

Existing Multifamily Tenant Appliance Efficiency Saturation Study

Market Research Report

PREPARED BY

RLW Analytics

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**EXISTING MULTIFAMILY TENANT
APPLIANCE EFFICIENCY
SATURATION STUDY**

Final Report

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RLW ANALYTICS

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Multifamily Appliance Efficiency

Introduction

RLW conducted 83 on-site tenant surveys at 32 complexes spanning October through December 2004. These complexes were selected to be representative of the larger multifamily complexes in the Idaho, Oregon, and Washington areas. RLW produced a final report in May 2005 for the Northwest Energy Efficiency Alliance (2004 Multifamily Building Stock Survey) that summarized the saturation levels of lighting and appliances in the common area and tenant spaces at these 32 complexes. The report did not contain any analyses of the efficiency of equipment and appliances in the tenant spaces since RLW did not perform any matching of the collected model numbers to efficiency databases.

This report is a follow-on to the 2004-05 study. RLW matched the appliance and equipment model numbers to efficiency databases, summarized the efficiencies, and this report provides a summary of our findings.

Approach

During the on-site visits, the surveyors collected data on the major appliances and lighting systems in the home. The surveyors collected nameplate data for the following appliances and equipment:

- ◆ Refrigerator-Freezer
- ◆ Dishwashers
- ◆ Clothes Washers and Dryers
- ◆ Water Heaters
- ◆ Heating Equipment
- ◆ Cooling Equipment

As the data were collected, the surveyors uploaded the site data from the PDA units to RLW's SQL database. The data underwent quality control measures and model numbers were matched to databases of appliance efficiencies. RLW used databases from the previous study, in addition to new data sources, including CEC, BLUEBOOK, AHAM, and more. Once the model numbers were linked, the corresponding efficiency was assigned to the matched appliance.

We then calculated adjusted weights for the appliance efficiency data in order to account for the uneven match rates of the models. This weighting adjustment to the appliance data is performed on baseline studies for existing homes in order to remove the upward bias in efficiency due to the lower matching rates for older models.

Once the matching was performed, RLW analyzed the efficiency information by appliance, for all appliances where sufficient numbers of matches were made. Reasonably good match rates were found for refrigerators, dishwashers and water heaters. All other appliances however had very low match rates. Cooling had ten matches, and these were summarized as well. The analysis could not be performed for the other appliances.

Model Number Matching

Matching rates varied greatly by appliance type and age. In most cases this was due to the comprehensiveness of the efficiency databases that were available for each appliance.

Table 1 presents each appliance for which we collected data in 2005-06 *for multifamily units*. The tables contain the following data in the same column order as listed below:

- Name of appliance,
- Number of each appliance found during all on-site visits,
- Number of model numbers found for each appliance,
- Percentage of model numbers that surveyors were **able** to identify on-site,
- Number of model numbers matched to efficiency database(s),
- Percentage of model numbers matched among **all** appliances recorded,
- Percentage of model numbers matched among appliances with model numbers.

For example, we recorded the presence of 86 refrigerators. During the on-site surveys, the surveyors were able to locate model numbers for 73 of those refrigerators, or 85% of all refrigerators.

When the data were aggregated at RLW's offices and linked to the refrigerator efficiency databases, 69 of the 73 (95%) refrigerators with model numbers were matched. Another way to look at the match rate is to consider the percentage of the *total* number of refrigerators (86) that were successfully matched (69), which for refrigerators was 80%. This statistic combines the success rate of the matching with the success of the auditors in collecting model numbers. A high match rate among the units with model numbers collected is less meaningful if the auditors were only able to collect data on a handful of units.

Similar to single family, and based upon our experience from previous studies, we anticipated in the design stages of this project that the match rates would approximate what are shown in the table above. We knew that matching model numbers to appliance databases would be a long process. One of the problems is that wildcards (*, /, #, etc.) are often included in the model number. The wildcards add to the complexity of the query designs and decrease match rates. The "layered" queries that we built searched several databases for matching model numbers. Once the automated process was complete, a manual process of looking up the unmatched appliances was undertaken.

Efficiency databases were exhausted using the above protocols for matching appliances. RLW is confident that the great majority of model numbers found on-site were matched if they appeared in any of the efficiency databases. The problem with the low matching rates lies in the efficiency databases themselves. Simply put, much of the equipment found in the field is not documented in publicly or privately available efficiency databases. Furthermore, the private data such as the refrigerator-freezer data that were purchased from AHAM were not in the best condition, and somewhat partial in content.

Appliance/ Equipment	Total Number in Database (A)	Model Numbers Found (B)	% of Appliances with Model Number (B/A)	Model Numbers Matched (C)	% of All Appliances Matched (C/A)	% of Appliances with Model Numbers Matched (C/B)
Cooling	28	16	57%	10	36%	63%
Refrigerator	86	73	85%	69	80%	95%
Water Heat	83	57	69%	37	45%	65%
Washer	31	19	61%	2	6%	11%
Dishwasher	56	53	95%	24	43%	45%
Dryer	30	26	87%	0	0%	0%
Heating Systems						
Heating System Fuel	Total Systems	Model Numbers Known	% of Systems with Model Number	Total Matched and Known Efficiency	% of All Appliances Matched	% of Systems with Model Numbers Matched
Electricity	120	42	35%	-	0%	0%
Kerosene	1	-	0%	-	0%	N/A
Natural Gas	13	9	69%	1	8%	11%

Table 1: Model Number Match Rates By Appliance

As can be seen from Table 1, the match rates for heating were very low for multifamily. The analysis could not be performed for heating as a result. There were 139 heating systems in the data. However, out of 139 systems, model numbers were available for only 51 systems. Thirty-seven of the heating systems with model numbers (73%) were manufactured by companies that were not in the master model number database that was compiled from numerous data sources for matching¹. This is largely due to the high number of space heating systems in these units, for which matching data are less available.

The analyses of multifamily appliances summarized in this report are at the regional level. Each site was given its appropriate sampling weight to project to the population or various subsections of the population.

Refrigerator Freezers

Primary Refrigerators

The following abbreviations (common for refrigerators) are used throughout this section to describe the various types of refrigerator types as found:

- ◆ **SI** = Side-by-Side with Ice Dispenser (All Automatic)
- ◆ **TF** = Standard Top Mounted Freezer without Ice Dispenser (Partial and Automatic Defrost)
- ◆ **BF** = Bottom Mounted Freezer (All Automatic)

The average annual nameplate unit energy consumption (UEC) for refrigerator/freezers was obtained from the model number matches to manufacturer data. A sample of 69

¹ These manufacturers were BERKO, KING ELECTRICALS, NUTONE, TPI CORP, CADET, MARLEY for Baseboards, RADCO and RODEO for Forced Air Furnaces and APOLLO for Hydronic systems.

nameplate UECs were obtained for the analysis below. Table 2 shows the average nameplate UEC by type of refrigerator and size range.

The average overall nameplate UEC for all types of refrigerators is 660 kWh/yr with an error bound of 37 kWh/yr. The most efficient units are standard refrigerators with top mounted freezers, which have the lowest nameplate UEC at 648 kWh/yr, the sample for this was 46 refrigerators. The second most efficient type are refrigerators with bottom mounted freezers, which have an average nameplate UEC at 664.5 kWh/yr. The efficiency was the worst for Side by Side refrigerators – although the sample size was only 1 in this group.

Ref Type	Size Range (CuFt)	Average UEC	EB	Sample Size
All Types	Overall	660.3	37.1	69
	11.00-14.99	646.0	43.6	25
	15.00-18.99	626.1	44.9	40
	19.00-21.99	898.5	112.3	3
	>22.00	1034.0	0.0	1
SI	Overall	1034.0	0.0	1
	>22.00	1034.0	0.0	1
TF	Overall	647.9	47.3	46
	11.00-14.99	637.2	42.4	20
	15.00-18.99	604.1	68.1	23
	19.00-21.99	898.5	112.3	3
BF	Overall	664.5	46.2	22
	11.00-14.99	687.9	144.4	5
	15.00-18.99	659.0	45.9	17

Table 2: Average Nameplate UEC by Type of Refrigerator

The bin distribution of unit energy consumption of all successfully matched full size primary refrigerators is shown below in Table 3 grouped by size and type. The nameplate UEC range that makes up the largest percentage of all refrigerators is the range between 550 to 749.9 kWh/year, which includes 52.2% of all refrigerators.

Ref Type	Unit Energy Consumption Ranges (kWh/Year)								
	Size Range (CuFt)	350 to 549.9		550 to 749.9		750 to 949.9		950 to 1149.9	
		%	n	%	n	%	n	%	n
All Types	Overall	29.0%	20	52.2%	36	11.6%	8	7.2%	5
	11.00-14.99	16.0%	4	68.0%	17	8.0%	2	8.0%	2
	15.00-18.99	40.0%	16	45.0%	18	12.5%	5	2.5%	1
	19.00-21.99	-	0	33.3%	1	33.3%	1	33.3%	1
	>22.00	-	0	-	0	-	0	100.0%	1
SI	Overall	-	0	-	0	-	0	100.0%	1
	>22.00	-	0	-	0	-	0	100.0%	1
TF	Overall	32.6%	15	50.0%	23	10.9%	5	6.5%	3
	11.00-14.99	15.0%	3	70.0%	14	10.0%	2	5.0%	1
	15.00-18.99	52.2%	12	34.8%	8	8.7%	2	4.3%	1
	19.00-21.99	-	0	33.3%	1	33.3%	1	33.3%	1
BF	Overall	22.7%	5	59.1%	13	13.6%	3	4.5%	1
	11.00-14.99	20.0%	1	60.0%	3	-	0	20.0%	1
	15.00-18.99	23.5%	4	58.8%	10	17.6%	3	-	0

Table 3: Percentage of Primary Refrigerators by Nameplate UEC Ranges and Type within Size Ranges

Secondary Refrigerators

As there was only one secondary refrigerator in the sample; no analysis could be performed.

Water Heaters

Energy Factor

Energy factor for water heaters is a measure of efficiency expressed as the ratio defined below, where a higher energy factor equates to a more efficient water heater:

$$\frac{\text{heater supplied energy content of the delivered hot water}}{\text{energy consumed by the water heater}}$$

Table 4 compares the average energy factor for water heaters of a specific size and fuel type to the 2004 federal standard. It should be noted that it is difficult to make any comprehensive comparisons between the collected data and the 2004 standard due to the standard being a function of water heater volume. Therefore a 40 gallon unit has a different energy factor than a 41 gallon unit. In order to provide some comparison RLW averaged the energy factor of all similar water heaters for several popular sizes and fuel types. The average energy factor for the 40 gallon gas fired water heater is 0.58, which is slightly below the average of 0.59 from the National Appliance Energy Conservation Act Standards (NAECA), implemented in 2004. The average energy factor for electric models of the other three sizes (30, 40 and 50 gallon) are also below the federal standard, which is not surprising given the vintage of the units.

Energy Factor Comparison			
Size	Fuel Type	2004 Energy Factor Standard	Average Energy Factor
30 Gallons	Electric	0.93	0.89
40 Gallons	Electric	0.92	0.88
40 Gallons	Gas	0.59	0.58
50 Gallons	Electric	0.90	0.87

Table 4: Energy Factor Comparison

Table 5 shows the average energy factor by fuel type within each size range. The energy factor was obtained from the efficiency databases, thus only the models that matched were included in the following summary table. The average energy factor from matched electric units is 0.87 while the average energy factor for all gas units is 0.58.

Size Gallons (n=37)	Electric			Gas		
	Average Energy Factor	EB	Sample Size	Average Energy Factor	EB	Sample Size
All Sizes	0.87	0.01	33	0.58	0.01	4
30 to 39 Gallons	0.89	0.00	1	0.00	0.00	0
40 to 49 Gallons	0.88	0.00	2	0.58	0.01	4
49 to 59 Gallons	0.87	0.01	30	0.00	0.00	0

Table 5: Average Energy Factor by Fuel Type in Size Ranges

Table 6 shows the percentage of water heaters within each fuel type and size range that fall into each of the energy factor ranges. Energy factors of gas water heaters are clustered throughout the range from 0.56 to 0.599, while all electric water heaters fall within the range from 0.84 to 0.959.

Fuel Type	Size Range (Gallons)	0.56 to 0.599		0.84 to 0.879		0.88 to 0.919		0.92 to 0.959		Sample Size
			EB		EB		EB		EB	
Electric	All Sizes	-	-	67.7%	12.2%	23.9%	10.9%	8.4%	8.6%	33
	30 to 39	-	-	-	-	100.0%	-	-	-	1
	40 to 49	-	-	-	-	100.0%	-	-	-	2
	50 to 59	-	-	73.2%	0.0%	17.7%	0.0%	9.1%	9.6%	30
Gas	All Sizes	100.0%	-	-	-	-	-	-	-	4
	30 to 39	-	-	-	-	-	-	-	-	0
	40 to 49	100.0%	-	-	-	-	-	-	-	4
	50 to 59	-	-	-	-	-	-	-	-	0

Table 6: Percentage of Water Heaters in Energy Factor Ranges by Fuel Type and Size

Dishwashers

Energy factor for dishwashers is defined as loads per kWh. The average energy factor for all dishwashers that were matched to the CEC database is 0.483. Table 7 displays the average energy factor compared to the current federal minimum standard, enacted in 1994 (n=24). Overall, only 43% of the dishwasher model numbers were successfully

matched. There should not be any systematic bias in the efficiency of the units matched, but the reader should be aware of the low match rate.

Dishwasher Energy Factor		
Current Federal Standards	Minimum Energy Star Qualification	Average Energy Factor
0.46	0.58	0.483

Table 7: Comparison of Energy Factor with Federal Standards

The distribution of dishwasher energy factors is found in Table 8. The highest percentage of dishwashers with energy factors falls within the range of 0.460 to 0.579, containing over 95% of the dishwashers. This energy factor range encompasses all dishwashers that met 1994 federal standard (EF=0.46) but are below the current ENERGY STAR minimum (EF= 0.58). There are no dishwashers which linked to the efficiency databases that qualified as ENERGY STAR. This does not necessarily mean that none of the dishwashers at the homes were ENERGY STAR, but it could be due to the relatively low match rate for dishwashers. It is possible that some of the non-matched dishwashers were ENERGY STAR. The sample size for the distribution of the energy factors is 24, which is the total number of dishwashers in single-family residences that we were able to match with the CEC database.

Energy Factor	Percentage	EB
0.259 - 0.459	3.5%	3.8%
0.460 - 0.579	96.5%	17.3%

Table 8: Distribution of Energy Factor of Dishwashers

Cooling

As can be seen from Table 9, the model numbers could be matched for 10 cooling systems out of a total of 28. Table 9 presents the unweighted average EER by cooling system type for the 10 matched systems. A full analysis could not be performed for cooling as the number of matched records was so few.

Cooling System Type	Number of Systems	Average EER
PTAC	6	9.6
Packaged System A/C	3	8.5
Split System A/C	1	9.5
Total	10	9.3

Table 9: Average EER of Matched Cooling System types

**EXISTING MULTIFAMILY TENANT
APPLIANCE EFFICIENCY
SATURATION STUDY**

Appendix

July 27, 2007

Prepared for:



Prepared by:



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Onsite Survey Instrument

Customer: _____ Customer ID # _____
Address _____
City: _____ MO# _____
Phone: _____
Inspector _____
Date _____ Time _____

Occupant Interview - Introduction

Hello, my name is _____ with RLW Analytics, working on behalf of (UTILITY NAME).
I'm here to meet with _____. (**Show Identification and business card.**)
[Customer should be expecting inspector].

On-Site Interview

During my visit I'll be asking a few questions about your home's primary lighting fixtures and major appliances. Then I'll go on to inspect your heating and cooling equipment, washer, dryer, dishwasher, refrigerator, freezer, water heating equipment, and the insulation levels in your home. Do you have any questions regarding my visit?

General Information

1. Type of Residence?
 - Single Family, Unattached, One story
 - Single Family, Unattached, Two story
 - Single Family, Unattached, Three or more stories
 - Townhouse or Rowhouse
 - Duplex, Triplex, or Quadplex
 - Apartment/Condo with more than 4 units (1 or 2 stories)
 - Apartment/Condo with more than 4 units (3 or more stories)
 - Mobile Home, Single Wide
 - Mobile Home, Double Wide
 - Mobile Home, triple Wide
 - Modular/prefabricated
 - Other _____
2. What month/year did you move into home? _____

- water heater
- other _____

10. Participated in gas utility efficiency program during the last year?

- Yes
- No (skip next)

11. If yes what measures?

- audit
- heating system
- windows
- insulation
- caulking/WS
- water heater
- other _____

12. What is the total annual income for the home?

- < \$25,000
- \$25,001 - \$50,000
- \$50,001 - \$75,000
- \$75,001 - \$100,000
- \$100,000
- D/K
- Refused

13. In what year was the house built? _____ (Only one source for the age of the residence is needed)

7a Source: Auditor B. Customer

- Age: <1950
- 1950-1959
- 1960-1969
- 1970-1979
- 1980-1990
- 1991-1995
- >1995

14. What is the total conditioned floor area of the home?

- Fewer than 600 square feet
- 600 to 999 square feet
- 1,000 to 1,599 square feet
- 1,600 to 1,999 square feet
- 2,000 to 2,399 square feet
- 2,400 to 2,999 square feet

- 3,000 or more square feet
- Don't Know

15. Do you have a garage?

- No
- Single
- Double
- Triple

16. Is the garage heated?

- No heat
- Electric Heat
- Gas Heat
- Propane
- Wood stove
- Other

17. Frequency of use?

- Never
- Very Little
- Sometimes
- Often

Thermostat Information

18. Thermostat type:

- Digital
- Hybrid
- Mechanical
- Not Observed
- Other

19. Heating: Daytime Temp: _____/OFF
Cooling: Daytime Temp: _____/OFF/No Cooling

Nighttime Temp _____ /OFF
Nighttime Temp _____ /OFF(not used)

Heating Information

20. Primary heating system fuel type:

- Gas
- Fuel Oil
- Electricity
- Wood: cords per year _____
- Kerosene
- Solar
- Propane

21. Primary heating system type:

- Wall
- Heat pump w/ electric supplement
- Heat pump w/o electric supplement
- Forced Air Furnace
- Portable
- Hydronic System
- Floor
- Ceiling Cable
- Fireplace
- Window Unit Resistance
- Woodstove
- Baseboards

22. Heating System # 1 Specs:

- Manufacturer
- Model #:
- Manufacture Date:
- Estimated Age:
- Input Capacity (kW, kBtu):
- Output Capacity (kW, kBtu):
- Efficiency:

Secondary Heating System

23. Is there a secondary heating system in your home? o yes o no (if no, skip to next section)

24. Secondary heating system fuel type:

- Gas
- Fuel Oil
- Electricity
- Wood: cords per year _____
- Kerosene
- Solar
- Propane

25. Secondary heating system type:

- Baseboards
- Wall
- Heat pump w/ electric supplement
- Heat pump w/o electric supplement
- Forced Air Furnace
- Portable
- Hydronic System
- Floor

- Ceiling Cable
- Fireplace
- Window Unit Resistance
- Woodstove

26. Heating System # 2 Specs:

- Manufacturer
- Model #:
- Manufacture Date:
- Estimated Age:
- Input Capacity (kW, kBtu):
- Output Capacity (kW, kBtu):
- Efficiency:

Primary Cooling System

27. Do you have an air conditioning/cooling system for your home? [Do not include fans]?

- Yes No [Go to next section]

28. Typical summer AC use:

- Not at all
- Low (When needed)
- Moderate (Frequently)
- High (All the time)
- Usually gone in Summer

29. AC system type:

- Split System AC
- Packaged System AC
- Window/ Wall Room Air Conditioner
- Evaporative System
- Portable- Stand Alone
- Heat Pump
- PTAC
- PTHP

30. Cooling System # 1 Specs:

- Manufacturer
- Model #:
- Manufacture Date:
- Estimated Age:
- Capacity (kW, kBtu):
- Efficiency:

31. Do you have a second air conditioning/cooling system for your home? [Do not include fans]?

- Yes No [Go to next section]

32. Typical summer AC use:

- Not at all
- Low (When needed)
- Moderate (Frequently)
- High (All the time)
- Usually gone in Summer

33. Secondary AC system type:

- Split System AC
- Packaged System AC
- Window/ Wall Room Air Conditioner
- Evaporative System
- Portable- Stand Alone
- Heat Pump
- PTAC
- PTHP

34. Cooling System # 2 Specs:

- Manufacturer
- Model #:
- Manufacture Date:
- Estimated Age:
- Capacity (kW, kBtu):
- Efficiency:

Clothes Washer

35. Do you have a Clothes Washer?

- Yes
- No

36. Clothes washer use per week:

- 1 Load
- 2-4 Loads
- 5-9 Loads
- 10-14 Loads
- >15 Loads

37. Type of washer: Standard Horizontal axis

38. Washing Machine Specs:

- Manufacturer:
- Model #:
- Manufacture Date:
- Estimated Age:

39. Do you have a second washing machine that you regularly use?

- Yes
- No

Clothes Dryer

40. Clothes Dryer

- Yes
- No

41. Use of dryer:

- Used for All Loads
- Used for Most Loads
- Infrequent Use
- Unknown

42. Fuel type: Electric Gas Propane Other

43. Dryer Specs:

- Manufacturer:
- Model #:
- Manufacture Date:
- Estimated Age:

Refrigerators:

44. Type of Primary Refrigerator:

- Standard
- Side by Side
- Built-in
- Top-Bottom Freezer

45. Primary Refrigerator Options:

- None
- Ice maker
- Through the door service

46. Refrigerator Volume:

- VERY SMALL (<=10 CUBIC FEET)

- SMALL (11-14 CUBIC FEET)
- MEDIUM (15-18 CUBIC FEET)
- LARGE (19-22 CUBIC FEET)
- VERY LARGE (>22 CUBIC FEET)

47. Primary Refrigerator Specs:

- Manufacturer:
- Model #:
- Manufacture Date:
- Estimated Age:

**SAME INFO FOR SECONDARY AND THIRD REFRIGERATOR (IF APPLICABLE),
ALSO INCLUDE THE FOLLOWING QUESTIONS FOR THESE UNITS.**

48. Is this refrigerator plugged in year round?

- Yes
- No

49. If not plugged in year round, what percent of the time is it used?

- Fall _____%
- Spring _____%
- Winter _____%
- Summer _____%
- Not used

Other Kitchen Appliances:

50. Range Usage:

- >Once per Day
- 4-6 times per week
- <4 times per week

51. Range Specs:

- Fuel Type:
- Manufacturer:
- Model #:
- Manufacture Date:
- Estimated Age:

52. Microwave Usage:

- >Once per Day
- 4-6 times per week
- <4 times per week

53. Microwave Specs:

- Fuel Type:

- Manufacturer:
- Model #:
- Manufacture Date:
- Estimated Age:

54. Dishwasher Usage:

- >Once per Day
- 4-6 times per week
- <4 times per week

55. Dishwasher Specs:

- Fuel Type:
- Manufacturer:
- Model #:
- Manufacture Date:
- Estimated Age:

Freezer

56. Do you have a Freezer that is used?

- Yes
- No

57. Freezer Type:

- Upright
- Chest
- Other

58. Freezer Volume:

- VERY SMALL (<=10 CUBIC FEET)
- SMALL (11-14 CUBIC FEET)
- MEDIUM (15-18 CUBIC FEET)
- LARGE (19-22 CUBIC FEET)
- VERY LARGE (>22 CUBIC FEET)

59. Primary Freezer Specs:

- Manufacturer:
- Model #:
- Manufacture Date:
- Estimated Age:

60. Is this freezer plugged in year round?

- Yes
- No

61. If not plugged in year round, what percent of the time is it used?

- Fall _____%
- Spring _____%
- Winter _____%
- Summer _____%
- Not used

Water Heater

62. Water Heater Type?

- GAS STORAGE
- PROPANE STORAGE
- ELECTRIC STORAGE
- GAS INSTANTANEOUS
- ELECTRIC INSTANTANEOUS
- HEAT PUMP
- Solar
- Solar w/ Electric Storage
- Solar w/ Gas Storage
- Solar w/ Propane

63. Hot Water Heater Specifications

- Manufacturer:
- Model #:
- Tank Size:
- Input (kW or kBtu):
- Energy Factor:
- External Tank Wrap:
- Internal R-value:
- Manufacture Date:
- Estimated Age:

Spa/Pool

64. Do you have a hot tub?

- Yes

- No
- Yes, but no currently used

65. What fuel does your hot tub's hot water heater use?

- Electric
- Gas
- Propane
- Solar / Electric
- Solar / Gas
- Solar / Propane

66. Do you have a pool?

- Yes
- No
- Yes, but no currently used

67. What fuel does your pools heater use?

- Electric
- Gas
- Propane
- Other
- Solar Only
- Solar / Electric
- Solar / Gas
- Solar / Propane

Insulation (if customer has any contractor invoices regarding insulation, use these instead of visual inspection for the following)

68. Floor Construction? Crawlspace:____% Concrete slab:____% Basement ____% (must sum to 1)

69. Basement finished?

- Yes
- No
- Partial

70. Wall construction type:

- 2 x 4
- 2 x 6
- Masonry
- Not observable

71. What percentage of the exterior walls in the home are insulated?

- 0%
- 25%
- 50%
- 75%
- 100%
- Unknown

72. Estimate Wall Insulation R-Value:

- <R-11
- R-11
- R-13
- R-14
- R-15
- R-19
- Not observable
- None

73. Blown-in attic insulation (estimate number of inches): _____

74. Attic/Ceiling Batt insulation (estimate number of inches): _____

75. Attic/Ceiling Batt insulation R-Value:

- <R-11 R-28
- R-11 R-30
- R-13 R-36
- R-14 R-38
- R-15 R-49
- R-19 Not observable
- R-21 None
- R-22

76. Floor insulation?

- <R-11 Slab on grade
- R-11 Not observable
- R-13 None
- R-15
- R-19
- >R-19

Basement

77. Basement wall R-value

- <R-11
- R-11
- R-13
- R-15
- R-19
- >R-19
- None

78. Basement knee wall R-value

- <R-11
- R-11
- R-13
- R-15
- R-19
- R-21
- R-30
- Not observable
- None

Windows

79. What is the predominant window type in the home?

Frame Type	Panes	Low E Coating	Storm
Metal	Single	Yes	Yes
Wood	Double	No	No
Vinyl	Triple	Unk	Unk
Other			

80. Square footage by orientation (N, W, E, S)

	North	West	East	South
Area (sf)				
Shading Fraction				

Other major end uses:

81. Waterbed yes no
82. Aquarium yes no
83. Welding equipment yes no
84. Shop attached yes no
85. # of TVs
86. # of computers/workstations
87. #faxes
88. Solar PV yes no _____ #watts

89. Other large gas or electric end uses? _____

Lighting and Ceiling Fans (census of sockets in home by room)

In each of the following rooms, record the number of fixtures by type and the number of lamps by type:

Room	Fixture Type (Track lighting, Table lamps, Chandelier / Hanging, Torchiere, Recessed can, Recessed lighting-Other, Wall mount, Ceiling fixtures, Ceiling Fan, Floor Lamp, Architecturally Integrated, Other, Garage Door Opener)	Number of Each Fixture	Lamp Type (CF-I-A, CF-I-DEC, CF-I-GLO, CF-I-REF, CF-I-SPRN, CF-I-SQR, CF-I-UNK, CF-M-DEC, CF-M-GLO, CF-M-REF, CF-M-SQR, CF-M-UNK, F-12, F-4, F-5, F-8, F-CIR, F-OTH, F-TUBE-UNK, HAL-MR, HAL-OTH, HAL-PAR, HALQTZTUB, HAL-UNK, I-DEC, I-GLO, I-OTH, I-REF, I-STD, I-UNK)	Number of Each Lamps per Fixture	Wattage per lamp	Controller (Dimmer, Motion, None, Photo, Photo/Motion, Timer)
(Categorize Using the above list)						

Room	Fixture Type	Number of Each Fixture	Lamp Type	Number of Each Lamp per Fixture	Wattage per lamp	Controller

Appliance Data Tables

Definitions

All Refrigerators Table

Field Heading	Value	Comments
RLWID	RLW Site Identification Number	
FridgeType	Standard, side by side, freezer on bottom, single door	
YearsOld	Age of refrigerator in years	
Options	Icemaker, water and ice service in door, none	
SizeRange	Small, medium, large, very large	
MFG	Name of manufacturer	
ModelNo	Model number	
MFGdate	Date of manufacture	
UsageR	Primary or secondary and percentage of year in use (0-25%,...,75-100%)	
AEC	Annual Energy Consumption	
Match	Matching model number found in efficiency database?	
Notes	Notes, if any	
Fresh	Fresh Food Volume	
Freezer	Freezer Volume	
Volume	Total Volume (Fresh + Freezer)	

Cooling System Table

RLWID	RLW Site Identification Number	
CoolingSystem	Y if present, N if not present	
ACUsage	Level of usage, high, low or moderate	
SysType	Type of System, portable, PTAC, Split etc.	
SysCap	Capacity of cooling system	999 denotes missing information
MFG	Date of manufacture from efficiency database	
Model Number	Model number of system from on-site	
YearsOld	Customer reported age of system in years old, from on-site	
MFGdate	Date of manufacture	
SEER	Matched Efficiency	
PriSec	If primary system then 1, otherwise 0	
Match	Y if a match was found, otherwise N	
EER	Matched Efficiency	
Notes	Notes, if any	

Dishwasher Table

Field Heading	Value	Comments
RLWID	RLW Site Identification Number	
Appliance	Type of Appliance	
YearsOld	Age from model number match	
MFG	Manufacturer from on-site	
ModelNo	Model number from onsite	
MFGdate	Date of manufacture	
Energy Factor	Energy Factor	[load/kWh]-from database
Notes	Notes, if any	
Fuel	Fuel Type	
Match	Y if a match was found, otherwise N	

General Information Table

Field Heading	Value	Comments
SiteID	RLW Site Identification Number	
Type of Residence	Single Family Home, Apartment, etc.	
Total People	Total Number of Residents at Site	
Total Adults	Total Number of Adults at Site	18 and Over
People	Total Number of Residents at Site	
Adults	Total Number of Adults at Site	
People Under 1 year	Total Number of People Under 1 Year at Site	
People 2 to 5 years	Total Number of People between 2 to 5 years at site	
People 6 to 18 years	Total Number of People between 6 to 18 years at site	
People 18 to 29 years	Total Number of People between 18 to 29 years at site	
People 30 to 49 years	Total Number of People between 30 to 49 years at site	
People 50 to 64 years	Total Number of People between 50 to 64 years at site	
People 65 or more years	Total Number of People over 65 years at site	
Income	Annual Household Income Range	Resident Supplied
Total Heated Floorspace	Square Footage of Heated Floorspace of Residence	
Total Heated Sqft	Square Footage Range of Residence	
Age Range	Age Range of Residence	
Rent or Own	Ownership Status of Residence	
Who_Pays_Electric___Occ _or_Landl	Responsibility for Electric Bill, Occupant or Landlord	
'Who_Pays_Gas_	Responsibility for Gas Bill	

Water Heater Table

Field Heading	Value	Comments
RLWID	RLW Site Identification Number	
HWHtype	Type of Domestic Hot Water	
YearsOld	Estimated Age of Water heater in years old	Resident reported
MFG	Manufacturer from on-site	
ModelNo	Model number from on-site	
MFGDate	Date of manufacture	
Gallons	Storage capacity in gallons from database match	
IntRV	R-Value of Internal Tank insulation from on-site	
ExtRV	"Blanket" or "No Blanket"	
OutputBTU	Capacity in kBtuh if gas	
OutputkW	Capacity in kW if Electric	
Energy Factor	Energy Factor from database matching	Energy Factor for water heater is unit less, (water heater delivered energy/energy consumed)
Match	Y if a match was found, otherwise N	
Notes	Notes, if any	