main home heating fuel but heat the water with electricity (17%); or heat their home with fuel oil but the water with electricity (16%). The remaining 7% of single-family homes use some other combination of fuels for their main home heating and water heat.

A similar pattern is seen for midsize homes, except for the absence of fuel oil for home heating. Nearly half (47%) are all-electric “single-fuel” homes, and a third (32%) are all-gas “single-fuel” homes. The “dual fuel” group, with natural gas for the main home heating fuel and electricity for water heat, comprises the remaining 20%. In midsize homes, the water heat equipment is most commonly 2-10 years old (29%) or 11-20 years old (30%), with 21% older than that.
Reports on water heat equipment in multifamily buildings are split between these two age groups (16% and 12% respectively). Note that half of multifamily residents do not know the age of their building’s water heat equipment.

The profile for age of water heat equipment among midsize homes is closer to that for single-family homes. One-third of respondents do not know the age of their water heat equipment—a proportion that is higher than for single-family but lower than for multifamily respondents.

**Figure 78: Main Water Heat Fuel by Decade Building Constructed**

In single-family homes, electric water heating equipment is most common for homes built from the 1940s to the 1980s, but the trend has dramatically reversed in the past two decades. Since 1990, gas water heat has been installed in four out of five newly constructed single-family homes.

In multifamily homes, electricity is the predominant fuel used for water heat, especially in those built since the 1950s (63–88%). Similar to the findings for home heating systems installed in the past decade (see Section 2 of this report), the proportion of gas water heat systems has increased and the proportion of electric systems decreased in newly constructed multifamily buildings. Note that relatively few multifamily buildings were constructed during the 1940-49 decade. The apparent peak in central systems (fuel unknown) and other fuels is based on a small sample subgroup, and may be anomalous.

**Supplementary Water Heat**

**Figure 79: Additional Water Heat Equipment**

Most residents who have a supplementary water heat system have a tank system in a heated (5% of all households) or unheated (3%) area. Only 1% of all households report a point-of-use tankless system.

**Figure 80: Additional Water Heat Fuels**

Most supplementary water heat systems use electricity (7% of all households), compared to 3% that use gas.
Changes in Water Heat

Figure 81: Prior Main Water Heat System, in Single Family Homes that Changed Equipment since January 2007

Only 6% of households reported a change in their water heat equipment over the prior two-year period. Of the households able to report on changing water heat equipment since January 2007, 95% were single-family homes. The largest portion (62%) of households that changed switched from an electric tank in a heated area to another piece of equipment. One-third switched from a natural gas tank in a heated area.

Among residents who changed their water heat systems in the prior two years, twice as many changed from electricity as changed from natural gas.

The numbers of cases described in the next figure are very small (for instance, 42 households switched away from an electric tank, and 23 switched from a natural gas tank). These are the only groups which showed a pattern of change. Most combinations from one equipment type to another involved fewer than five households.

Whether the water heat equipment change-out was from an electric tank or a natural gas tank, most new equipment is natural gas heated (70-71%). Only one-quarter (24-26%) of households changing equipment selected electricity as the replacement fuel, during the past two years.

Not displayed in this chart, half of the households acquiring new equipment (51%) switched fuels, either from electricity to gas (43%) or from gas to electricity (9%). One-third stayed with the prior fuel choice: electric-to-electric (14%), or gas-to-gas (23%).
The main reason for changing a water heat system was to replace worn out equipment. Lowering energy bills appears to be a motivator for single-family residents more than other residents. Further, saving energy was a reason for change more often for residents of single-family detached and midsize attached (multiplex) homes, and less so for multifamily residents. In contrast, water leaks were a greater concern for midsize and multifamily residents than for single-family residents.

These group differences depict trends consistent with the differences in home ownership (and electricity expenses) that various housing types represent. However, because the reason statements were part of a multiple-response question, group differences cannot be tested for statistical significance.

Single-family residents report installing more showerheads than other residents in the previous 5 years. However, midsize and multifamily residents are more likely to report they don’t know if a new showerhead has been installed.

Single-family residents are twice as likely as other residents to have installed a new efficient-flow showerhead. They are also somewhat more likely than others to have installed a standard flow model.

In all building types, about 11% of households have installed a rain shower or showerheads with multiple-nozzles, within the past five years.
Single-family residents report installing more new toilets than other residents. Similar to reports of showerhead installations, however, midsize and multifamily residents are more likely to say they don’t know if a new toilet had been installed.

Single-family homes are twice as likely as multifamily homes to have installed an efficient-flush model (1.6 gallons per flush or less). Midsize attached (multiplex) residents fell between the two groups, but installed efficient-flush toilets only slightly more often than multifamily residents.

Implications

Water Heating

Housing types differ greatly in the type of water heating system they use. Understanding the profile of each housing type is important for planning and targeting programs to customer groups.

Multifamily Homes

Two features of multifamily residences indicate that the efficiency of their fixtures and water heating systems could have greater implications for energy use in general than other housing types. First, multifamily residences were most likely to have an electric water heater, rather than gas, and second, a large proportion of multifamily buildings that use electricity for water heat have been built since 1950 and are likely to be part of the housing market for many more decades. Some findings for multifamily homes suggest inefficiencies, whereas others suggest more efficient water heating among these residences. Multifamily homes present a complex picture.

Multifamily homes may heat water more efficiently because two-thirds of multifamily water heating systems are located in heated areas (similar to the proportion in single-family homes), compared to 38% in midsize homes. However, multifamily homes may use hot water less efficiently because fewer new showerheads have been installed in multifamily (and midsize) homes in the past five years, and when a new showerhead was installed, fewer of them were efficient-flow models, compared to single-family homes.

Single Family Detached & Midsize Attached (multiplex) Homes

Both single-family and midsize homes may be vulnerable to heat loss because the water heaters often are located in unheated areas (more so than for multifamily homes).

Supplementary Water Heat

About 10% of households have a supplementary water heat system. Most of these were electric systems and were traditional tanks in heated areas of the home. This is a substantial number of residents for whom the main water heat system was inadequate to meet their needs.

Few tankless, point-of-use systems were reported. Yet, where the fuel for these systems is natural gas, they have the potential to provide significantly more
efficient supplemental hot water delivery than a second tank (this is not true if electricity is the fuel).

Age of Water Heat Systems

About half of the residential water heating systems in use were more than 10 years old. If the average life of these systems is 12 to 16 years, many are due for replacement. Seattle City Light can help educate residents in their system choices and facilitate these purchases.

Given that half the multifamily respondents, and one-third of midsize attached (multiplex) respondents, do not know the age of their water heat systems, it may be important to confirm the ages of these water heat systems through other means (such as, home audits, or surveys of building owners and managers).

Changes in Water Heat

On average, it appears that 5.6% of homes (mainly single-family households) bought a new water heater in the prior two years. This implies that water heaters “turn over” about once every 18 years.

Most changes in water heat systems over the prior two-year period were motivated by a need to replace worn out equipment. However the survey did not ask if the equipment failed. These equipment changes might have occurred after an equipment failure or might have occurred because residents perceived their equipment needed a replacement due to its age or some other reason. Changes in water heating equipment could be encouraged with education about the average life of this type of equipment.

Nearly as important, lowering energy bills and saving energy were the next most frequently reported motivators for all residents, and could continue to be used effectively in promotional materials.

Beyond these motivators, a smaller segment (but more than 10%) of residents in single-family detached homes appreciated: living more sustainably, reducing my carbon footprint, and having more hot water. Midsize attached (multiplex) residents endorsed: living more sustainably, and no more concern about leaks (19% each). Multifamily residents endorsed: no more concern about water leaks (12%). These differential concerns might be addressed in promotional materials to different building types.

Fixtures

Fixtures of convenience, such as showerheads and toilets may be less often replaced in multifamily homes because, in the absence of a specific problem, it is up to the tenants to initiate action. Renters (the majority of multifamily residents) may be reluctant to invest in equipment for a unit they do not own.

Extrapolating from survey responses, about 114,000 households installed new efficient-flow showerheads in the past five years within the Seattle City Light service area. In 2002-2007, The City of Seattle (City Light and Public Utilities) operated programs that distributed about 66,000 efficient showerheads to utility customers.

In all building types, about 11% of households have installed a rain shower or showerheads with multiple-nozzles, within the past five years. This is of concern to Seattle City Light and Seattle Public Utilities, because this type of installation is highly inefficient in the use of water, including heated water. The City utilities have promoted high-efficiency showerheads for the past 17 years, and find this new trend troubling, because it undermines federal efficiency standards as well as utility conservation goals.

On the other hand, the proportion of households installing efficient-flush models of toilets over the past five years is gratifying and reflects well on conservation programs operated by Seattle Public Utilities. Over one-third of single-family homes have installed an efficient toilet (1.6 gallons per flush or less) in the past five years, as have nearly a quarter of midsize homes. This measure has not reached as far into the multifamily sector, so potential remains there for utility programs to target.
The proportion of homes with electricity as the main water heat fuel has declined steadily over the past three decades, from 88% in 1979 to 58% in 2009. Thus, one third of all homes that formerly had electric water heat have now converted to natural gas for water heating.

Meanwhile, the reciprocal pattern happened for non-electric water heat, rising from 11% in 1979 to 38% in 2009, a tripling of market share.

This pattern reflects on shifting prices of natural gas, relative to electricity, over the past three decades. As newer residential buildings are constructed, builders make water heat equipment choices based on first cost and projected operating costs. Homeowners make a similar choice every 12 to 18 years, when it comes time to replace a failing water heater, or the choice is made to supplement water heat at the tap.

The overall trends seen in this figure mirror to some extent those seen in the earlier chart (Figure 78), on Main Water Heat by Decade Building Constructed.

More and more, water heating equipment is found within heated areas of the dwelling, rather than outside the building envelope. This suggests that fewer tanks are being located in garages or porches, and that formerly unheated basements are being converted to heated spaces.
Major Findings • 5

Major Appliances

Refrigerators

Figure 88: Refrigerators per Household

Except for two multifamily households, all residents surveyed have at least one refrigerator. Residents of single-family detached homes are more likely than those in other housing types to have two or three refrigerators; 29% say they have two, and an additional 3% say they have three refrigerators.

A substantial number of midsize attached (multiplex) homes have two (18%) or three (4%) refrigerators. Multifamily homes are least likely to have two or more refrigerators, compared to other housing types.

Figure 89: Refrigerators per Household and Those Plugged-in more than 3 Months of the Year

For all building types, nearly all (96%) of the refrigerators in homes are plugged in for more than 3 months of the year.

The chart shows the average number of refrigerators owned and the average number plugged in for more than 3 months of the year for each housing type. Single-family homes have 130 refrigerators plugged in most of the year (in use) for every 100 single-family homes, compared to 117 for midsize, and 95 refrigerators for every 100 multifamily homes.

Figure 90: Location of Refrigerators in Heated and Unheated Areas

Across all building types, 87% of refrigerators are located in a heated area, and 13% in an unheated area.

The transparent portions of the columns in the chart show that single-family homes have a slightly larger proportion of refrigerators in unheated areas, on average, than other housing types.
Among all building types, respondents in 9% of homes bought a new refrigerator in 2008.

Most of the main refrigerators in use, regardless of housing type, are between 2 and 10 years old; about two-thirds fall in this age category. A substantial proportion of refrigerators (31%) are older than that.

A large proportion of midsize and multifamily respondents are unsure how old their refrigerator is, suggesting that the proportions of refrigerators in each age category are underestimated for these groups. (That is, these “don’t know” cases would be distributed among the other columns, which would increase the percentages in each age bracket.)

More than one-third of single-family households (41%) have at least one stand-alone freezer. This is more than twice the number of freezers in other household types. Multifamily households are least likely to have a stand-alone freezer (9%).

In single-family homes, about there are about 36 working stand-alone freezers per 100 homes. The incidence of freezers in other household types is much lower, and they are much less likely to have a second working freezer.

Based on the total number of freezers in surveyed homes, rather than the average number per home, similar proportions of stand-alone freezers are plugged in for more than 3 months of the year: 72% in single-family and 71% in midsize homes. Among multifamily homes the proportion is lower (34%).
Regardless of building type, respondents in 4% of homes bought a new stand-alone freezer in 2008.

About half the freezers in single-family homes are more than 10 years old, and about one-quarter are more than 20 years old. The pattern is similar for midsize households, but 25% of respondents do not know the age of their freezers, so all other categories are underestimated by these data.

The findings for multifamily households are less reliable due to the large proportion who do not know the age of their freezer, combined with the small sample size of freezer owners in this group.

There is a clear and significant relationship between how many refrigerators are in the home and whether the home also has a separate, stand-alone freezer in use. Where there is one refrigerator in use, 30% of homes also have a stand-alone freezer in use. Where there are two refrigerators in use, the proportion of freezers rises to half; and where there are three or more refrigerators in use, 60% of homes also have a stand-alone freezer plugged in and in use.
**Clothes Washers & Dryers**

*Figure 97: Clothes Washers in Home per Household*

Twice as many single-family homes (91%) as multifamily homes (40%) have a clothes washer. Most multifamily residents (58%) do not have a clothes washer in their residential unit.

Only a small proportion of respondents (2% overall) has more than one clothes washer.

*Figure 98: Clothes Washers in Home per Household, by Type of Machine*

Top loading washers with an agitator are the most popular model of washer in all types of homes. There are 57 of this model type for every 100 single-family homes, 46 for every 100 midsize homes, and 31 for every 100 multifamily homes.

Front load washers are more popular in single-family homes than in multifamily homes. About one-third of washers in single-family homes are front load models, whereas about one-fourth of washers in multifamily homes are front load models.

*Figure 99: Age of Clothes Washer*

Among all building types, respondents in 7% of homes bought a new clothes washer in 2008.

Most of the clothes washers in use in all types of households are less than 11 years old. Midsize and multifamily respondents were less able to report the age of their washers, but the pattern of age categories is similar among all groups.
The pattern of households with clothes dryers is nearly identical to that for clothes washers.

Twice as many single-family homes (93%) as multifamily homes (41%) have a clothes dryer. Most multifamily residents (58%) do not have a clothes dryer in their dwelling unit.

Only a small proportion of residents (3% overall) have more than one clothes dryer.

The vast majority of clothes dryers are electric. There are 80 electric clothes dryers but only 8 natural gas clothes dryers for every 100 households. Multifamily households are least likely to have a gas clothes dryer.

In general, a microwave oven (green lines) is the most common electric (EL) cooking appliance in all types of households; 78-89% of all household subgroups have a microwave oven. Electric cooktops with an oven (blue lines) have a large market share in both electric-heated and non-electric-heat households.
Households with electric heat also have an electric cooktop with oven about as often as they have a microwave. Much smaller proportions of electric-heat households have a separate electric cooktop and separate oven. Single-family homes are more likely to have these separate items than other household types.

Not charted, a small group of electric-heat homes (7%) have a gas cooktop with oven, and fewer (less than 2%) have a separate gas cooktop.

For homes that are heated by natural gas or oil, electric cooktops with oven (blue lines) are more common than natural gas (NG) cooktops with oven (yellow lines) for the single-family group (57% electric vs. 28% gas) and the multifamily group (61% electric vs. 32% gas). Midsize homes are evenly divided between electric and gas cooktops with oven.

The upper chart shows the selected other appliances in households that have electric space heat, and the lower chart shows these appliances in households that have gas or oil space heat.

The main distinction of homes heated by natural gas or oil is that they more often have a natural gas (NG) indoor fireplace. Single-family residents, more than other groups, have an outdoor barbecue fueled by bottled gas (BG).

Dishwashers are found in more than two-thirds of all homes, but least often in the few multifamily buildings heated with natural gas or fuel oil.

**Familiarity with Energy Star Logo**

**Figure 104: Familiarity with Logo by Age of Refrigerator**

Survey respondents viewed a copy of the Energy Star logo and were asked how familiar they are with it. Half of all residents say they have a product in their homes with an Energy Star label. The following comparisons for various ages of major appliances do not refer to whether the appliance itself has an Energy Star label.

Familiarity with the Energy Star logo varies by age of the refrigerator in residents’ homes. Residents who purchased a refrigerator within the previous 10 years are more likely than residents with older refrigerators to say they have some Energy-Star labeled product in the home.
In contrast, residents with refrigerators older than 11 years are more likely to say they had seen the Energy Star logo on products in stores, had heard about it, or were not familiar with the labeling.

**Figure 105: Familiarity with Logo by Age of Freezer**

![Familiarity with Logo by Age of Freezer](image)

Familiarity with the Energy Star logo also varies by age of the freezer in residents’ homes. Those who had purchased a freezer in the previous two years are more likely than any other group (even those with relatively new freezers) to say they had seen the Energy Star logo on products in stores.

The older the freezer, the more likely residents are to say they are unfamiliar with the Energy Star logo.

Residents who have no freezer are as familiar with the Energy Star logo as residents who have a freezer that is at least 2 years old.

**Figure 106: Familiarity with Logo by Age of Clothes Washer**

![Familiarity with Logo by Age of Clothes Washer](image)

Familiarity with the Energy Star logo varies by age of the clothes washer in residents’ homes. The newer the clothes washer, the more likely residents are to say they have some product with this label in the home.

Residents with older washers (similar to those with older refrigerators and freezers) are more likely to say they are not familiar with the logo. In the case of washers, those with older models also were more likely to say that they had seen the Energy Star logo on products in stores. This pattern was similar to that for age of refrigerators and freezers.

**Implications**

**Refrigerators**

The predominance of second and third refrigerators in single-family detached and midsize attached (multiplex) homes, suggests that programs to upgrade or remove old refrigerators could be concentrated within these segments.

Because single-family households are most likely to have a refrigerator located in an unheated area, they are most likely to “lose” energy from the heat expended by those refrigerators. Assuming that the refrigerators in unheated areas are the “second” and probably older models, they would be good targets for replacement or removal.

Because nearly 30% of the refrigerators used most often were purchased more than 10 years ago, the utility has an opportunity to promote the newest, most efficient refrigerators to this portion of the market. It will be important to direct these promotions to the right groups of consumers. To reach the majority of single-family homes, promotions would likely best be directed to individual home owners.

In contrast, promotions for energy efficient major appliance purchases in midsize and multifamily buildings would need to include owners and managers of apartment complexes. Although some renters and condominium owners provide their own appliances, major appliances in multifamily homes often come with the unit (or, as with shared laundry...
machines, are located in a common area). As well, condominium associations could facilitate purchases among condo owners.

Among all building types, respondents in 9% of homes bought a new refrigerator in 2008. This implies that refrigerators “turn over” about once every 12 years.

**Freezers**

The proportion and use (proportion plugged in) of freezers in single-family households suggests that the greatest energy savings could be achieved by considering programs specifically for single-family homes.

There is a significant relationship between the number of refrigerators in the home (plugged in most of the year) and the likelihood of a separate stand-alone freezer in use. These homes may have particular characteristics that could be explored to identify efficiency opportunities. For example, some of these homes might be involved in a small grocery or food preservation business.

On average, respondents in 4% of homes, regardless of building type, bought a new stand-alone freezer in 2008. Over the previous nine years (freezers aged 2-10), 4% of respondents purchased a new freezer each year. This implies that freezers “turn over” about once every 23-24 years – or, that many households have purchased them for the first time during the past decade.

**Clothes Washers & Dryers**

Top-load washers are more prevalent than front-load washers, among all household types. However, front-load washers have gained a significant market share. They now comprise 37% of clothes washing appliances in single-family homes, 38% among midsize homes, and 25% among multifamily homes.

With these levels of market saturation, there are likely about 111,000 front-loading clothes washers in homes within Seattle City Light’s service area. Over the period 1997-2008, this municipal electric utility, in partnership with Seattle Public Utilities (providing water, sewer, garbage and recycling), paid over 48,500 incentive rebates to customers for buying these efficiency-qualifying clothes washers. The apparent redemption rate of 44% for this rebate offer is right in line with marketing industry experience for this type of rebate (as averred by Aberdeen Group, a major market research firm).

Front-load washers are more dominant among single-family and midsize households than they are among multifamily households having a machine in the residential unit. Because front-load washers are more expensive than top-load products, market transformation among these residents may be a challenge. They do have the advantage of being stackable with clothes dryers, which may make them desirable in smaller residential units.

Single-family households, while more receptive to front-load models up to now, are important in the clothes washer/dryer market because twice as many of these households have these appliances as in other households.

On average, respondents in 7% of homes, regardless of building type, bought a new clothes washer in 2008. This implies that clothes washers “turn over” about once every 14 years.

Electric clothes dryers dominate the market for all household types, making the use of clothes dryers an important focus of energy savings. The incidence of clothes washers and dryers is almost identical, suggesting that households with one of these appliances generally have both. Because the amount of drying time needed is dependent upon the efficiency of the clothes washer, it is important to make energy efficient washers the main focus of product promotions. However, residents may need guidelines for setting their dryers at a lower heat or for a smaller amount of time when making a clothes washer transition from a top load model to a more efficient non-agitator or front-load model.
Other Cooking Appliances

The high incidence of microwave ovens in Seattle homes indicates that microwaves continue to be a standard electric cooking appliance in all types of households with all types of heating fuels.

The electric cooktop with oven is the most popular (non-microwave) cooking appliance in both electric-heat and non-electric-heat homes. The energy savings from using microwave ovens might offset the impact of the high market share for electric ovens.

Dishwashers are the next most common electrical appliance across all households, although they are not as common in multifamily homes.

Energy Star Logo

Although the Environmental Protection Agency introduced the Energy Star logo in 1992, only half of Seattle residents are aware that a product with that logo has made its way into their homes, and 14% are unfamiliar with the logo. However, because recent purchasers of major appliances (within the last 10 years) are more likely to say they have such an appliance in the home, we can expect that over time more households will acquire and be aware of their Energy Star products.

The main concern is that not all residents are familiar with the logo, even though it is applied to energy-efficient buildings as well as small consumable products, such as compact fluorescent light bulbs.

Incidentally, the proportion of residents who do not have CFL bulbs in their homes (14%) is the same size as the proportion who are not familiar with the Energy Star logo. (It may not be the same individual respondents in each group). Even if residents have not purchased a major appliance recently, those who have used CFL bulbs have been exposed to the logo.

Controversy has arisen recently over the effectiveness of the program and product testing procedures (see Seattle Times, September 13, 2008). The utility might want to further study the impact of the Energy Star program and consider the utility’s role in heightening residents’ awareness of the Energy Star designation and its meaning for energy savings.

Trends over Three Decades of Residential Customer Characteristics Surveys

Figure 107: Major Kitchen Appliance Saturations: Trends over 3 Decades

The most dramatic shift in ownership of major appliances can be seen in the case of microwave ovens. In 1979, only 13% of households had a microwave oven; by 2009, microwaves have become nearly ubiquitous, being found in 87% of homes.

A slightly less dramatic shift can be seen for dishwashing machines, which increased in saturation from 49% of homes in 1979 to 77% of homes today. Meanwhile, the share of homes with a separate food freezer has remained relatively constant at 34%.
Major laundry appliances are found in 2009 homes more often than in 1979, but saturations have not increased appreciably in the past decade.

Clothes washer saturation has increased from 70% in 1979 to 83% in 2009. Electric clothes dryers are more common than gas heated models, and increased in saturation from 63% in 1979 to 78% in 2009. Meanwhile, gas dryer saturation rose modestly from 2% to 8% over the same three-decade period.
**Major Findings • 6**

Electronic Equipment

**Rechargers**

*Figure 109: Rechargers for Cell Phones, per Household*

Most households have one or two cell phone rechargers (76%). About 14% of respondents report three or more cell phone rechargers. The average number per household (1.6 overall) is greater for single-family detached and midsize attached (multiplex) households (1.7 each) than for multifamily households (1.2).

*Figure 110: Rechargers for Bluetooth Devices, per Household*

Most households have no rechargers for “Bluetooth” devices (which exchange data wirelessly over a short range, as with mobile phones and headsets, computer keyboards or mice, printers, digital cameras, PDAs, and other mobile devices).

Multifamily households are least likely to have this kind of recharger (14%) compared to single-family (24%) and midsize households (22%). The average number per household (0.3 overall) is greater for single-family and midsize households (0.3 each) than for multifamily households (0.2).

*Figure 111: Rechargers for PDAs and Pocket PCs, per Household*

Most households do not have any rechargers for “personal digital assistants” (PDAs or Pocket PCs). Regardless of housing type, 12% of respondents report one or more of this type of recharger. The average number per household overall is 0.2.

*Figure 112: Rechargers for iPod, Zune, MP3 Players, per Household*

More than half of all households (59%) have one or more rechargers for personal music players, such as an iPod, Zune, or MP3 player. Among those that do have this type of recharger, most have only one, but 16% have more than one. The average number per household overall is 0.6.
Figure 113: Rechargers for AA, C, and D Batteries, per Household

About one-fourth of households have a recharger for AA, C, or D batteries, and about 8% have two or more of these rechargers. The average number per household overall is 0.4.

Figure 114: Rechargers for Camera Batteries, per Household

Half of all households (51%) have one or more rechargers for camera batteries. Single-family and midsize households are more likely to have these rechargers than are multifamily households. The average number per household overall is 0.7.

Computer Equipment

Figure 115: Total Number of Computers per Household

Not every Seattle household has a computer; 12% of respondents report none. But those that do have a computer are more likely to have two or more (50%) than they are to have just one (39%).

The average number of computers per home is 1.8 in single-family homes, 1.7 in midsize homes, and 1.3 in multifamily homes. The average number per household overall is 1.7.

Figure 116: Desktop Computer CPU Equipment, per Household

Overall, 65% of households have at least one desktop computer. Further, 14% of all respondents report more than one desktop computer in the home. The average number per household overall is 0.8. Multifamily households are less likely than others to have a desktop computer.
Overall, 60% of households have at least one laptop or portable computer. Further, nearly one-fourth have two or more, indicating a higher market penetration rate for laptops (22%) than for desktop computers (14%; see previous figure). Among those households that have at least one laptop, about one-third have more than one. The average number per household overall is 0.9.

Although multifamily households are less likely than others to own any type of computer, they are more likely to have a laptop computer than a desktop model.

One-fourth of all households have a standard CRT monitor. More single-family homes have this type of monitor than do other housing types. The average number per household overall is 0.3.

Nearly half of all households (44%) have one or more LCD flat screen computer displays. Again, single-family homes (46%) are more likely to have this type of equipment compared to midsize (40%) and multifamily homes (33%). The average number per household overall is 0.6.

More than two-thirds of households have a printer, scanner, copy or fax machine. Single-family households are more likely than other housing types to have multiple machines, whereas multifamily households are more likely to have none of this type of equipment (46%). The average number per household overall is 0.9.
Most households (70%) have a modem that allows connection with the Internet. More multifamily households (45%) do not have this equipment compared to single-family (27%) and midsize (27%) households without a modem. The average number per household overall is 0.8.

About one-fourth of households (26%) have a home computer network. Single-family homes are more likely to have one (28%) compared to midsize (22%) or multifamily (19%) homes. The average number per household overall is 0.3.

A small proportion of households (5%) have home server equipment. The proportion does not vary by housing type. The average number per household overall is 0.1.

One in seven households (14%) has an uninterruptible power supply. This is an emergency battery back-up which instantaneously supplies power to electronics for a short period of time, should a home circuit breaker open, or utility mains fail and the home experiences an unexpected power outage. The average number per household overall is 0.1.
**Televisions**

**Figure 125: Total Televisions per Household**

![Bar chart showing the distribution of televisions per household.]

Although not everyone has a television, the pool of televisions in Seattle homes is enough to average two for every single-family or midsize household, and more than one per multifamily household. The average number per household overall is 2.0. Only 3% of households lack a television.

**Figure 126: Standard Television (CRT), 12-22 Inches, per Household**

![Bar chart showing the distribution of standard televisions per household.]

Nearly half of all households surveyed (46%) have at least one standard television with a 12-22-inch screen. Multifamily respondents are least likely to report one of these models. The average number per household overall is 0.6.

**Figure 127: Standard Television (CRT), 23-38 Inches, per Household**

Again, half of all households (46%) have at least one standard television with a 23-38-inch screen. One-third of all households (34%) have exactly one of these larger TV models. However, single-family respondents are more likely than are the other housing types to report two or more of these models. The average number per household overall is 0.6.

**Figure 128: Rear Projection Television (large screen), per Household**

Only one in twenty households (6%) has a large screen rear projection television. Single-family households are twice as likely to have this equipment as are other housing types. The average number per household overall is 0.1.
Figure 129: Television with Built-in DVD or VCR, per Household

Only 13% of households have a television with a built-in DVD player or VCR deck. The average number per household overall is 0.2.

Figure 130: LCD Flat Screen Television, Less than 45 Inches, per Household

One-third of all households (33%) have at least one LCD flat screen television, less than 45 inches. Only slightly more single-family and midsize households have this equipment compared to multifamily households. The average number per household overall is 0.4.

Figure 131: LCD Flat Screen Television, 45 Inches or More, per Household

Fewer residents have a larger LCD flat screen television, 45 inches or more, than a smaller model of this type. Only 8% of households have this equipment. The average number per household overall is 0.1.

Figure 132: Plasma Flat Screen Television, Less than 45 Inches, per Household

Still fewer households have a plasma flat screen television (5%), less than 45 inches. This proportion is similar for different housing types. The average number per household overall is 0.1.
Figure 133: Plasma Flat Screen Television, 45 Inches or More, per Household

94% 97% 98% 5% 3% 2% 0% 0% 0% 0% 0%

Single Family | Midsize | Multifamily

Average: 0.06

About the same proportion of households overall (5%) have a larger plasma flat screen television, 45 inches or more, as have a smaller model of this type. Single-family households are more likely to have this equipment. The average number per household overall is 0.1.

Video Equipment

Figure 134: Digital Video Deck (DVD) Equipment, per Household

37% 40% 47% 46% 44% 46%

Single Family | Midsize | Multifamily

Average: 0.84

About two-thirds of all households surveyed (61%) have at least one DVD player. About 15% have two or more. Single-family households are more likely to have multiple items of DVD equipment than are multifamily households. The average number per household overall is 0.8.

Figure 135: Video-cassette Deck (VCR) Equipment, per Household

61% 63% 69% 33% 32% 28% 6% 5% 2% 1% 0% 0%

Single Family | Midsize | Multifamily

Average: 0.47

About one-third of all households (37%) have at least one VCR deck. A small subgroup of about 6% has more than one unit. Single-family and midsize households are more likely to have a VCR (and to have multiple items of equipment) than are multifamily households. The average number per household overall is 0.4.

Figure 136: VCR-DVD Combo Unit Equipment, per Household

69% 76% 78% 27% 20% 20% 4% 3% 2% 1% 2% 0%

Single Family | Midsize | Multifamily

Average: 0.37

Nearly one-third of households (29%) have a combination VCR-DVD player. Notice that more households have an individual DVD or VCR unit than a combination VCR-DVD unit.

Single-family households are more likely to have a combination VCR-DVD than are midsize or multifamily households. The average number per household overall is 0.3.
Figure 137: Video Game Console Equipment, per Household

One out of five households (21%) has video game console equipment. Of those households who have a game console, one-fourth have two or more units (these make up 5% of total households). Single-family homes are more likely than are multifamily homes to have this kind of console. The average number per household overall is 0.3.

Figure 138: Digital to Analog TV Signal Converter Equipment, per Household

About 13% of all households have digital-to-analog TV signal converter equipment. This equipment is used with older models of televisions that do not receive digital signals on their own. The average number per household overall is 0.2. More midsize and multifamily households have a converter for a single television. Of those single-family households having any, one-third have two or more converters.

Figure 139: Set Top Box for Cable or Satellite TV Reception, per Household

Just more than one-third of all households (37%) have at least one set top box for cable or satellite TV reception.

Notice that about one-fourth of all households (25%) have exactly one set top box. This proportion is the same for all housing types. However, few multifamily households have more than one of these boxes (3%) compared to single-family (13%) and midsize homes (14%). That is, one-third of the single-family and midsize homes that have this type of set top box have more than one unit. The average number per household overall is 0.5.

Figure 140: Set Top Box for TiVo or Replay TV Reception, per Household

Fewer households (10% overall) have a set top box for TiVo or Replay TV service. The average number per household overall is 0.1.
Still fewer households (4%) have a computer-run media system. This proportion does not vary by housing type. The average number per household overall is 0.04.

**Audio Equipment**

**Figure 142: Component Stereo System Equipment, per Household**

More than half of all households (54%) have a component stereo system. Single-family (59%) and midsize homes (54%) are more likely to have this equipment than are multifamily homes (37%). The average number per household overall is 0.6.

**Figure 143: Compact All-in-One Stereo Equipment, per Household**

More than one-fourth of all households (27%) have at least one compact all-in-one stereo. Single-family households are slightly more likely to have this equipment than are multifamily households. The average number per household overall is 0.3.

**Figure 144: Portable Boom-Box Audio Equipment, per Household**

One-fourth of households (25%) have a portable boom-box. Single-family homes are more likely to have this equipment (27%) than are other housing types (20%). The average number per household overall is 0.3.
A very small proportion of households (2%) have karaoke audio equipment. This proportion does not vary by housing type. The average number per household overall is 0.02.

**Power Strips & Timers**

Nearly all households (93%) have at least one power strip in the home; most have 1-3 power strips.

More than half of all households surveyed (57%) do not use their power strips to turn electronic equipment on and off. About one-third of households use power strip switches to turn off their computer equipment, and one-fourth turn off their televisions this way. Video equipment, audio equipment and rechargers are less often turned off via a power strip switch.

Few residents use timers to turn off electronic equipment (3%) or small kitchen appliances (5%). About one-fourth (23%) do use timers to turn their lights on and off.

**Implications**

In general, the more prevalent a particular type of electronic equipment, and the more energy it requires, the greater the concern about energy consumption, and also the greater the opportunity for energy savings.
Educational messages for broadly used products can be distributed broadly, to the general public, and might be used to gain the attention of the audience. Messages about lesser used items, in contrast, might best be delivered at point of purchase or in community settings where the products are most used.

**Rechargers**

In most cases, the number of rechargers for electronic equipment is a stand-in for the electronic devices themselves. Consistent with other findings, single-family residents, who have higher average incomes than other residents, tend to have more electronic products that require chargers.

Single-family residents, however, are not alone in their use of these rechargers, suggesting a broad approach to educating customers about their recharger use.

Currently, the most widely used rechargers are for cell phones, personal music players, and camera batteries. A much smaller proportion of residents use rechargers for handheld computers, Blue tooth devices, and regular AA, C or D batteries.

**Computer Equipment**

In Seattle area homes, computers have become nearly as plentiful as televisions. Only 12% of households do not have a computer, compared to 3% without a TV. In addition, two-thirds of households have a modem and printer or copier.

This widespread use of computer equipment could account for a significant amount of energy use that has not yet been addressed by utility programs. However, national efforts have been successful at implementing federal standards and adopting Energy Star labeling.

LCD monitors, the more efficient type of display equipment, are more prevalent than standard CRT monitors, yet CRTs are in one-fourth of Seattle households.

Further, one-fourth of households have home networking equipment. Fewer have uninterruptible power supplies or servers.

**Television Equipment**

The most popular television equipment in Seattle households is a standard CRT model. About half of all households have a smaller model, with 12-22 inch screen, and almost half have a larger model, with 23-38 inch screen. (These two groups of households may overlap, such that some of these households may have one of each.)

One-third of all households have an LCD flat screen television with a screen less than 45 inches. Another 13% of households have a television with a built-in DVD player or VCR.

Less common, each found in less than 8% of Seattle households, are large LCD flat screen TVs (45 inches or more), smaller and larger plasma TVs (less than 45 inches, and 45 inches or more), and rear projection TVs.

**Video Equipment**

Seattle City Light customers use a variety of video accessory equipment. The proportions of the total households surveyed that have each type of equipment are as follows:

<table>
<thead>
<tr>
<th>Video Equipment:</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Digital video disk: DVD</td>
<td>61%</td>
</tr>
<tr>
<td>Set top box for cable/satellite</td>
<td>38%</td>
</tr>
<tr>
<td>Videocassette recorder: VCR</td>
<td>37%</td>
</tr>
<tr>
<td>VCR / DVD combo</td>
<td>29%</td>
</tr>
<tr>
<td>Video game console</td>
<td>21%</td>
</tr>
<tr>
<td>Digital-to-analog converter</td>
<td>13%</td>
</tr>
<tr>
<td>Set top box for TiVo / Replay TV</td>
<td>10%</td>
</tr>
<tr>
<td>Computer to run media center</td>
<td>4%</td>
</tr>
</tbody>
</table>
DVD players are part of the standard electronic equipment in more than half of all households surveyed. In addition, more than one-third of households have a VCR unit or combination VCR-DVD unit, indicating that residents perceive a need for both technologies.

As well, over one-third of the households surveyed have a set top box for cable or satellite reception. Among single-family and midsize homes that have this type of box, one-third of them have more than one box.

Only one out of eight (13%) of households have a digital-to-analog converter box. This type of box is used only by those who have older TV models that receive their TV signal over the air rather than by cable. The proportion of households that have this type of box can be expected to decrease as older TVs are replaced with newer models.

About one-fourth of households have video game consoles. Similar to the pattern for set top boxes and for cable TV, about one-fourth of those who have at least one game console have two or more.

Smaller but substantial proportions of households have the newest technologies for recording TV. Some have a set top box for TiVo or Replay TV (10%), and fewer (4%) use a computer to run their media center.

Audio Equipment

More households have a component stereo system (54%) than a compact all-in-one system (27%) or a portable boom box (25%). Single-family homes are more likely to have each of these types of audio equipment.

Less than 2% of households have a Karaoke machine. However, the half dozen Karaoke shops in Seattle suggest that more residents might rent them for use in the home.

Power Strips & Timers

The “power source” or “converter” in electronic devices and rechargers transforms alternating current (AC) from the electrical outlet into direct current (DC). The transformation process puts off waste energy in the form of heat (which is why rechargers get warm when operating). The process is also somewhat inefficient, and continues even when charging is complete. And, many electronics consume energy to remain in a state of continual readiness to power up quickly upon demand.

“Phantom” or “vampire” electricity (the amount of power consumed while electronics are turned off but still plugged in) is generally estimated at 10% of residential electricity use. However, although 93% of respondents report using power strips, most households do not use the power strip switch to turn off the kinds of equipment that can draw phantom electric loads.

Neither do residents generally use timers to turn on and off small kitchen appliances or electronic equipment, although more (23%) use timers for lighting.

If residents currently leave electronic equipment or appliances plugged in when not in use, potential energy savings could result by encouraging residents to unplug these items, turn them off with a conventional power strip switch, use a “smart” power strip that turns some equipment off automatically, or use timers to shut equipment off when it is not likely to be used.

However, residents are unlikely to do so with equipment having clock displays or internal timers. And, some electronic equipment is currently designed only to be powered continuously (“24/7”).

Hours Plugged in to Live Electrical Outlet

For each type of electronic equipment presented in the preceding figures (excepting power switches), survey respondents indicated how many hours the most frequently used unit is plugged in to a live electrical outlet. This information may allow inferences to be drawn about how much “phantom” or “vampire” electricity is being consumed by these devices in the typical household.
Figure 149: Hours that the Most Frequently Used Unit is Plugged in to a Live Electric Outlet: Re-chargers (for specified equipment)

Rechargers for small electronics and batteries appear to be plugged in on the most intermittent schedule, among all types of electronic equipment.

Half of the most-frequently-used cell-phone rechargers are plugged in to a live electrical outlet weekly or less often (21%, 1-4 hours per month) or semi-weekly (30%, 2-6 hours per week). A third of cell-phones, however, are plugged in most of the day (15%, 6-12 hours per day) or continuously (19%, 24 hours a day).

Personal digital assistants (PDAs and Pocket PCs) are recharged on a schedule similar to cellphones. Bluetooth (short-range wireless) devices are more often recharged weekly or less often (51%, 1-4 hours per month).

Three-fourths of rechargers for personal music players (such as iPods, Zunes, or MP3 players) are plugged in to a live electrical outlet weekly or less often (46%, 1-4 hours per month) or semi-weekly (28%, 2-6 hours per week).

Batteries are mostly recharged weekly or less often. Most rechargers for AA, C, and D batteries are plugged in to a live electrical outlet weekly or less often (73%, 1-4 hours per month), as are most rechargers for camera batteries (85%, 1-4 hours per month).

Figure 150: Hours that the Most Frequently Used Unit is Plugged in to a Live Electric Outlet: Computer Equipment

The preponderance of the most-frequently-used computer equipment is plugged in continuously to a live electrical outlet (69-75%, 24 hours a day).
These include liquid crystal display (LCD) flat screen monitors; desktop central processing units (CPUs); print, scan, copy, and fax machines; and standard cathode-ray tube (CRT) display monitors.

The exception is laptop or portable computers, less than half of which are plugged in continuously (41%, 24 hours a day). The other half of laptop or portable computer plug-in periods range from semi-weekly (11%, 2-6 hours per week), to daily (19%, 6-12 hours per day).

**Figure 151:** Hours that the Most Frequently Used Unit is Plugged in to a Live Electric Outlet: Computer Support Equipment

<table>
<thead>
<tr>
<th>Server CPU</th>
<th>Modems: cable, DSL, wireless</th>
<th>Uninterruptible power supply</th>
<th>Home network or LAN</th>
</tr>
</thead>
<tbody>
<tr>
<td>1-4 per month</td>
<td>10%</td>
<td>1%</td>
<td>4%</td>
</tr>
<tr>
<td>2-6 per week</td>
<td>5%</td>
<td>2%</td>
<td>1%</td>
</tr>
<tr>
<td>1-2 per day</td>
<td>3%</td>
<td>3%</td>
<td>2%</td>
</tr>
<tr>
<td>3-5 per day</td>
<td>4%</td>
<td>3%</td>
<td>2%</td>
</tr>
<tr>
<td>6-12 per day</td>
<td>5%</td>
<td>3%</td>
<td>2%</td>
</tr>
<tr>
<td>24 per day</td>
<td>74%</td>
<td>89%</td>
<td>90%</td>
</tr>
</tbody>
</table>

Three-fourths of the most-frequently-used television units (of the types specified above) tend to be plugged in continuously to a live electrical outlet (74-80%, 24 hours a day).

This includes standard cathode-ray tube (CRT) televisions in both size ranges (12-22” and 23-38”), rear projection large-screen TVs, and TVs with a built-in digital video disk (DVD) or videocassette recorder (VCR) player.
Figure 153: **Hours that the Most Frequently Used Unit is Plugged in to a Live Electric Outlet: LCD and Plasma Screen Televisions**

Three-fourths of the most-frequently-used large-screen televisions (of the types specified above) tend to be plugged in continuously to a live electrical outlet (76-79%, 24 hours a day).

This includes liquid crystal display (LCD) flat screen televisions in both size ranges (less than 45”, and 45” or more), and plasma screen televisions in both size ranges (less than 45”, and 45” or more.)

Figure 154: **Hours that the Most Frequently Used Unit is Plugged in to a Live Electric Outlet: Video Equipment**

Three-fourths of the most-frequently-used video equipment items (of the types specified above) tend to be plugged in continuously to a live electrical outlet (69-81%, 24 hours a day).

This includes digital video disk (DVD) with videocassette recorder (VCR) combination units, DVD players, VCR decks, and video game consoles.
Three-fourths of the most-frequently-used audio equipment items (component stereo systems and compact all-in-one stereo systems) tend to be plugged in continuously to a live electrical outlet (75-79%, 24 hours a day). Half of the most-frequently-used portable “boom-boxes” tend to be plugged in continuously to a live electrical outlet (51%, 24 hours a day).

Over half the most-frequently-used “karaoke” machines are plugged into a live outlet weekly or less often (58%, 1-4 hours per week), while a third are plugged in continuously to a live electrical outlet (30%, 24 hours a day).

**Implications**

This portion of the study attempted to capture the ways in which residents use their electronic equipment, whether or not the equipment is in use. It did not try to assess how often or how long residents use their equipment (have them turned on), but how long the equipment is plugged in to a live (energized) electrical outlet.
These data tell which equipment residents keep “at the ready,” plugged in at all times and ready to function on a regular basis. As such, the data do provide an indirect assessment of the extent to which residents use their equipment.

However, a focus of this portion of the study was the potential “phantom load” of different categories of electronics. As this survey demonstrates, phantom electricity use is greater for the electronics that are most prevalent in homes, and for those that are most often plugged in 24 hours per day. A combination of these two features – high incidence and long plug in time – suggests electronics that could be a focus of utility programs to reduce phantom energy use.

**Rechargers**

Only a small proportion of respondents (less than 20%) appear to leave rechargers of any type plugged in all the time. The proportions of the most-frequently-used recharger units left plugged in to a live electrical outlet less than 24 hours a day (81-97%) imply that most rechargers are plugged in only for the period of use, but not usually left plugged in to an electrical outlet (or power switch) at other times.

Rechargers of all types have the lowest plug-in times of all the electronics assessed in the survey. However, this category of electronics presents particular measurement difficulties. People may not be used to thinking of their rechargers as separate from the electronic equipment that is plugged into them. Cell phones, for example, may be attached to the rechargers a few times per month, but the rechargers may stay plugged in at other times. It is difficult to know if the findings captured the recharge time of the cell phones or the actual plug-in time of the rechargers.

As a result, it may be important for future studies, especially during home audits, to assess recharger plug-in time.

**Computer Equipment**

Except for laptops, computer equipment is likely to be plugged in to an electrical outlet 24 hours per day in at least 70% of residences that have this equipment. Given the high proportion of residents who own computer equipment, it is worth exploring ways to help residents turn off the equipment that is not needed for optimal functioning.

**Television & Video Equipment**

Television and video equipment are most likely to be kept plugged in to a live electrical outlet 24 hours a day; 75% or more of residents who have these items keep them plugged in all the time. However, the most important products to address are televisions of all types. TVs are the only electronic equipment more pervasive in residents’ homes than computers.

**Audio Equipment**

Most households that own stereo systems (75% or more) are likely to keep them plugged in to a live electrical outlet. Because between one-third and two-thirds of households have this equipment, these electronics may fall below TVs and computers in priority for utility programs. However, they may be addressed in conjunction with other electronic equipment because they are often integral parts of home entertainment systems.

Portable boom-boxes and Karaoke machines are less likely to be plugged in all the time.

**Power Strip Use**

Of interest, the proportion of respondents who use power strips to turn their TVs on and off (23%) approximates the proportion of residents who “unplug” their TVs (do not plug in 24 hours per day). Although the use of power strips may be responsible for some of these “unpluggings,” the findings can not address causal relationships. Power strips may, however, be promoted as an effective tool for reducing home electricity use.
Major Findings • 7

Selected Lighting Equipment

Compact Fluorescent Lighting (CFL) Bulbs Installed & Stored

However, the chart shows that CFL bulbs have greater market penetration and saturation among residents of single-family and midsize homes. These groups are more likely than multifamily residents to use or store more than 10 bulbs for future use (moderate market saturation). About one-fourth of both single-family and midsize households have 11 or more bulbs installed, compared to 8% for multifamily households. Similarly, more single-family and midsize households have 11 or more bulbs stored for future use (9% and 6%, respectively) than do multifamily homes (2%).

Further, about one quarter of multifamily residents do not use any CFL bulbs, compared to only 10% of other housing types. Put another way, about 90% of single-family and midsize homes have one or more CFL bulb installed in their homes (high market penetration), whereas a smaller proportion, about three-quarters (76%), of multifamily homes have at least one CFL installed.

In many cases, especially among those households that have 1-5 bulbs in use, residents have more CFL bulbs in storage than in use.

CFL (compact fluorescent light) bulbs are broadly used by residents of all housing types. About 85% of all residents have at least one CFL bulb installed in their homes. Half the residents of single-family detached and midsize attached (multiplex) homes and nearly that many multifamily homes (46%) have 3-10 CFL bulbs in use.
The differences in CFL bulb use between renters and home owners parallel the differences between multifamily residents, who are mostly renters, and residents of other household types. Renters are less likely to have CFLs installed and have fewer stored for the future than their home owner counterparts.

Although residents who own their homes free and clear appear to use slightly fewer CFL bulbs than those who hold a mortgage, both groups have the same number of CFL bulbs stored in their homes for future use.

*Figure 159: CFL Bulbs Installed and Stored, by Square Footage of Residence*

![Graph showing CFL bulbs installed and stored by square footage](image)

Homes with more than 4000 square feet (orange line) tend to have the largest number of CFL bulbs installed (11 or more). More than half of these homes have 11-20 CFL bulbs installed. The smallest homes, in contrast, are most likely to have no CFL bulbs installed.

Residences in between the largest and smallest “peak” at 6-10 bulbs. That is, homes ranging from 500 to 4000 square feet are most likely to have 6-10 CFL bulbs installed.

Differences among households of different square footage are most noticeable when comparing households with the largest and smallest numbers of bulbs stored. The smallest homes (2000 square feet or less) are more likely than other homes to have no CFL bulbs stored, whereas the largest homes (3000 square feet or more) are more likely than others to have 21 bulbs or more on hand.

*Figure 160: CFL Bulbs Installed and Stored, by Number of Rooms in Residence*

![Graph showing CFL bulbs installed and stored by number of rooms](image)

Similar to the findings for square footage, homes with more rooms have more CFL bulbs installed than homes with fewer rooms. Households with 4 rooms or more (pink, blue and green lines on the chart) have similar profiles; they most commonly have 6-10 CFL bulbs installed. In contrast, households with 3 or fewer rooms tend to use fewer CFL bulbs. One-room homes are most likely to use none at all.
The largest homes, those with 10 or more rooms, are more likely than smaller homes to have 6 or more CFL bulbs on hand. Medium sized homes, those with 4-9 rooms, are most likely to have 3-5 CFL bulbs on hand. In contrast, homes with 1-3 rooms are most likely to have no CFL bulbs stored.

The relationship between the number of rooms in a household and the number of CFL bulbs stored is a strong one, as shown by the points plotted above “None at all.” The fewer the rooms in a home, the more likely a household has no CFL bulbs stored for future use.

**Figure 161: CFL Bulbs Installed and Stored, by Number of Home Occupants**

The profiles of households with 1 occupant (dotted black line) and those with 5 or more occupants (magenta line) differed from the rest. The somewhat flatter line for 1-person households indicates they are a heterogeneous group. They are nearly as likely to have no CFL bulbs installed as they are to have 1-2 or 6-10 installed. In contrast, households with 5 or more occupants most often have 6-20 bulbs installed.

The patterns of CFL bulbs stored for the future are similar for all groups except one-occupant households. One-occupant households are most likely to have no CFL bulbs stored for the future.

**Figure 162: CFL Bulbs Installed and Stored, by Decade Building Constructed**

The charts above provide profiles of CFL bulb use for households with different numbers of occupants. Households with 2, 3 or 4 occupants are very similar to each other in their use of CFL bulbs; the largest proportion of each group has 6-10 CFL bulbs installed.

The number of CFL bulbs installed generally does not differ by age of home. The one exception is that newer homes, those built since 1990, appear more likely than older homes to have the largest number of CFL bulbs installed (21 bulbs or more).

Homes of different ages do not differ in the number of CFL bulbs stored for future use.
The youngest respondents, those 15-24, distinguish themselves from the rest of the respondents in CFL bulb use. They are most likely to have 3-5 CFL bulbs installed, compared to a peak of 6-10 bulbs for all other age groups. The youngest respondents are also most likely to have no CFL bulbs stored for future use.

Survey respondents viewed a copy of the Energy Star logo and were asked how familiar they are with it. Half of all residents say they have a product in their homes with an Energy Star label. The following comparisons for various ages of major appliances do not refer to whether the appliance itself has an Energy Star label.

Familiarity with the Energy Star logo varies by the number of CFL bulbs currently installed in the home, as well as the number of bulbs stored for future use.

Residents who have no CFL bulbs installed at all are most likely to be unfamiliar with the logo. This group is least likely to say they have some Energy Star labeled products in the home.

The more bulbs that are installed (or stored), the more respondents who say they have an Energy Star-labeled product (of some kind) in the home, and the fewer respondents who say that they have merely seen the logo on products in stores.
Nearly one-third of multifamily residents and 12% of midsize residents do not know what type of light bulb is installed in the outside light fixture closest to their front door, compared to 6% of single-family residents who don’t know. As well, more multifamily households have no light fixture outside the front door compared to single-family households.

Among those who have a light fixture outside the front door and are able to tell the type of light installed, slightly more of the standard-shaped bulbs are CFLs than incandescents. Overall, standard-shaped bulbs far out-number reflector-style bulbs in these locations. The type of exterior bulb (CFL or incandescent) does not differ by housing type.

Compact fluorescent bulbs have a slightly stronger hold in nearby exterior fixtures for older homes (pre-1950) compared to the newest homes (built 2000-2009).

The older the respondents, the more likely they are to say they have a standard incandescent bulb installed in the exterior light fixture that is closest to the front door.
Residents 35-44 years of age are most likely to have a CFL installed in the closest exterior fixture. The proportion with CFL bulbs gradually decreases for older age groups and decreases more dramatically for younger age groups. The oldest (65 and over) and the youngest (15-24) respondents report the fewest CFL bulbs installed in the closest exterior fixtures.\(^1\)

**Halogen Lamps**

**Figure 168: Halogen Lamp Use by Housing Building Type**

![Bar chart showing halogen lamp use by housing building type.](chart)

The majority of homes do not have any halogen lamps. Residents of single-family detached homes are most likely to have a halogen lamp (41%), whereas residents of multifamily homes are least likely to (27%). Midsize attached (multiplex) homes are similar to single-family detached homes in the proportion having halogen lamps.

**Figure 169: Halogen Lamp Use by Decade Building Constructed**

![Bar chart showing halogen lamp use by decade building constructed.](chart)

The use of a halogen lamp is more common in homes built since 1970. Residents of the most recently built homes, those constructed in the past decade, are most likely to have a halogen lamp in use (58%).

**Figure 170: Halogen Lamp Use by Age of Respondent**

![Bar chart showing halogen lamp use by age of respondent.](chart)

Residents from 35 to 64 years of age are equally likely to have a halogen lamp in their homes, whereas younger (15-34) and older respondents (75+) are less likely to have one.

**Implications**

**Interior Use of CFL Bulbs**

CFL bulbs have seen wide acceptance in Seattle homes, especially in single-family detached and midsize attached (multiplex) homes, where 90% have at least one CFL bulb installed. This represents a dramatic shift in the market for which Seattle City Light served as a catalyst in 2001, by sending customers two free CFL bulbs as part of an energy savings program.

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\(^1\)The percentages of incandescent and CFL bulbs do not add to 100% for each group because 23% of respondents either did not know or named another type of bulb in their closest exterior fixture.
conservation kit. However, two-thirds of program participants tried out their first CFL bulb as a result of the program. Now, eight years later, more than half of all households have 3 or more CFL bulbs installed in their homes.

Still, certain segments of the market have not embraced the use of CFL bulbs. For example, 10% of single-family and midsize residents, and one-fourth of multifamily residents appear resistant to using CFL bulbs, possibly for different reasons. Other studies of CFLs have identified the perception of lower amount of light and different quality of light from CFL bulbs as barriers to using CFL bulbs. This perception can follow from not having access to correct wattage or light-color substitutions for more familiar incandescents. These are the most likely reasons for resistance across all resident groups.

However, the less frequent use among multifamily residents and renters suggests additional barriers to CFL use. Although CFL bulbs have come down in price significantly since first introduced to the Seattle market in the mid 1990s (when they could run about $5-10 dollars each), cost may still be a barrier to purchases, especially among multifamily residents (and renters) on more limited incomes. Even with the deep discounts offered through current utility retail buy-down programs, these residents may still consider CFLs costly. They may also believe they will not get their money’s worth from buying a product that might last longer than they will rent their apartments.

The size of a household, whether measured by square footage, number of rooms in the home, or number of occupants, has some impact on the number of CFL bulbs in use. First, larger homes require more lighting in general, and may be expected to absorb more CFLs. They might also use more incandescent bulbs, but a comparison of the two was beyond the scope of this study. It is important to note that CFL use increases with the size of home, because it indicates CFL bulbs are not limited to only a few uses, such as garages or halls.

The high numbers of CFL bulbs that residents have on hand for future use suggests that residents anticipate using more CFL bulbs as their current bulbs (of any type) burn out. The bulbs in storage might also indicate the marketing success of specially priced packages of multiple bulbs (multi-packs).

With so many bulbs already in the home, Seattle City Light may have an opportunity to promote the use of these bulbs in more places where incandescents are currently used.

The larger proportion of multifamily residents who have no CFL bulbs installed suggests an opportunity for the utility to further promote their use among these residents, keeping in mind they have been slower to adopt this technology and may have concerns about costs.

The use of CFL bulbs in new construction is encouraging. Residents who buy homes that come with more CFL bulbs installed may be more likely to continue their use. CFL bulb use should be further monitored in new construction, as the findings of this study are based on a small sample of respondents in newer homes. Seattle City Light can be instrumental in encouraging installation of CFL bulbs and fixtures in new residential buildings.

**Familiarity with Energy Star Logo**

Not all residents are familiar with the Energy Star logo, even though it is applied to small consumable products, such as compact fluorescent light bulbs.

Incidentally, the proportion of residents who do not have CFL bulbs in their homes (14%) is the same size as the proportion who are not familiar with the Energy Star logo. (It may not be the same individual respondents in each group). Even if residents have not purchased a major appliance recently, those who have used CFL bulbs have been exposed to the logo.

On the other hand, respondents who do not have any CFL bulbs in their homes are least familiar with

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the Energy Star logo, and least likely to recognize the presence of any logo-labeled products in their home. Instead, they are more likely (than CFL bulbs users) to say they have seen the logo on products in stores.

**Exterior Use of CFL Bulbs**

It will be gratifying to program operators that messages to customers over the years, about the suitability of compact fluorescent bulbs for porch lights, have been successful. More CFL bulbs are now found in this location than incandescent bulbs.

However, the large proportion of exterior light bulbs that are still incandescent rather than CFL suggests a specific opportunity to promote CFL bulbs. While utility programs have focused on interior CFL lighting and exterior porch lights (using standard CFL “twist” bulbs), reflector flood lights for exterior lighting have not seen the same promotions and reductions in price (due to utility programs or volume in the marketplace).

The tendency for older residents to have incandescent bulbs installed in exterior fixtures presents another opportunity. The longer life of CFL bulbs makes them ideally suited to exterior applications, where it may be difficult, especially for older residents, to make frequent bulb changes. However, it is possible that older residents choose the brightest exterior bulbs. CFL bulb promotions might need to address this concern.

**Halogen Bulbs**

Although a majority of residents have not used a halogen lamp, nearly half of single-family and more than one-third of midsize households do have some experience using them.

The increased use of halogen lamps in homes built in the past two decades suggests they may be gaining in popularity. Compact fluorescent lighting may have to compete with halogens in specific applications, such as track lighting, where halogens have become commonplace.

The common use of halogen lighting in homes is a fire safety concern, as these lamps can generate heat up to 1,000 degrees or more. Newer torchiere standing lamps have a “tip sensor” control, to cut power to the bulb when the lamp stem tilts over from a vertical position. Nonetheless, the bulb remains very hot until it cools down, and can cause burns to the skin as well as flammable materials in the vicinity.

The prevalence of halogen lamps in residences suggests that the utility has a great opportunity to increase home safety by promoting alternatives to halogen lamps, especially those models most likely to contribute to injury and fire loss in the home.

Seattle City Light may want to consider promoting higher-wattage CFL bulbs, or directional-reflect LED lamps, in track lighting to replace halogen flood- or spot-light applications. Although not as energy efficient as their lower-wattage CFL counterparts, CFL bulbs that emit the most light may provide an alternative to halogen lamps.

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3 Filament tube wall temperatures do not go below 482°F, while hot spots on the bulb wall itself can go as high as 1230°F in normal operation; according to the Lamp Products Catalog 2004 of GE Lighting.
Major Findings • 8

Windows & Weather Sealing (thermal envelope, all building types)

Windows

Figure 171: Age of Most Windows

In more than one-third of households, most windows are 10 years old or newer. Half of the households have windows that are more than 10 years old. A third of the households have windows that are more than 20 years old. For 15% of households, respondents are unsure of the age of the windows.

Figure 172: Type of Glazing in Most Windows

Nearly two-thirds of all homes have either double-pane glass (61%) in most of their windows or have triple-pane glass (2%). The other one-third of homes have single-pane windows (27%) or a mixture of single and double-pane windows (10%).

Figure 173: Type of Frame for Most Windows

One-third of respondents say all or most of their windows have vinyl frames, and another third have wood frames, generally the most energy efficient types. However, one-third have aluminum frames, which can be an inefficient choice, especially among windows more than 20 years old.

Figure 174: Perceived Need for New Windows

One-third of respondents (about the same proportion of respondents who say they have all or partial single-pane windows) say they need new windows, 16% are unsure, and half (52%) say they do not need new windows.
Midsize attached (multiplex) and multifamily homes are somewhat more likely to have all single-pane glass windows than are single-family detached homes. However, single-family and midsize homes are more likely than multifamily to have a mixture of single and double-pane glass windows.

In homes where the main home heating fuel is electricity, the profiles for window glazing are similar to those described (left column) without reference to heating fuel. However, midsize attached (multiplex) homes are slightly more likely to have all single-pane and less likely to have double-pane windows than those heated by other fuels.

Aluminum window frames predominate in multifamily homes; nearly two-thirds of these homes (60%) have aluminum windows. Midsize homes are somewhat more likely to have aluminum windows than other types of windows, but the difference is not as great as for multifamily buildings.

In contrast, single-family homes are nearly as likely to have either wood, aluminum or vinyl window frames.

Only 2% of all respondents say their home has fiberglass frames on all or most windows.

In homes where the main home heating fuel is electricity, the profiles for window frames are similar to those described (left column) without reference to heating fuel. The main exception is that all building types in this group are less likely to have wood frames and much more likely to have aluminum frames than those heated by other fuels. Midsize homes heated electrically are more likely to have aluminum window frames and are less likely to have vinyl frames than those heated by nonelectric fuels.
Residents with different heat fuels do not differ substantially in the glazing of their windows, among all building types combined.

Residents with electric space heat more often have aluminum window frames (51%) and less often have wood frames (18%) compared to residents with other heat fuels, among combined building types.

Renters, compared to home owners, more often report they have single-pane glass in their windows and less often report they have double-pane glass.

Renters more often report they have aluminum window frames and less often report they have wood or vinyl frames, compared to home owners.
Figure 183: Window Glazing by Decade Building Constructed

Homes built since 1940 more often have double-pane windows and less often have single-pane windows, compared to homes built before that time.

Homes built before 1940 more often have a mixture of single and double-pane windows than homes built later.

Figure 184: Window Frames by Decade Building Constructed

Homes built before 1940 are much more likely to have wood window frames, whereas homes built after 1940 are more likely to have aluminum or vinyl frames.

In a more recent trend, vinyl frames were used more often than aluminum frames in homes built in the past two decades.

Figure 185: Preparation of Windows for Winter

Only a small proportion of residents prepare their windows for winter by adding storm windows on the outside (5%) or by adding plastic film on the inside (3%). Most residents (93%) make no routine changes to their windows for winter.

The following charts describe only those households where the respondent does prepare the windows for winter.

Figure 186: Preparation of Windows for Winter by Housing Building Type

Single-family residents are more likely to add storm windows and midsize residents are more likely to add plastic film to their windows to prepare for winter.
Residents with oil heat are most likely to apply storm windows in winter; residents with electric heat are least likely to do so.

Resident of the oldest homes are more likely to add storm windows in winter, compared to residents of newer homes, whereas the use of plastic film does not vary by age of home.

Most residents (70%) did not replace the weather stripping on their windows or doors in the two years prior to the survey. One in ten residents (11%) applied new weather stripping to “a few” doors or windows, but few residents added new weather stripping to all their windows (5%) or all their doors (3%).

Most residents (64%) did not update the caulking on the outside of their buildings in the two years prior to the survey. Another 14% do not know whether there had been any caulking during that time.

One in ten residents (11%) applied caulking to “a few” windows or doors, but few replaced caulking on all or most of their siding (6%) or window frames (4%).
The following charts describe only those households where the respondent did update the weather-stripping or caulking within the previous two years.

**Figure 191: Weather Stripping Replaced, by Housing Building Type**

Weather stripping was replaced on a few windows or doors more often in single-family homes than in other housing types.

**Figure 192: New Caulking Added, by Housing Building Type**

Caulking was added to a few windows or doors in the previous two years more often in single-family homes than in other housing types.

**Figure 193: Weather Stripping Replaced, by Main Home Heat Fuel**

Homes heated by gas or oil are slightly more likely to have had weather stripping added to a few windows or doors than homes with electric heat.

**Figure 194: New Caulking Added, by Main Home Heat Fuel**

Homes heated by natural gas are slightly more likely to have had new caulking added to the outside of the building than homes with electric heat.
Figure 195: Weather Stripping Replaced, by Home Ownership

<table>
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<tr>
<td>14%</td>
<td>9%</td>
<td>4%</td>
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All or most of windows got new weather stripping | All or most of doors got new weather stripping | A few windows or doors got new weather stripping

Home owners are more likely to have replaced the weather stripping on a few windows or doors than are renters. The same relationship holds for replacements of weather stripping on all windows and all doors, although the differences among housing types are not as pronounced.

Figure 196: New Caulking Added, by Home Ownership

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<td>14%</td>
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All or most of the siding got new caulking | All or most of window frames got new caulking | All or most of door frames got new caulking | A few windows or doors got new caulking

Home owners are more likely than renters to report that caulking had been added to the outside of their homes.

Figure 197: Weather Stripping Replaced, by Decade Building Constructed

The oldest homes, those built before 1960, are most likely to have received new weather stripping to a few windows or doors, than are newer homes. Findings are suggestive of a similar trend for weather stripping on “all doors.”

As well, more recently built homes, those built since 1990, appear to have received weather stripping to all windows in greater proportion than older homes. The small sample sizes in each cell, however, require caution in the interpretation of these findings.

Figure 198: New Caulking Added, by Decade Building Constructed
Similar to the findings for weather stripping, the oldest homes, those built before 1960, are more likely to have had caulking added to a few windows or doors, than are newer homes. Again, the incidence of caulking on all or most of the siding spiked upward for homes built since 1990. However, residents of new homes may have been referring to caulking applied when the home was first built.

**Implications**

**Windows: Glazing & Frames**

Because we assume the most efficient windows in general 1) are newer (installed within the last 10 years), 2) have double- (or triple-) pane glass, and 3) have vinyl or wood frames (particularly those installed within the last 10 years), buildings that do not have these features are potential targets for energy-saving programs.

Across the entire sample, about one-third of residents are in need of double-pane glass in some or all of their windows, and about one-third have windows with aluminum frames. Further, one-third of respondents say they need new windows. These findings suggest a clear opportunity to promote energy-efficient windows to residents who already believe they need new windows. The challenge is to understand which segments of residents most need changes in their windows and how to reach them cost effectively.

Because some variables used to divide the respondent sample into subgroups are related to each other, some consistent patterns emerged to suggest the features of those homes most in need of updating their windows for energy efficiency purposes.

Multifamily homes (which also tend to have electric heat and renter-occupants) are particularly good targets for conversions from single-pane windows and aluminum frames, both features common in this type of household.

However, the building owners or property managers, not the residents, are the potential purchasers of these windows; and although renters might be supportive of changes in their windows, promotional programs must be directed to the owners and managers.

Because older buildings of all housing types are particularly likely to have single-pane windows or a mixture of single- and double-pane windows, they might be targeted for upgrades to double-pane glass. Residents in this same group might also have concerns about their wood frame windows, as energy efficiency can vary depending on the age and extent of their maintenance.

A concentration of aluminum frames found among homes built between 1950 and 1990 suggests a further focus for a program to upgrade window frames. Depending upon when these aluminum-framed windows were installed, their efficiency may lag considerably behind products available today.

Aluminum frames are also more common among single-family detached and midsize attached homes that use electricity as their main home heating fuel. This likely reflects the activity of utility conservation programs in the 1980s and early 1990s to weatherize these homes. Now that more energy-efficient designs and materials are available, all former participants in weatherization programs for this subsector would be an appropriate focus of a program to upgrade window frames.

**Winter Preparation**

In addition to having a larger proportion of inefficient windows, few multifamily residences get storm windows or plastic film added to their windows in preparation for winter. However, this lack of winterization measures is common among all residents. The concern about multifamily homes arises because the majority of windows in these homes are aluminum framed and may be least efficient. (Aluminum frames from 1980-1992 did not have thermal breaks as effective as those in newer aluminum frames or in vinyl-frame windows).

A program urging energy efficiency might promote the addition of plastic film as an economical measure that renters could take in lieu of window replacement.
Weather Sealing: Stripping & Caulking

For about two-thirds of households, neither weather stripping nor caulking had been applied even to a few windows or doors in the two years prior to the survey. Only about one in ten residents report the addition of weather stripping or caulking to some of their windows or doors, and about half that many had applied each to all their windows or doors.

The low level of weather sealing updates overall suggests an opportunity to promote the energy savings of these measures. Simply describing the opportunity and potential may not be sufficient, given the low level of weather sealing activity demonstrated among these respondents.

Homeowners and residents of single-family homes, who more often applied weather sealing products, may feel more responsible for the upkeep of their homes than renters. Yet, utilities could make all residents who pay their own energy bills more aware that they have potential to save.
**Major Findings • 9**

Insulation & Additional Features
(thermal envelope, single family detached & midsize attached homes)

Residents of single-family detached homes and of midsize attached (multiplex) units responded to questions about their home insulation.

“Midsize home” or “midsize building” refers to the type of small multifamily building with two to four units, as well as attached row-homes and town-homes; this label does not refer to the size of the individual residence. Residents of multifamily buildings with five or more units attached were directed past this section of the survey booklet.

In some cases, large groups (as many as one-third of a respondent subgroup) were unsure how to respond to questions about their buildings. Most often these are midsize building residents, or renters who were unsure about their building insulation.

The uncertainty of respondents about these “hidden” attributes is to be expected. Detailed information about insulation levels will be explored further in a separate building stock characteristics study, based on in-home professional audits.

Sample sizes permitting, calculations exclude those who could not report on a feature of their home. Because this process introduces an unknown amount of error, findings are interpreted conservatively. However, this method allows the findings to be compared from question to question.

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**Walls**

*Figure 199: Estimation of Wall Insulation*

One-fourth of all respondents (25%) could not report the level of wall insulation in their homes.

*Figure 200: Estimation of Wall Insulation by Housing Building Type*

Among those respondents who were able to report on their wall insulation, half (50%) say their walls are fully insulated, 36% say they are partly insulated, and 14% say they are not insulated at all. Slightly more midsize residents (59%) report their walls are fully insulated than do single-family residents (50%).
Those with electric heat are most likely to report that their walls are fully insulated (60%).

Homes that use fuel oil to heat their homes are least likely to report their walls are fully insulated (36%, compared to more than half of homes with other heating fuels), and more likely to report their walls are partly (42%) or not at all insulated (22%).

Residents who live in the most recently built homes are more likely to say their walls are fully insulated. Residents who live in homes built between 1910 and 1940 are most likely to say the walls are not insulated at all. Of homes built before 1960, residents say nearly two-thirds (60%) are insulated only partly or not at all. Those homes built after 1970 are much more likely to be fully insulated (81%).

Among those who could report their level of wall insulation, homeowners, regardless of mortgage status, more often say their walls are fully insulated (51%) than renters (34%).

Not charted, renters (64%) are far more likely than home owners (22%) to say they are unsure of the insulation in their walls.

Residents who live in homes built before 1910 and 1940 are most likely to say the walls are not insulated at all. Of homes built before 1960, residents say nearly two-thirds (60%) are insulated only partly or not at all. Those homes built after 1970 are much more likely to be fully insulated (81%).

Among those who could report on their insulation, respondents across all income groups report similar insulation levels.

Not charted, respondents from households in the lowest income quartile are more often (34%) unsure of their wall insulation, compared to those in the highest quartile (20%). This is consistent with the differences among owners versus renters.
**Attics**

*Figure 205: Type of Attic*

The proportion of single-family detached homes that have full attics (60%) is twice that of units in midsize attached (multiplex) buildings (31%). Midsize buildings more often have no attic above the top story (45%) compared to single-family buildings (16%). Single-family and midsize building types are equally likely to have a partial attic (25% and 24%, respectively).

*Figure 206: Estimation of Attic Rafter Insulation*

One of four respondents overall (26%) are unsure of their attic rafter insulation. Among residents of single-family detached homes, 25% of residents are unsure. Over half (55%) of midsize attached (multiplex) residents are unable to report about their attic insulation. For midsize residents, this leaves a small sample, and the findings should be interpreted cautiously.

However, this sample of midsize residents tends to report higher levels of attic rafter insulation, and ceiling insulation where there is no attic, than single-family residents.
One in three (34%) of all respondents do not know about the insulation level of their attic end-walls or side-walls, and findings must be interpreted cautiously. Similar to reports about attic rafters, midsize residents tend to report higher levels of attic end-wall and side-wall insulation, compared to single-family residents.

More midsize residents (38%) tend to report that their attic walls have full or partial interior finish compared to single-family residents (27%). One in four (24%) of respondents are unable to report on the interior finish of their attics.

Only 3% of all respondents say they heat their attic in winter.
Respondents were asked about the insulation over the portion of their homes where they have only a partial attic or no attic. One-fourth (20%) of respondents are unable to report the amount of ceiling insulation in this part of their homes.

Half of all households have a full attic. Among only those households without a full attic, 38% report the ceiling is fully insulated, 13% say partly, 9% say not at all, and 40% report that they don’t know (not shown).

Among those who could describe their non-attic ceiling insulation, about two-thirds of residents, regardless of housing type, say this part of their home is fully insulated.

Before 1960, about 60% of homes were built with a full attic. Over the decades, from a peak of 70% in the 1940s, fewer and fewer homes were built with full attics.

The most recently constructed homes, those built since 1990, are more likely than older homes to have no attic space. More than one-third of these newer homes have no attic and only about one third have a full attic.

Partial attics are somewhat more common in residences built before 1940 and after 1990.
Home owners are more likely to have a full attic (59%), whereas renters are more likely to have no attic (34%).

Residents in the lowest income quartile more often live in a residence with no attic (25%) and less often live in a residence with a full attic, compared to all other income groups. Residents in the top half in income are slightly more likely to have a partial attic (26-27%).

Most home foundations are concrete, cement or stone with space below (58% for single-family and 44% for midsize), or concrete slabs poured on the ground (34% for single-family vs. 47% for midsize). Few foundations (8-10%) are wooden post-and-beam on piers or pilings.

Single-family detached home foundations are more often concrete, cement or stone with a space below, whereas midsize attached (multiplex) building foundations are more often reported to be concrete slab poured on the ground.
In more than one-third of all residences, ceilings of basements or crawl spaces are completely uninsulated.

Ceilings of basements or crawl spaces are more likely to be fully insulated in midsize homes (52%) than in single-family homes (37%).

Figure 218: Estimation of Crawl Space or Basement Ceiling Insulation

In more than half of all residences, walls of basements or crawl spaces are completely uninsulated.

Walls of basements or crawl spaces are more likely to be fully insulated in midsize homes (28%) than in single-family homes (22%).

Notice that basement or crawl space ceilings are more often fully insulated than walls; conversely, walls are more often uninsulated than ceilings. Over one-third of single-family homes have an uninsulated basement or crawl space ceiling (42%), and still more have uninsulated basement or crawl space walls (55%).
Large proportions of respondents are unsure of the insulation in their basement or crawl space ceilings (21%) or walls (22%).

Twice as many midsize residents as single-family residents are unsure of the insulation in their basement or crawl space ceilings (47% and 19%, respectively) and walls (56% and 20%). (The data for these subgroups are not illustrated.)

Although about the same proportion of residents of both housing types say their basement ceilings are fully finished with plywood or a ceiling material, in single-family homes these are more often completely unfinished.

One-third (31%) of single-family basements or crawl spaces have walls that are fully finished with wallboard or an interior finish.

Midsize buildings more often have fully finished basement walls, but nearly half of this subgroup (41%) are unsure about the basement finishes, leaving a very small sample. Their data should be interpreted cautiously.

However, the midsize respondents in this sample report slightly higher proportions of basement ceiling insulation and finishing, and wall insulation and finishing, compared to single-family residents.
Ceilings of basements or crawl spaces are least likely to be insulated in residences heated by fuel oil; over half (61%) of oil-heated homes have no insulation in this location. Ceilings of basements or crawl spaces are less likely to be fully insulated in gas heated homes (36%) than in homes heated by electricity (48%).

Walls of basements or crawl spaces are least likely to be insulated in residences heated by fuel oil (69%). Homes heated by gas and electricity are similar in their levels of insulation in this area.

The ceilings of basements and crawl spaces are most likely to be insulated in residences built since 1970. More than half the homes built since 1970 have this space fully insulated, whereas only about one-fourth of homes built before 1970 have this space fully insulated. More than one third of the homes built in the first half of the century have no insulation in the space.

Among homes built since 1990, one-third have walls of basements and crawl spaces that are fully insulated; homes built before this time have lower rates of complete insulation in this part of the building.

The proportion of homes whose basement walls are “partly insulated” has steadily decreased from a high of 42% in residences built 1900-1910 to a low of 2% in homes built 2000-2009. However, taking their place have been more homes with no insulation than homes with full insulation in the walls of the basement or crawl space.
More renters than homeowners report that the ceilings of their crawl space or basement are uninsulated (55% vs. 41%).

Slightly more renters (67%) than owners (55%) report that the walls of their crawl space or basement are uninsulated.

Among those who could report on these features, residents with incomes between $35,000 and $65,000 are more likely to say they have no insulation in the ceiling of the basement or crawl space, and least likely to say that area is fully insulated.

Concerning basement or crawl space walls, residents in the highest quartile in income are more likely to have partial or full insulation in this area and least likely to have none at all.
**Garages**

Nearly three-fourths (73%) of single-family homes and more than half (57%) of midsize homes have garages.

*Figure 230: Proportion of Homes with Garage*

Garages in single-family homes are about as likely to be located under or within the house (26%), to be freestanding (24%), or attached to the side of the house (22%).

Among midsize buildings, in contrast, one-fourth of the garages (29%) are located under or within the building, 17% are freestanding and only 10% are to the side.

Garages are equally likely to be underneath or attached to houses constructed after 1950. Very few garages of these homes were built free standing from the house. For homes constructed prior to 1930, the majority (55-68%) of garages are freestanding, whereas just under half (43%) of homes built from 1930-1950 are found to be free standing.

*Figure 232: Estimation of Garage Ceiling Insulation, by Location of Garage*

About one out of eight respondents does not know whether the garage ceiling is insulated.
Survey respondents indicate that half of the garages (54%) underneath the home have full ceiling insulation. In another third (31%) garage ceilings are completely uninsulated, whereas 16% are only partly insulated. Thus about half (46%) of garages underneath the home have inadequate insulation in the garage ceiling.

Free standing garages tend not to have any ceiling insulation (85% uninsulated).

About one out of eight respondents does not know whether the garage walls are insulated.

Half of the garages underneath (42%) or attached (51%) to the home do not have any wall insulation at all. Another quarter of these garages are only partly insulated in the walls. Thus, the majority (66–74%) of garages attached or underneath the house have inadequate wall insulation.

Free standing garages tend not to have any wall insulation (81% uninsulated).

Garage ceilings (32%) are more often fully insulated than their walls (24%). However, more than half the ceilings (58%) and walls (59%) are not insulated at all (not shown in the figure).

Garages that are under or attached to the home are twice as likely to have an interior finish as are free-standing garages.
Most garages have no source of water heat (89%). Most of those that do have hot water share the hot water from the house (9%). Only 2% of garages have a separate water heater tank, and fewer than 1% have an on-demand heater.

**Accessory Dwellings**

**Figure 237: Proportion of Homes with Accessory Dwelling**

About 6% of single-family homes and 10% of midsize buildings have an accessory dwelling. In single-family homes, half of these are freestanding, not attached to the house, about half are located under or within the house, and a few are attached to the side of the house. In contrast, accessory dwellings in midsize buildings tend to be under the home rather than freestanding.

Fewer than 100 respondents total answered these questions, resulting in a potentially high error rate; summary data gives only an initial picture of insulation in accessory dwellings.

**Figure 238: Estimation of Accessory Dwelling Ceiling Insulation**

About one out of eight respondents does not know whether the accessory dwelling ceiling is insulated.

Survey respondents indicate that half of accessory dwellings (51%) have full ceiling insulation. Another quarter of accessory dwellings are completely uninsulated, and 14% are only partly insulated. Thus about a third (37%) of accessory dwellings have inadequate insulation in the ceiling.

Notice that accessory dwelling ceilings are insulated (51%) in the same proportion as attic floors in the main dwelling (53%). And, the accessory dwelling floor is insulated (30%) about as often as a basement ceiling (26%).

Accessory dwelling walls are, in fact, more often insulated (47%) than main dwelling walls (37%). And they are fitted with wallboard or an interior finish (67%) significantly more often than attic end- or side-walls (11%), basement ceilings (29%), or garage walls (33%).
About one out of eight respondents does not know whether the accessory dwelling floor is insulated.

About one-third (30%) of all residents with an accessory dwelling say the floor is fully insulated. Residents more often say the accessory dwelling ceilings are fully insulated than floors.

In nearly half (47%) of all accessory dwellings, walls are fully insulated.

Notice that similar proportions of accessory dwelling ceilings (51%) and walls (47%) are fully insulated. In contrast, the floors are more likely to be completely uninsulated (46%) than the ceilings or walls (23%).

Two-thirds of the accessory dwellings are fitted with wallboard or an interior finish, but less than half have ceiling or wall insulation, and still fewer have floor insulation.

Half of accessory dwellings are heated by electric sources, either electric baseboards (34%) or portable heaters (14%). Another 12% use a gas forced-air furnace. One-fourth of the accessory dwellings are not heated at all (27%).
One-third of accessory dwellings (37%) have no source of water heat. Of those that have hot water, the largest proportion (37%) share hot water from the house, and a smaller proportion (25%) have a separate water heater tank.

**Perceived Need for More Energy Efficiency**

One third of all residents (33%) say their homes need new windows, but half of all respondents (51%) say they do not need new windows. Only a small proportion (16%) are unsure whether they need new windows. The perceived need for new windows is similar for the different building types, with the exception that single-family residents are more sure of their response than residents of other building types.

When asked to rate the energy efficiency of their homes overall, only 13% of residents say their homes are very efficient, a little more than half (57%) say their homes are somewhat efficient, and 24% say they are not very efficient.

Single-family residents are cautious in their evaluations of their home insulation. They are slightly more likely to say their homes are “somewhat efficient” (59%) than other residents, and less likely than multifamily residents to say their homes are “very efficient.” Midsize residents are most likely to say their homes are “not very efficient.”
Among single-family residents, about one-third (30%) say the walls of their homes need more insulation. Another one-third (33%) say the walls do not need more insulation, and 38% say they are not sure. Responses are similar for midsize homes.

Only one-quarter (25%) of single-family and midsize residents believe their attic needs more insulation. Most say they are not sure (44%) or that they do not need more insulation (31%). Responses are similar for the different building types.
Only slightly more than one-quarter (29%) of single-family residents say their basement or crawl space needs more insulation. Most were not sure (37%) or did not feel they need more insulation (35%). Slightly fewer midsize residents (21%) say their basements or crawl spaces need more insulation, and slightly more (47%) were unsure. Twice as many single-family residents (21%) as midsize residents (8%) felt their garages need more insulation. More than half say they need no more insulation, and the rest were unsure.
Only 17% of single-family and 21% of midsize residents who have an accessory dwelling feel that the accessory dwelling needs more insulation. More than half (61% of single-family and 43% of midsize) say their unit does not need more insulation, and one-fourth are unsure.

Implications:

This portion of the report addresses only single-family detached homes and residential units in midsize attached (multiplex) buildings.

Wall Insulation

About half of the respondents who were able to report on their wall insulation say their walls were only partly or not at all insulated. City Light has an opportunity to help residents more fully insulate their walls, especially among homes constructed before 1960.

As was noted among Major Findings on Home Heating, programs may be targeted to homes built during periods when electricity was installed in greater proportion. For example, single-family homes built with electric heating between 1970 and 1990 may be good targets for energy-efficiency measures and may be due for updating.

However, it is important to remember that this group accounts for only 7% of the existing single-family housing stock, whereas 72% of the current housing stock was built before 1960. Older homes with electric heat may be in greater need of energy efficiency measures due to less efficient construction. Programs could be tailored to the different needs of these construction types.

On the other hand, electric heat homes were very likely to have received at least some efficiency measures through Seattle City Light or other utility conservation programs. The City Light weatherization programs in 1981-2006 reached over 80% of existing single-family homes having electric space heat and built prior to 1980 (when the first building energy code was enacted).

Attics

Residents more often say attic floors are fully insulated than attic rafters or side walls.

It is unclear why midsize residents report more fully insulated attic rafters and sidewalls than single-family homes. One possible explanation might be that attics in midsize buildings may be more often converted to usable storage or living space compared to single-family homes. This explanation is supported by the higher frequency of attic wall interior finishes in midsize homes.

Although 20% of respondents say their attic walls are fully finished, few (3%) residents heat their attics in winter. Even though the attic may be usable space, enough heat travels up to the attic to make additional heating unnecessary. Alternatively, most of the finished attics might be used only for storage, rather than as living space.

Basement & Crawl Spaces

The variety of configurations under a home means that no single insulation solution can be applied to all residential buildings. It is most important that
heated basements be well insulated. Even unheated basements and open crawl spaces, however, require enough insulation to minimize home heat loss.

Further analyses might determine the insulation levels under each set of circumstances. Meanwhile, the high proportions of homes with little or no insulation in these areas suggest a clear opportunity for energy savings.

**Garages**

A free-standing garage does not require insulation, for the most part (depending on how often it is used during cold weather, and if space heat is required for some of those uses).

However, a garage attached to the home by a side wall should have wall insulation, to ensure the thermal integrity of the home. And a garage underneath the home should have ceiling insulation, as well as wall insulation.

Garage ceilings (32%) were more often fully insulated than their walls (24%). However, more than half the ceilings (58%) and walls (59%) were not insulated at all.

Survey respondents indicate that half of the garages underneath or attached to the home do not have any wall insulation, and another quarter are only partly insulated in the walls. They also indicate that a third of garages underneath the home have no ceiling insulation.

These findings suggest that special attention should be paid to insulation in the walls and ceilings of garages that are not free standing, as heat loss through these surfaces likely compromises the thermal integrity of single-family and midsize homes, especially those built after 1950.

**Accessory Dwellings**

The number of accessory dwellings picked up by this survey sample is small, so cannot be treated as representative of all in the service area. The descriptions, however, give us a first indication of where they are located, relative to the house, how there are heated, and how well they are finished and insulated. Accessory dwelling insulation levels appear roughly equivalent to that those of the main dwelling. Two-thirds of accessory dwellings are fitted with wallboard or an interior finish, but less than half have ceiling or wall insulation, and still fewer have insulated floors.

**Summary of Insulation Levels**

The following figure summarizes insulation levels across the building elements described in this section of Major Findings.

**Figure 251: Estimation of Insulation of Various Building Surfaces**

<table>
<thead>
<tr>
<th>Surface</th>
<th>0%</th>
<th>20%</th>
<th>40%</th>
<th>60%</th>
<th>80%</th>
<th>100%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Attic floors</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ac.Dwelling floors</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ac.Dwelling ceiling</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>House walls</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Non-attic ceilings</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ac.Dwelling floor</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Garage ceiling</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Basement ceiling</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Attic rafters</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Garage walls</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Att. end/side-walls</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Basement walls</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Several figures show the contrast between homes having electric and nonelectric main space heating, with electrically-heated homes described by respondents as having higher levels of insulation, or efficiency at retaining space heat. This confirms that there is potential for weatherization of gas-heated and oil-heated homes.

Seattle City Light has the opportunity to share this information and work with Puget Sound Energy to meet natural gas conservation targets. Efforts in this direction would align with attempts by City of Seattle policy makers to address climate change by developing policies to encourage energy efficiency across all fuel types.
Residents’ Ability to Provide Information

The uncertainty of respondents about their homes’ “hidden attributes,” such as wall insulation, is to be expected. Detailed information about insulation levels will be explored further in a separate building stock study, based on professional in-home audits.

As might be expected, more home owners than renters (or single-family residents, who are mostly owners) were able to report on the levels of insulation in their walls and attics. It is reasonable to find that those responsible for the condition of their homes (owners) have more knowledge of its features. Owners of multifamily buildings would naturally be the better sources of this information as well as the better targets for insulation programs, rather than renter-occupants.

However, even home owners and single-family residents – between 18% and 38%, depending on the area of the home – were unsure of their insulation levels. This finding suggests that under-insulated homes might best be reached through personal contact with a professional, as with a home energy audit.

Less costly methods might include targeted educational materials to homes built during eras with less rigorous insulation standards. Residents might benefit from learning some simple ways to tell how susceptible their homes are to winter heat loss.

Residents’ Perceptions of Need for Insulation

Between one-fourth and one-third of respondents surveyed say they saw a need for greater energy efficiency in major home features that are vulnerable to heat loss. Residents were most likely to perceive a need for window replacement, and insulation in walls, attics and basements/crawlspaces.

Respondents were particularly clear about whether they need new windows; only 16% expressed uncertainty about this energy-saving measure. Perhaps partly due to an aggressive window industry and partly due to community education about home windows, most residents seem to have considered window products and know whether or not they need them. As a result, the substantial segment of residents (33%) who need windows may be most responsive to utility assistance with window replacement.

Residents were least convinced that they need insulation in their garages and accessory dwellings. Given the low incidence of heating in these household spaces, garages may not be used for extended periods of time and accessory dwellings might not always be occupied. Residents may believe that because they do not heat these spaces often they do not need to insulate them.

The 25-29% who say they do need insulation in their walls, attics and basements/crawlspaces, combined with the large proportion of residents who are unsure whether they need insulation in these areas (38-44%), suggest a large opportunity for City Light. Although some residents are aware of their needs and should be open to affordable products, utility programs designed to encourage insulation purchases will benefit by a strong educational component to help “undecided” residents evaluate their needs and the potential benefits of insulation products.

Most residents felt there is room for improvement in their homes’ overall energy efficiency. Only 13% say their homes are “Very efficient,” whereas 24% say they are “Not very efficient,” and 56% say they are “Somewhat efficient.” Respondents’ perceptions of their homes’ overall energy efficiency, especially those of single-family residents, suggest that most homes have at least one potential area for improvement.
The proportions of homes with insulation in attics or ceiling, walls, and floors were ascertained in different ways by successive rounds of RCCS surveys. An attempt was made, for this report, to align data points as much as possible. In 2000, there were no questions on this topic.

It appears that respondent perceptions of the degree to which their home is insulated have not changed appreciably over the past three decades. That is, 76% felt that their attic or ceiling is adequately insulated in 1979, and about 72% believe that in 2009. Similarly, the estimation of adequate wall insulation increased only moderately over that period, from 37% to 50%. The proportion estimating that floors were adequately insulated increase from 21% to 37%, over the past three decades.

Meanwhile, the proportion of homes reporting that windows were either double-pane or triple-pane glass, or received winter storm windows or insulating film, increased from 37% in 1979 to 73% in 1990; the level remains at 70% today. This marked change may reflect positively on the impact of building codes that took effect in 1980, requiring the installation of double-pane glass in residential new construction; as well as the penetration of utility programs to change-out pre-1980 windows in single-family homes and multifamily buildings.
Major Findings ▪ 10

Remodels Completed & Planned (single family detached & midsize attached homes)

The questions reported here were posed only to residents of single-family detached and midsize attached (multiplex) homes.

Past Remodels

Figure 253: Home Remodeled, within Past 2 Years

![Pie chart showing 15% yes and 85% no for home remodel within past 2 years]

About 15% of respondents had remodeled their homes in the two years prior to the survey.

Figure 254: Type of Remodel, within Past 2 Years

<table>
<thead>
<tr>
<th>Remodel Type</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Remodeled kitchen or bathroom</td>
<td>41%</td>
</tr>
<tr>
<td>Finished unused basement or attic space, now occupied space</td>
<td>24%</td>
</tr>
<tr>
<td>Remodeled another living space</td>
<td>15%</td>
</tr>
<tr>
<td>Re-built most of home on existing footprint</td>
<td>10%</td>
</tr>
<tr>
<td>Built new addition that added square footage to home</td>
<td>10%</td>
</tr>
</tbody>
</table>

The largest group of these remodels involved the kitchen or bathroom (41%), and one-fourth of the remodels converted an unused basement or attic to an occupied space.

Figure 255: Amount of Newly Added-on Space (square feet)

<table>
<thead>
<tr>
<th>Square Feet</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>2000-8000</td>
<td>0%</td>
</tr>
<tr>
<td>1001-2000</td>
<td>3%</td>
</tr>
<tr>
<td>601-1000</td>
<td>3%</td>
</tr>
<tr>
<td>301-600</td>
<td>5%</td>
</tr>
<tr>
<td>201-300</td>
<td>3%</td>
</tr>
<tr>
<td>101-200</td>
<td>4%</td>
</tr>
<tr>
<td>1-100</td>
<td>8%</td>
</tr>
<tr>
<td>0</td>
<td>77%</td>
</tr>
</tbody>
</table>

Almost one in four remodels (23%) added new space to the home. The amount of new space varied widely, up to 2000 square feet.

Figure 256: Amount of Formerly Unused Space Now Occupied (square feet)

<table>
<thead>
<tr>
<th>Square Feet</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>2000-8000</td>
<td>1%</td>
</tr>
<tr>
<td>1001-2000</td>
<td>2%</td>
</tr>
<tr>
<td>601-1000</td>
<td>12%</td>
</tr>
<tr>
<td>301-600</td>
<td>11%</td>
</tr>
<tr>
<td>201-300</td>
<td>5%</td>
</tr>
<tr>
<td>101-200</td>
<td>7%</td>
</tr>
<tr>
<td>1-100</td>
<td>6%</td>
</tr>
<tr>
<td>0</td>
<td>57%</td>
</tr>
</tbody>
</table>

More remodels (43%) involved converting existing (formerly unused) space to occupied space, compared to those that added on new space (23% in the preceding figure). Most of these remodels converted 301-1000 square feet.
Respondents added home heat for about one in three remodels. The majority did not require the addition of heating.

**Future Remodel Plans**

Most respondents who anticipated a major remodel in the next two years expected to renovate 301-1000 square feet.

Most respondents who anticipated a minor remodel in the next two years expected to renovate 1-200 square feet, but more than one third of remodels characterized as a minor (37%) involved 301-8000 square feet.

Although square footage is not the only criterion for distinguishing a major or minor remodel, the two previous figures suggest that residents consider major those remodels that involve 600 square feet or more, and consider minor those remodels that involve 200 square feet or less.
Plan to Add Space Heating for Future Remodeled or Added Space

Consistent with the proportion who added home heat for remodels completed in the previous two years, one in three respondents who anticipates a remodel in the next two years expects to add heat to the remodeled space.

Receptivity to Energy-saving Options (for planned remodels only)

Energy Saving Options to be Considered for Future Remodel or Renovation

The most popular options are CFL fixtures (44%), daylighting design (33%) and LED fixtures (22% of respondents). Photovoltaic panels (18%) and solar water heat (16%) received endorsement from a smaller but substantial portion of this group.

Implications

Reports of remodels in the previous two years, combined with the anticipated remodels in the next two years, suggest that about 15% of single-family detached and midsize attached (multiplex) homes remodel some part of the home during each two-year period. Renovation projects present opportune times to add energy-efficient features to a home. This seems a steady audience for messages about energy-efficient housing products.

More than one-third of respondents say their remodels converted formerly unused space to occupied space. Although heating, insulation, windows, and fixtures that accommodate compact fluorescent lighting might all be needed in these cases, they might also be added in the process of any remodel. Energy-saving features can be promoted and may be added during any renovation.

Respondent groups who characterized their planned remodels as “major” or “minor” overlapped each other in describing the expected square footage involved. That is, some respondents considered “major” a remodel of 600 square feet or less, and some respondents considered “minor” a remodel of more than 300 square feet.

Further research may be needed to determine the features residents use to classify a remodel into these categories. Ultimately, the terms “major” and “minor” remodels may not be useful constructs to understand residents’ perceptions of the extent of change. Rather, square footage may be a better indicator of the potential for energy savings by adding efficient features.

To identify residents’ needs for energy-saving products or features, it may be more important to gain an understanding of the type of room or features of the home that residents anticipate renovating.
The areas of the home that residents remodeled suggest the types of features that might be promoted. For example, removing or adding wall finishes offers opportunities to add insulation or windows, whereas a kitchen remodel might include purchasing energy-efficient appliances. Because so many different products may be required by different types of remodels, point-of-purchase education may be an especially effective strategy to reach residents when they are ready to renovate.

Because heating appears to be involved in about one-third of remodels, both prior remodels and those anticipated in the next two years, reaching residents during a remodel might be a key time for utilities to influence residents’ and contractors’ choices. Beyond the type of heating system, utilities can provide education about other housing features (such as windows and insulation) that would maximize comfort while mitigating increased energy costs.

When residents were asked about energy-saving options they would consider when remodeling, the most popular options involved lighting. These may be favored because they seem the least expensive options, and are consistent with measures Seattle residents have already taken (see Major Findings, Section 7).

A portion of residents seem genuinely interested in using solar power in their homes; utilities could help these technologies become a more prominent player in the marketplace. The less frequent endorsement of other space and water heating options suggests greater challenges in promoting their use.
**Major Findings • 11**

Green Energy Housing Features & Household Products

The questions reported here were posed only to residents of single-family detached and midsize attached (multiplex) homes.

**Housing Design (single family detached & midsize attached homes)**

**Figure 263:** Home Designed Now to Capture Passive Solar Heating

One in five residents say their homes are designed with large south-facing windows to capture passive solar heat during the winter. Very few residents (1%) say they have masonry thermal mass for this purpose.

**Figure 264:** Home Designed Now to Capture Daylight

About one in four residents say their homes are designed to capture daylight other than by windows in the wall. Most of these design features are skylights in the roof (21%). A small proportion of residents have sun-tubes in the roof (2%) or “daylight shelves” on their windows (1%).

**Awareness of & Receptivity to Recently Introduced Energy-saving Vehicles**

**Figure 265:** Number of Household Vehicles by Type

- Gasoline Powered Vehicles
- Gas-electric Hybrid Vehicles (no plug)
- Gas-electric Hybrid Vehicles (with plug)
- All-electric Vehicles (with plug)
Among the vehicles that survey respondents own, gasoline powered vehicles are most prevalent. Nine out of ten respondents say they own at least one gasoline-powered vehicle, and more than half say they have two or more.

One in twenty respondents own a gas-electric hybrid car. Only a few own a gas electric hybrid or an all-electric car with a plug (less than 1% each).

**Figure 266: Likelihood in the Next 5 Years of Respondent or Household Members Buying Energy Efficient Vehicles**

There is no relationship of this type for the other varieties of energy-savings vehicles.

**Awareness of & Receptivity to Recently Introduced Energy-saving Products**

Respondents are more aware of some recently introduced energy-saving products than others. The following products are discussed in approximate order of respondent awareness.

**Figure 267: Awareness of and Likelihood in the Next 5 Years of Respondent or Household Members Buying Solar Panels to Heat Water**

Three out of four respondents say they are familiar with hot water solar panels. Most, however, have only heard about this technology (58%); fewer have seen one working, or on display or on TV (19%), or used one in the home (1%). Nearly one-quarter of respondents (23%) are not familiar with this technology.

Most respondents (65%) say they are unlikely to buy this technology, whereas a small group (13%) say they are at least “somewhat likely” to do so.

One in five respondents say they or a household member are somewhat or very likely to buy a gas-electric hybrid vehicle in the next five years, whereas fewer say they are as likely to buy a hybrid with a recharging plug (17%) or a plug-in all-electric vehicle (12%).

Of those respondents who say they or a household member are somewhat or very likely to buy a gas-electric hybrid vehicle (without a recharging plug) in the next five years, 15% already own such a vehicle, compared to 7% of those unlikely to buy.
Familiarity with this product was not queried in the survey because it is a new concept untied in the utility service area.

Although most respondents say they are Not very likely” (23%) or “Not at all likely” (38%) to buy part of a community photovoltaic project, one in ten respondents say they are at least “Somewhat likely” (10%) to do so.

Nearly one-third say they don’t know if they would buy this type of community product.

Most respondents (63%) are not familiar with a program to buy “green” wind energy through Seattle City Light’s “Green-up” program. One in three say they have heard about this program, and 5% say they already participate in this utility program.

About half of respondents (45%) say they are unlikely to buy this product in the next five years. One in four respondents (28%) say they are at least “somewhat likely” to buy this type of product, and a similar proportion say they don’t know if they would buy energy from this type of program.
Three out of four respondents have not heard about “Smart” power strips. Some (20%) have heard about them, but only 2% have seen one, and only 1% used one in the home.

In spite of respondents’ general lack of familiarity with these products, more than half (51%) say they are at least “Somewhat likely” to buy one in the next 5 years.

Three out of four respondents (73%) are not familiar with home energy monitoring devices. The rest have had some exposure to this type of product; 22% have heard about it, 4% have seen it, but only 1% used one in the home.

The survey did not assess willingness to buy this product because these units usually are supplied by the utility.

This figure summarizes for comparison the familiarity survey respondents have about various energy-saving products with the likelihood to buy these products in the next five years. Products are ordered by the proportion of respondents who are familiar to some degree with the product or service. Likelihood to buy combines respondents who stated they or other household members would be “very” or “somewhat” likely to buy the product or service in the next five years.

**Implications**

**Housing Design**

One-fifth of respondents say their homes are designed to capture passive solar heat. It is unclear from these findings whether these homes are energy-efficient overall. One challenge is to determine whether the insulation and other construction in these homes supports the passive solar features, resulting in a net gain in heating in winter. This assessment could be made as part of a standard home energy audit.
Skylights are in greater use than sun tubes or daylight shelves. This is another area important to assess in a home energy audit. It may be important to assess whether these products trade lighting for heat loss in winter.

**Energy-saving Vehicles**

Although only about 6% of respondents say they have one of the most energy-efficient vehicles (hybrid or all electric), one in four are open to buying a hybrid, and more than 10% are open to buying an all-electric car.

This is a technology to watch for its impact on demand for electricity. The City of Seattle can also anticipate some improvement in atmospheric carbon emissions as these vehicles come onto the electric grid and the roads.

**Other Energy-saving Products**

Usually, customers need to be aware of a product in order to consider its purchase. When customers are very familiar with a product but are not open to buying, it may be helpful to examine the barriers to buying.

This is the case for hot water solar panels and photovoltaic panels for electricity production, where familiarity is relatively high, but plans to purchase are relatively low. (The gap between familiarity and likelihood of buying is greater for PV panels.)

In contrast, although most respondents are not familiar with smart power strips, enough information about the product was included in the survey to interest about half the respondents in buying them. In this case the likelihood of buying out-strips the initial familiarity with the product. Not completely unintentional, the survey description itself may have influenced respondents’ interest in this product. And, respondents may have perceived this as an affordable action to take.

Because only one in four respondents are familiar with energy monitoring devices, it will be important to introduce the benefits of these products to residents before introducing them into the market.
Reaching SCL Customers

Communication

Figure 274: Preferred Method of Communications from Seattle City Light

<table>
<thead>
<tr>
<th>Method</th>
<th>All Households</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bill inserts</td>
<td>59%</td>
</tr>
<tr>
<td>E-mail</td>
<td>31%</td>
</tr>
<tr>
<td>Separate mailings</td>
<td>28%</td>
</tr>
<tr>
<td>Brochures</td>
<td>21%</td>
</tr>
<tr>
<td>City Web sites</td>
<td>19%</td>
</tr>
<tr>
<td>Newspaper articles</td>
<td>12%</td>
</tr>
<tr>
<td>Television</td>
<td>12%</td>
</tr>
<tr>
<td>Radio</td>
<td>8%</td>
</tr>
<tr>
<td>Other</td>
<td>2%</td>
</tr>
</tbody>
</table>

Most Seattle residents (59%) prefer to receive communications from the utility through bill inserts. One in three respondents favors email and mailings separate from bills. One in five respondents prefers brochures or city websites.

Major media are the least favored methods of communication overall, among those methods included in the survey.

Those who own their homes free and clear are slightly more interested in bill inserts and less interested in email and websites as methods of receiving communications from Seattle City Light, compared to owners with mortgages and renters.

The lowest income residents (under $35,000 annually) are least interested in receiving information by email (16%) or City websites (7%). Higher income residents (over $65,000 annually) are least likely to want to receive messages by television (8%), compared to lower income groups (16%).

Seattle residents appear open to receiving many types of conservation information from Seattle City Light.

The survey items most frequently endorsed are information about changes residents can make that are free of charge (67%), discount programs (57%), and ways to conserve and reduce energy costs (59%). These concepts are at the heart of what customers expect from Seattle City Light.

Other items, endorsed by about half the respondents, are variations on requests for information: instructions for do-it-yourself (DIY) improvements (50%), and information about whether they are saving or wasting energy in the home (48%), or what uses the most energy in the home (47%).

Smaller but substantial groups of residents would like help from Seattle City Light to help them find energy saving products (43%), cost estimates for repairs (31), and contractors for conservation oriented projects (22%).

One in ten residents would like help in managing energy bill payments.
Residents of single-family detached homes are more interested in DIY information, cost estimates for repairs, and how to locate conservation contractors, compared to other household types.

*Figure 276: Respondent Access to Internet and Email*

Three out of four residents have access to Internet websites and to email. Slightly larger proportions of respondents in single-family detached and midsize attached (multiplex) households have email access, compared to those in multifamily households. However, access to websites does not vary by housing type.

Further, respondents from multifamily households are most likely to have no Internet access at all (21%), neither email nor websites.

Residents with the lowest incomes (up to $35,000) are least likely to have Internet or email access, compared to other income groups. And one out of eight households in the income range of $35-65,000 lack access to websites and email. Still, more than half of the residents in the lowest quarter in income do have access to websites and email.

*Figure 277: Respondent Access to Internet and Email, by Income Quartiles*

Residents who own their homes with a mortgage are more likely to have Internet and/or email access (93%) than those who own their homes free and clear (75%) or renters (80%).
Residents of homes built in 1940 to 1969 are least likely to have Internet and/or email access.

**Bill-Pay Method**

Most single-family detached and midsize attached (multiplex) households have natural gas, but only about one in ten multifamily households have natural gas.

Nearly all single-family and midsize residents pay their gas bills to Puget Sound Energy. A small percentage of midsize households have their gas charges included in their rent or condo fee (2%) or pay a third-party provider (3%).

Multifamily households are markedly different in their payment methods. Only one in ten pay directly to Puget Sound Energy, twice as many have their gas charges included in their rent or condo fee (20%), and 2% pay a third-party provider.

The way residents pay for utility services other than electricity varies by housing type. More single-family residents pay directly to Seattle Public Utilities (85%) than midsize (50%) or multifamily residents (9%). Multifamily residents most often have these utilities included in their rent or condo fee (81%), and one in ten (9%) pay to a third-party provider.
**Home Energy Audits**

**Figure 282:** Household Ever Had an Energy Audit or Green Audit of the Home

One in 20 single-family residents says the home has had a professional Energy Audit or Green Audit. Fewer (3%) of multifamily residents, and no midsize residents, say they had one.

**Figure 283:** Respondent Would like More Information about a City of Seattle Free Home Energy Audit Service, by Household Type

Large proportions of residents are interested in receiving more information from Seattle City Light about a free home energy audit service. The interest level is higher among single-family residents (42%) than among residents of midsize (31%) or multifamily (19%) homes.

Homeowners who hold a mortgage are more interested a home audit (47%) than those who own their homes free and clear (32%) or renters (16%).

**Figure 284:** Respondent Would like More Information about a City of Seattle Free Home Energy Audit Service, by Ownership

The interest level is higher among respondents with email or website access (40-41%) than among those with no access (17%).

Among those respondents with no access to either email or Internet websites, most (83%) do not want to be contacted regarding a home energy audit.

Lower, but still notable, proportions of respondents with email (59%) or website access (60%) access stated that they do not want the utility to contact them about home audits.
Implications

Communication Method, Information & Internet Access

Seattle City Light customers appear to prefer bill inserts as a method of communication. They are used to this method and want to continue to receive information from Seattle City Light this way.

A significant group of residents would like to receive information by email or on city websites. Residents of single-family detached and midsize attached (multiplex) homes are more interested in this method than those who live in larger multifamily households.

Preferred methods of communication are related to access to information. Higher income residents (the top three income categories), who are more likely to have Internet access, are more likely to prefer this method of communication than lower income residents (those in the lowest fourth in income).

As might be expected, residents are most eager to receive information about measures they could take that are free, or about discount programs and ways they can reduce energy costs. However, almost as many residents are interested in information that would guide their home improvement projects and store purchases, or information about their current energy use and whether they are saving or wasting energy.

These findings suggest that residents are unsure of how energy-efficient their homes and their practices are, and would like more guidance from the utility.

Residents’ requests for more information also present an opportunity for the utility to provide feedback to residents that goes beyond the energy usage that is included in billing statements. Seattle City Light could consider creative ways, perhaps online, to provide detailed feedback, even for those who may participate in a one-on-one energy audit (see below).

Bill-Pay Method

When residents pay their utility bills directly, we assume that they might be more aware of their expenses, which might drive their conservation efforts.

As presented in the first section of Major Findings (Housing Stock & Occupants), only 5.5% of residential customers currently receive rate assistance: 4.5% on low-income rates and 1.0% on rates for the elderly and disabled, according to records in the Seattle City Light customer information system. By comparison, 21% of survey respondents appear eligible for rate assistance. This implies that up to 15% of eligible customers are not taking advantage of the rate assistance program intended to help them afford energy bills. That is, three-fourths of those eligible are not receiving this assistance.

The discrepancy between the proportion of residents eligible for bill pay assistance and those who receive it suggests a potentially high impact on the utility in difficult economic times, when more residents might request help.

It is likely that half of these eligible customers are in the group without Internet access, given that 40% of customers with incomes below $40,000 do not have either email or website access. This being so, customer services such as on-line billing and payment will be less useful to this group.

Among survey respondents, it appears that in recent years about 2% of multifamily residents accessed emergency bill payment assistance each year. This proportion should be monitored in the next administration of this survey, to judge the impact of more difficult economic times on this ratio.

Home Energy Audits

The level of interest in a free home energy audit, especially compared to the much smaller proportion of households that have already received an audit, was overwhelming. Seattle City Light will need to look at the cost effectiveness of energy audits, and decide whether and how to meet the demand.
The high level of interest means that this program could reach a much larger audience than it has in the past. The face-to-face nature of the program has the potential to educate and to promote energy-efficiency changes, especially if the audits can educate customers about new products and services, and energy-saving Seattle City Light programs.

Home Energy Audits & Communicating with Customers

By examining some of the characteristics of residents who express interest in a utility program, and examining the modes of communication they prefer, we can identify ways to approach residents to involve them in the program. Using the example of home energy audits, we can examine some ways of targeting messages to the appropriate residents.

Because homeowners with a mortgage appear more interested in an audit program, consider collaborations with mortgage lenders to distribute information about the Seattle City Light program. This could contribute to positive public relations for mortgage lenders while promoting a Seattle City Light program.

The higher proportion of interested residents who have Internet access suggests that more program participants might be reached, at least initially, through web or email promotions.

Conversely, caution is advised how customers are approached, given the large proportions with Internet and email access who stated that they do not want the utility to contact them about home audits.

Further analyses could identify groups of residents who are not only interested in an audit, but also are among the most in need of energy-saving upgrades. These specific groups could be targeted in future promotions.

About 16% of respondents (364 of the 2,312 who identified their building type) gave comments in the space provided on the final page of the survey. For the purposes of these analyses, respondents from midsize attached (multiplex) homes are grouped together with those in larger multifamily buildings, to compare their responses with respondents in single-family homes. This combined group of respondents from small and large multifamily buildings more often made comments (21%) than single-family respondents (14%).

Because comments were voluntary and not from a random sample (respondents were self-selected), group differences have not been subjected to statistical tests. Group differences are noted in this section only when groups vary by 3% or more. These differences can be considered trends to be interpreted in conjunction with other evidence.
Reactions to the Survey & Seattle City Light

Taken together, positive comments about the survey and Seattle City Light are slightly more prevalent than negative comments. Among those who made a comment:

- 28% are complimentary (4% of the entire sample). Fully 17% of commenters expressed appreciation or thanks for the survey, 6% volunteered a comment in favor of conservation or the environment, and 3% complimented Seattle City Light.

- 26% are critical of some aspect of the survey. Commenters were most likely to mention the length of the survey (7%), a topic or question that the survey did not include (5%), or concerns about wasting resources or the impact of the survey (paper and pen incentive) on the environment (5%). Nearly 4% requested an online survey.

- About 3% mentioned the high cost of energy, and 1% are critical of the utility itself.

- One in twenty (5%) expressed individual requests for help. Respondents asked for help with energy costs, bill payment, or a problem getting assistance (3%), or had an issue with a specific building (2%).

- Respondents from multifamily homes more often expressed concern about energy costs and need for assistance with bill payment.

Energy Saving Activity

Those who made comments were eager to describe their own conservation activities; 17% did so:

- 7% mentioned a completed project,
- 5% mentioned a project planned for the future, and
- 5% mentioned their own energy-saving habit or practice.

More single-family residents than multifamily residents mentioned a completed household project.

Barriers to Making Changes

About 15% of commenters mentioned one or more barriers to making an energy-efficient change in the home.

- Commenters most often mentioned cost or their own financial situation as a barrier to change (9%).
- A smaller group (3%) mentioned that they are elderly and would not live in the home much longer, or lived in a house they considered a tear-down.
- About the same number (3%) mentioned physical limitations or health problems.

Requests for Specific Products, Services or Information

Some commenters expressed interest in a specific product or service that Seattle City Light could provide (15%), or wanted information from the utility about a product or technology (6%). Commenters most often mentioned:

- Solar products or technologies (4%),
- Incentives, loans or rebates (4%),
- Windows (4%),
- Insulation (3%), and
- Multifamily programs (3%).

Solar products, incentives, and windows are of greater interest to respondents in single-family homes than those in multifamily buildings.

Some comments indirectly indicated a possible need for services. More comments indicated that respondents lived in an old or inefficient building (9%) than in a generally energy-efficient home (3%).

Renter- or Apartment-Specific Comments

Nearly half of those commenters who live in an apartment, condominium, multifamily building, or rental property (46%) either made a specific comment that was relevant to apartment living or made some non-specific mention that they live in an apartment, condominium, multifamily building, or
rental property. That is, their living situation bore upon their reactions to the survey.

- Among this group, 17% say some or all of the survey was not relevant to their situation.
- Nearly as many, 15%, say that the building owner/manager must be contacted to make changes, or expressed concern about how to influence the owner/manager to do so. A smaller group, 4%, say their owner/manager does not care about conservation or making changes.

**Implications**

The large proportion of favorable comments (along with the overall good response rate to the survey, 44% of mailing recipients) indicates a good level of support for the types of conservation measures studied, as well as support for Seattle City Light in general.

Comments that describe a completed home project or one in the planning stages further indicate favorable attitudes toward energy savings, and efforts to make positive changes. Utility programs directed toward remodel projects can reach customers at an important time, when changes can affect energy use for years to come (otherwise “lost opportunities”).

Based on the proportion of respondents from multifamily homes who made comments on the survey, and their specific concerns, many of the survey items seemed not to apply to this group. Nevertheless, the survey response rates among multifamily households (29% in midsize homes, 38% in condominiums, and 46% in apartments) are only somewhat lower in the aggregate than among single-family homes (49%). It appears that respondents from midsize attached (multiplex) buildings had the greatest difficulty finding the survey relevant or appropriate to their building type.

In order to maximize future response rates, it will be important to consider a separate survey instrument for multifamily households in future research. This may also help for recruiting partners in Seattle City Light energy efficiency programs within the various multifamily residential subgroups. Separating survey items for single-family households may be just as important, in order to address concerns about the length of the survey.

Although a handful of products or services garnered the greatest interest among respondents who wrote in comments, respondents mentioned a broad array of energy-efficient technologies. Consistent with other survey findings reported in this section, Seattle residents are interested in receiving a variety of conservation information from Seattle City Light, but different groups are interested in different programs. To deliver utility programs and services efficiently, one important challenge is to identify and reach those groups that are most in need of energy-saving measures and most receptive to specific utility programs.

According to respondent comments, the greatest barrier to making energy-efficient household changes is the perceived cost of those changes. It will be important to address this concern in developing utility programs as well as their promotions.
**Major Findings • 13**

**Electricity Use per Household**

Total household electric energy use in 2008 (in kilowatt-hours) was compared for groups that varied by:

- Dwelling and occupant characteristics;
- Home heat (space heat) fuel, water heat fuel, and home cooling (space cooling) choices;
- Appliances in the home; and
- Respondent perceptions of the need for energy efficiency measures.

This is the initial look at relationships between these variables and electricity usage, and some cautions about interpreting the findings are in order. First, it is important to remember than the relationships are not causal. Rather, a given appliance may be **associated with** higher energy use, or **associated with** other features of the home that increase the home’s overall energy use.

For example, energy use is strongly related to the size of the home, and it is reasonable that a larger home requires more energy to heat the home and water, and run its lighting and appliances. Many additional household features, which are discussed in this chapter, also are related to size of home, or other household features that contribute to high energy use.

Second, and more specifically, the exact difference in average energy use between groups that have a given appliance compared to those that do not have the appliance probably cannot be attributed to any single appliance. For example, the number of appliances in the home, particularly multiple appliances of the same type, are likely to be associated with larger homes overall, and together with other appliances or features of the home contribute to higher energy use. In these analyses, it is best to consider a specific appliance a **contributor** to higher energy use, in combination with other appliances or home features.

More complex analyses can be conducted using the dataset developed for this study, in order to examine the relative contributions of household features to energy use.

**Variations by Dwelling & Occupant Characteristics**

The following sets of figures show two indices of energy usage. The top chart in each pair shows annual electrical use in kilowatt-hours (kWh). The bottom chart in each pair shows an energy use intensity (EUI) index, calculated as annual electrical use divided by the square footage of the home. In the case of multifamily homes, this refers to the occupied tenant area, exclusive of any common areas in a building.

Among midsize attached (multiplex) homes, the correspondence of metered electrical data and affected square footage is less clear, since not all multiplex units have their own meters, and any common areas may be attached to one of the unit meters rather than recorded by a separate meter.

*These charts plot the mean (center square) bracketed by plus-or-minus the standard deviation (“whiskers”). The bracketed range represents the variability of data around the average (mean); 68% of cases lie within this range. Many of the top charts have been fitted with a simple trend line to illustrate the degree to which energy use varies by each characteristic.*
In this figure, housing types are ordered by ascending means on 2008 annual electricity usage. Based on overall use, multifamily apartments use the least energy per unit of any housing type. In 2008, multifamily apartments averaged 6,290 kWh. Additional types of dwellings that use less energy are fourplexes, condos and row- or town-homes.

Single-family detached homes are among the housing types that used the most energy per household in 2008; they averaged 11,055 kWh.

Accessory dwellings, houseboats, duplexes and manufactured mobile homes, also seem to be at the high end of energy use, although they are represented by very small sample sizes. It is possible that accessory dwelling cases are each represented by an electric meter that includes consumption from the host dwelling; some duplexes also share a single meter for the entire building, which cannot be discerned from the data.

Home owners use more electricity annually than do renters. These findings are consistent with the smaller average size of multifamily homes, which are primarily rented households.

Rental properties, however, show a higher energy use intensity per square foot than owner-occupied properties.
Figure 289: Annual Household Electricity Use, by Whether Business is Operated in Home During the Day

Housing built in the 1970s and 1980s used the most energy in 2008. Homes built most recently, since 1990 had the lowest energy use. Homes built in the decades before 1970 are similar to each other in their energy use, and close to the overall mean.

Energy use intensity appears lowest for homes built before 1940 (smaller and more often heated by fuel oil) and after 1990 (built under more stringent energy codes).

Figure 290: Annual Household Electricity Use, by Decade Building Constructed

The larger the home is in self-reported square footage, the more energy is used. However, a home twice the size of a smaller home does not generally use twice the energy. That is, there is some economy of scale with larger homes. Rather, homes with 3000-4000 square feet use twice as much energy as homes with 500-750 square feet; they do not use four times the energy of the smaller homes, as the square footage might suggest.

On a square foot basis, homes with the lowest energy intensities have over 2,000 square feet of living space.
The more rooms are in a home, the more energy is used. The number of rooms is highly correlated with square footage, and a similar pattern is seen. That is, a home with 12 rooms does not use twice the energy of a home with 6 rooms.

Similar to the pattern for living space square footage, the energy use intensity is lowest for homes with eight or more rooms. The energy use intensity is higher in homes with 3 to 5 rooms.

The more rooms respondents say they heated, the more energy used. Notice that this relationship with energy use is not as strong as for the total number of rooms in the home.

A similar pattern of energy use intensity is demonstrated for the number of rooms that are heated, with intensity lowest in homes with eight or more rooms. Intensity is higher in homes heating 2 to 4 rooms.
The more household occupants are in a home, the more energy is used in the home. The relationship is most clear for households with up to five people. The findings may be less reliable for households with more than five occupants due to smaller sample sizes for higher-occupancy household groups.

Energy use intensity does not vary with the number of household occupants.
The longer respondents had been Seattle City Light customers at their current address, the more energy their households used. Note that longevity in a home is related to size of the home.

Figure 297: Annual Household Electricity Use, by Number of Years a Seattle City Light Customer at Any Location

The pattern of electricity use across various reporting areas, north to south, in the City Light service area, may be thought to reflect the prevalence of multifamily housing. Around Lake Union, in Downtown, the East Hills (First Hill, Capitol Hill), and the Central Area, energy use is lower than the overall Citywide average. In North King County and South King County, suburban areas beyond the City boundaries, electricity use is higher, reflecting the prevalence of single-family housing in those communities.

Average energy use intensity is higher in suburban locations in North and South King County. Intensity is also greater in Delridge and Greater Duwamish area homes.
Variations by Home Heating, Water Heating & Household Type

For each combination of home heating and water heating fuels, the following sets of figures show two indices of energy usage: annual electrical use in kilowatt-hours (kWh), and the energy use intensity (EUI) index.

The next figure presents a baseline for all the following eight figures comparing households by home heat and water heat fuel combinations. A common set of cases was selected that has no missing responses to questions about housing type, main home heat fuel (restricted to electricity, natural gas, and fuel oil), and main water heat fuel (restricted to electricity and natural gas).

Figure 299: Annual Household Electricity Use, for All Home Heat and All Water Heat Fuels (baseline)

For all households in the sample, the average electric energy use is 10,395 kWh per year, as observed for the year 2008. Single-family homes used an average of 11,165 kWh, midsize used 9,549 kWh and multifamily used 7,119 kWh. These values provide a “baseline” for the following subgroup comparisons.

As we examine households with different combinations of space and water heat fuel types, we will also see this same general pattern of energy use, the highest use for single-family homes, and the lowest use for multifamily homes.

The average energy use intensity (EUI) index for Seattle area homes is 6.3 kWh per square foot. This value provides another “baseline” for the following subgroup comparisons. The intensity is lower in single-family homes and higher in multifamily homes.

Figure 300: Annual Household Electricity Use, for Homes with Electric Home Heat (all water heat fuels)

Comparing energy usage to the baseline groups of all households, the subgroup of households with electric home heat—regardless of water heat fuel—uses more electric energy than average. For example, these single-family households use about 5,050 kWh more per year than the baseline single-family household.

Homes with electric home heat have an EUI of 9.2 kWh per square foot, which is 3.0 kWh higher than the baseline for all housing types.
Again, comparing energy usage to the baseline figure, this subgroup of households with nonelectric home heat (natural gas or fuel oil)—regardless of water heat fuel—uses less electric energy than the average household. For example, these single-family households use about 1,475 kWh less per year than the baseline single-family household.

Homes with nonelectric (natural gas or fuel oil) home heat have an EUI of 4.7 kWh per square foot, which is 1.6 kWh lower than the baseline for all housing types.

Comparing energy usage to the baseline figure, this subgroup of households with electric water heat—regardless of home heat fuel—uses more energy than the average household. For example, these single-family households use about 1,650 kWh more per year than the baseline single-family household.

Homes with electric water heat have an EUI of 7.6 kWh per square foot, which is 1.3 kWh higher than the baseline for all housing types.
Comparing energy usage to the baseline figure, this subgroup of households with natural gas water heat—regardless of home heat fuel—uses less energy than the average household. For example, these single-family households use about 1,925 kWh more per year than the baseline single-family household.

Homes with nonelectric (natural gas) water heat have an EUI of 4.3 kWh per square foot, which is 2.0 kWh lower than the baseline for all housing types.

This figure illustrates electric energy usage by households with both electric home heat and electric water heat. These are the “all-electric” homes. As expected, they have the highest average energy use among the subgroups of respondents.

Single-family “all-electric” households used the most energy of any single group, averaging 16,970 kWh per year in 2008. This is about 5,800 kWh more per year than the baseline single-family household.

“All-electric” homes have an EUI of 9.4 kWh per square foot, which is 3.2 kWh higher than the baseline for all housing types.
The average energy usage for “dual-fuel” homes, that have electric home heat but natural gas water heat, is shown for completion purposes. However, this combination of fuel types is the rarest in the population and only the single-family subgroup is represented by a sample size of more than 20.

“Dual-fuel” homes with electric home heat and natural gas water heat have an EUI of 6.8 kWh per square foot, which is only 0.5 kWh higher than the baseline for all housing types.

The next figure shows the average electrical energy usage for “multi-fuel” homes that have electric water heat, but non-electric home heat (either natural gas or fuel oil). A comparison between this chart and the “all electric homes” on the previous page approximates the energy use that is attributable to electric home heat alone, at least among households that have electric water heat.

By this logic, the average household likely uses about 2,300 kWh of electricity for home heat each year. Single-family homes provide a particularly striking example; the average single-family home with electric home heat likely uses about 6,600 kWh more than single-family homes without electric home heat (16,970 minus 10,363).

Other types of households appear to use less energy for home heat (about 3,600 kWh for midsize and 3,000 kWh for multifamily households). However, these figures should be considered gross approximations because midsize and multifamily homes with this combination of electric water heat and non-electric home heat are rare in Seattle housing stock and are represented by small groups in the survey sample.

“Multi-fuel” homes with natural gas or fuel oil home heat and electric gas water heat have an EUI of 5.4 kWh per square foot, which is 0.8 kWh lower than the baseline for all housing types.
Figure 307: Annual Household Electricity Use, for Homes with Natural Gas or Fuel Oil Home Heat and Natural Gas Water Heat (non-electric homes)

![Chart showing electricity use per household for homes with natural gas or fuel oil home heat and natural gas water heat.]

This figure shows the average electric energy use for “non-electric” households that have non-electric (natural gas or fuel oil) home heat and nonelectric (natural gas) water heat. It should not be surprising that these subgroups have the lowest average energy usage of all subgroups (with adequate sample sizes).

However, a comparison of this chart with the “all-electric” homes indicates that households with no electric home heat or water heat still use half, or more than half, as much energy as households that have both electric home heat and electric water heat.

“Non-electric” homes with natural gas or fuel oil home heat and natural gas water heat have an EUI of 4.1 kWh per square foot, which is 2.2 kWh lower than the baseline for all housing types.

Variations by Programmable Thermostat, Air Conditioning, CFL Light Bulbs & Major Appliance Holdings

Figure 308: Annual Single-Family Household Electricity Use, by Presence of Programmable Thermostat

![Chart showing electricity use per household by presence of programmable thermostat.]

Single-family homes with a programmable thermostat use less electricity than homes regulating home heat manually.

There is a lower energy use intensity among homes having a programmable thermostat. Note that the presence of such a thermostat has previously been shown to be greatest in single-family homes.
Households that have air conditioning (about 14% of homes) use more energy than those without air conditioning.

Energy use intensity appears to be 20% higher in homes with air conditioning.

Households with more CFL bulbs use somewhat more energy than those with fewer bulbs.

Energy use intensity is highest among households that have no CFL bulbs installed, and lowest among households with 21 or more bulbs installed.
The more microwave ovens in a household, the more energy the home uses. The energy use intensity of these homes does not vary.

Homes with an electric cooktop that is separate from the oven use more energy than those without this feature.

The more electric cooktops with ovens, the more energy the home uses.

The more electric ovens of this type (separate from a range) in a household, the more energy the home uses.
The more electric dishwashers a household has, the more energy the home uses. Homes with one dishwasher have an energy use intensity 15% lower than homes with no dishwasher.

Households with one or more clothes washers of this type (top loading with agitator) use more energy than homes with no clothes washer of this type, and more than the small group of homes with two of these washers.

The more electric clothes dryers a household has, the more energy the home uses.
Households with a clothes washer of this type (top loading, no agitator) use more energy than those with no clothes washer of this type.

**Figure 320:** Annual Household Electricity Use, by Number of Electric Clothes Washers: Front Loading

Households with one front loading washer used only slightly more energy than homes without this type of washer. The small group of households with 2 of this type of washer used nearly twice as much energy as those with no clothes washer.

The more refrigerators plugged in more than 3 months of the year, the more energy a home uses.

**Figure 321:** Annual Household Electricity Use, by Number of Refrigerators (plugged in more than three months of the year)

The more stand-alone freezers plugged in more than three months of the year, the more energy the household uses.
Households that have a Jacuzzi with electric booster heat use more energy than households without a Jacuzzi.

Households that have a swimming pool with electric heater or pump use more energy than those without a swimming pool. Although the sample of households with a swimming pool consisted of 28 respondents, the difference in their energy consumption is dramatic. They use twice as much energy as households that have no swimming pool.

Households that have a hot tub with electric heater use more energy than those without a hot tub.
Households with an electric sauna use more energy than households that do not have a sauna.

Households that have a waterbed with electric heater use more energy than those that do not have this equipment.

Households that have a fish tank with electric pump use more energy than those that do not have this equipment.
Residents’ perceptions of their home’s overall energy efficiency are somewhat related to actual energy use. Those who say their home is *not very* energy efficient used an average of 11,039 kWh, whereas those who say their homes were *very* efficient used an average of 9,403 kWh.

Those homes reported as *not very* energy efficient also had an energy use intensity 21% higher than that of homes reported as *somewhat* or *very* energy efficient.

Residents’ perceptions of whether their homes need new windows are not related to actual energy use.

However, the energy use intensity of homes perceived as needing new windows is 14% higher than that of homes reported as *not* needing new windows.
Residents’ perceptions that their homes need more wall insulation are inversely related to actual energy use. That is, those who perceive a need for more wall insulation use less energy on average than those who perceive they do not need more insulation.

Residents’ perceptions that their attics need more insulation are inversely related to actual energy use. That is, those who perceive a need for more attic insulation use less energy on average than those who perceive they do not need more insulation.
Residents’ perceptions that their basements or crawl spaces need more wall insulation are inversely related to actual energy use. That is, those who perceive a need for more basement or crawl space insulation use less energy on average than those who perceive they do not need more insulation.

Residents who have had a professional home audit or green audit use more energy than those who have not had this type of audit service.

The energy use intensity of homes that had a professional home audit or green audit is 22% lower than that of homes where the respondent was not sure or did not know.
Implications

Variations by Dwelling & Occupant Characteristics

Households that tended to use more energy on average had the following features:

- Single family
- Owner-occupied
- Business operated in the home
- More square footage
- More total rooms, more rooms that are usually heated
- More occupants
- Respondent was a long-time Seattle City Light customer at that address
- Respondent was a long-time Seattle City Light customer at any address

Although each of these features might drive additional energy use, the relationship between each and household energy use are correlational, not necessarily causal. Each feature might be related to other household features that contribute directly to energy consumption.

Additional analyses are planned to explore the interrelationships among these variables.

Variations by Home heating, Water Heating, Space Cooling & Household Type

As might be expected, single-family homes, which have more square footage on average than midsize homes, use more electric energy per year than midsize homes. In turn, midsize homes use more energy than multifamily homes.

As well, the more electric heating services in the home (space and water), the more electric energy a household uses on average.

Because space and water heat have typically been the greatest drivers of energy use, it is sobering to find that households with neither of these electricity uses consume at least half as much energy as households with both electric space and water heat.

The findings point to a new challenge to identify and plan strategies to decrease energy use from a variety of appliances and electronics.

Following is a summary of the two energy use indices presented in this report: annual electricity use in kilowatt-hours (kWh) and electricity use per square foot—the energy use intensity (EUI).

<table>
<thead>
<tr>
<th>2008 Annual Electricity Use</th>
<th>kWh</th>
<th>EUI</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Single-Family Households</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>All-electric (EL space, water)</td>
<td>16,970</td>
<td>10.48</td>
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<tr>
<td>Dual-fuel (EL space, NE water)</td>
<td>10,551</td>
<td>6.16</td>
</tr>
<tr>
<td>Multi-fuel (NE space, EL water)</td>
<td>10,363</td>
<td>5.43</td>
</tr>
<tr>
<td>Non-electric (NE space, water)</td>
<td>9,162</td>
<td>4.14</td>
</tr>
<tr>
<td><strong>Midsize Households</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>All-electric (EL space, water)</td>
<td>12,174</td>
<td>10.67</td>
</tr>
<tr>
<td>Non-electric (NE space, water)</td>
<td>6,215</td>
<td>4.15</td>
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<tr>
<td><strong>Multifamily Households</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>All-electric (EL space, water)</td>
<td>7,417</td>
<td>8.82</td>
</tr>
<tr>
<td>Non-electric (NE space, water)</td>
<td>4,066</td>
<td>3.57</td>
</tr>
<tr>
<td><strong>All Households</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>All-electric (EL space, water)</td>
<td>12,396</td>
<td>9.77</td>
</tr>
<tr>
<td>Non-electric (NE space, water)</td>
<td>8,869</td>
<td>4.12</td>
</tr>
</tbody>
</table>

Dual-fuel and multi-fuel combinations are not shown for midsize attached (multiplex) and multifamily homes because these are rare combinations and the number of cases in each subgroup is less than 20. As a reminder, these observations are limited to meters associated with the residential unit and exclude any reference to meters for common areas of buildings.

Air conditioning appears to be associated with higher household energy use. Although air conditioning may contribute to overall energy consumption, it is possible that air conditioning is more common in larger (more affluent) households, which might also be related to greater energy use.
Simple regression analyses were performed separately for single-family and multifamily homes. For single-family homes, this analysis found an annual baseload of 8,893 kWh, with 5,696 kWh added if electric main home heat is present, and 1,792 kWh added if electric water heat is present.

The goodness-of-fit measure (R-squared) for the single-family household analysis was 0.19. This indicates that only 19% of the variation among homes could be accounted for by the presence or absence of electric home heat or electric water heat. Other factors play stronger roles in determining electric consumption in single-family homes.

For multifamily homes, a similar analysis found an annual baseload of 4,763 kWh, with 1,814 kWh added if electric main home heat is present, and 826 kWh added if electric water heat is present.

The goodness-of-fit measure (R-squared) for the multifamily household analysis was 0.06. This indicates that only 6% of the variation among homes could be accounted for by the presence or absence of electric home heat or electric water heat. Other factors play much stronger roles in determining electric consumption in multifamily homes.

Variations by Appliance Holdings

Households used a greater amount of energy if they had any of the following electrical products or appliances:

- CFL bulbs *
- Microwave ovens *
- Electric cooktop with oven
- Electric cooktop separate from oven
- Electric oven separate from range *
- Electric dishwasher *
- Electric clothes dryer *
- Electric clothes washer (top loading, with agitator)
- Electric clothes washer (top loading, no agitator)
- Electric clothes washer, front loading *
- Refrigerators *
- Stand-alone freezers *
- Jacuzzi tub with electric booster heat *

Items with an asterisk (*) showed a linear relationship with electricity use; that is, the more of each product in the home, the greater the electrical consumption. Other items are associated with higher electricity use when present, and lower use when absent.

Large appliances, particularly those that produce heat, probably have a direct impact on annual household energy consumption.

Some relationships between products in the home and household energy consumption might be deceiving, however. For example, households with more CFL bulbs appear to use more energy than households with fewer CFL bulbs. Instead of concluding that CFL bulbs contribute to greater energy consumption, it is important to remember that households that can put many CFL bulbs to use probably are among the largest households and use more energy merely due to their size.

As well, given the relatively small energy use of the average fish tank, they are not likely to use the same energy on their own as a sauna; yet, the charts look similar for both products. Rather, fish tanks may be “indicator appliances.” They might indicate that a home has other features (e.g., the size to accommodate a fish tank, or residents who have extra leisure time) that are related to greater household energy use.

A recent New York Times article (reprinted in Seattle Times, Sept. 20, 2009, A7) suggested that although household appliances have decreased their energy consumption due to efficiency standards, efforts to create such standards for household electronics have been unsuccessful due to industry resistance. In addition to working with the electronics industries, utilities may want to introduce new technologies, such as smart power strips, that address the energy use of gadgets that are constantly turned on.
Residents’ Perceptions of Efficiency Needs

Residents who felt their homes were not very energy efficient used more energy than those who felt their homes were very efficient. Their overall perceptions of energy efficiency were reflected in actual energy consumption.

In contrast, residents’ perceptions of specific energy efficiency features either were unrelated or inversely related to energy consumption. That is, those who felt their homes needed new windows, more wall, attic, and basement insulation used less energy, on average, than those who did not feel they needed these products.

It is possible that those who felt they needed new windows or more insulation had put off these improvements (due to cost concerns) or simply recognized their needs more readily than others. They would benefit by programs that include financial assistance with energy efficiency measures.

It is also possible that residents are simply unaware of their specific needs for household improvements and could benefit by educational programs. In this case, home energy audits and product-specific discounts may be most beneficial.

The higher energy usage by homes that have had an energy audit should not be attributed to the impact of home energy audits. Residents who have requested an energy audit may simply be among the highest energy users. An appropriate evaluation of the utility’s energy audit program would involve a comparison of pre-audit and post-audit energy use, taking into account changes made to the home that resulted from the audit.

Using Energy Consumption Data

Each section of this report includes suggestions for ways the utility might use survey findings to plan energy-saving programs. The findings also can be used to directly inform customers about their energy usage.

At a minimum, Seattle City Light could make available average annual energy usage for some simple subgroups, such as the housing types charted in this chapter. Then customers could compare their own energy use to those averages.

In a more elaborate application that requires an interactive webpage, customers could enter information about additional characteristics of their households, such as home size, and occupancy, and compare their energy use to more specific subgroup averages. This type of energy-use feedback could give customers a clear idea of their potential for saving energy and money. The website could further direct residents to products and services that could help them lower their energy use.

One additional advantage to the utility of an interactive webpage is the opportunity to collect data from more customers as they respond to the demographic questions posted. This type of system could provide a continual feedback loop between the utility and its customers.

Trends over Three Decades of Residential Customer Characteristics Surveys

Figure 336: Annual Household Electricity Use, by Housing Type: Trends over 3 Decades

Annual energy consumption has been trending downward over the past three decades among both single-family and multifamily homes. The average single-family home in 2009 uses 3,314 kWh less than in 1979 (a reduction of 23%). The average
multifamily home now uses 1,782 kWh less (likewise a 20% reduction). These long-term reductions average to just under one percent per year.

These observations suggest that various factors have been at work over the past three decades to curb energy consumption in residential dwellings. These factors may include economic effects of fuel prices, natural conservation activity of residents and property owners, as well as the impacts of Seattle City Light conservation programs operated over the past thirty years.

What is more, major appliances have become more efficient, along with lighting products. Even the advent and ubiquity of electronic equipment in homes has been accompanied by increasing levels of energy efficiency. In 2000 there were strong behavioral impacts that followed on a major drought and West Coast energy crisis; and in 2009, the severe world-wide economic recession.

Annual energy consumption has been trending downward for single-family homes with non-electric home heat, but not among multifamily homes with non-electric home heat. The average single-family home with non-electric home heat in 2009 uses 2,462 kWh less than in 1979 (a reduction of 20%). The average multifamily home with non-electric home heat now uses 962 kWh more (a 29% increase).

The 2000 survey report observation for multifamily homes with non-electric home heat appears anomalous, in the series of observations, perhaps due to a small number of cases and sampling error.

**Figure 338: Annual Household Electricity Use, by Water Heat in Electric Home Heat Homes: Trends over 3 Decades**

Annual energy consumption has been trending downward over the past three decades among homes having both electric home heat and electric water heat (solid lines). The average all-electric single-family home in 2009 uses 4,625 kWh less than in 1982 (a reduction of 21%), while the average all-electric multifamily home now uses 2,669 kWh less (a 26% reduction). These long-term reductions average to about one percent per year.

Among homes with electric home heat but non-electric water heat (dashed lines), the average single-family home in 2009 uses 4,809 kWh less than in 1982 (a reduction of 31%), while the average multifamily home now uses 2,191 kWh more (a 29% increase).
The 2000 survey report observation for single-family homes with non-electric water heat appears anomalous, perhaps due to sampling error.

Likewise, the 2009 survey report observation for multifamily homes with non-electric water heat appears anomalous, which again may be due to the sampling error.

**Figure 339: Annual Household Electricity Use, by Water Heat in Non-electric Home Heat Homes: Trends over 3 Decades**

Among homes with non-electric home heat but electric water heat (solid lines), the average single-family home in 2009 uses 2,378 kWh less than in 1982 (a reduction of 19%), while the average multifamily home now uses 1,116 kWh less (a 20% reduction). These long-term reductions average to about three-fourths of a percent per year.

Among homes with non-electric home heat and also non-electric water heat (dashed lines), the average single-family home in 2009 uses just 414 kWh less than in 1982 (a reduction of 4%), while the average multifamily home now uses 1,779 kWh more (a 78% increase).

The 2000 survey report observation for multifamily homes with electric water heat appears anomalous, perhaps due to sampling error (only 14 cases were observed).
Appendix A

Stakeholder Interviews

**Stakeholder Interviews - Overview**

During the review of previous versions of the RCCS survey, interviews with key stakeholders throughout Seattle City Light helped focus attention on the types of information that would be helpful in utility planning and program development.

**Interview Participants**

Each of the following participated in a key informant interview.

- Allegra Abramo, Seattle Public Utilities, Customer Programs & Contract Management, Administration
- Glenn Atwood, Conservation Resources Planning, Research & Evaluation, Manager
- Bob Balzar, Conservation Resources, Director
- Robert Bartley, Finance Division, Financial Planning Unit, Energy Research & Evaluation Analyst
- Jean Becker, Strategic Planning Director’s Office, Strategic Advisor
- Leslie Brazeau, Conservation Resources Marketing, Manager
- Carol Dickinson, Customer Care Director’s Office, Manager
- Al Dietemann, Seattle Public Utilities, Resource Conservation, Water Conservation Program Development
- Andrew Gibb, Community Conservation Resources, Energy Planning Supervisor
- Lars Henrikson, Community Conservation Resources, Energy Planning Analyst
- Ken Katayama, Community Conservation Resources, Field Services Manager
- Eugenia Morita, Community Conservation Resources, Multifamily Field Program Supervisor
- Chris Thompson, Resources Conservation Resources Planning, Research & Evaluation, Economist
- Mary Winslow, Integrated Resource Planning & Forecasting, Senior Power Analyst

**Stakeholder Interview Protocol**

The following protocol guided stakeholder interviews.

1) **Use of Previous RCCS studies.** How have you used previous RCCS studies? What was most useful or helpful? What information do you have now that drives current programs, services or decisions?

2) **Information needed.** What information from residential customers would help you decide how to move forward with your programs? What information might help you do your job, or meet your goals?

3) **Evaluation component.** Do you have baseline data you need concerning residents’ conservation measures (of the type you work on)? Is there an evaluation component to your program? What household trends are of interest to you?

4) **Work focus (if not evident).** Tell me about the focus of your work and how it can be informed by residential housing characteristics or conservation measures.

5) **Current programs (if not evident).** How does your work try to affect community conservation? What residential conservation programs do you run currently?

6) **New or discontinued programs.** What programs are under consideration? Have you run programs that have been discontinued?

7) **Show DRAFT RCCS 2009.** Which questions are important to keep?
Use of Previous RCCS Study Results

Most stakeholders had many years of experience at SCL and had used RCCS data in the past. Those who had used the RCCS data in the past were no longer using it because they considered it outdated and wanted current information. Prior uses of the RCCS findings include:

1) Understanding energy usage by housing characteristics such as fuel for space and water heating,
2) Estimating energy savings due to efficient showerheads in use,
3) Planning single family weatherization,
4) Conducting the conservation potential assessment (CPA),
5) Learning what customers want or need to better manage their energy use,
6) Load forecasting (historically),
7) Planning a variety of residential energy savings programs, and
8) Distribution system planning.

Current Programs to Benefit by RCCS Information

Stakeholders mentioned a variety of current or recent SCL programs they felt would be informed by the survey findings.

1) Further weatherization
2) Expansion of appliance-type rebates
3) Proportion of customers with window air conditioning
4) WashWise rebates
5) Twist & Save CFL buy down
6) Home resource profile online
7) Green audits, with CFLs and Conservation Kits distributed
8) Refrigerator recycling
9) Lighting fixture rebates, currently limited marketing through two retail outlets
10) MF weatherization and ambient light
11) Built Smart (multifamily new construction, for developers and contractors)
12) Proportion of Energy Star appliances in homes — concern about how to get good data
13) Average household electrical use information that electrical service reps can use when meeting with customers
14) Onsite audit — level of interest
15) Right-sizing efforts for distribution engineering that can be informed by coordinated databases
16) Goal to serve all groups or populations in the service area
17) Electric consumption estimates based on square footage, existing databases — concern regarding accuracy
18) Customer service — can give average household billing by size and type of building
19) CFL promotion in hallways, outside the door
20) Marketing strategy by neighborhood — want information by neighborhood
21) Home Energy Audit — want to know if residents have had this service

Potential New Programs to Benefit by RCCS Information

Some stakeholders were particularly interested in the implications of the study for new programs the utility was considering or new energy uses, including:

1) Small appliances or electronics — what we don’t know now
2) More levels of CFL use — not just 1-CFL threshold
3) Residents’ preferred communication method with the utility, including bill insert, customer service hotline
4) Smart strips that shut off power automatically for audio-visual electronics
5) Level of interest in heat pumps
6) Promotion of LCD televisions rather than plasma (via small incentive and label at retail outlets)
7) Inclusion of LCD televisions in Energy Star label program
8) Single family weatherization possibly marketed to residents
9) Water heater rebate incentives in Built Smart
10) Expanded appliance rebates for electric water heaters, refrigerators, dish washers
11) Heat pumps to replace electric furnaces in ducted systems, also, insulation and sealing
12) Air conditioning baseline, anticipating low current saturation
13) Potential programs to target renters, 2-4-plex and multifamily: air conditioning add-ons, audio-visual electronics, behavioral measures such as resetting thermostats, cold water clothes washing
14) Online electrical use information tailored to customers’ home features with the goal of providing conservation suggestions
15) Automatic metering
16) Encouraging customers to put energy back into the grid — assess the role of solar, photovoltaics, wind generated energy
17) Online billing statements
18) Billing options such as monthly vs. bi-monthly, choice of first day of monthly billing cycle
19) Coordination of King County and SCL-CIS databases, more powerful databases to learn about consumers
20) More effective website
21) Program to encourage ductless heat pumps
22) Customized home energy reports — providing customers their household energy use compared to that of 100 homes of the same square-footage
23) Pilot of Home Energy Monitors — provides real-time information regarding energy usage

Other Information Requested

Stakeholders responded to a draft version of the survey instrument. Some referred to specific questions already planned as part of the survey, and some suggested additional or related topics, including the following.

1) Plans to buy flat screen television, computer, window air conditioning
2) Use of power strips
3) Refrigerator use, location, whether operating, if recycled
4) Proportion of space hearing furnaces in heated vs. unheated space
5) Proportion gas vs. electric water heaters and whether in heated space
6) Type of heating fuel as baseline for both space and water heat
7) Audio-visual appliances and other plug-ins
8) Cold vs. warm or hot water clothes washing to assess assumptions about average use.
9) Square footage of entire household, and converted space — concern about comparisons with county records
10) What information customers want or need from SCL to help them save energy
11) Any information to help customers save on their bills — “back to basics”
12) Receptivity to automatic metering, willingness to test the technology
13) Current sources of online information about household maintenance and upgrades
14) Proportion of customers who have Internet access, Email, and surf the web for information
15) Indications of whether SCL has done all necessary conservation
16) Whether decreased electricity consumption can be attributed to publicity re global warming, recycling or drought
17) Findings for neighborhoods, particularly South Lake Union, South Downtown, and Queen Anne
18) Age of buildings, especially apartments (available in King County data)
19) Number of stories in single family homes (useful for heat pump program)
20) Proportion of homes with baseboard heat in single family homes or condos (anticipating program for ductless heat pumps)
21) Proportion of homes with accessory dwelling
22) Number of water heaters and if used year-round
23) Number “point of use,” or instant-on, water heaters
24) Proportion windows double- and triple-pane
25) Home remodel plans
26) Reaction to daylighting measures, e.g., solar tubes
27) Frequency of air conditioning use and importance to customer
28) Perceived need for more insulation
29) Solar panels vs. photo-voltaics currently installed, but concern whether residents could report this
30) Storm windows for single-pane windows
31) Whether basement is heated
32) Essential: Stock, Awareness, Receptivity, Plan to purchase

**Potential Focus Group Topics**

Some topics suggested for study appeared broad or complex enough to be appropriate potential topics for follow-on focus groups. These topics included:

1) Receptivity to alternative metering
2) Receptivity to new technologies, such as, hybrid or electric vehicles, solar panels, photo-voltaics; new generation of renewables, such as geothermal, tidal power
3) Customer expectations for electric service reliability and willingness to trade-off for lower rates
4) Importance of air conditioning and how often used
5) Reaching under-served populations, or populations unlikely to be reached by English-language printed survey (renters, lowest-income households, households with main language other than English)
Community Reporting Areas

**Neighborhoods**

Community Reporting Areas (CRAs) were adopted by the City of Seattle in 2004 as a standard, consistent, citywide geography for reporting purposes across all departments, as appropriate. There are 53 CRAs derived from census tract geography.

CRAs do not represent an attempt to identify neighborhood boundaries as defined by neighborhoods themselves. The CRA system gives the City a familiar system of common place names with a geography of suitable scale to represent neighborhood areas/conditions. It is reasonably stable over time, consistent with census geography, relatively easy to use in a data context, and respectful of neighborhood district geography. The CRA boundaries were created after reviewing numerous “neighborhood” geographies, including:

- neighborhood planning areas (Department of Neighborhoods).
- neighborhood districts (Department of Neighborhoods / City Neighborhood Council / Neighborhood District Councils),
- city sectors / neighborhood plan implementation areas (Department of Neighborhoods),
- urban centers / urban villages (Department of Planning & Development),
- population sub-areas (Department of Planning & Development),
- the Neighborhood Map Atlas (City Clerk), and
- various other geographic information sources related to neighborhood areas.  

The Community Reporting Areas describe the City of Seattle, but do not cover all areas within the bounds of Seattle City Light’s service area. To assign data by U.S. Census Tracts to City neighborhoods and CRAs, two new coding categories were created for this project, areas 14 (north King County) and 15 (south King County).

The following two tables and the map show which neighborhoods are located in each CRA, and which census tracts make up each neighborhood and CRA.

---

### Community Reporting Areas

<table>
<thead>
<tr>
<th>CRA</th>
<th>Neighborhood</th>
<th>CRA</th>
<th>Neighborhood</th>
</tr>
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<td>1</td>
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<td>Madison Park</td>
</tr>
<tr>
<td>1</td>
<td>Alki - Admiral</td>
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<td>Madrona - Leschi</td>
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<td>Miller Park</td>
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<td>Belltown</td>
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<td>Montlake - Portage Bay</td>
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<td>Broadview - Bitterlake</td>
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<td>Mt.Baker - North Rainier</td>
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<td>Capitol Hill</td>
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<td>Cascade - Eastlake</td>
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<td>North Beacon Hill - Jefferson Park</td>
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<td>Downtown Commercial Core</td>
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<td>Olympic Hills - Victory Heights</td>
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<td>Laurelhurst - Sand Point</td>
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<td>9</td>
<td>Licton Springs</td>
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<td>Wedgwood - View Ridge</td>
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<tr>
<td></td>
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<td>1</td>
<td>West Seattle Junction - Genesee Hill</td>
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<td>Whittier Heights</td>
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### Census Tracts

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<tr>
<td>1  2 Fauntleroy - Seaview</td>
<td>106   116</td>
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<tr>
<td>1  3 West Seattle Junction - Genesee Hill</td>
<td>97.2  98  105</td>
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<tr>
<td>1  4 Alki - Admiral</td>
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Community Reporting Areas for Seattle & Census 2000 Tracts

City of Seattle
Department of Neighborhoods
January 14, 2005

Notes:
1) Proposed and approved as a standard, consistent, citywide geography for reporting purposes across all departments, as appropriate.
2) CRAs were identified in the proposal. The CRAs can be aggregated into CRA Groups which can be used to approximate the geographic areas of the 13 neighborhood districts. CRAs are derived from census tract (2000) geography.
3) This is not an attempt to identify neighborhood boundaries as defined by neighborhoods themselves.
4) The following geographies were reviewed during this effort:
   - neighborhood planning areas (DON);
   - neighborhood districts (DON/CNG/Neighborhood District Councils);
   - city sectors/neighborhood plan implementation areas (DON);
   - urban centers/urban villages (DPD);
   - population sub-areas (DPD);
   - Neighborhood Map Atlas (City Clerk);
   - Census 2000 geography;
   - topography; and,
   - various other geographic information sources related to neighborhood areas.
5) The following criteria for a CRA geography were defined for this effort:
   - no overlapping areas;
   - complete coverage of the city;
   - suitable scale to represent neighborhood areas/conditions;
   - reasonably stable over time;
   - consistent with census geography;
   - relatively easy to use in a data context;
   - familiar system of common place names; and,
   - respects neighborhood district geography.
6) The CRA common place names denoted on this map are an alternative form of general identification and reference (an alternative to the CRA numeric ID system). More detailed common place name references can be found in an associated look-up table.
7) The CRA concept was conceived and evaluated by a working group that included staff from the following offices: DON, DPD, DOIT, OSE, SDOT, and SPU. Staff from DON and DPD worked closely together to define a suitable proposed CRA geography. Additionally, staff from the City Clerk’s Office worked with the working group to explain the background and purpose of the Neighborhood Map Atlas.
8) Outreach to departments and staff has been completed by way of DON, Management Team and Senior Staff, Growth Management Sub-Cabinet, Capital Cabinet, Business Management Council, GIS Board, and Executive Senior Staff.

Washington State
Lake Washington
Southeast
Puget Sound

Census 2000 Tract

Elliott Bay

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Conservation Resources Seattle City Light
Appendix C

General Recommendations for Future RCC Surveys

The 2009 project was conducted by a team drawing on internal and external resources:

- Seattle City Light project manager (trained survey researcher and conservation evaluator)
- Consulting research director (PhD survey professional with City of Seattle research experience)
- Sub-consulting data analyst (survey professional with telephone fielding house and SPSS capabilities)
- Contracted graphic design professional
- Contracted printing vendor
- Contracted mailing fulfillment house (with data entry capabilities)

The following guidelines include practices put into place for this 2009 project that were essential to the efficient completion of the project. Also provided are recommendations for the future, based on what was learned in the course of this collaboration.

Preparatory Work & Needs Assessment

Consult with Seattle City Light and City of Seattle “stakeholders” in the project, and prioritize the information that may be most useful to them.

Ask for their feedback about the survey instrument.

Keep stakeholders apprised of the project progress.

Maintain a detailed calendar through all phases of development and administration, to track respective responsibilities and target dates of all collaborating parties on the project team.

Survey Development

Address concerns and complaints from respondents about the length of the survey.

Create a separate survey for residents of single-family housing versus multifamily housing.

Include only questions about which residents can provide information easily; e.g., leave out features of multifamily buildings that are not known to residents.

Reconsider multi-part questions with a grid format, such as B1 and E1, which were difficult for respondents to understand.

Given the utility industry interest in amount of energy usage for different household equipment, for key items consider asking about hours used.

Clarify to respondents the survey items about hours electronics are plugged in to a live outlet.

Assess which electronics are of greatest concern for high energy use.

Examine how subsequent surveys can have an evaluative component for utility programs that have been implemented in the interim.

Survey Administration

Method of Administration

Maintain strict control of identities for sampled households, dissociating address, name, billing account number, and meter number from the survey tracking code. Encrypt identity codes in any necessary cross-referencing files.
Use a short (e.g., three character) alphabetic code to imprint booklets and track responses. Avoid numeric codes or bar codes, if possible. (In 2009, no booklets were returned with the three-letter code removed or obscured – a problem in prior RCCS studies.)

Offer an Internet on-line survey option.

When administering a mailed survey with a printed, hard-copy instrument, work very closely with the U.S. Postal Service to establish mailing accounts at the appropriate station. Confirm all transactions and mailing permit codes. Allow sufficient lead time to conduct trial runs to ensure correct operation.

For sampled households, maintain a tracking worksheet that contains date of initial mailing, date of telephone contact, dates of any mailings in subsequent waves, and date completed booklet was returned.

Mail a second-wave copy of the instrument three to four weeks after the initial (first-wave) mailing, only to non-responding households.

For all sampled households, purchase telephone numbers from a service provider, to supplement numbers maintained in the Seattle City Light customer information system.

Follow up the initial mailing with a brief, scripted telephone call to all households with obtainable telephone numbers. Explain the importance of the survey and answer any outstanding questions.

Mail a third-wave copy of the instrument three to four weeks after telephone contact, only to non-responding households.

Depending on the response rate by sample subgroups, mail a fourth copy of the instrument three to four weeks after the third wave of mailing, only to non-responding households.

If follow-up professional home audits are desirable, offer respondents a return post-card that would allow them to volunteer for this service. Also allow respondents an opportunity to participate in other market research projects.

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**Sample**

Select a sample that conforms to the proportion of housing types as counted in the most recent U.S. Census. Do not rely solely on a random sample from the SCL customer information system to provide an overall representative sample of residents of different housing types.

Begin by drawing an over-sample of accounts on residential rates. Cull accounts that are not addressed to an individual person. Match that sample to utility bill history records for the preceding calendar year. Analyze records with and without a full year of billing data. Continue on to administer the survey to accounts with a complete bill history.

**Data Management**

**Data Entry**

Work with a mailing fulfillment house only under a contract with the City that controls access to mailing lists. Share files only on a controlled-access server (e.g., secured FTP site).

Aim for automated data entry (printed instruments that can be data scanned, as well as on-line direct response by residents of sampled households).

Hire a seasoned data entry service; and meet with data entry personnel regularly to maintain consistent data entry methods.

“Pre-code” each survey instrument before data entry from any hard-copy survey instrument. Examine and correct patterns of incompletely marked choices such as failing to check “none” in a series of similar items. Use an Excel workbook, manipulating data filters to locate items requiring recoding. This step is **very important** before proceeding to data analysis.

Move the data into SPSS\(^2\) for the analysis phase.

---

\(^2\) SPSS: Statistical Package for the Social Sciences.
**Data Analysis**

Create a planning spreadsheet in Excel, detailing analyses to be completed for all variables, including each breakdown or cross-tabulation, and all test statistics required. This worked well as a planning and communication tool, to guide data analyses and report writing for each section of the final report.

Review the SPSS data code book (variable labels and value labels) before any tables are run, to ensure absolute clarity. Include booklet item numbers in the variable labels.

Develop coding schemes and recoding combinations within a single SPSS master data set, shared by all analysts.

Create charts after the tables are produced.

Keep detailed notes of data manipulations; this was important to coordinate the efforts of multiple data analysts.

**Final Product**

Maintain the report in manageable chunks – sections or chapters.

Keep a punch-list of changes to be made for the report, organized by section.

Consider using an on-line production site so that multiple collaborators can work on a single report copy and can share analytical workbooks.

Report the findings to project stakeholders. (An interim report based on the second draft was very well received.)

Publication on-line would ensure the broadest audience and transparency.

**Study Report**

**Format**

Establish a format, template, and style sheet for the report, tables, and charts before beginning to write the report. This was especially useful for writing the report collaboratively.

**Management**

Complete an entire first draft of all sections before returning to edit previous sections, to get the best overview of the findings.

Assign the editorial role to one individual, to maintain continuity and consistency. This person requires excellent skills in word processing, graphic design, publication production, and technical analysis using Excel and SPSS.
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The 95% confidence interval for an observed proportion, P, based upon a sub-group size, N, is found by selecting the table cell with the closest value to P from the left-most column and the closest sub-group size to N from the top-most row. The cell gives the half interval and the confidence interval is P ± the value in the table.
Appendix • E

2009 Survey Booklet

Following is a copy of the instrument mailed to sampled households for the 2009 Residential Customer Characteristics Survey.
March 2009

Dear City Light Customer,

**Your electric utility is planning for the future, and we invite you to be a part of it.** We are looking for ways to serve you better and help you manage energy bills. To do this, we ask for your help to improve our understanding of how residents use electricity in their homes.

**Your reply to this survey will represent about 100 households in your neighborhood.** Only a small group of our customers will receive this booklet, so every response is important.

Whether you live in a single-family house, an apartment or a condominium, your help is needed. Even if you use only a small amount of electricity each month, we still need to hear from you. We depend on your help to represent your neighborhood accurately.

**Your name or address will never be attached to the survey.** Your participation is completely voluntary and confidential. We will take every care to protect your privacy – we understand how important that is. We will use the information you give us only for research purposes here at Seattle City Light. This booklet has an a mailing code that will be used to avoid sending reminders to those who have already replied.

**Your response is a valuable part of your utility's success.** Your completed booklet will:

- Be used to plan for future electricity needs, conservation programs, and customer services.
- Give us information that only you can provide.
- Take about 30 minutes on average to complete.

Seattle City Light has a 30-year history of national leadership in conservation, with award-winning, innovative programs. Join your public power utility in planning for the challenges of the next decade.

**Please return your completed booklet in the postage-paid envelope – no stamps are needed.** You can mail the yellow and green postcards with your booklet or separately. And please accept our thanks for your help.

Sincerely,

Bob Balzar, Director, Conservation Resources Division
Planning for Our Energy Future

PART A. YOUR HOME AND OCCUPANCY

Energy use is affected by household characteristics like these. For example, the more occupants and heated rooms, the higher the average energy use. And, a single-family house uses more energy than an apartment.

A1 Check how you would rate the energy efficiency of your home overall.
- Very efficient
- Somewhat efficient
- Not very efficient
- I’m not sure right now

A2 Check what type of building your home is in.
- Single-family home............a detached house
- Row-home or town-home ....with attached sidewalk
- Accessory dwelling .................a “mother-in-law unit”
- Manufactured home ............or mobile home
- Houseboat..............................or other boat
- Duplex home........ 2 units in building
- Triplex home ........ 3 units in building
- Fourplex home.... 4 units in building
- Apartment........ 5+ units in building, rented
- Condominium ....... 5+ units in building, owned

A3 Check how your home is owned. We ask because owners can make more changes to a property than renters can.
- Owned by you or someone in this household with a mortgage or loan
- Owned by you or someone in this household free and clear (without a mortgage or loan)
- Rented from the owner or manager
- Occupied without payment of rent

A4 Check how your home is occupied.
- Year-round, occupied full-time
- Seasonal or part-time, occupied more than 6 months of the year
- Vacant more than 6 months of the year

A5 Do you operate a business in your home during the day? □ Yes □ No

A6 Check the decade in which your home was built.
- 1900 - 1909
- 1910 - 1919
- 1920 - 1929
- 1930 - 1939
- 1940 - 1949
- 1950 - 1959
- 1960 - 1969
- 1970 - 1979
- 1980 - 1989
- 1990 - 1999
- 2000 - 2009
- Don’t know

A7 Check how many square feet of living space are in your home. Do not count garages, unheated porches, and unoccupied basements or attics.
- Less than 250
- 250 - 500
- 501 - 750
- 751 - 1,000
- 1,001 - 1,250
- 1,251 - 1,500
- 1,501 - 2,000
- 2,001 - 2,500
- 2,501 - 3,000
- 3,001 - 4,000
- 4,001 - 5,000
- 5,000 or more
A8 Check the number of these rooms that are in the living space of your home. Note: A studio apartment has no separate bedroom. If your home has an open layout, check the rooms that are included.

<table>
<thead>
<tr>
<th></th>
<th>None</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5+</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kitchen</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dining room</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Living room</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Family room or den</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Office or study</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fully enclosed sunroom</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Utility / laundry room</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bed rooms</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Other rooms (please describe):</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Bath rooms

A9 Based on the types of rooms you marked above, check the total number of rooms in your home. Do NOT count bath rooms, balconies, closets, foyers or hallways.

Of these, check how many rooms are usually heated.

A10 Check how many people, including you, lived in this household at least 6 months of 2008.

A11 Check your age group, as the person filling out this booklet.

A12 Check how many people living in this household are in each of these age groups, including you.
**PART B. HEATING YOUR HOME**

*Home heating is generally the greatest energy use in Seattle area households. Also, some homes have programmable thermostats to allow you to set different temperatures for different times of day.*

**B1**

1. **Check the main way you heat your home.**
2. **Then check other heating you use now.**
3. **Last, check the main way you heated your home 2 years ago, before Jan. 2007.**

<table>
<thead>
<tr>
<th>Main Home Heat Now? (Check one)</th>
<th>Other Home Heat Now? (Check all types)</th>
<th>Main Heat before January 2007? (Check one)</th>
</tr>
</thead>
<tbody>
<tr>
<td>None</td>
<td>None</td>
<td>No change</td>
</tr>
<tr>
<td>None</td>
<td>None</td>
<td>Don't know</td>
</tr>
</tbody>
</table>

- **ELECTRICITY** from wired equipment
  - Central forced-air furnace (with ducts)
  - Central heat pump (with ducts)
  - Baseboards or wall heaters
  - Radiant heat coils or cables (in ceiling or floor)
  - Radiators or portable heaters
  - Plug-in fireplace
  - Cooking stove or oven

- **NATURAL GAS** from an underground pipe
  - Central forced-air furnace (with ducts)
  - Radiators, baseboards, or in-floor piping that circulate hot water
  - Gas fireplace
  - Cooking stove or oven

- **FUEL OIL** and **KEROSENE** from storage tanks
  - Central forced-air furnace (with ducts)
  - Kerosene space heater

- **WOOD** and **BURNED FUEL**, including pellets
  - Woodstove, or fireplace with stove insert
  - Fireplace alone, with air exchanger
  - Fireplace alone, without air exchanger

- **ACTIVE SOLAR** collection from the sun
  - With panel, pump and/or fans

- **PASSIVE SOLAR** design from the sun
  - With collector windows and/or thermal mass

- **OTHER** (please describe):

**IF UNSURE ABOUT YOUR HOME HEATING, CALL (206) 684-3800 FOR ASSISTANCE.**

**B2**

**Check the reasons for making the change in your home heating.**

- Replace worn out equipment
- Make my home safer
- Make my home cleaner
- Make my home more comfortable
- Lower my energy bills
- Save energy
- Live more sustainably
- Reduce my "carbon footprint"
- No more deliveries of oil or bottled fuel
- No change in home heat system
B3 Check the age of your main home heating equipment that you use most now.

<table>
<thead>
<tr>
<th>New in 2009</th>
<th>2 - 10 years</th>
<th>21 - 30 years</th>
</tr>
</thead>
<tbody>
<tr>
<td>New in 2008</td>
<td>11 - 20 years</td>
<td>31 years or more</td>
</tr>
</tbody>
</table>

B4 Check the number of thermostats that control your main or most-used home heating equipment.

<table>
<thead>
<tr>
<th>None</th>
<th>2 thermostats</th>
<th>4 thermostats</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 thermostat</td>
<td>3 thermostats</td>
<td>5 thermostats or more</td>
</tr>
</tbody>
</table>

B5 Check the typical winter-time temperature settings of your main thermostat (in Fahrenheit degrees).

<table>
<thead>
<tr>
<th>Morning 6 AM - 9 AM</th>
<th>Day 9 AM - 5 PM</th>
<th>Evening 5 PM - 10 PM</th>
<th>Night 10 PM - 6 AM</th>
</tr>
</thead>
<tbody>
<tr>
<td>OFF or less</td>
<td>55°</td>
<td>56- 60°</td>
<td>61°</td>
</tr>
</tbody>
</table>

B6 Do you have a programmable thermostat, with a clock that allows different settings for times of day?

- Yes
- No  → Skip to Item B8

B7 Check all the different time settings that your programmable thermostat allows.

- Seasons of the year (or, change for daylight savings time)
- Day of the week (7 days, or weekday/weekend)
- Morning, day, evening, and night (4 periods)
- Day and night only (2 periods)

B8 Check how familiar you are with the "Energy Star" logo.

- Have heard about this
- Have seen this on products in the stores
- Have a product with this logo in my home
- Not familiar with it / not sure

PART C. COOLING YOUR HOME

Even in our mild climate, some residents use air conditioning in the summer. Please tell us how you stay cool.

C1 Check what kinds of fans you use during the summer heat.

- Portable fans
- Ceiling fans
- Bathroom/kitchen fans
- Whole house fan
- Attic fans
- Window fan
- None

C2 Check whether you plan to buy a new air conditioner in the next 2 years.

- Will buy a central system
- Will buy a window or wall unit
- Will buy a heat pump system
- Plan to buy, but don’t know yet what kind
- No plans to buy
C3  Do you have air conditioning in your home now?  □ Yes  □ No........ → Skip to PART D

C4  Check the type of air conditioning that you have.

□ Central heat pump (with ducts) that provides cooling
□ Portable units
□ Another type of central air conditioning
□ Window or wall air conditioners

C5  Check the age of your main air conditioner that you use most.

□ New in 2009  □ 2 - 3 years  □ 6 - 10 years  □ Don't know
□ New in 2008  □ 4 - 5 years  □ 11 - 15 years  □ 16 - 20 years
□ 16 - 20 years  □ 21 years or more

C6  Check the indoor temperature at which you choose to turn on the air conditioning.

□ 70 - 73° F  □ 78 - 81° F  □ 86 - 89° F
□ 74 - 77° F  □ 82 - 85° F  □ 90° F or more

C7  Check how many days per year you use air conditioning.

□ 1 - 10 days  □ 21 - 30 days  □ 41 - 50 days  □ 61 - 90 days
□ 11 - 20 days  □ 31 - 40 days  □ 51 - 60 days  □ 91 days or more

C8  Check how important your home air conditioning is to you.

□ I wouldn't want to do without it in summer
□ I could do without it half of the summer
□ I could do without it most of the summer
□ I could get along fine without it

PART D. WATER FIXTURES

Showerheads control the use of hot water, and old products can send a lot down the drain. Toilet technology has also been updated in recent years. Please tell us about changes you may have made to these major water users.

D1  Have you installed any new showerheads in the past 5 years?

□ Yes, a standard-flow model
□ Yes, an efficient-flow model (2.0 gallons per minute or less)
□ Yes, a model with a rain-shower or multiple nozzles
□ No, have not installed any new ones
□ Don't know

D2  Have you installed a new bathroom toilet in the past 5 years?

□ Yes, a standard-flush model
□ Yes, an efficient-flush model (1.6 gallon flush or less)
□ No, have not installed a new one
□ Don't know
**PART E. HEATING YOUR WATER**

Water heating is generally the second greatest energy use in Seattle area households. Please tell us about how you heat your water.

### E1

1. **Check the main way you heat your water.**
2. Then check other heating you use now.
3. Last, check the main way you heated your water 2 years ago, before Jan. 2007.

<table>
<thead>
<tr>
<th>Main Water Heat Now? (Check one)</th>
<th>Other Water Heat Now? (Check all types)</th>
<th>Main Heat before January 2007? (Check one)</th>
</tr>
</thead>
<tbody>
<tr>
<td>None</td>
<td>None</td>
<td>No change</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Don't know</td>
</tr>
</tbody>
</table>

**ELECTRICITY from wired equipment**
- Tank (most common):
  - Located inside a heated area
  - Located in an unheated area
- Tank-less, on-demand, whole house or floor
- Tank-less, on-demand, point of use
- Central boiler system

**NATURAL GAS from an underground pipe**
- Tank (most common):
  - Located inside a heated area
  - Located in an unheated area
- Tank-less, on-demand, whole house or floor
- Tank-less, on-demand, point of use
- Central boiler system

**ACTIVE SOLAR collection from the sun**
- With panel, pump and/or fans:
  - Located inside a heated area
  - Located in an unheated area

**UNKNOWN water heat fuel**
- Central apartment or condominium system

**OTHER (please describe):**

---

**IF UNSURE ABOUT YOUR WATER HEATING, CALL (206) 684-3800 FOR ASSISTANCE.**

### E2

**Check the reasons for making the change in your water heating.**

- Replace worn out equipment
- Make my home safer
- Make my home cleaner
- Have more hot water
- Lower my energy bills
- Save energy
- Live more sustainably
- Reduce my "carbon footprint"
- No more concern about water leaks
- No change in water heat system

### E3

**Check the age of your main water heat system that you use most.**

- New in 2009
- New in 2008
- 2 - 5 years
- 6 - 10 years
- 11 - 20 years
- 21 years or more
- Don't know
Major appliances still use significant energy, with more efficient models becoming available every year. Keep your eyes open in stores for Energy Star choices, which use less energy than other appliances of the same type.

### F1 Check the number of these **ELECTRIC appliances** that you have in your home.

<table>
<thead>
<tr>
<th>Appliances at home</th>
<th>None</th>
<th>1</th>
<th>2</th>
<th>3+</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cooktop / range together with oven</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Separate cooktop or range</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Separate oven</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Microwave oven</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dishwasher</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Clothes dryer (electric)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Clothes washer in your home or unit:</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>... Top loading, with agitator</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>... Top loading, no agitator</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>... Front loading</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Jacuzzi tub with booster heat</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hot tub with electric heater</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Swimming pool with heater or pump</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sauna (dry heat)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sump pump (drainage, sewage)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Water bed with heater</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fish tank with pump</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### F2 Check the number of these **NATURAL GAS appliances** that you have in your home.

<table>
<thead>
<tr>
<th>Appliances at home</th>
<th>None</th>
<th>1</th>
<th>2</th>
<th>3+</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cooktop / range together with oven</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Separate cooktop or range</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Separate oven</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Clothes dryer (gas heat)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Indoor fireplace</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Outdoor fireplace</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Outdoor barbecue</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### F3 Check the number of these **BOTTLED GAS appliances** that you have in your home.

<table>
<thead>
<tr>
<th>Appliances at home</th>
<th>None</th>
<th>1</th>
<th>2</th>
<th>3+</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cooktop / range together with oven</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Separate cooktop or range</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Separate oven</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Outdoor cooktop or range</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Outdoor fireplace</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Outdoor barbecue</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Patio heater</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
**F4** Check the number of your home refrigerators in each category.

<table>
<thead>
<tr>
<th></th>
<th>None</th>
<th>1</th>
<th>2</th>
<th>3+</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total number of refrigerators</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>Plugged in more than 3 months of the year</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>Located inside a HEATED area</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>Located in an UNHEATED area</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
</tbody>
</table>

**F5** Check the age of your main refrigerator that you use most.

- ☐ New in 2009  ☐ 2 - 10 years  ☐ 21 years or more
- ☐ New in 2008  ☐ 11 - 20 years  ☐ Don't know

**F6** Check the number of your stand-alone freezers in each category.

<table>
<thead>
<tr>
<th></th>
<th>None</th>
<th>1</th>
<th>2</th>
<th>3+</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total number of stand-alone freezers</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>Plugged in more than 3 months of the year</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>Located inside a HEATED area</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>Located in an UNHEATED area</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
</tbody>
</table>

**F7** Check the age of your main stand-alone freezer that you use most.

- ☐ New in 2009  ☐ 2 - 10 years  ☐ 21 years or more  ☐ Don’t know
- ☐ New in 2008  ☐ 11 - 20 years  ☐ No stand-alone freezer

**F8** Check the age of your main clothes washer (in your home or unit) that you use most.

- ☐ New in 2009  ☐ 2 - 10 years  ☐ 21 - 30 years  ☐ Don’t know
- ☐ New in 2008  ☐ 11 - 20 years  ☐ 31 years or more  ☐ No clothes washer

---

**PART G. LIGHTING YOUR HOME**

Lighting options are changing, and many people are switching to compact fluorescent lighting (CFL bulbs). Please tell us whether you have these in your home.

**G1** Check the number of compact fluorescent light bulbs (CFLs) installed in light fixtures and lamps, right now in your home.

- ☐ 1 - 2 bulbs  ☐ 6 - 10 bulbs  ☐ 21 bulbs or more
- ☐ 3 - 5 bulbs  ☐ 11 - 20 bulbs  ☐ None at all

**G2** Check the number of compact fluorescent light bulbs (CFLs) stored for future use, right now in your home.

- ☐ 1 - 2 bulbs  ☐ 6 - 10 bulbs  ☐ 21 bulbs or more
- ☐ 3 - 5 bulbs  ☐ 11 - 20 bulbs  ☐ None at all
G3  Check the kind of bulb that is in the closest light fixture, when you look outside your front door. This could be on the porch, attached to the building, or in a building hallway outside your door.

- Standard-shape bulb(s): incandescent
- Standard CFL bulb(s): compact fluorescent
- Reflector-style bulb(s): incandescent
- Reflector-style bulb(s): compact fluorescent
- High intensity light (sodium vapor, metal halide HID)
- Landscape light system: low voltage
- Landscape light system: solar photovoltaic
- Mini-light strings
- Not sure / don’t know
- None, there is no fixture nearby outside

G4  Do you have any halogen lamps in your home now? These have a small narrow bulb that can get very hot.

- Yes
- No
- Not sure / don’t know

PART H. ELECTRONIC EQUIPMENT

Major home electronics also use significant energy, even when “turned off,” if plugged in. Keep your eyes open in the stores for Energy Star choices, which use less electricity than other electronics of the same type.

H1  Check the number of each type of RE-CHARGER used in your home.

<table>
<thead>
<tr>
<th>Rechargers at home</th>
<th>Hours plugged in</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1-4 per month</td>
</tr>
<tr>
<td>Cell phones</td>
<td></td>
</tr>
<tr>
<td>Bluetooth devices</td>
<td></td>
</tr>
<tr>
<td>PDAs, Pocket PCs</td>
<td></td>
</tr>
<tr>
<td>iPod, Zune, MP3</td>
<td></td>
</tr>
<tr>
<td>AA, C, D batteries</td>
<td></td>
</tr>
<tr>
<td>Camera batteries</td>
<td></td>
</tr>
</tbody>
</table>

H2  Check the number of each type of COMPUTER EQUIPMENT used in your home.

Note: For an all-in-one computer, check both CPU and screen type.

<table>
<thead>
<tr>
<th>Items at home</th>
<th>Hours plugged in</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1-4 per month</td>
</tr>
<tr>
<td>Desktop computer CPU</td>
<td></td>
</tr>
<tr>
<td>Standard monitor/display (CRT)</td>
<td></td>
</tr>
<tr>
<td>LCD flat screen display</td>
<td></td>
</tr>
<tr>
<td>Laptop or portable computer</td>
<td></td>
</tr>
<tr>
<td>Print, scan, copy, fax machines</td>
<td></td>
</tr>
<tr>
<td>Modems: cable, DSL, wireless</td>
<td></td>
</tr>
<tr>
<td>Home network or LAN</td>
<td></td>
</tr>
<tr>
<td>Server CPU</td>
<td></td>
</tr>
<tr>
<td>Uninterruptible power supply</td>
<td></td>
</tr>
</tbody>
</table>
### H3

Check the number of each type of **TELEVISION** used in your home.

*Note: Television size is measured diagonally across the screen.*

<table>
<thead>
<tr>
<th>Items at home</th>
<th>Hours plugged in</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1-4 per month</td>
</tr>
<tr>
<td>None</td>
<td></td>
</tr>
<tr>
<td>Standard television (CRT), 12-22&quot;</td>
<td>✗</td>
</tr>
<tr>
<td>Standard television (CRT), 23-38&quot;</td>
<td>✗</td>
</tr>
<tr>
<td>Rear projection TV (large screen)</td>
<td>✗</td>
</tr>
<tr>
<td>TV with built-in DVD or VCR</td>
<td>✗</td>
</tr>
<tr>
<td>LCD flat screen TV, less than 45&quot;</td>
<td>✗</td>
</tr>
<tr>
<td>LCD flat screen TV, 45&quot; or more</td>
<td>✗</td>
</tr>
<tr>
<td>Plasma screen TV, less than 45&quot;</td>
<td>✗</td>
</tr>
<tr>
<td>Plasma screen TV, 45&quot; or more</td>
<td>✗</td>
</tr>
</tbody>
</table>

### H4

Check the number of each type of **VIDEO EQUIPMENT** used in your home.

*Think about your most frequently used unit in each category. Then check how many hours it is plugged into a live electric outlet.*

<table>
<thead>
<tr>
<th>Items at home</th>
<th>Hours plugged in</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1-4 per month</td>
</tr>
<tr>
<td>None</td>
<td></td>
</tr>
<tr>
<td>DVD: digital video deck</td>
<td>✗</td>
</tr>
<tr>
<td>VCR: videocassette deck</td>
<td>✗</td>
</tr>
<tr>
<td>VCR / DVD combo unit</td>
<td>✗</td>
</tr>
<tr>
<td>Video game console</td>
<td>✗</td>
</tr>
<tr>
<td>Digital to analog converter</td>
<td>✗</td>
</tr>
<tr>
<td>Set top box for cable, satellite</td>
<td>✗</td>
</tr>
<tr>
<td>Set top box for Tivo, Replay TV</td>
<td>✗</td>
</tr>
<tr>
<td>Computer to run media center</td>
<td>✗</td>
</tr>
</tbody>
</table>

### H5

Check the number of each type of **AUDIO EQUIPMENT** used in your home.

*Think about your most frequently used unit in each category. Then check how many hours it is plugged into a live electric outlet.*

<table>
<thead>
<tr>
<th>Items at home</th>
<th>Hours plugged in</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1-4 per month</td>
</tr>
<tr>
<td>None</td>
<td></td>
</tr>
<tr>
<td>Component stereo system</td>
<td>✗</td>
</tr>
<tr>
<td>Compact all-in-one stereo</td>
<td>✗</td>
</tr>
<tr>
<td>Portable boom-box</td>
<td>✗</td>
</tr>
<tr>
<td>Karaoke machine</td>
<td>✗</td>
</tr>
</tbody>
</table>
H6 Check the number of **plug-in power strips** used in your home. These plug into an electric outlet, usually have a power circuit interrupter to prevent surges, allow multiple items to be plugged in at once, and can be switched off when you want to save energy.

- [ ] 0 strips
- [ ] 1 strip
- [ ] 2 strips
- [ ] 3 strips
- [ ] 4 strips
- [ ] 5 strips
- [ ] 6 strips
- [ ] 7 strips
- [ ] 8 strips or more

H7 Check which types of equipment you usually **turn on-and-off** with the switches on **plug-in power strips**. Note: All of the types of equipment listed have “power converters” that can draw energy, even when the item is turned off.

- [ ] Re-chargers
- [ ] Video equipment (VCR, DVD, or game console)
- [ ] Computer equipment
- [ ] Audio equipment (sound system)
- [ ] Televisions
- [ ] None of these

H8 Check which types of equipment you **turn on-and-off** with **timers**.

- [ ] Small appliances in the kitchen
- [ ] Electronic equipment (of any kind)
- [ ] Lighting
- [ ] None of these

### PART I. WINDOWS & WEATHER SEALING

Some windows save more energy than others. Caulking and weather stripping also help to keep home heat inside. Please tell us about the types of windows in your home.

I1 **Do you feel that your house or building needs new windows?**

- [ ] Yes
- [ ] Maybe, not sure
- [ ] No

I2 **Check the age of most of the windows.**

- [ ] New in 2009
- [ ] New in 2008
- [ ] 2 - 5 years
- [ ] 6 - 10 years
- [ ] 11 - 20 years
- [ ] 21 - 30 years
- [ ] 31 years or more
- [ ] Don’t know

I3 **Check the one statement that best describes most of the glass in your windows.**

- [ ] All or most have single-pane glass (one layer)
- [ ] All or most have double-pane glass (two layers)
- [ ] About ½ have single-pane and ½ have double-pane glass
- [ ] All or most have triple-pane glass (three layers - typically used for sound-proofing)

I4 **Check the one statement that best describes most of the frames on your windows.**

- [ ] All or most have wood frames
- [ ] All or most have aluminum frames
- [ ] All or most have vinyl frames
- [ ] All or most have fiberglass frames (may have wood interior finish)

I5 **Check the one statement that best describes how you prepare windows for winter.**

- [ ] All or most get glass storm windows added on the outside
- [ ] All or most get plastic film added on the inside
- [ ] Do not make these changes to windows for winter
Within the past 2 years, has the **weather-stripping** on your windows and doors been replaced?
Weather stripping is applied to the movable parts of windows and doors.

- All or most of windows got new weather-stripping
- All or most of doors got new weather-stripping
- A few windows or doors got new weather-stripping
- Did not update weather-stripping
- Not sure / don’t know

### J1
Check the number of your **household vehicles** that are of each type.  Note: Vehicles include cars, mini-vans, station wagons, sport utility vehicles, and pick-up trucks, but **not** motorcycles.

<table>
<thead>
<tr>
<th></th>
<th>None</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4+</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gasoline powered vehicle</td>
<td>☐</td>
<td>☑</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Gas-electric hybrid – no plug</td>
<td>☐</td>
<td>☑</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Gas-electric hybrid – with plug in</td>
<td>☐</td>
<td>☑</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>All-electric vehicle – with plug in</td>
<td>☐</td>
<td>☑</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### J2
Are you familiar with **solar panels** (with pump or fan) that can **heat the water** for your home?

- Yes, have heard about this
- Yes, have seen one working, or on display, or on TV

- Yes, use this in my home
- No, not familiar with this

### J3
Are you familiar with **photovoltaics** (PV panels) that can create **electricity** for your home?

- Yes, have heard about this
- Yes, have seen one working, or on display, or on TV

- Yes, use this in my home
- No, not familiar with this

### J4
Are you familiar with **“smart” power strips** that turn off electronics after a period of inactivity?  These plug into an electric outlet, have a power circuit interrupter to prevent surges, allow multiple items to be plugged in at once, and switch off automatically when electronic equipment “sleeps”.

- Yes, have heard about this
- Yes, have seen one working, or on display, or on TV

- Yes, use this in my home
- No, not familiar with this
Are you familiar with home energy monitoring devices that have a display screen? These can tell you how much energy is being used right now, or has been used over a period of time, and how much money was spent on electricity in the past month.

☐ Yes, have heard about this  ☐ Yes, use this in my home
☐ Yes, have seen one working, or on display, or on TV  ☐ No, not familiar with this

Have you heard that you can buy “green” wind energy for your household through Seattle City Light’s “Green Up” program?

☐ Yes, have heard about this  ☐ Yes, my household buys from the program  ☐ No, not familiar with this

Check how likely it is, in the next 5 years, that you or other household members will buy these products or services.

<table>
<thead>
<tr>
<th>Product Description</th>
<th>Very Likely</th>
<th>Somewhat Likely</th>
<th>Not Very Likely</th>
<th>Not at All Likely</th>
<th>Don't Know</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gas-electric hybrid vehicle – no plug</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Gas-electric hybrid vehicle – with plug in</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>All-electric vehicle – with plug in</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Solar panels to heat your water</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Photovoltaic panels to produce electricity</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Part of a community photovoltaic project</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>“Smart” power strips for your electronics</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>“Green” wind energy for your home</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

PART K. COMMUNICATING & BILL ASSISTANCE

Your answers to these questions are about helping you and your neighbors use City services to take control of energy bills.

Check how long you have been a Seattle City Light customer at this address.

☐ New in past year  ☐ 6 - 10 years  ☐ 21 - 30 years
☐ 1 - 5 years       ☐ 11 - 20 years  ☐ 30 years or more

Check how long you have been a Seattle City Light customer at any location.

☐ New in past year  ☐ 6 - 10 years  ☐ 21 - 30 years
☐ 1 - 5 years       ☐ 11 - 20 years  ☐ 30 years or more

Check how you pay your utility bills, besides the Seattle City Light electric bill.

Natural Gas:  ☐ Pay to Puget Sound Energy  ☐ Pay to a billing service or a third-party provider
☐ Included in my rent or condo fee  ☐ Don't have natural gas

Water, sewer, garbage & recycling:
☐ Pay to Seattle Public Utilities  ☐ Pay to a billing service or a third-party provider
☐ Included in my rent or condo fee  ☐ Pay to another public utility
K4  Check the types of conservation information that you would like Seattle City Light to provide.

☐ How to manage payments on energy bills  ☐ Cost estimates for repairs or upgrades
☐ Find out if I'm saving or wasting energy  ☐ How to locate conservation contractors
☐ Find out what uses the most energy in my home  ☐ Information on rebates or discount programs
☐ How to conserve and reduce energy costs  ☐ Information on changes that are free
☐ How to find energy saving products  ☐ Instructions for do-it-yourself improvements
☐ Other (what?): ____________________________

K5  Check the methods you prefer for Seattle City Light to communicate with you and your household.

☐ Bill inserts  ☐ Radio  ☐ E-mail
☐ Brochures  ☐ Television  ☐ City Web sites
☐ Separate mailings  ☐ Newspaper articles  ☐ Other (what?): ____________________________

K6  Check what kinds of Internet access you have on a regular basis.

☐ Have access for E-mail  ☐ Have access to Web sites  ☐ Have no access

K7  Have you ever had a professional Energy Audit or Green Audit of your home?  A home audit gives you specific, customized tips about what you can do to conserve and save on energy bills.

☐ Yes  ☐ No  ☐ Not sure / don’t know

K8  Would you like Seattle City Light to contact you with more information about a City free home energy audit service?

☐ Yes, I am interested ..................................  ➔
☐ No, do not contact me

We expect the general need to rise for City assistance during the winter heating season. Your answers to the next two questions will help to plan for future rate and bill payment assistance.

K9  Check the category for the total gross income for your household, from all sources, in 2008?

☐ Less than $25,000  ☐ $25 - 30,000  ☐ $30 - 35,000  ☐ $35 - 40,000  ☐ $40 - 45,000  ☐ $45 - 50,000  ☐ $50 - 55,000  ☐ $55 - 60,000  ☐ $60 - 65,000  ☐ $65 - 70,000  ☐ $70 - 100,000  ☐ More than $100,000

K10  In the past 3 years, has your household ever received emergency bill payment help from the City of Seattle?  (This includes EAP, ELIA, Project Share, and other emergency programs.)

☐ Yes  ☐ No  ☐ Not sure / don’t know

REMINDER: This survey is confidential. Your name and address will not be attached.

If you live in an Apartment or Condominium (with 5 or more units in the building) please ...............➔ Skip to Back Cover
If you live in a Single-Family home (detached), Row-home or Town-home, Duplex, Triplex, or Fourplex, please ..... → Continue to PART L

PART L. WALLS & ATTICS

More and more, attics and basements offer the chance to add usable space to your home. How about yours?

L1 Check how well insulated the walls of your house are.
- [ ] Fully insulated
- [ ] Partly insulated
- [ ] Not at all insulated
- [ ] Not sure / don't know

L2 Do you feel that the walls need more insulation?
- [ ] Yes
- [ ] Maybe, not sure
- [ ] No

L3 Check the best description of the top layer of your house or building. Note: An attic usually has rafters and a sloped roof.
- [ ] There is NO attic space at all, above the top story ceiling .......... → Skip to Item L7
- [ ] There is an attic over ALL of the top story ceiling .................... → Continue to Item L4
- [ ] There is an attic over PART of the top story ceiling .................. → Continue to Item L4

L4 Do you usually heat the attic in the winter?
- [ ] Yes
- [ ] No

L5 Check the items that best describe the attic of your house.

<table>
<thead>
<tr>
<th>Description</th>
<th>Fully</th>
<th>Partly</th>
<th>Not at all</th>
<th>Don't know</th>
</tr>
</thead>
<tbody>
<tr>
<td>The rafters above are insulated</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>The floor is insulated</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>The end-walls or side-walls are insulated</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>The walls are finished with wallboard or an interior finish</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

L6 Do you feel that any part of the attic needs more insulation?
- [ ] Yes
- [ ] Maybe, not sure
- [ ] No

L7 Thinking about the top story of your house that has no attic above it, check how well insulated this ceiling is, only where there is no attic.
- [ ] Does not apply because house DOES have a full attic
- [ ] Fully insulated
- [ ] Partly insulated
- [ ] Not at all insulated
- [ ] Not sure / don't know
PART M. BASEMENTS & CRAWL SPACES

M1 Check the kind of foundation that is under most of your house. If a combination, as on a slope, check all that apply.
- Concrete, cement, or stone with space below .......  ➔ Continue to Item M2
- Wooden post-and-beam, on piers or pilings ...........  ➔ Continue to Item M2
- Concrete slab(s), poured on the ground ...............  ➔ Skip to PART N, if concrete slab ONLY

M2 Check the item that best describes what lies under most of the bottom story of your house.
Note: A crawl space has a dirt floor, while a basement has a cement or finished floor.
- An open or closed-in crawl space
- An unheated basement
- A heated basement

M3 Check the items that best describe the basement or crawl space of your house.

<table>
<thead>
<tr>
<th>Item Description</th>
<th>Fully</th>
<th>Partly</th>
<th>Not at all</th>
<th>Don't know</th>
</tr>
</thead>
<tbody>
<tr>
<td>The ceiling is finished with plywood or a ceiling material</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>The ceiling is insulated</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>The walls are finished with wallboard or an interior finish</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>The walls are insulated</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

M4 Do you feel that the basement or crawl space needs more insulation?
- Yes
- Maybe, not sure
- No

PART N. GARAGES

People are changing how garages are used, adding interior-type finishes and functions. How about you?

N1 Does your house have a garage?
- Yes
- No  ➔ Skip to PART O

N2 Check where your garage is located.
- Underneath or within the house
- Attached to a side of the house
- Freestanding, not attached to the house

N3 Check the items that best describe the garage.

<table>
<thead>
<tr>
<th>Item Description</th>
<th>Fully</th>
<th>Partly</th>
<th>Not at all</th>
<th>Don't know</th>
</tr>
</thead>
<tbody>
<tr>
<td>The ceiling is insulated</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>The walls are insulated</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>The walls are finished with wallboard or an interior finish</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

N4 Do you feel that the garage needs more insulation?
- Yes
- Maybe, not sure
- No
N5 Check what type of **heating** the garage has.
- Electric baseboard or wall heater
- Portable electric heater or radiator
- Heat pump
- Kerosene space heater
- Plug-in fireplace
- Gas fireplace
- Wood or pellet stove
- No space heat

N6 Check what source of **water heat** the garage has.
- Shares hot water from the house
- Has a separate water heater tank
- Has an on-demand heater
- No water heat

---

**PART O. ACCESSORY DWELLINGS**

*Now legal and encouraged in Seattle, with kitchen and bathroom facilities, these can provide affordable housing. These dwellings are either partitioned from an existing house, or added as a backyard cottage.*

O1 **Does your house have an accessory dwelling?**
- Yes
- No ....... ➔ Skip to PART P

O2 **Check where your accessory dwelling is located.**
- Underneath or within the house
- Attached to a side of the house
- Freestanding, not attached to the house

O3 **Check the items that best describe the accessory dwelling.**

<table>
<thead>
<tr>
<th>Fully</th>
<th>Partly</th>
<th>Not at all</th>
<th>Don't know</th>
</tr>
</thead>
<tbody>
<tr>
<td>The ceiling is insulated</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>The floor is insulated</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>The walls are insulated</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>The walls are finished with wallboard or an interior finish.</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

O4 **Do you feel that the accessory dwelling needs more insulation?**
- Yes
- Maybe, not sure
- No

O5 **Check what type of heating the accessory dwelling has.**
- Electric baseboard or wall heater
- Portable electric heater or radiator
- Heat pump
- Kerosene space heater
- Plug-in fireplace
- Gas fireplace
- Wood or pellet stove
- No space heat

O6 **Check what source of water heat the accessory dwelling has.**
- Shares hot water from the house
- Has a separate water heater tank
- Has an on-demand heater
- No water heat
PART P. PAST & FUTURE CHANGE TO SPACE

Finally, we have a few questions about factors that might affect energy use in the future. Adding floor space can increase home energy use. Has your space been changing?

P1  As it is now, is your home designed to capture passive solar heat during the winter?
   □ Yes, large south-facing windows
   □ Yes, masonry thermal mass (on inside floor or wall)               □ No, not designed this way

P2  As it is now, is your home designed to capture daylight other than by windows in the wall?
   □ Yes, skylights in roof                                   □ Yes, "daylight shelves" on windows
   □ Yes, sun-tube(s) in roof                                 □ No, not designed this way

P3  Has your home been remodelled in the past 2 years, since January 2007?  □ Yes          □ No  ..........  → Skip to Item P8

P4  Check what type of remodel was done.
   □ Finished an unused basement or attic space, now is occupied space
   □ Re-built most of the home on the existing footprint
   □ Built a new addition that added square footage to home
   □ Remodeled the kitchen or bath room
   □ Remodeled another living space: ________________________________

P5  Write in how much formerly unused space is now occupied space.  __________ square feet

P6  Write in how much space was newly added on.  __________ square feet

P7  Did you add new space heating for the remodelled or added space?  □ Yes          □ No

P8  Within the next 2 years, do you have plans to remodel or renovate any occupied space in your home?
   □ Yes, major remodel, affecting ______ square feet
   □ Yes, minor remodel, affecting ______ square feet               □ No  ..........  → Skip to Back Cover

P9  Will you add heat for this space?  □ Yes          □ No

P10 Check which of these energy-saving options you will consider when you remodel or renovate.
   For electricity: □ PV/Photovoltaic panels                      □ Windmill on-site
   For space heat/cooling: □ Air-source heat pump               □ Ground-source heat pump
   For hot water: □ Air-source heat pump                        □ Solar heat panels
   For lighting: □ CFL fixtures                                 □ Daylighting design
                  □ Other (what?) _____________________________________
                    □ None of these
We appreciate the time you took to fill out this booklet.

Thank you for supporting public power in the Seattle area.

This completes the survey questions. Your responses WILL make a difference.

As you might imagine, planning for Seattle’s energy future requires understanding the many household characteristics that this survey asks about. At Seattle City Light, we will summarize what we learn about each neighborhood. We will then plan the best ways to make public power work for you.

Thank you for taking part in planning for our electricity future.

Want more information? While completing this booklet you may have thought about many choices that go into using energy at home. For more information about ways to conserve energy, go to www.seattle.gov/light/Conserve. Click on “Featured Conservation Programs” in the green box on the right, or “Conservation Resources” on the left. Or call (206) 684-3800.

Please fold in half and return this booklet in the enclosed postage-paid envelope.

Your comments:

________________________________________________________________________

________________________________________________________________________

________________________________________________________________________

________________________________________________________________________

________________________________________________________________________

If you need further assistance, please call Seattle City Light’s Conservation Help Line at (206) 684-3800