

UTILITY ALLOWANCE STUDY

SEPTEMBER 2023

HOUSING CHOICE VOUCHER PROGRAM

RENTON HOUSING AUTHORITY

MR. MICHAEL BISHOP EXECUTIVE DIRECTOR RENTON HOUSING AUTHORITY 2900 NE 10TH STREET RENTON, WASHINGTON 98056-3133 (425) 226-1850







September 4, 2023

Mr. Michael Bishop Executive Director Renton Housing Authority 2900 NE 10th Street Renton, Washington 98056

Dear Mr. Bishop:

Enclosed please find a *final* copy of the 2023 Utility Allowance Update for the *Renton Housing Authority's* Housing Choice Voucher Program.

The allowances were developed in accordance with 24 CFR Part 982.517, using heat loss/gain engineering calculations based upon the thermal characteristics of each building type and considering the climate and standard of living within the local community. The allowances were updated based on the current rates of the local utility providers.

Many of the utility rates increased since the previous update was completed in February 2022. Fuel Oil and natural gas saw the largest increases at 48.4% and 29.1%, respectively. The electric rate increased by 14.4% while sanitation increased by 10.1%. The water and sewer rates for Soos Creek increased by 8.0% and the rates for the City of Renton did not change. A table comparing the current rates to those used in the previous update is included in the enclosed report.

Due to the significant increases in the utility rates since the previous update, we recommend the proposed allowances be implemented according to the Authority's policy.

As always, we appreciate the opportunity to provide this consulting service to you and the **Renton Housing Authority**. If you should require additional information of any kind, please do not hesitate to contact Chuck Antignane or myself at (770) 977-4134.

Sincerely,

W. Sawyer Shirley, P. E.

President

National Facility Consultants, Inc.

WSS/cra

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EXECUTIVE SUMMARY

Executive Summary

The United States Department of Housing and Urban Development requires that Public Housing Agencies administering Housing Choice Voucher (HCV) Programs review their utility allowances for program participants on at least an annual basis. Based on the results of the review, the allowances should be updated as appropriate. This report contains the updated HCV Utility Allowances for the Renton Housing Authority beginning July 1, 2023.

The Renton Housing Authority administers a variety of housing types using a variety of fuels. The units analyzed consist of zero through five bedroom Duplex/Row/Townhouses, Flat/Garden/Multifamily (Low High-Rise), Mobile Home, and Single Family units. The fuel types studied for each unit type and size are natural gas, electricity, fuel oil, and propane. Allowances were also developed for water, sewer and sanitation service. Additionally, allowances were developed for various pieces of medical equipment to allow the Authority to increase the Utility Allowances for disabled persons who require supplementary utility consumption.

The allowances were developed using estimated consumption figures and applicable utility rates. Consumption figures for each category were developed using standard engineering heat loss/gain calculation methods and the standard consumption levels for various systems and equipment. These consumption figures were sub-divided by category and bedroom size, and the rate estimates including any relevant adjustments and riders were applied. The proposed allowances were then compared with the Authority's current allowances. The allowances for HCV Housing in Renton are presented on the following pages.

Form (HUD - 52667) can be photocopied and used directly by the Authority to establish housing allowances for tenant furnished utilities and other services.

HCV UTILITY ALLOWANCES (FORM HUD 52667)

U.S. Department of Housing and Urban Development

Utility Allowance Schedule

Office of Public and Indian Housing

LOCALITY/PHA			UNIT TYPE			DATE
Renton Housing Authority			Duplex/Row/7	Гownhouses	7/1/2023	
UTILITY OR SERVICE	0-BR	1-BR		LLAR ALLOWANCE	1.00	7 DD
HEATING	U-DK	I-DK	2-BR	3-BR	4-BR	5-BR
a. Natural Gas	\$28	\$31	\$37	\$40	\$46	\$50
b. Electric	\$36	\$41	\$50	\$56	\$66	\$73
c. Heat Pump	\$20	\$23	\$28	\$31	\$37	\$40
d. Fuel Oil	\$86	\$97	\$114	\$126	\$146	\$158
e. Propane	\$53	\$60	\$70	\$77	\$89	\$96
AIR CONDITIONING	\$2	\$3	\$4	\$5	\$6	\$7
COOKING						
a. Natural Gas	\$8	\$8	\$10	\$11	\$12	\$12
b. Electric	\$11	\$11	\$13	\$14	\$15	\$16
c. Propane	\$16	\$17	\$20	\$21	\$23	\$24
OTHER ELECTRIC	\$28	\$30	\$34	\$40	\$44	\$52
WATER HEATING						
a. Natural Gas	\$12	\$16	\$20	\$29	\$38	\$47
b. Electric	\$11	\$18	\$26	\$40	\$56	\$72
c. Fuel Oil	\$34	\$46	\$58	\$81	\$107	\$133
d. Propane	\$24	\$32	\$41	\$57	\$75	\$93
WATER						
a. In - City of Renton	\$24	\$29	\$34	\$48	\$64	\$81
b. Out - City of Renton	\$36	\$43	\$51	\$72	\$96	\$122
c. Soos Creek	\$22	\$26	\$32	\$49	\$70	\$92
SEWER						
a. In - City of Renton	\$84	\$84	\$84	\$84	\$84	\$84
b. Out - City of Renton	\$126	\$126	\$126	\$126	\$126	\$126
c. Soos Creek	\$75	\$75	\$75	\$75	\$75	\$75
SURFACE WATER	\$16	\$16	\$16	\$16	\$16	\$16
TRASH COLLECTION	\$26	\$26	\$26	\$26	\$26	\$26
REFRIGERATOR	\$5	\$ 5	\$5	\$5	\$5	\$5
<u> </u>	\$4	\$4	\$4			
RANGE				\$4	\$4	\$4
OTHER: Natural Gas Basic Charge	\$13	\$13	\$13	\$13	\$13	\$13
ACTUAL FAMILY ALLOWANCES: (May be	used by the family to			JUTILITY		I PER
compute allowance while searching for a unit.)	U			OR SERVICE		MONTH
HEAD OF HOUSEHOLD			***************************************	HEATING		s
				AIR CONDITIONING		s
UNIT ADDRESS		· · · · · · · · · · · · · · · · · · ·				6
OHI ADORESS				COOKING		2
				OTHER ELECTRIC		\$
				WATER HEATING		\$
				WATER		\$
				SEWER		s
				TRASH COLLECTION		s
				REFRIGERATOR		<u> </u>
						,
TA 4DCD OF DCDD OC 4C				RANGE		3
NUMBER OF BEDROOMS				OTHER	~~~	<u> </u> \$
				TOT.	AL	\$

U.S. Department of Housing and Urban Development Office of Public and Indian Housing

Utility Allowance Schedule

LOCALITY/PHA UNIT TYPE DATE Renton Housing Authority Flat/Garden/Multifamily (Low High-Rise) 7/1/2023 MONTHLY DOLLAR ALLOWANCE UTILITY OR SERVICE 0-BR I-BR 4-BR 2-BR 3-BR 5-BR HEATING a. Natural Gas \$22 \$27 \$30 \$35 \$40 \$44 b. Electric \$27 \$34 \$40 \$48 \$57 \$63 c. Heat Pump \$15 \$19 \$22 \$27 \$32 \$35 d. Fuel Oil \$69 \$82 \$94 \$110 \$127 \$140 e. Propane \$43 \$51 \$58 \$67 \$78 \$85 AIR CONDITIONING \$2 \$3 \$4 \$5 \$6 \$7 COOKING a. Natural Gas \$8 \$8 \$10 \$11 \$12 \$12 b. Electric \$11 \$11 \$13 \$14 \$15 \$16 c. Propane \$16 \$17 \$20 \$21 \$23 \$24 OTHER ELECTRIC \$28 \$30 \$34 **\$4**0 \$52 \$44 WATER HEATING a. Natural Gas \$16 \$12 \$20 \$29 \$38 \$47 b. Electric \$11 \$18 \$26 \$40 \$56 \$72 c. Fuel Oil \$34 \$46 \$58 \$81 \$107 \$133 d. Propane \$24 \$32 \$41 \$57 \$75 \$93 WATER a. In - City of Renton \$24 \$29 \$34 \$48 \$64 \$81 b. Out - City of Renton \$36 \$43 \$51 \$72 \$96 \$122 c. Soos Creek \$22 \$26 \$32 \$49 \$70 \$92 SEWER a. In - City of Renton \$84 \$84 \$84 \$84 \$84 \$84 b. Out - City of Renton \$126 \$126 \$126 \$126 \$126 \$126 c. Soos Creek \$75 \$75 \$75 \$75 \$75 \$75 SURFACE WATER \$16 \$16 \$16 \$16 \$16 \$16 TRASH COLLECTION \$26 \$26 \$26 \$26 \$26 \$26 REFRIGERATOR \$5 \$5 \$5 \$5 \$5 \$5 RANGE \$4 \$4 \$4 \$4 \$4 \$4 OTHER: Natural Gas Basic Charge \$13 \$13 \$13 \$13 \$13 \$13

CTUAL FAMILY ALLOWANCES: (May be used by the family to ompute allowance while searching for a unit.)	OR SERVICE	PER MONTH
EAD OF HOUSEHOLD	HEATING	s
	AIR CONDITIONING	\$
NIT ADDRESS	COOKING	\$
	OTHER ELECTRIC	\$
	WATER HEATING	\$
	WATER	\$
	SEWER	\$
	TRASH COLLECTION	\$
	REFRIGERATOR	\$
	RANGE	\$
UMBER OF BEDROOMS	OTHER	\$
	TOTAL	\$

U.S. Department of Housing and Urban Development

Utility Allowance Schedule

Office of Public and Indian Housing

LOCALITY/PHA			UNIT TYPE			DATE
Renton Housing Authority			Mobile Home			7/1/2023
			MONTHLY DO	LLAR ALLOWANCE		
UTILITY OR SERVICE	0-BR	I-BR	2-BR	3-BR	4-BR	5-BR
HEATING a. Natural Gas	\$28	£22	020			
b. Electric	\$36	\$32 \$42	\$38 \$52	\$44	\$47	\$55
c. Heat Pump	\$20	\$42 \$23	\$29	\$62 \$35	\$67 \$37	\$80
I. Fuel Oil	\$86	\$23 \$98	\$118	\$139	\$37 \$148	\$44 \$174
e. Propane	\$53	\$61	\$72	\$85	\$148 \$90	\$174
AIR CONDITIONING	\$2	\$3	\$3	\$4	\$5	\$6
COOKING		***************************************				30
n. Natural Gas	\$8	\$8	\$10	\$11	\$12	\$12
b. Electric	\$11	\$11	\$13	\$14	\$15	\$16
c. Propane	\$16	\$17	\$20	\$21	\$23	\$24
OTHER ELECTRIC	\$28	\$30	\$34	\$40	\$44	\$52
WATER HEATING						
a. Natural Gas	\$12	\$16	\$20	\$29	\$38	\$47
b. Electric	\$11	\$18	\$26	\$40	\$56	\$72
c. Fuel Oil	\$34	\$46	\$58	\$81	\$107	\$133
Propane	\$24	\$32	\$41	\$57	\$75	\$93
WATER						
ı. In - City of Renton	\$24	\$29	\$34	\$48	\$64	\$81
o. Out - City of Renton	\$36	\$43	\$51	\$72	\$96	\$122
: Soos Creek	\$22	\$26	\$32	\$49	\$70	\$92
SEWER				1 4 7 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	\$10	392
ı. In - City of Renton	\$84	\$84	\$84	\$84	\$84	\$84
o. Out - City of Renton	\$126	\$126	\$126	\$126	\$126	\$126
: Soos Creek	\$ 75	\$75	\$75	\$75	\$75	\$75
SURFACE WATER	\$16	\$16	\$16	\$16	\$16	\$16
FRASH COLLECTION	\$26	\$26	\$26	\$26	\$26	\$26
REFRIGERATOR	\$5	\$5	\$5	\$5	\$5	\$5
RANGE	\$4	\$4	\$4	\$4	\$4	\$4
OTHER: Natural Gas Basic Charge	\$13	\$13	\$13	\$13	\$13	\$13
L	····			913	913	
ACTUAL FAMILY ALLOWANCES: (May be t	sed by the family to			UTILITY		PER
compute allowance while searching for a unit.)				OR SERVICE		MONTH
HEAD OF HOUSEHOLD				HEATING		\$
				AIR CONDITIONING		\$
JNIT ADDRESS				COOKING		\$
				OTHER ELECTRIC		s
				WATER HEATING		5
				"		6
				WATER		3
				SEWER		\$
				TRASH COLLECTION		\$
				REFRIGERATOR		\$
				RANGE		s
UMBER OF BEDROOMS				OTHER		s

U.S. Department of Housing and Urban Development

Utility Allowance Schedule

Office of Public and Indian Housing

LOCALITY/PHA			UNIT TYPE			DATE
Renton Housing Authority			Single Family	1		7/1/2023
				LLAR ALLOWANCE	***************************************	
UTILITY OR SERVICE	0-BR	1-BR	2-BR	3-BR	4-BR	5-BR
HEATING a. Natural Gas	625	611	T.16	0.53	0.50	
b. Electric	\$35 \$47	\$41 \$57	\$46 \$66	\$53 \$78	\$58 \$87	\$62
c. Heat Pump	\$26	\$32	\$37	\$43	\$48	\$93 \$52
d. Fuel Oil	\$109	\$129	\$146	\$169	\$187	\$198
e. Propane	\$67	\$79	\$89	\$102	\$113	\$120
AIR CONDITIONING	\$2	\$3	\$4	\$5	\$7	\$8
COOKING						
a. Natural Gas	\$8	\$8	\$10	\$11	\$12	\$12
b. Electric	\$11	\$11	\$13	\$14	\$15	\$16
c. Propane	\$16	\$17	\$20	\$21	\$23	\$24
OTHER ELECTRIC	\$28	\$30	\$34	\$40	\$44	\$52
WATER HEATING					······································	
a. Natural Gas	\$12	\$16	\$20	\$29	\$38	\$47
b. Electric	\$11	\$18	\$26	\$40	\$56	\$72
c. Fuel Oil	\$34	\$46	\$58	\$81	\$107	\$133
d. Propane	\$24	\$32	\$41	\$57	\$75	\$93
WATER						
a. In - City of Renton	\$24	\$29	\$34	\$48	\$64	CO1
b. Out - City of Renton	\$36	\$43	\$51	\$72	\$96	\$81 \$122
c. Soos Creek	\$22	\$26	\$32	\$49	\$70	\$92
SEWER	322	920	332	349	\$70	392
a. In - City of Renton	\$84	\$84	\$84	\$84	\$84	\$84
b. Out - City of Renton	\$126	\$126	\$126	\$126	\$126	\$126
c. Soos Creek	\$75	\$75	\$75	\$75	\$ 75	\$75
SURFACE WATER	\$16	\$16	\$16	\$16	\$16	\$16
TRASH COLLECTION	\$26	\$26	\$26	\$26	\$26	\$26
REFRIGERATOR	\$5	\$5	\$5	\$5	\$5	\$5
RANGE	\$4	\$4	\$4	\$4	\$4	\$4
OTHER: Natural Gas Basic Charge	\$13	\$13	\$13	\$13	\$13	\$13
	1	¥1.	1 413	1 413	D £3	. 313
ACTUAL FAMILY ALLOWANCES: (May be	ised by the family to			UTILITY	······································	PER
compute allowance while searching for a unit.)				OR SERVICE		MONTH
HEAD OF HOUSEHOLD				HEATING		\$
				AIR CONDITIONING		s
UNIT ADDRESS				COOKING		s
				OTHER ELECTRIC		s
				WATER HEATING		· ·
				WATER HEATING		6
				i		3
				SEWER		S
				TRASH COLLECTION		\$
				REFRIGERATOR		\$
				RANGE		\$
NUMBER OF BEDROOMS		***************************************		OTHER		s
				TOT		s

Medical Equipment Allowances

Item	Hrs/Day	Wattage	Monthly Consumption (kWh)	Allowance
Oxygen Concentrator	18	400	219	\$25
Nebulizer	2	75	5	\$1
Electric Hospital Bed	0.2	200	1	\$1
Alternating Pressure Pad	24	70	51	\$6
Low Air-Loss Mattress	24	120	88	\$10
Power Wheelchair/Scooter	3	360	33	\$4
CPAP Machine	10	30	9	\$2

Oxygen Concentrator

Use per day varies, assume 12 to 24 hours a day.

The 5-Liter model uses 400 W, the 3-Liter model uses 320 W.

Nebulizer

A medicine delivery system used mostly for pediatric care.

Used 4-6 times a day for 20 minutes at a time at 75 W.

Semi/Fully Electric Hospital Beds

Use depends on adjustments. 200 W.

Alternating Pressure Pad

An air-filled mattress overlay.

Used 24 hours a day for someone who is bed-ridden.

Low Air-Loss Mattress

Takes the place of mattress - air-filled pressurized mattress.

Cycles air around every 15-20 minutes.

Power Wheelchairs and Scooters

Need to be charged approximately 8 hours every 3 days.

Batteries are 120 V, 3 Amp, 360 W.

CPAP Machines

Used for Sleep Apnea. Machines run only at night for people who have a tendency to stop breathing at night. At maximum pressure they use 40 Watts. On average - 30Watts.

UTILITY RATE COMPARISON

Renton Housing Authority Housing Choice Voucher Program Utility Rate Comparison July-2023

Utility	Provider	Type of Charge	February 2022 Rate**	July 2023 Rate	Percent Change
		Basic Charge (per month)	\$7.49	\$7.49	%0.0
Electricity	Puget Sound Energy	First 600 kWh (per kWh) Total Energy Charge Energy Exchange Credit Total Other Charges and Credits Total	\$0.095631 (\$0.006689) \$0.007862 \$0.096804	\$0.110228 (\$0.006689) \$0.007230 \$0.110769	14.4%
		Over 600 kWh (per kWh) Total Energy Charge Energy Exchange Credit Total Other Charges and Credits Total	\$0.115462 (\$0.006689) \$0.007862 \$0.116635	\$0.129645 (\$0.006689) \$0.007230 \$0.130186	%9'11
		Basic Charge (per month)	\$11.52	\$12.50	8.5%
G as	Puget Sound Energy	All therms (per therm) Total Delivery Charge Total Cost of Gas Other Natural Gas Charges and Credits Total	\$0.492910 \$0.489580 \$0.020190 \$1.002680	\$0.535620 \$0.730550 \$0.028750 \$1.294920	29.1%
Fuel Oil	Genesee Energy and All Discount Heating Oils	Average Consumption Charge (per gallon)	\$3.450	\$5.120	48.4%
Propane	Suburban and Ferreligas Propane	Average Consumption Charge (per gallon)	\$2.520	\$2.474	-1.8%

Renton Housing Authority Housing Choice Voucher Program Utility Rate Comparison July-2023

Utility	Provider	Type of Charge	February 2022 Rate**	July 2023 Rate	Percent Change
		Basic Charge (per month)	\$18.68	\$18.68	%0.0
N.	City of Renton	Consumption Charge (per CCF) 0 - 500 CCFs per month 500 - 1000 CCFs per month Over 1000 CCFs per month	\$2.69 \$3.62 \$4.57	\$2.69 \$3.62 \$4.57	0.0% 0.0% 0.0%
W 486		Basic Charge (per month)	\$16.35	\$17.66	8.0%
	Soos Creek Water and Sewer District	Consumption Charge (per CCF) 0 - 500 CCFs per month 500 - 1000 CCFs per month Over 1000 CCFs per month	\$2.17 \$4.25 \$5.35	\$2.34 \$4.59 \$5.78	7.8% 8.0% 8.0%
		Single Family (per month)	\$31.74	\$31.74	0.0%
	City of Renton	Other Users Base Charge (per month) Consumption Charge (per CCF)	\$31.74	\$31.74	%0.0 0.0%
Sewer	Soos Creek Water and Sewer District	Sewer System Maintenance(per month) King Co. Treatment Charge (per month) Total Charge (per month)	\$21.22 \$49.27 \$70.49	\$22.92 \$52.11 \$75.03	8.0% 5.8% 6.4%
	King County	Single Family (per month)	\$49.27	\$52.11	5.8%
Surface Water	City of Renton	Monthly Charge	\$15.76	\$15.76	%0.0
Sanitation	City of Renton	Monthly Charge	\$24.00	\$26.43	10.1%

^{*}The last time the utility allowances were updated.

METHODOLOGY

Methodology

The Renton Housing Authority's Housing Choice Voucher Utility Allowances were developed by applying local utility rates to estimated consumption levels for various systems and equipment. Allowances were established for Duplex, Garden, High-Rise, Mobile Home, Single Family, and Townhouse unit types with bedroom sizes zero (efficiency) through five. The specific utility categories for which allowances were made include Heating, Air Conditioning, Cooking, Other Electric, Water Heating, Water, Sewer, Sanitation, an allowance for a Refrigerator and a Range, and a Medical Disability Allowance. This section provides a brief summary of how the allowances were established for each category and includes assumptions and estimates made in the process.

Heating

Utility allowances were set for four types of heating fuels/systems: natural gas, electric, fuel oil, and propane. Consumption levels for each category were developed using standard engineering heat loss/gain calculation methods. The variables in the formula include design heat loss, number of heating degreedays, and the design temperature difference. The formula where all variables are defined and global variable values are listed can be found in Appendix A of this report. The design heat loss calculations also take into consideration the thermal design characteristics of each structure type. Due to the variance in HCV housing construction, certain general assumptions concerning the thermal characteristics and size of each unit type were made.

The assumptions made in order to calculate the heat loss for each unit type (e.g., one bedroom apartment, three bedroom single family, etc.) can be broken down into two categories: dimensions and thermal characteristics.

<u>Dimensions</u> Thermal Characteristics

Area of ceiling R-value of ceiling

Area of net exterior wall R-value of walls

Area of windows R-value of windows

Area of doors R-value of doors

Crack length of windows and doors Infiltration factor

(windows/doors)

Perimeter foot length Perimeter insulation factor

Heating (cont.)

The specific values of each sub-category can be found in Appendix A. The assumptions concerning dimensions are based on engineering estimates of the average unit for each type and size. The assumptions of thermal characteristics are based on HUD Handbook 7420.7, The Administrative Practices Handbook for the Section 8 Existing Housing Program, Chapter 5, Housing Quality Standards, page 5-7, paragraph (c), Tenant Preference. While this HUD handbook has expired, the regulation itself remains valid and the handbook continues to be a useful tool. "The tenant may...determine the acceptability of the amount of weather stripping and insulation to prevent inadequate heat distribution and excessive air infiltration. The tenant may also determine if storm doors and windows are important. If the PHA believes that weather stripping and insulation for the unit are inadequate, this concern should be discussed with the tenant or owner."

In other words, it is the tenant's responsibility to select a unit that has adequate thermal characteristics (insulation, weather stripping, etc.). The Authority is only responsible to the tenant in so far as to inform the tenant that the unit he/she has selected is inadequate in this respect. The Authority must inform the tenant that he/she should select a unit with adequate thermal characteristics and that it is not the Authority's responsibility to pay the additional cost associated with high utility bills resulting from inadequate thermal characteristics. The Authority should also inform the owner that the unit would not be recommended to tenants until its thermal characteristics have been improved. The specific value of each thermal characteristic has been set at what we recommend as the minimum acceptable level. These values can be found in Appendix A.

Cooking

Natural gas, electricity, and propane have been considered for cooking fuels. Consumption allowances were calculated using the following method with the following assumptions.

Assumptions:

- Estimated energy consumed by a gas range is 25,000 BTUs per hour of operation
- Assume 65% of the gas burner used during meal preparation
- Estimated energy consumed by an electric range is 2.5 kWh
- Range operation time per day to prepare meals

0 BR = 1.2 hours 1 BR = 1.25 hours 2 BR = 1.5 hours 3 BR = 1.6 hours 4 BR = 1.75 hours 5 BR = 1.8 hours

Formulations:

Therms/Month = $\frac{25,000 \text{ BTUs x } .65/\text{Hr x Hours x } 30 \text{ days/Month}}{100,000}$

Gallons/Month = 25,000 BTUs x .65/Hr x Hours x 30 days/Month 95,500

kWh/Month = Hours/day x 2.5 kw x 30 days/Month

Other Electric

This category includes items such as lighting, refrigeration, microwave, television, and other necessary appliances. Standard consumption levels for all items were added together to obtain the total consumption for the Other Electric category. The full amount of the monthly service charge for electricity has been included in the Other Electric category since all tenants must pay this charge. In contrast, it would not be accurate to split the service charge between Heating and Other Electric because some tenants may use natural gas heat.

Water Heating

As with heating, allowances for Water Heating were developed using engineering based calculations. Assumptions were made as to the number of people living in each bedroom size and the amount of hot water used per person per day. Appendix C contains all relevant calculations and assumptions.

Water and Sewer

Water consumption is calculated based on assumptions concerning the number of people living in the unit and the amount of water each person uses in his/her daily activities.

Ranges and Refrigeration

Allowances were made for Ranges and Refrigerators in the event that these items are not furnished by the landlord/owner. The allowances are based on the cost of a refrigerator and the cost of a range spread over the expected life of the appliance. The following details the cost allowances, as they are included on each Utility Allowance schedule:

Appliance	Total Cost	Life Exp.		Monthly A	<u>Allowance</u>
Small Refrigerator	\$580	10 yrs		\$4.83	\$5
Large Refrigerator	\$690	10 yrs	•	\$5.75	\$6
Small Range	\$480	10 yrs		\$4.00	\$4
Large Range	\$520	10 yrs		\$4.50	\$5

Medical Equipment Allowances

We have determined typical monthly consumption figures for several different types of medical equipment in order for the Authority to make additional utility allowances for residents who request supplementary utility consumption due to a disability. This is completed by using a typical wattage for each piece of equipment and converting to monthly kWh by estimating the hours per day of required use. The table that outlines these consumption and cost allowances has been included with the Utility Allowance HUD forms in Tab 2 of this report.

Utility Rate Estimates

Electricity

Some HCV participants reside in homes with electric space heating, water heating and/or cooking. The resulting allowance is based on Puget Sound Energy's current residential electric rates. These rates are also used for other electric uses such as lighting, appliances, etc. The following details the electric rates as they are used in the utility allowance calculations.

Puget Sound Energy

Basic Charge	\$7.49 per month
First 600 kWh	
Energy Charge	\$0.089437 per kWh
Low Income Program	\$0.002687 per kWh
Property Tax Tracker	\$0.002612 per kWh
Energy Charge Credit Recovery Adjustment	\$0.001828 per kWh
Colstrip Adjustment Rider	\$0.002669 per kWh
Rates Not Subject to Refund Rate Adjustment	\$0.010007 per kWh
Rates Subject to Refund Rate Adjustment	\$0.005029 per kWh
Transportation Electrification Plan Rider	\$0.000319 per kWh
Unprotected Excess Deferred Income Tax Reversals	(\$0.000884) per kWh
Revenue Decoupling Adj. Mechanism	(\$0.003476) per kWh
Energy Exchange Credit	(\$0.006689) per kWh
Power Cost Adjustment (Supplemental Rate)	\$0.002135 per kWh
Federal Wind Power Credit	\$0.000051 per kWh
Electric Conservation Service Rider	\$0.005044 per kWh
Total Rate	\$0.110769 per kWh

Total Rate	\$0.130186 per kWh
Electric Conservation Service Rider	\$0.005044 per kWh
Federal Wind Power Credit	\$0.000051 per kWh
Power Cost Adjustment (Supplemental Rate)	\$0.002135 per kWh
Energy Exchange Credit	(\$0.006689) per kWh
Revenue Decoupling Adj. Mechanism	(\$0.003476) per kWh
Unprotected Excess Deferred Income Tax Reversals	(\$0.000884) per kWh
Transportation Electrification Plan Rider	\$0.000319 per kWh
Rates Subject to Refund Rate Adjustment	\$0.005029 per kWh
Rates Not Subject to Refund Rate Adjustment	\$0.010007 per kWh
Colstrip Adjustment Rider	\$0.002669 per kWh
Energy Charge Credit Recovery Adjustment	\$0.001828 per kWh
Property Tax Tracker	\$0.002612 per kWh
Low Income Program	\$0.002687 per kWh
Energy Charge	\$0.108854 per kWh
Over 600 kWh	

City Tax 6%

Natural Gas

Other HCV participants reside in homes that use natural gas for space heating, water heating and/or cooking. The allowance for these uses is based on Puget Sound Energy's current residential natural gas rates. The following details the natural gas rates as they are used in the utility allowance calculations.

Puget Sound Energy

Basic Charge	\$12.50 per month
Delivery Charge	\$0.45613 per therm
Low Income Program	\$0.003160 per therm
Property Tax Tracker	\$0.02285 per therm
Dist. Pipeline Provisional Recovery Adjustment	\$0.003260 per therm
Rates Not Subject to Refund Rate Adjustment	(\$0.00170) per therm
Rates Subject to Refund Rate Adjustment	\$0.048650 per therm
Unprotected Excess Deferred Income Tax Reversals	(\$0.00137) per therm
Revenue Decoupling Adj. Mechanism	\$0.004640 per therm
Gas Cost	\$0.69019 per therm
Deferred Account Adjustment	\$0.01541 per therm
Deferred Account Adjustment (Supp. Rate B)	\$0.024950 per therm
Gas Conservation Service Rider	\$0.028275 per therm
Total Charge	\$1.29492 per therm
City Tax	6%

Propane

Some HCV participants reside in homes where space heating, water heating and/or cooking is provided by propane-fired appliances. The utility allowance for these homes is based on the current residential rates of Suburban Propane and Ferrellgas, two local propane suppliers. The following details the propane rates as they are used in the utility allowance calculations.

Suburban Propane

Consumption Charge

\$2.549 per gallon

Ferrellgas

Consumption Charge

\$2.399 per gallon

Average

\$2.474 per gallon

Fuel Oil

Some HCV participants live in homes which use fuel oil-fired appliances to provide space heating and/or water heating. The allowance for these homes is based on the current residential fuel oil price as provided by two local suppliers, Genesee Energy and All Discount Heating Oils. The following details the fuel oil rates as they are used in the utility allowance calculations.

Genesee Energy

Consumption Charge

\$5.19 per gallon

All Discount Heating Oils

Consumption Charge

\$5.05 per gallon

Average

\$5.12 per gallon

Water and Sewer

Allowances are also provided for water and sewer costs. The resulting allowances are based on the City of Renton, King County and Soos Creek's residential water and sewer rates. The water and sewer rates used for calculating the utility allowances for the HCV participants are as follows.

City of Renton - Water

Base Charge	\$18.68 per month

Consumption Cost

0 - 500 CF	\$2.69 per CCF
600 – 1000 CF	\$3.62 per CCF
Over 1000 CF	\$4.57 per CCF

City of Renton - Sewer

Base Charge - single family	\$31.74 per month
Surface Water	\$15.76 per month

The above rates are for customers who live inside the city limits. Rates for customers who live outside the city limits are 1.5 times the above rates.

King County - Sewer

Base Charge – single family	\$52.	П	per month
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Soos Creek - Water

Base Charge	\$17.66 per month
Consumption 0 – 500 CF	\$2.34 per CCF
500 – 1000 CF	\$4.59 per CCF

\$5.78 per CCF

1001 - 1500 CF

Soos Creek - Sewer

Maintenance of the Sewer System	\$22.92 per month
King County Treatment Charge	\$52.11 per month
Total Sewer Charges	\$75.03 per month

Sanitation

City of Renton \$26.43 per month

SPACE HEATING CONSUMPTION LEVELS

Space Heating Consumption Levels and Cost Figures

-	,								
		Cost per Month	\$35	S41	\$46	\$53	\$58	\$62	
	amily	Therms/ Fan kWh/ Month Month	29	35	28	33	28	30	
	Single	Therms/ Month	23	27	31	36	40	42	
		Cost per Month	\$28	\$32	\$38	\$44	\$47	\$55	•••
	Home	Therms/ Fan kWh/ Month Month	25	29	36	36	39	46	
GAS	Mobile	Therms/ Month	<u>«</u>	21	25	29	31	37	
HEATING - NATURAL GAS		Cost per Month	\$22	\$27	\$30	\$35	\$40	\$44	
TING - N	nep	Therms/ Fan kWh/ Month Month	91	20	24	20	24	27	
HEA	Ē	Therms/ Month	51	81	20	24	27	30	
		Cost per Month							
	olex	Fan kWh/ Month	22	25	30	24	28	31	
	ΠΩ	Therms/ Fan kWh/ Month Month	18	21	24	27	31	34	
		Sq. Ft.					1300-1500		
		Bedrooms	0	1000	2	3	4	2	

Based on an average cost per therm of \$1,29492

	Cost per Month	7,2	\$57	995	278	287	393	
Family	Fan kW Monti	13	16	13	15	13	14	
Single	kWh per Fan kWh/ Month Month	390	473	552	646	727	778	
	Cost per Month	\$36	\$42	\$52	\$62	295	088	-
Home	kWh per Fan kWh/ Month Month	12	41	17	17	82	22	
Mobile	kWh per Month	293	344	424	515	552	859	
	Cost per Month	\$27	\$34	\$40	\$48	\$57	\$63	•
Garden	Fan kWh/ Month	∞	01	11	10	=	13	
Gar	kWh per Month	224	280	329	400	473	526	
	Ŭ [∠] 1	\$36	241	\$50	\$56	99\$	\$73	
Duplex	kWh per Fan kWh/ Month Month	01	12	14	=	13	4	
Dut	kWh per Month	296	341	411	465	551	604	
***************************************	Sq. Ft.	400-550	500-700	700-900	1000-1200	1300-1500	1600-2000	
	Bedrooms	0	-	7	3	4	'n	

Based on an average cost per kWh of \$0.110769

П						-	-		
		Cost per	Month	\$26	\$32	\$37	\$43	\$48	\$52
	Family	Fan kWh/	Month	\$	9	S	5	2	ĸ
	Single	kWh per	Month	218	264	308	361	407	435
		Cost per	Month	\$20	\$23	628	\$35	\$37	244
	Home	Fan kWh/	Month	4	2	9	9	9	00
TPUMP	Mobile	kWh per	Month	164	192	237	288	309	368
RIC HEA		Cost per	Month	\$15	819	\$22	\$27	\$32	\$35
D313-5	len	Fan kWh/	Month		6	4	6	4	4
HEATING	Gar	kWh per	Month	125	156	184	224	265	294
		Cost per		\$20	\$23	\$28	\$31	\$37	\$40
	lex	kWh per Fan kWh/	Month	4	4	5	4	5	S
	Dup	kWh per	Month	165	161	230	260	308	337
		ů,	X	400-550	500-700	700-900	1000-1200	1300-1500	1600-2000
		7	Sedrooms	0		7	3	4	S

Based on an average cost per kWh of \$0.110769

Space Heating Consumption Levels and Cost Figures

		Cost per Month	\$109	\$129	\$146	\$169	\$187	\$198
	amily	Fan kWh/	40	84	39	46	39	42
	Single 1	Gallons per Fan kWh/ Month Month	61	23	26	30	34	36
		Cost per Month	988	86\$	\$118	\$139	\$148	\$174
	Home	Gallons per Fan kWh/	35	4	51	50	54	49
1	Mobile	Gallons per	15	17	21	25	26	31
FUELO		Cost per Month						
EATING	den	Gallons per Fan kWh/ Month Month	23	29	34	29	34	38
Ξ	Gar	Gallons per Month	12	15	17	20	23	25
		Cost per Month	 					
	ole x	Jallons per Fan kWh/ Month Month	30	35	42	33	39	43
	Dat	Gallons per Month	15	17	20	22	26	78
		So Ft	400-550	500-700	700-900	1000-1200	1300-1500	1600-2000
		Bedrooms	0	_	61	м	4	'n

Based on an average cost per gallon of \$5.12

					H	CATING -	PROPAN	Œ					
		Dup	ex		Garden	len		Mobile	Home		Single Family	amily	
ooms	Sq. Ft.	Gallons per Month	Gallons per Fan kWh/ Month Month	Cost per Month	Gallons per Fan kWh/ Month Month	Fan kWh/ Month	Cost per Month	er Gallons per Fan kWh/	Fan kWh/ Month	Cost per Month	Gallons per Fan kWh/ Month Month	Fan kWh/ Month	Cost per Month
0	400-550	61	22	\$53	16	91	\$43	19	25		24	29	295
_	500-700	22	25	\$60	18	20	\$51	22	29		29	35	879
2	200-000	25	30	870	21	24	\$58	26	36		33	28	888
3	1000-1200	28	24	217	25	20	295	31	36		38	33	\$102
4	1300-1500	33	28	688	29	24	878	33	39		42	28	\$113
2	1600-2000	35	31	96\$	31	27	\$85	38	46		4	30	\$120
												•	

Based on an average cost per gallon of \$2.474

AIR-CONDITIONING CONSUMPTION LEVELS

Air Conditioning Consumption Levels and Cost Figures

									-
		•••••							***************************************
	Family	Cost per Month		\$2	\$3	\$	\$2	2.3	88
	Single	kWh per Cost per Year Month		241	324	414	535	675	792
	e Home	Wh per Cost per Year Month		23	S	 S3	\$	\$5	98
NING	Mobil	kWh per Year		202	261	324	421	517	929
NIK CO	rden	Wh per Cost per		2 5	83	\$4	\$\$	98	2.2
,	G	kWh per Year	-	220	294	374	488	618	728
	iplex	kWh per Cost per Year Month	THE PARTY OF THE P	\$2	\$3	\$4	\$5	\$6	22
	ď	kWh per Year	-	222	295	376	487	819	728
		Sa. Ft		400-550	500-700	700-900	1000-1200	1300-1500	1600-2000
		Bedrooms		0	-	7	3	4	S

Based on an average cost per kWh of \$0.110769

Air Conditioning Consumption Levels

Townhouse

Bedrooms	Sq. Ft.	Cooling BTUH	SEER	Full Load Hours	Electric Consumption
0 1 2 3 4 5	400-550 500-700 700-900 1000-1200 1300-1500 1600-2000	7,363 10,432 13,789 18,386 23,762 28,467	10 10 10 10 10 10	240 240 240 240 240 240 240	221 295 375 486 615 728

Garden

Bedrooms	Sq. Ft.	Cooling BTUH	SEER	Full Load Hours	Electric Consumption
0 1 2 3 4 5	400-550 500-700 700-900 1000-1200 1300-1500 1600-2000	7,317 10,418 13,741 18,468 23,886 28,490	10 10 10 10 10 10	240 240 240 240 240 240 240	220 294 374 488 618 728

Duplex

Bedrooms	Sq. Ft.	Cooling BTUH	SEER	Full Load Hours	Electric Consumption
0 1 2 3 4 5	400-550 500-700 700-900 1000-1200 1300-1500 1600-2000	7,396 10,443 13,835 18,445 23,886 28,468	10 10 10 10 10 10	240 240 240 240 240 240 240	222 295 376 487 618 728

Air Conditioning Consumption Levels

Single

Bedrooms	Sq. Ft.	Cooling BTUH	SEER	Full Load Hours	Electric Consumption
0 1 2 3 4 5	400-550 500-700 700-900 1000-1200 1300-1500 1600-2000	8,177 11,630 15,413 20,438 26,258 31,161	10 10 10 10 10 10	240 240 240 240 240 240 240	241 324 414 535 675 792

Mobile Home

Bedrooms	Sq. Ft.	Cooling BTUH	SEER	Full Load Hours	Electric Consumption
0 1 2 3 4 5	400-550 500-700 700-900 1000-1200 1300-1500 1600-2000	6,547 9,035 11,655 15,678 19,705 24,657	10 10 10 10 10 10	240 240 240 240 240 240 240	202 261 324 421 517 636

High-Rise

Bedrooms	Sq. Ft.	Cooling BTUH	SEER	Full Load Hours	Electric Consumption
0 1 2 3 4 5	400-550 500-700 700-900 1000-1200 1300-1500 1600-2000	6,201 8,388 10,670 15,074 19,245 23,074	10 10 10 10 10 10	240 240 240 240 240 240 240	193 246 300 406 506 598

COOKING CONSUMPTION LEVELS

Cooking Consumption Levels and Cost Figures

	COOKING - NA	ATURAL GAS	
<u>Bedrooms</u>	Sq. Ft.	Therms per Month	Cost per <u>Month</u>
0	400-550	6	\$8
1	500-700	6	\$8
2	700-900	7	\$10
3	1000-1200	8	\$11
4	1300-1500	9	\$12
5	1600-2000	9	\$12

Based on an average cost per therm of \$1.29492

	COOKING -	ELECTRIC	
<u>Bedrooms</u>	<u>Sq. Ft.</u>	kWh per <u>Month</u>	Cost per <u>Month</u>
0	400-550	90	\$11
1	500-700	94	\$11
2	700-900	113	\$13
3	1000-1200	120	\$14
4	1300-1500	131	\$15
5	1600-2000	135	\$16

Based on an average cost per kWh of \$0.110769

	COOKING -	PROPANE	
<u>Bedrooms</u>	<u>Sq. Ft.</u>	Gallons per <u>Month</u>	Cost per <u>Month</u>
0	400-550	6	\$16
1	500-700	6	\$17
2	700-900	8	\$20
3	1000-1200	8	\$21
4	1300-1500	9	\$23
5	1600-2000	9	\$24

Based on an average cost per gallon of \$2.474

OTHER ELECTRIC CONSUMPTION LEVELS

Other Electric Consumption Levels and Cost Figures

	OTHER EL	LECTRIC	
Bedrooms	Sq. Ft.	kWh per <u>Month</u>	Cost per Month
0	400-550	171	\$28
1	500- 700	191	\$30
2	700-900	224	\$34
3	1000-1200	271	\$40
4	1300 -1500	309	\$44
5	1600-2000	378	\$52

Costs are based on an average of \$0.110769 per kWh plus a base charge of \$7.49 per month

Estimated Monthly Electrical Consumption Levels

NUMBER OF BEDROOMS	LIGHTING kWh	REFRIG kWh	TV kWh	RADIO kWh	SM.APPL. kWh	FAN (For 6 months)	TOTAL kWh
0 BR	61	19	21	4	17	2	171
I BR	81	19	21	4	17	2	191
2 BR	108	1.9	21	4	21	4	224
3 BR	149	19	21	4	25	9	271
4 BR	189	29	21	4	29	8	309
5 BR	243	29	21	4	33	0	378
Typical Value		<i>L9</i>	21	4	24		

WATER HEATER CONSUMPTION LEVELS

Domestic Hot Water Heating Consumption Levels and Cost Figures

		WATER HEATING al Gas	
<u>Bedrooms</u>	Sq. Ft.	Therms per Month	Cost per <u>Month</u>
0	400-550	9	\$12
1	500-600	12	\$16
2	700-900	15	\$20
3	1000-1200	21	\$29
4	1300 -1500	28	\$38
5	1600-2000	34	\$47

Based on an average cost per therm of \$1.29492

	DOMESTIC HOT V		
<u>Bedrooms</u>	<u>Sq. Ft.</u>	kWh per <u>Month</u>	Cost per <u>Month</u>
0	400-550	92	\$11
1	500-600	155	\$18
2	700-900	218	\$26
3	1000-1200	343	\$40
4	1300 -1500	478	\$56
5	1600-2000	611	\$72

Based on an average cost per kWh of \$0.110769

Domestic Hot Water Heating Consumption Levels and Cost Figures

		WATER HEATING	
<u>Bedrooms</u>	Sq. Ft.	Gallons per <u>Month</u>	Cost per Month
0	400-550	9	\$24
1	500-600	12	\$32
2	700-900	16	\$41
3	1000-1200	22	\$57
4	1300 -1500	29	\$75
5	1600-2000	36	\$93

Based on an average cost per gallon of \$2.474

		WATER HEATING I Oil	
<u>Bedrooms</u>	Sq. Ft.	Gallons per Month	Cost per Month
0	400-550	6	\$34
1	500-600	8	\$46
2	700-900	11	\$58
3	1000-1200	15	\$81
4	1300 -1500	20	\$107
5	1600-2000	24	\$133

Based on an average cost per gallon of \$5.12

WATER AND SEWER CONSUMPTION LEVELS

Water, Sewer and Sanitation Consumption Levels and Cost Figures

Consumption Levels and Cost Figures

		GARBAGE	\$26	\$26	\$26	\$26	\$26	\$26
		SURFACE WATER	\$16	\$16	\$16	\$16	\$16	\$16
		Soos Creek	\$75	\$75	\$75	\$75	\$75	\$75
	<u>Posts</u>	Out - City of Renton	\$126	\$126	\$126	\$126	\$126	\$126
ITATION	Sewer Costs	In - City of Renton	\$84	\$84	\$84	\$84	\$84	\$84
SEWERAND SAN		SEWER USAGE	2	4	9	6	13	17
WATER,		Out - City of Renton	\$36	\$43	\$51	\$72	\$68	\$122
	Costs	Soos Creek	\$22	\$26	\$32	\$49	\$70	\$92
	Water Costs	In - City of Renton	\$24	\$29	\$34	\$48	\$64	\$81
		WATER CONSUMPTION	2	4	9	6	13	17
		NUMBER OF BEDROOMS	0 BR	1 BR	2 BR	3 BR	4 BR	5 BR

Water, Sewer and Sanitation Consumption Levels and Cost Figures

Gross Water Consumption

Type Occupan		Toilet Shower	Shower	Dishes	Clothes	Ceeking	Hands	Other	Gal/Day	Gal/Month	CCF/Month
0 BR	1.00	25.00	15.00	1.50	2.00	0.30	00.1	1.00	45.80	1,393	1.86
I BR	2.00	20.00	30.00	3.00	4.00	09:0	2.00	2.00	91.60	2,786	3.72
2 BR	3.00	75.00	45.00	4.50	90.9	06.0	3.00	3.00	137.40	4,179	5.59
3 BR	5.00	125.00	75.00	7.50	10.00	1.50	5.00	5.00	229.00	6,965	9,31
4 BR	7.00	175.00	105.00	10.50	14.00	2.10	7.00	7.00	320,60	9,752	13.04
5 BR	90.6	225.00	135.00	13.50	18.00	2.70	00.6	9.00	412.20	12,538	16.76

Type	Gallons	Times	Usage	Type Gallons Times Usage
Toilet Flush	5	X	5	Flushes per person per day
Shower	115	×		Showers per person per day
Dishload	3	×	0.5	Dishloads per person per day
Laundry	10	×	0.2	Clothesloads per person per day
Meal	0.1	×	3	Meals per person per day
Handwashing	0.1	×	10	Handwashings per person per day
Other	,	×		per person per day

APPENDICES

APPENDIX A. – HEATING FORMULAS AND ASSUMPTIONS

Heating Consumption Levels

The following formulas were used in the calculation of the overall heat loss for each unit type and size. These formulas were taken from Modern Heating, Ventilating and Air Conditioning by George E. Clifford.

HEAT LOSS FORMULATIONS

1. Roof/Ceiling Loss

(Roof Area) x (Roof/Ceiling "U" Factor) x Delta T = Btuh

2. Wall Loss

(Wall Area) x (Wall "U" Factor) x Delta T = Btuh

3. Window Loss

(Window Area) x (Window "U" Factor) x Delta T = Btuh

4. <u>Door Loss</u>

(Door Area) x (Door "U" Factor) x Delta T = Btuh

5. <u>Crack Loss Formulations</u>

Crack Method for Windows and Doors Wind Velocity - 15 mph

Crack Infiltration Factor (CFM/LF) x Crack Length (LF) x Delta T(F) x 1.08 BTUH-F/CFM

6. Perimeter Heat Loss

(Exterior Perimeter Foot Length) x (Perimeter Factor) = Btuh

Heating Formulations Variable Values

The following page contains the formulation used to calculate the Annual Heating Load for each unit type and size. All the variables and constants are defined. The formula and all of the constants were adopted from <u>Heating</u>, <u>Ventilating</u> and <u>Air Conditioning</u> by George E. Clifford.

1. Calculation of Annual Heating Load

$$E = \frac{(H \times D \times 24hours)}{(T \times K \times V)} \times (cd)$$

Where:

E =Fuel or energy consumption for the estimate period, Btu

H = Design heat loss, including infiltration and ventilation, Btu/h

D = Number of heating degree days for the estimated period

T = Design temperature difference in degrees F

K = A correction factor that includes the effects of rated full load efficiency, port load performance, oversizing and energy conservation devices

V = Heating value of fuel, units consistent with H and E

cd = Empirical correction factor for heating effect versus degrees days

H= Is calculated by the heat-load tables and is based upon the U-values determined by the physical survey of each unit type

2. Information for Calculations

- ➤ Winter Design Temperature Difference is 38.2° F based on a Design Dry Bulb of 29.8° F for Seattle, Washington and a Design Temperature of 68° F. Occupants, appliances, and heat from the sun supply the remaining heat necessary to reach 72° F.
- ➤ Summer Design Temperature Difference is 5° F based on a Design Dry Bulb of 80° F for Seattle, Washington and a Design Temperature of 75° F.
- K value for a conventional, atmospherically vented natural gas furnace is 65%.
- ➤ Heating Degree-Day Value is 4376 based on data for Seattle, Washington.
- ➤ Cooling Degree-Day Value is 265 based on data for Seattle, Washington.

Assumptions for Annual Heat Loss Calculations

Global Data

Design Temp. Diff.(F) = 38.4Heating Degree Days = 4376

Duplex

Dimensions	0	-	2	3	4	5
Perimeter Foot Length		75	85	92	104	109
Roof Area(SF)	500	625	800	950	1,200	1,325
Exterior Wall Area(SF)	454	392	428	458	200	515
Window Area(SF)	45	70	100	120	155	175
Exterior Door Area(SF)	38	38	38	38	38	38
Crack Length of Windows	40	80	100	120	140	180
Crack Length of Doors	40	40	40	40	40	40
Size of heating system	42,000	42,000	42,000	000,09	60,000	000,09

Garden

Dimensions	0	_	2	3	*	5
Perimeter Foot Length	54	19	99	78	87	92
Roof Area(SF)	475	009	700	975	1,200	1,350
Exterior Wall Area(SF)	353	382	391	466	500	522
Window Area(SF)	45	70	100	120	155	175
Exterior Door Area(SF)	38	38	38	38	38	38
Crack Length of Windows	40	80	100	120	140	081
Crack Length of Doors	40	40	40	40	40	40
Size of heating system	42,000	42,000	42,000	000'09	60,000	000'09

Assumptions for Annual Heat Loss Calculations

High-Rise

Perimeter Foot Length Roof Area(SF)						
Roof Area(SF)	0	0	0	0	0	0
	0	0	0	0	0	0
Exterior Wall Area(SF)		220	249	267	276	326
Window Area(SF)		58	73	100	122	136
Exterior Door Area(SF)	20	20	20	20	20	20
Crack Length of Windows			98	105	128	142
Crack Length of Doors	20		20	20	20	20
Size of heating system 42.		42,000 4	2,000	60,000	000'09	60,000

Mobile Home

Dimensions	0	1	2	3	+	5
Perimeter Foot Length	68	93	101	109	110	115
Roof Area(SF)	325	400	550	750	800	1,000
Exterior Wall Area(SF)	498	543	634	746	757	829
Window Area(SF)	4	59	78	92	110	145
Exterior Door Area(SF)	38	38	38	38	38	38
Crack Length of Windows	35	51	65	80	95	120
Crack Length of Doors	40	40	40	40	40	40
Size of heating system	36,000	36,000	36,000	44,000	44,000	44,000

Single Family

Dimensions	0_	1	2	3	4	5
Perimeter Foot Length	86	110	114	122	124	126
Roof Area(SF)	009	750	925	1,225	1,400	1,525
Exterior Wall Area(SF)	069	751	810	932	996	992
Window Area(SF)	56	88	125	150	194	220
Exterior Door Area(SF)	38	38	38	38	38	38
Crack Length of Windows	56	104	128	152	184	195
Crack Length of Doors	40	40	40	40	40	40
Size of heating system	42,000	42,000	000'09	60,000	80,000	80,000

Assumptions for Annual Heat Loss Calculations

Townhouse

Dimensions	0	1	2	3	4	5
Perimeter Foot Length	40	43	48	53	65	99
Roof Area(SF)	250	300	375	450	550	700
Exterior Wall Area(SF)	549	585	637	691	745	845
Window Area(SF)	45	70	100	120	155	175
Exterior Door Area(SF)	38	38	38	38	38	38
Crack Length of Windows	40	80	100	120	140	180
Crack Length of Doors	40	40	40	40	40	40
Size of heating system	42,000	42,000	42,000	000'09	000'09	60,000

Minimum Standards	Coal	Electric	Heat Pump	Mobile Home	Natural Gas	ΙΙΟ	Wood
Thermal Resistance	R-Value	R-Value	R-Value		R-Value	R-Value	ı
R-value of ceiling	15.00	15.00	15.00	13.00	15.00	15.00	15.00
R value of exterior walls	9.01	9.01	9.01	66.9	9.01	9.01	
R value of windows	1.61	1.61	1.61	1.61	1.61	1.61	1.61
R value of doors	1.72	1.72	1.72	1.72	1.72	1.72	1.72
Window fit:	average	average	average	average	average	average	average
Door fit:	average	average	average	average	average	average	average

APPENDIX B. - HEAT LOAD TABLES

Back-Up Calculations - Heat Load Tables

Heat-Load Tables

The HCV Utility Allowance Study for the Renton Housing Authority produced many possible scenarios. This information has been organized, set to dollar figures, and presented in six simple forms in the Executive Summary. The following section contains sample tables for the possible scenarios. These tables contain information on the dimensions and thermal characteristics used for each heat load calculation and are organized first by bedroom size and then by fuel type and building type.

Renton Housing Authority HOUSING CHOICE VOUCHER

Unit Type: Number of Bedrooms: Heating Fuel:	Duplex 2 Natural Gas	Heating Degree Days = Design Temp. Diff.(F) = Correction Factor (CD) =	4376 38 0.62
APARTMENT DATA:			
	of Stories Per Unit:	1	
		1	
	er Linear Footage:	85	ft.
Perimet	er Factor:	17.24	Btuh/lf
Perimet	er Heat Loss:	1463.03	Btuh
Roof Sc	quare Footage:	800	sq.ft.
Roof U-	-Value:	0.067	Btuh/F-sf
Roof He	eat Loss:	2048.00	Btuh
Exterior	r Wall Area:	428	sq.ft.
Wall U-	-Value:		Btuh/F-sf
Wall He	eat Loss:	1822.97	Btuh

Window Area:100sq.ft.Window U-Value:0.62Btuh/F-sfWindow Heat Loss:2380.80Btuh

Door Area:38 sq.ft.Door U-Value:0.58 Btuh/F-sfDoor Heat Loss:846.34 Btuh

Window Crack Length: 100 ft
Infiltration Loss Factor: 0.15 CFM / Lf
Infiltration Loss: 622.08 Btuh

Door Crack Length:

Infiltration Loss Factor:

Infiltration Loss:

40 ft

0.15 CFM / Lf

248.83 Btuh

Total Apartment Heat Loss Rate: 9432.05 Btuh
Estimated Heating System Overall Efficiency: 65%
Standing Pilot? (yes or no) Yes
Pilot BTU/hr.: 500 BTU/hr.
Pilot Operating Hours: 8760 hrs/yr

Pilot Operating Hours: 8760 hrs/yr
Pilot Consumption: 4380 kBTU/yr

Heating Fuel? (Natural Gas, Electric, Propane)
Estimated Heating System Consumption:
Heating System Fan? (yes or no)
Heating Output:
Fan Size:
Fan Operating Hours:
Fan Energy:

Natural Gas

290 THERMS

Yes

27,300 Btuh

400 Watts

901 hours

360 kWh

Renton Housing Authority HOUSING CHOICE VOUCHER

Unit Type: Number of Bedroo Heating Fuel:	Garden ms: 2 Natural Gas	Heating Degree Days = Design Temp. Diff.(F) = Correction Factor (CD) =	4376 38 0.62
•		` '	
APARTMENT DA			
	mber of Stories Per Unit:	1	
	imeter Linear Footage:	66	ft.
	imeter Factor:	17.24	Btuh/lf
Per	imeter Heat Loss:	1140.45	Btuh
Roe	of Square Footage:	700	sq.ft.
	of U-Value:		Btuh/F-sf
Roc	of Heat Loss:	1792.00	
TD .	* *** *1 A		
	erior Wall Area:		sq.ft.
	Il U-Value:		Btuh/F-sf
Wa	ll Heat Loss:	1667.24	Btuh
Wi	ndow Area:	100	sq.ft.
Wi	ndow U-Value:		Btuh/F-sf
Wi	ndow Heat Loss:	2380.80	Btuh
Do	or Area:	38	sq.ft.
	or U-Value:		Btuh/F-sf
	or Heat Loss:	846.34	
	or rivat 2000.	040.54	Bluir
	ndow Crack Length:	100	ft
	Itration Loss Factor:	0.15	CFM / Lf
Infi	Itration Loss:	622.08	Btuh
Doe	or Crack Length:	40	ft
	Itration Loss Factor:		CFM / Lf
Infi	Itration Loss:	248.83	
Tot	al Apartment Heat Loss Rat	e: 7557.29	Rtuh
	imated Heating System Ove		
	nding Pilot? (yes or no)	Yes	
	ot BTU/hr.:		BTU/hr.
	ot Operating Hours:		hrs/yr
	ot Consumption:		kBTU/yr
	-		•

Heating Fuel? (Natural Gas, Electric, Propane)

Estimated Heating System Consumption:

Heating System Fan? (yes or no)

Natural Gas

241 THERMS

Yes

Heating Output: 27,300 Btuh
Fan Size: 400 Watts
Fan Operating Hours: 722 hours
Fan Energy: 289 kWh

Renton Housing Authority HOUSING CHOICE VOUCHER

		HOUSING C	HOICE VOUCHER		
Unit Type: Number of Bed Heating Fuel:	rooms:	High-Rise 2 Natural Gas	Heating Deg Design Temp Correction F	o. Diff.(F) =	4376 38 0.62
APARTMENT	DATA:				
	Number of	f Stories Per Unit:		1	
	Perimeter 1	Linear Footage:		0	ft.
	Perimeter	Factor:		17.24	Btuh/lf
	Perimeter 1	Heat Loss:		0.00	Btuh
	Roof Squa	re Footage:		0	sq.ft.
	Roof U-Va	-			Btuh/F-sf
	Roof Heat			0.00	
	Extenion II	7-11 A		240	0
	Exterior W Wall U-Va				sq.ft.
	Wall Heat				Btuh/F-sf
	wali rieal	LOSS:		1061.34	Btun
	Window A			73	sq.ft.
	Window U	I-Value:		0.62	Btuh/F-sf
	Window H	leat Loss:		1737.98	Btuh
	Door Area			20	sq.ft.
	Door U-Va	alue:			Btuh/F-sf
	Door Heat	Loss:		445.44	Btuh
	Window C	rack Length:		86	fì
		Loss Factor:			CFM / Lf
	Infiltration			534.99	
	Door Crac	k I enath:		20	A
		Loss Factor:			CFM / Lf
	Infiltration			124.42	
	Total Anar	tment Heat Loss Ra	ta:	3904.17	Dtuh
	_	Heating System Ove		65%	Dtuli
		rilot? (yes or no)	rair Efficiency.	Yes	
	Pilot BTU				BTU/hr.
		ating Hours:			hrs/yr
	Pilot Cons	-			kBTU/yr
		•			KD1 O/yl
		iel? (Natural Gas, E		Natural Gas	
		Heating System Cor			THERMS
		stem Fan? (yes or n	0)	Yes	
	Heating O	utput:		23,400	
	Fan Size:				Watts
	Fan Opera	ting Hours:			hours
	1. a.a. 1			1 = 1	1.8871

Fan Energy:

174 kWh

Renton Housing Authority

HOUSING CHOICE VOUCHER

Unit Type: Number of Bed Heating Fuel:		Mobile Home 2 Natural Gas	Heating Degro Design Temp. Correction Fa	. Diff.(F) =	4376 38 0.62
APARTMENT	· DATA·				
7 THE INDIVI		Stories Per Unit:		1	
		re Footage:		550	ft.
	Perimeter I				Btuh/lf
	Floor Heat			1265.00	
	Roof Squar	a Faataga		550	A
	Roof U-Va				sq.ft. Btuh/F-sf
	Roof Heat			1624.62	
	ROOT HOUE	1.033.		1024.02	Diun
	Exterior W	all Area:		634	sq.ft.
	Wall U-Va			0.14	Btuh/F-sf
	Wall Heat	Loss:		3483.98	Btuh
	Window A	rea:		78	sq.ft.
	Window U	-Value:			Btuh/F-sf
	Window H	eat Loss:		1857.02	
	D A			2.0	0
	Door Area: Door U-Va				sq.ft.
	Door Heat			0.38 846.34	Btuh/F-sf
	Door Heat	LU55.		840.34	Blun
	Window Ci	rack Length:		65	ft
	Infiltration	Loss Factor:		0.15	CFM / Lf
	Infiltration	Loss:		404.35	Btuh
	Door Crack	c Length:		40	ft
		Loss Factor:			CFM / Lf
	Infiltration	Loss:		248.83	Btuh
	Total Apart	tment Heat Loss Rate:		9730.14	Btuh
	•	Heating System Overa		65%	Dian
		ilot? (yes or no)		Yes	
	Pilot BTU/	,		500	BTU/hr.
	Pilot Opera	ting Hours:		8760	hrs/yr
	Pilot Consu	imption:			kBTU/yr
	Heating Fu	el? (Natural Gas, Elec	etric Propage)	Natural Gas	
		Heating System Consu			THERMS
		stem Fan? (yes or no)		Yes	A AREJESTIVELY
	Heating Ou			23,400	Btuh
	Fan Size:	•			Watts
	Fan Operat	ing Hours:		1,085	
	Fan Energy	" :		434	kWh

Renton Housing Authority HOUSING CHOICE VOUCHER

Unit Type:	Single Family	Heating Degree Days =	4376
Number of Bedrooms:	2	Design Temp. Diff.(F) =	38
Heating Fuel:	Natural Gas	Correction Factor (CD) =	0.62

APARTMENT DATA:

Number of Stories Per Unit:	1	
Perimeter Linear Footage:	114	ft.
Perimeter Factor:	17.24	Btuh/lf
Perimeter Heat Loss:	1965.59	Btuh

Roof Square Footage:	925	sq.ft.
Roof U-Value:	0.067	Btuh/F-sf
Roof Heat Loss:	2368.00	Btuh

Exterior Wall Area:	810	sq.ft.
Wall U-Value:	0.11	Btuh/F-sf
Wall Heat Loss:	3453.58	Btuh

Window Area:	125	sq.ft.
Window U-Value:	0.62	Btuh/F-sf
Window Heat Loss:	2976.00	Btuh

Door Area:	38	sq.ft.
Door U-Value:	0.58	Btuh/F-sf
Door Heat Loss:	846.34	Btuh

Window Crack Length:	128	ft
Infiltration Loss Factor:	0.15	CFM / Lf
Infiltration Loss:	796.26	Bruh

Door Crack Length:	40	ft
Infiltration Loss Factor:	0.15	CFM / Lf
Infiltration Loss:	248.83	Btuh

Total Apartment Heat Loss Rate:	12654.59 Btuh
Estimated Heating System Overall Efficiency:	65%
Standing Pilot? (yes or no)	Yes
Pilot BTU/hr.:	500 BTU/hr.
Pilot Operating Hours:	8760 hrs/yr
Pilot Consumption:	4380 kBTU/yr

Heating Fuel? (Natural Gas, Electric, Propane)	Natural Gas	
Estimated Heating System Consumption:	374 THERN	MS
Heating System Fan? (yes or no)	Yes	
Heating Output:	39,000 Btuh	
Fan Size:	400 Watts	
Fan Operating Hours:	846 hours	

338 kWh

Fan Energy:

Renton Housing Authority HOUSING CHOICE VOUCHER

HOUSING CHOICE VOUCHER					
Unit Type: Number of Bed Heating Fuel:	łrooms:	Townhouse 1 Natural Gas	Design	ng Degree Days = n Temp. Diff.(F) = ction Factor (CD) =	4376 38 0.62
APARTMENT	DATA				
AFAKTMENT		Stories Per Unit:		2	
		Linear Footage:		43	
	Perimeter I	_			Btuh/lf
	Perimeter I			746.60	
				740.00	Dian
	-	re Footage:		300	sq.ft.
	Roof U-Va			0.067	Btuh/F-sf
	Roof Heat	Loss:		768.00	Btuh
	Exterior W	all Area:		585	sq.ft.
	Wall U-Va				Btuh/F-sf
	Wall Heat			2492.74	
				, , , , , , , , , , , , , , , , , , ,	254411
	Window A			70	sq.ft.
	Window U			0.62	Btuh/F-sf
	Window H	eat Loss:		1666.56	Btuh
	Door Area	•		3.8	sq.ft.
	Door U-Va				Btuh/F-sf
	Door Heat			846.34	
				0,0,0,1	2,411
		rack Length:		80	
		Loss Factor:			CFM / Lf
	Infiltration	Loss:		497.66	Btuh
	Door Cracl	k Length:		40	ft
		Loss Factor:			CFM / Lf
	Infiltration	Loss:		248.83	Btuh
	Total Apar	tment Heat Loss R	ate:	7266.73	Rtuh
		Heating System Ov			Dun
		ilot? (yes or no)	cian Binerene,	Yes	
	Pilot BTU/				BTU/hr.
		ating Hours:			hrs/yr
	Pilot Const	-			kBTU/yr
		•			RET CTY
		el? (Natural Gas, I			
		Heating System Co			THERMS
		stem Fan? (yes or	no)	Yes	
	Heating Ou	ıtput:		27,300	
	Fan Size:				Watts
	Fan Operat	-			hours
	LON LINGTON	**		370	1-XX/1-

278 kWh

Fan Energy:

Renton Housing Authority HOUSING CHOICE VOUCHER

Unit Type:	Duplex	Heating Degree Days =	4376
Number of Bedrooms:	1	Design Temp. Diff.(F) =	38
Heating Fuel:	Electric	Correction Factor (CD) =	0.62

APARTMENT DATA:		
Number of Stories Per Unit:	1	
Perimeter Linear Footage:	75	ft.
Perimeter Factor:	17.24	Btuh/lf
Perimeter Heat Loss:	1293.15	Btuh

Roof Square Footage:	625	sq.ft.
Roof U-Value:	0.067	Btuh/F-sf
Roof Heat Loss:	1600.00	Btuh

Exterior Wall Area:	392	sq.ft.
Wall U-Value:	0.11	Btuh/F-sf
Wall Heat Loss:	1670.86	Btuh

Window Area:	70	sq.ft.
Window U-Value:	0.62	Btuh/F-sf
Window Heat Loss:	1666.56	Btuh

Door Area:	38	sq.ft.
Door U-Value:	0.58	Btuh/F-sf
Door Heat Loss:	846.34	Btuh

Window Crack Length:	80	ft
Infiltration Loss Factor:	0.15	CFM / Lf
Infiltration Loss:	497.66	Btuh

Door Crack Length:	40	ft
Infiltration Loss Factor:	0.15	CFM / Lf
Infiltration Loss:	248.83	Btuh

Total Apartment Heat Loss Rate:	7823.40 Btuh
Estimated Heating System Overall Efficiency:	95%
Standing Pilot? (yes or no)	No
Pilot BTU/hr.:	0 BTU/hr.
Pilot Operating Hours:	0 hrs/yr
Pilot Consumption:	0 kBTU/yr

Heating Fuel? (Natural Gas, Electric, Propane)	Electric
Estimated Heating System Consumption:	4,092 KWH
Heating System Fan? (yes or no)	Yes
Heating Output:	39,900 Btuh
Fan Size:	400 Watts
Fan Operating Hours:	350 hours
Fan Energy:	140 kWh

Renton Housing Authority

HOUSING CHOICE VOUCHER

Unit Type:	Garden	Heating Degree Days = Design Temp. Diff.(F) = Correction Factor (CD) =	4376
Number of Bedrooms:	1		38
Heating Fuel:	Electric		0.62
APARTMENT DATA: Number of	of Stories Per Unit:	1	

Perimeter Linear Footage:	61	ft.
Perimeter Factor:	17.24	Btuh/lf
Perimeter Heat Loss:	1055.85	Btuh
Poof Squara Footogo	600	A

Roof Square Footage:	600	sq.ft.
Roof U-Value:	0.067	Btuh/F-sf
Roof Heat Loss:	1536.00	Btuh

Exterior Wall Area:	382	sq.ft.
Wall U-Value:	0.11	Btuh/F-sf
Wall Heat Loss:	1627.80	Btuh

Window Area:	70	sq.ft.
Window U-Value:	0.62	Btuh/F-sf
Window Heat Loss:	1666.56	Btuh

Door Area:	38	sq.ft.
Door U-Value:	0.58	Btuh/F-sf
Door Heat Loss:	846.34	Btuh

Window Crack Length:	80	ft
Infiltration Loss Factor:	0.15	CFM / Lf
Infiltration Loss:	497.66	Btuh

Door Crack Length:	40	ft
Infiltration Loss Factor:	0.15	CFM / Lf
Infiltration Loss:	248.83	Btuh

Total Apartment Heat Loss Rate:	6423.19 Btuh
Estimated Heating System Overall Efficiency:	95%
Standing Pilot? (yes or no)	No
Pilot BTU/hr.:	0 BTU/hr.
Pilot Operating Hours:	0 hrs/yr
Pilot Consumption:	0 kBTU/yr

Heating Fuel? (Natural Gas, Electric, Propane)	Electric
Estimated Heating System Consumption:	3,359 kWh
Heating System Fan? (yes or no)	Yes
Heating Output:	39,900 Btuh
Fan Size:	400 Watts
Fan Operating Hours:	287 hours
Fan Energy:	115 kWh

Renton Housing Authority HOUSING CHOICE VOUCHER

Unit Type:	High-Rise	Heating Degree Days =	4376
Number of Bed	drooms: 1	Design Temp. Diff. $(F) =$	38
Heating Fuel:	Electric	Correction Factor (CD) =	0.62
APARTMENT	DATA:		
	Number of Stories Per Unit:	1	
	Perimeter Linear Footage:	0	ft.
	Perimeter Factor:	17.24	Btuh/lf
	Perimeter Heat Loss:	0.00	Btuh
	Roof Square Footage:	0	sq.ft.
	Roof U-Value:		Btuh/F-sf
	Roof Heat Loss:	0.00	Btuh
	Exterior Wall Area:	220	sq.ft.
	Wall U-Value:	0.11	Btuh/F-sf
	Wall Heat Loss:	937.73	Btuh
	Window Area:	58	sq.ft.
	Window U-Value:	0.62	Btuh/F-sf
	Window Heat Loss:	1380.86	Btuh
	Door Area:	20	sq.ft.
	Door U-Value:	0.58	Btuh/F-sf
	Door Heat Loss:	445.44	Btuh
	Window Crack Length:	63	ft
	Infiltration Loss Factor:	0.15	CFM / Lf
	Infiltration Loss:	391.91	Btuh
	Door Crack Length:	20	ft
	Infiltration Loss Factor:	0.15	CFM / Lf
	Infiltration Loss:	124.42	Btuh

Total Apartment Heat Loss Rate:

Standing Pilot? (yes or no)

Pilot BTU/hr.:

Estimated Heating System Overall Efficiency:

Pilot Operating Hours:	0	hrs/yr
Pilot Consumption:	0	kBTU/yr
Heating Fuel? (Natural Gas, Electric, Propane)	Electric	
Estimated Heating System Consumption:	1,716	kWh
Heating System Fan? (yes or no)	Yes	
Heating Output:	34,200	Btuh

3280.36 Btuh

95%

No

0 BTU/hr.

Fan Size: 400 Watts
Fan Operating Hours: 171 hours
Fan Energy: 68 kWh

Renton Housing Authority

HOUSING CHOICE VOUCHER

HOUSING CHOICE VOUCHER			
Unit Type: Number of Bedroon Heating Fuel:	Mobile Home ns: 2 Electric	Heating Degree Days = Design Temp. Diff.(F) = Correction Factor (CD) =	4376 38 0.62
Floo	nber of Stories Per Unit: or Square Footage:		sq. ft.
	meter Factor: or Heat Loss:	2.30 1265.00	Btuh/lf Btuh
Roo	f Square Footage: f U-Value: f Heat Loss:		sq.ft. Btuh/F-sf Btuh
Wal	erior Wall Area: Il U-Value: Il Heat Loss:		sq.ft. Btuh/F-sf Btuh
Win	ndow Area: ndow U-Value: ndow Heat Loss:		sq.ft. Btuh/F-sf Btuh
Doo	or Area: or U-Value: or Heat Loss:		sq.ft. Btuh/F-sf Btuh
Infil	dow Crack Length: tration Loss Factor: tration Loss:	65 0.15 404.35	CFM / Lf
Infil	or Crack Length: tration Loss Factor: tration Loss:	40 0.15 248.83	CFM / Lf
Esti Stan Pilo Pilo	al Apartment Heat Loss Rate mated Heating System Overa ding Pilot? (yes or no) t BTU/hr.: t Operating Hours: t Consumption:	All Efficiency: 95% No 0 0	Btuh BTU/hr. hrs/yr kBTU/yr
Hea Esti Hea Hea Fan Fan	ting Fuel? (Natural Gas, Elemated Heating System Consting System Fan? (yes or no) ting Output: Size: Operating Hours: Energy:	ctric, Propane) Electric umption: 5,089 Yes 34,200 400 508	kWh

Renton Housing Authority

HOUSING CHOICE VOUCHER

Unit Type:	Single Family	Heating Degree Days =	4376
Number of Bedrooms:	2	Design Temp. Diff.(F) =	38
Heating Fuel:	Electric	Correction Factor (CD) =	0.62
APARTMENT DATA:	of Stories Der Unit	1	

Number of Stories Fer Unit.	1	
Perimeter Linear Footage:	114	ft.
Perimeter Factor:	17.24	Btuh/lf
Perimeter Heat Loss:	1965.59	Btuh

Roof Square Footage:925 sq.ft.Roof U-Value:0.067 Btuh/F-sfRoof Heat Loss:2368.00 Btuh

Exterior Wall Area: 810 sq.ft.
Wall U-Value: 0.11 Btuh/F-sf
Wall Heat Loss: 3453.58 Btuh

Window Area:125sq.ft.Window U-Value:0.62Btuh/F-sfWindow Heat Loss:2976.00Btuh

Door Area:38sq.ft.Door U-Value:0.58Btuh/F-sfDoor Heat Loss:846.34Btuh

Window Crack Length: 128 ft

Infiltration Loss Factor: 0.15 CFM / Lf Infiltration Loss: 796.26 Btuh

Door Crack Length: 40 ft

Infiltration Loss Factor:0.15 CFM / LfInfiltration Loss:248.83 Btuh

Total Apartment Heat Loss Rate: 12654.59 Btuh Estimated Heating System Overall Efficiency: 95% Standing Pilot? (yes or no) No

Pilot BTU/hr.:0BTU/hr.Pilot Operating Hours:0hrs/yrPilot Consumption:0kBTU/yr

Heating Fuel? (Natural Gas, Electric, Propane)
Estimated Heating System Consumption:
Heating System Fan? (yes or no)
Heating Output:
Fan Size:
Fan Operating Hours:
Fan Energy:

Electric

6,618 KWH

Yes

57,000 Btuh

400 Watts

396 hours

Fan Energy:

158 kWh

Renton Housing Authority HOUSING CHOICE VOUCHER

Unit Type:	Townhouse	Heating Degree Days =	4376
Number of Bedrooms:	2	Design Temp. Diff. $(F) =$	38
Heating Fuel:	Electric	Correction Factor (CD) =	0.62

APARTMENT DATA:

Number of Stories Per Unit:	2	
Perimeter Linear Footage:	48	ft.
Perimeter Factor:	17.24	Btuh/lf
Perimeter Heat Loss:	834.72	Btuh

Roof Square Footage:	375	sq.ft.
Roof U-Value:	0.067	Btuh/F-sf
Roof Heat Loss:	960.00	Btuh

Exterior Wall Area:	637	sq.ft.
Wall U-Value:	0.11	Btuh/F-sf
Wall Heat Loss:	2713.43	Btuh

Window Area:	100	sq.ft.
Window U-Value:	0.62	Btuh/F-sf
Window Heat Loss:	2380.80	Btuh

Door Area:	38	sq.ft.
Door U-Value:	0.58	Btuh/F-sf
Door Heat Loss:	846 34	Rtuh

Window Crack Length:	100	ft
Infiltration Loss Factor:	0.15	CFM/If

Infiltration Loss Factor: 0.15 CFM/L Infiltration Loss: 622.08 Btuh

Door Crack Length: 40 ft

Infiltration Loss Factor: 0.15 CFM / Lf Infiltration Loss: 248.83 Btuh

Total Apartment Heat Loss Rate: 8606.20 Btuh Estimated Heating System Overall Efficiency: 95% Standing Pilot? (yes or no) No

Pilot BTU/hr.:0BTU/hr.Pilot Operating Hours:0hrs/yrPilot Consumption:0kBTU/yr

Heating Fuel? (Natural Gas, Electric, Propane)	Electric
Estimated Heating System Consumption:	4,501 KWH
Heating System Fan? (yes or no)	Yes
Heating Output:	39,900 Btuh
Fan Size:	400 Watts
Fan Operating Hours:	385 hours
Fan Energy:	154 kWh

Renton Housing Authority HOUSING CHOICE VOUCHER

Unit Type: Number of Bedi Heating Fuel:	rooms:	Duplex 2 Heat Pump	Heating Degree Design Temp. D Correction Factor	iff.(F) =	4376 38 0.62
APARTMENT	DATA:				
		Stories Per Unit:		1	
	Perimeter L	inear Footage:		85	ft.
	Perimeter F			17.24	Btuh/lf
	Perimeter F	leat Loss:		1463.03	Btuh
	Roof Squar	e Footage:		800	sq.ft.
	Roof U-Val				Btuh/F-sf
	Roof Heat l	Loss:		2048.00	Btuh
	Exterior Wa	all Area:		428	sa.ft.
	Wall U-Val	ue:			Btuh/F-sf
	Wall Heat I	Loss:		1822.97	Btuh
	Window Ar	ea:		100	sq.ft.
	Window U-	Value:			Btuh/F-sf
	Window He	eat Loss:		2380.80	Btuh
	Door Area:			38	sq.ft.
	Door U-Va	lue:			Btuh/F-sf
	Door Heat	Loss:		846.34	Btuh
	Window Cr	ack Length:		100	ft
	Infiltration	Loss Factor:		0.15	CFM / Lf
	Infiltration	Loss:		622.08	Btuh
	Door Crack	Length:		40	ft
		Loss Factor:			CFM / Lf
	Infiltration	Loss:		248.83	Btuh
	•	ment Heat Loss Rate:		9432.05	Btuh
		leating System Overal	Il Efficiency:	170%	
	_	lot? (yes or no)		No	
	Pilot BTU/I				BTU/hr.
	Pilot Opera	-			hrs/yr
	Pilot Consu	mption:		0	kBTU/yr
	Heating Fu	el? (Natural Gas, Elec	tric, Propane) I	leat Pump	
		leating System Consu	mption:	2,757	KWH
		stem Fan? (yes or no)		Yes	
	Heating Ou	tput:		63,000	
	Fan Size:	la a II a			Watts
	Fan Operati	-			hours
	Fan Energy	•		60	kWh

Renton Housing Authority HOUSING CHOICE VOUCHER

HOUSING CHOICE VOUCHER						
	Unit Type: Number of Bed Heating Fuel:	drooms:	Garden 3 Heat Pump	D	eating Degree Days = lesign Temp. Diff.(F) = orrection Factor (CD) =	4376 38 0.62
	APARTMENT	DATA:				
		Number of	Stories Per Unit:		1	
		Perimeter I	Linear Footage:		78	ft.
		Perimeter I	Factor:		17.24	Btuh/lf
		Perimeter I	Heat Loss:		1345.95	Btuh
		Roof Squar	re Footage:		975	sq.ft.
		Roof U-Va	lue:			Btuh/F-sf
		Roof Heat	Loss:		2496.00	
		Exterior W	all Area:		466	sq.ft.
		Wall U-Va				Btuh/F-sf
		Wall Heat			1988.41	
		Window A	raa.		120	aa fi
		Window A Window U				sq.ft. Btuh/F-sf
		Window B			2856.96	
		Door Area:				sq.ft.
		Door U-Va				Btuh/F-sf
		Door Heat	Loss:		846.34	Btuh
		Window C	rack Length:		120	ft
			Loss Factor:		0.15	CFM / Lf
		Infiltration	Loss:		746.50	Btuh
		Door Crack	c Length:		40	ft
			Loss Factor:			CFM / Lf
		Infiltration	Loss:		248.83	Btuh
		Total Apar	tment Heat Loss R	ate:	9183.03	Btuh
		-	Heating System Ov			
			ilot? (yes or no)		No	
		Pilot BTU/	hr.:		0	BTU/hr.
			iting Hours:		0	hrs/yr
		Pilot Consu	ımption:		0	kBTU/yr
		Heating Fu	el? (Natural Gas, I	Electric. Pr	ropane) Heat Pump	
		_	Heating System Co			KWH
			stem Fan? (yes or		Yes	
		Heating Ou	1.0	-	90,000	
		Fon Cimo			100	337 44

Fan Size:

Fan Energy:

Fan Operating Hours:

400 Watts

102 hours

41 kWh

Renton Housing Authority HOUSING CHOICE VOUCHER

		HOUSING	CHOICE	VOUCHER	
Unit Type: Number of Bed Heating Fuel:	lrooms:	High-Rise 3 Heat Pump	I	Heating Degree Days = Design Temp. Diff.(F) = Correction Factor (CD) =	4376 38 0.62
APARTMENT	DATA:				
	Number of	Stories Per Unit:			1
	Perimeter 1	Linear Footage:		0	ft.
	Perimeter	Factor:		17.24	Btuh/lf
	Perimeter 1	Heat Loss:		0.00	Btuh
	Roof Squa	re Footage:		0	sq.ft.
	Roof U-Va	~			Btuh/F-sf
	Roof Heat	Loss:			Btuh
	Exterior W	/all Area·		267	sq.ft.
	Wall U-Va				Btuh/F-sf
	Wall Heat			1138.06	
	Window A	raa:		100	- A
	Window A				sq.ft. Btuh/F-sf
	Window C			2380.80	
	William 11	icut Eoss.		2300.00	Dian
	Door Area				sq.ft.
	Door U-Va			0.58	Btuh/F-sf
	Door Heat	Loss:		445.44	Btuh
	Window C	rack Length:		105	ft
	Infiltration	Loss Factor:		0.15	CFM / Lf
	Infiltration	Loss:		653.18	Btuh
	Door Crac	k Length:		20	ft
		Loss Factor:		0.15	CFM / Lf
	Infiltration	Loss:		124.42	Btuh
	Total Apar	tment Heat Loss	Rate:	4741.90	Btuh
	-	Heating System C			
		ilot? (yes or no)		N	0
	Pilot BTU	/hr.:		0	BTU/hr.
	Pilot Opera	ating Hours:		0	hrs/yr
	Pilot Cons	umption:		0	kBTU/yr
	Heating Fu	el? (Natural Gas,	Electric. F	Propane) Heat Pum	o
		Heating System C		=	KWH
		stem Fan? (yes or	•	Ye	
	Heating O		,	66,000	
	Fan Size:	-			Watts
	E 0				•

72 hours29 kWh

Fan Operating Hours: Fan Energy:

Renton Housing Authority

HOUSING CHOICE VOUCHER

		HOUSING	CHOICE	VOUCHER		
Unit Type: Number of Bedroo Heating Fuel:	oms: 3	Mobile Home Heat Pump]	Heating Degree Design Temp. E Correction Fact	Diff.(F) =	4376 38 0.62
FI Pe		ctor:				sq. ft. Btuh/lf Btuh
Ro	oof Square oof U-Valu oof Heat Lo	e:			750	sq.ft. Btuh/F-sf
W	xterior Wal /all U-Valu /all Heat Lo	e:				sq.ft. Btuh/F-sf Btuh
W	indow Are indow U-Vindow Hea	'alue:				sq.ft. Btuh/F-sf Btuh
De	oor Area: oor U-Valu oor Heat Lo					sq.ft. Btuh/F-sf Btuh
In	indow Crae filtration L filtration L	oss Factor:			80 0.15 497.66	CFM / Lf
In	oor Crack I filtration L filtration L	oss Factor:			40 0.15 248.83	CFM / Lf
Es St Pi Pi	stimated He	ng Hours:		iciency:	0	Btuh BTU/hr. hrs/yr kBTU/yr
Es He He Fa Fa	stimated He		onsumptio	-	179	

Renton Housing Authority HOUSING CHOICE VOUCHER

		HOUSING	CHOICE V	OUCHER	
Unit Type: Number of Bed Heating Fuel:	Irooms:	Single Family 3 Heat Pump	D	leating Degree Days = besign Temp. Diff.(F) = forrection Factor (CD) =	4376 38 0.62
APARTMENT	Number of				l 2 ft. 1 Btuh/lf 2 Btuh
	Roof Squar Roof U-Va Roof Heat	lue:			sq.ft. Btuh/F-sf Btuh
	Exterior W Wall U-Va Wall Heat	lue:			2 sq.ft. Btuh/F-sf Btuh
	Window A Window U Window H	-Value:			sq.ft. Btuh/F-sf Btuh
	Door Area: Door U-Va Door Heat	lue:		0.58	sq.ft. Btuh/F-sf Btuh
		rack Length: Loss Factor: Loss:		0.15	ft CFM/Lf Btuh
	Door Crack Infiltration Infiltration	Loss Factor:		0.15	oft CFM/Lf Btuh
	Estimated I Standing Pi	ement Heat Loss R Heating System Or Hot? (yes or no)		14824.01 ciency: 1709 N	% 0
	Pilot BTU/ Pilot Opera Pilot Consu	ting Hours:		((
	Estimated I Heating Sy	el? (Natural Gas, I Heating System Co stem Fan? (yes or	onsumption	1. 4,332 Ye	KWH
	Heating Ou Fan Size: Fan Operat	ing Hours:		400	Btuh Watts hours

66 kWh

Fan Energy:

Renton Housing Authority HOUSING CHOICE VOUCHER

Unit Type: Number of Bedrooms: Heating Fuel:	Townhouse 2 Heat Pump	Heating Degree Days = Design Temp. Diff.(F) = Correction Factor (CD) =	4376 38 0.62
APARTMENT DATA			
Numbe	er of Stories Per Unit:	2	
Perime	ter Linear Footage:	48	ft.
Perime	ter Factor:	17.24	Btuh/lf
Perime	ter Heat Loss:	834.72	Btuh
Roof S	quare Footage:	375	sq.ft.
Roof U	J-Value:		Btuh/F-sf
Roof H	leat Loss:	960.00	Btuh
Exterio	or Wall Area:	637	sq.ft.
Wall U	-Value:		Btuh/F-sf
Wall H	leat Loss:	2713.43	Btuh
Windo	w Area:	100	sq.ft.
Windo	w U-Value:		Btuh/F-sf
Windo	w Heat Loss:	2380.80	Btuh
Door A	area:	38	sq.ft.
Door U	J-Value:	0.58	Btuh/F-sf
Door H	leat Loss:	846.34	Btuh
Windo	w Crack Length:	100	ft
Infiltra	tion Loss Factor:	0.15	CFM / Lf
Infiltra	tion Loss:	622.08	Btuh
Door C	Crack Length:	40	ft
	tion Loss Factor:		CFM / Lf
Infiltra	tion Loss:	248.83	Btuh
	Apartment Heat Loss Rate		
	ted Heating System Overa	Ill Efficiency: 170%	
	ng Pilot? (yes or no)	No	
	TU/hr.:	0	BTU/hr.
	perating Hours:	0	hrs/yr
Pilot C	onsumption:	0	kBTU/yr

Heating Fuel? (Natural Gas, Electric, Propane)	Heat Pump
Estimated Heating System Consumption:	2,515 KWH
Heating System Fan? (yes or no)	Yes
Heating Output:	63,000 Btuh
Fan Size:	400 Watts
Fan Operating Hours:	136 hours
Fan Energy:	54 kWh

Renton Housing Authority HOUSING CHOICE VOUCHER

	noesh to c	SHOICE VOCCHER	
Unit Type:	Duplex	Heating Degree Days =	4376
Number of Bedroom		Design Temp. Diff.(F) =	38
Heating Fuel:	Fuel Oil	Correction Factor (CD) =	0.62
APARTMENT DAT			
	ber of Stories Per Unit:	1	
	neter Linear Footage: neter Factor:		ft.
	meter Heat Loss:		Btuh/lf
I CI II	neter freat Loss.	1463.03	Bun
Roof	Square Footage:	800	sq.ft.
Roof	U-Value:		Btuh/F-sf
Roof	Heat Loss:	2048.00	Btuh
Fyte	rior Wall Area:	428	sq.ft.
	U-Value:		Sq.n. Btuh/F-sf
	Heat Loss:	1822.97	
** 4,1	Ticat Loss.	1622.97	Dun
Wind	dow Area:	100	sq.ft.
	dow U-Value:	0.62	Btuh/F-sf
Wind	dow Heat Loss:	2380.80	Btuh
Door	: Area:	38	sq.ft.
	: U-Value:		Btuh/F-sf
Door	Heat Loss:	846.34	
Wind	dow Crack Length:	100	fr
	ration Loss Factor:		CFM / Lf
	ration Loss:	622.08	
***************************************	Autor 2000.	022.00	Bun
	· Crack Length:	40	
	ration Loss Factor:		CFM / Lf
intitt	ration Loss:	248.83	Btuh
Tota	l Apartment Heat Loss R	ate: 9432.05	Btuh
Estin	nated Heating System Ov	verall Efficiency: 55%	•
Stand	ding Pilot? (yes or no)	Yes	1
Pilot	BTU/hr.:	500	BTU/hr.
Pilot	Operating Hours:	8760	hrs/yr
Pilot	Consumption:	4380	kBTU/yr
Heat	ing Fuel? (Natural Gas, E	Electric, Propane) Fuel Oil	
	nated Heating System Co	- '	GALLONS
	ing System Fan? (yes or i		
	ing Output:	23,100	
Fan S	• .		Watts
	Operating Hours:		hours
	Sperating Hours.	1,239	110413

504 kWh

Fan Energy:

Renton Housing Authority

HOUSING CHOICE VOUCHER

HOUSING CHOICE VOUCHER						
Unit Type: Number of Bed	drooms:	Garden 2		Heating Degree Days Design Temp. Diff.(F		4376 38
Heating Fuel:		Fuel Oil	•	Correction Factor (Cl	D) =	0.62
APARTMENT	DATA:					
	Number of	Stories Per Unit:			1	
	Perimeter I	Linear Footage:			66	ft.
	Perimeter I	Factor:		1	7.24	Btuh/lf
	Perimeter I	Heat Loss:		114	0.45	Btuh
	Roof Squar	re Footage:			700	sq.ft.
	Roof U-Va	ılue:		0	.067	Btuh/F-sf
	Roof Heat	Loss:		179	2.00	Btuh
	Exterior W	all Area:			391	sq.ft.
	Wall U-Va	lue:				Btuh/F-sf
	Wall Heat	Loss:		166	7.24	Btuh
	Window A	rea:			100	sq.ft.
	Window U	-Value:			0.62	Btuh/F-sf
	Window H	eat Loss:		238	0.80	Btuh
	Door Area	:			38	sq.ft.
	Door U-Va	alue:				Btuh/F-sf
	Door Heat	Loss:		84	6.34	Btuh
	Window C	rack Length:			100	ft
		Loss Factor:			0.15	CFM / Lf
	Infiltration	Loss:		62	2.08	Btuh
	Door Crack				40	ft
		Loss Factor:				CFM / Lf
	Infiltration	Loss:		24	8.83	Btuh
	Total Apar	tment Heat Loss F	Rate:	755	7.29	Btuh
	Estimated 1	Heating System O	verall Eff	iciency:	55%	
	Standing P	ilot? (yes or no)			Yes	
	Pilot BTU/	hr.:			500	BTU/hr.
	Pilot Opera	ating Hours:		:	3760	hrs/yr
	Pilot Const	umption:		4	4380	kBTU/yr
	Heating Fu	iel? (Natural Gas,	Electric,	Propane) Fu	el Oil	
	Estimated 1	Heating System C	onsumpti	on:	200	GALLONS
		stem Fan? (yes or	no)		Yes	
	Heating Ou	ıtput:		23	,100	Btuh
	Fan Size:				400	Watts
	F O	. * * * *			~ ~ ~	

1,009 hours

404 kWh

Fan Operating Hours:

Fan Energy:

Renton Housing Authority

HOUSING CHOICE VOUCHER

Unit Type:						
APARTMENT DATA: Number of Stories Per Unit: 1 1 1 1 1 1 1 1 1	Number of Bed	irooms:	2	Desi	gn Temp. Diff.(F) =	38
Number of Stories Per Unit: Perimeter Linear Footage: 0 ft. Perimeter Factor: 17.24 Btuh/lf Perimeter Factor: 17.24 Btuh/lf Perimeter Heat Loss: 0.00 Btuh Roof Square Footage: 0 sq.ft. Roof U-Value: 0.067 Btuh/F-sf Roof Heat Loss: 0.00 Btuh Exterior Wall Area: 249 sq.ft. Wall U-Value: 0.11 Btuh/F-sf Wall Heat Loss: 1061.34 Btuh Window Area: 73 sq.ft. Window Area: 73 sq.ft. Window Heat Loss: 1061.34 Btuh Door Area: 0.62 Btuh/F-sf Window Heat Loss: 1737.98 Btuh Door Area: 0.58 Btuh/F-sf Door U-Value: 0.58 Btuh/F-sf Door Heat Loss: 445.44 Btuh Window Crack Length: 1nfiltration Loss Factor: 0.15 CFM / Lf Infiltration Loss: 124.42 Btuh Total Apartment Heat Loss Rate: 3904.17 Btuh Estimated Heating System Overall Efficiency: 55% Standing Pilot? (yes or no) Yes Pilot BTU/hr. Pilot Operating Hours: 8760 hrs/yr Pilot Consumption: 4380 kBTU/yr Heating System Fan? (yes or no) Heating System Fan? (yes or no) Yes Heating System Fan? (yes or no) Yes Fuel Oil Factions Factor: 118 GALLONS Yes Heating System Fan? (yes or no) Watts Fan Size: 400 Watts Fan Operating Hours: 608 hours	Č					~
Roof Square Footage:	APARTMENT	Number of Perimeter I Perimeter I	Linear Footage: Factor:		0	
Roof U-Value: 0.067 Btuh/F-sf Roof Heat Loss: 0.00 Btuh Exterior Wall Area: 249 sq.ft. Wall U-Value: 0.11 Btuh/F-sf Wall Heat Loss: 1061.34 Btuh Window Area: 73 sq.ft. Window U-Value: 0.62 Btuh/F-sf Window Heat Loss: 1737.98 Btuh Door Area: 20 sq.ft. Door U-Value: 0.58 Btuh/F-sf Door Heat Loss: 445.44 Btuh Window Crack Length: 86 ft Infiltration Loss Factor: 0.15 CFM / Lf Infiltration Loss: 124.42 Btuh Total Apartment Heat Loss Rate: 3904.17 Btuh Estimated Heating System Overall Efficiency: 55% Standing Pilot? (yes or no) Yes Pilot		Perimeter I	Heat Loss:		0.00	Btuh
Wall U-Value: 0.11 Btuh/F-sf Wall Heat Loss: 1061.34 Btuh Window Area: 73 sq.ft. Window U-Value: 0.62 Btuh/F-sf Window Heat Loss: 1737.98 Btuh Door U-Value: 0.58 Btuh/F-sf Door Heat Loss: 445.44 Btuh Window Crack Length: 86 ft Infiltration Loss Factor: 0.15 CFM / Lf Infiltration Loss: 534.99 Btuh Door Crack Length: 20 ft Infiltration Loss Factor: 0.15 CFM / Lf Infiltration Loss: 124.42 Btuh Total Apartment Heat Loss Rate: 3904.17 Btuh Estimated Heating System Overall Efficiency: 55% Standing Pilot? (yes or no) Yes Pilot Druhr: 500 BTU/hr. Pilot Consumption: 4380 kBTU/yr Heating Fuel? (Natural Gas, Electric, Propane) Fuel Oil Estimated Heating System Consumption: Fuel Oil Heating Output: 19,800 Btuh Fan Size: 400 Watts Fan Operating Hours: 608 hours		Roof U-Va	lue:		0.067	Btuh/F-sf
Window U-Value: Window Heat Loss: Door Area: Door U-Value: Door U-Value: Door Heat Loss: Window Crack Length: Infiltration Loss Factor: Infiltration Loss: Total Apartment Heat Loss Rate: Estimated Heating System Overall Efficiency: Standing Pilot? (yes or no) Pilot BTU/hr.: Pilot Operating Hours: Pilot Consumption: Heating Fuel? (Natural Gas, Electric, Propane) Estimated Heating System Consumption: Heating Output: Fan Size: Fan Operating Hours:		Wall U-Va	lue:		0.11	Btuh/F-sf
Door U-Value: Door Heat Loss: 445.44 Btuh Window Crack Length: Infiltration Loss Factor: Infiltration Loss: 534.99 Btuh Door Crack Length: Infiltration Loss Factor: Infiltration Loss Factor: Infiltration Loss: 534.99 Btuh Door Crack Length: Infiltration Loss Factor: Infiltration Loss: 124.42 Btuh Total Apartment Heat Loss Rate: Estimated Heating System Overall Efficiency: Standing Pilot? (yes or no) Pilot BTU/hr.: Pilot Operating Hours: Pilot Consumption: Heating Fuel? (Natural Gas, Electric, Propane) Estimated Heating System Consumption: Heating System Fan? (yes or no) Heating Output: Fan Size: Fan Operating Hours: Fan Ope		Window U	-Value:		0.62	Btuh/F-sf
Infiltration Loss Factor: Infiltration Loss: Door Crack Length: Infiltration Loss Factor: Infiltration Loss Factor: Infiltration Loss Factor: Infiltration Loss: Infiltration Loss: Infiltration Loss: Infiltration Loss: Infiltration Loss: Infiltration Loss: Infiltration Loss Factor: Infiltration Loss: Infiltration Loss Factor: Infiltration Loss: Infi		Door U-Va	lue:		0.58	Btuh/F-sf
Infiltration Loss Factor: Infiltration Loss: Total Apartment Heat Loss Rate: Stimated Heating System Overall Efficiency: Standing Pilot? (yes or no) Pilot BTU/hr.: Pilot Operating Hours: Pilot Consumption: Heating Fuel? (Natural Gas, Electric, Propane) Estimated Heating System Consumption: Heating System Fan? (yes or no) Heating Output: Fan Size: Fan Operating Hours: 10.15 CFM / Lf 124.42 Btuh 3904.17 Btuh 590% S90% S90% S90% S90% S90% S90% S90% S		Infiltration	Loss Factor:		0.15	CFM / Lf
Estimated Heating System Overall Efficiency: Standing Pilot? (yes or no) Pilot BTU/hr.: Pilot Operating Hours: Pilot Consumption: Heating Fuel? (Natural Gas, Electric, Propane) Estimated Heating System Consumption: Heating System Fan? (yes or no) Heating Output: Fuel Oil System Fan? (yes or no) Yes Heating Output: 19,800 Btuh Fan Size: 400 Watts Fan Operating Hours: 608 hours		Infiltration	Loss Factor:		0.15	CFM / Lf
Heating Fuel? (Natural Gas, Electric, Propane) Estimated Heating System Consumption: Heating System Fan? (yes or no) Heating Output: Fan Size: Fan Operating Hours: Fuel Oil 118 GALLONS 19,800 Btuh 400 Watts 608 hours		Estimated I Standing P Pilot BTU/ Pilot Opera	Heating System O ilot? (yes or no) hr.: ting Hours:		ncy: 55% Yes 500 8760	BTU/hr. hrs/yr
Fan Operating Hours: 608 hours		Heating Fu Estimated I Heating Sy Heating Ou	el? (Natural Gas, Heating System Costem Fan? (yes or	onsumption:	rane) Fuel Oil 118 Yes 19,800	GALLONS Btuh
		Fan Operat	_		608	hours

Renton Housing Authority

HOUSING CHOICE VOUCHER

		nocon de	IOICE VOCCHER		
Unit Type: Number of Bed	drooms:	Mobile Home 2	Heating Degr Design Temp	. Diff.(F) =	4376 38
Heating Fuel:		Fuel Oil	Correction Fa	actor (CD) =	0.62
APARTMENT	· DATA·				
711711111111111111111111111111111111111		f Stories Per Unit:		1	
		are Footage:			sq. ft.
	Perimeter	_			Btuh/lf
	Floor Heat	Loss:		1265.00	
	Roof Squa	re Footage:		550	sq.ft.
	Roof U-Va	-			Btuh/F-sf
	Roof Heat			1624.62	
	Exterior W				sq.ft.
	Wall U-Va				Btuh/F-sf
	Wall Heat	Loss:		3483.98	Btuh
	Window A	rea:		78	sq.ft.
	Window U				Btuh/F-sf
	Window H	leat Loss:		1857.02	
	D 4				
	Door Area				sq.ft.
	Door U-Va				Btuh/F-sf
	Door Heat	LOSS:		846.34	Btuh
	Window C	rack Length:		65	ft
	Infiltration	Loss Factor:		0.15	CFM / Lf
	Infiltration	Loss:		404.35	Btuh
	Door Crac	k I enoth:		40	f r
		Loss Factor:			CFM / Lf
	Infiltration			248.83	
	Total A	stmant Hagt I D			
	_	tment Heat Loss Rat		9730.14	Btuh
		Heating System Ove 'ilot? (yes or no)	ran Emciency:	55%	
	Pilot BTU			Yes	
		ating Hours:			BTU/hr.
	Pilot Cons	_			hrs/yr kBTU/yr
	i not Cons	umption.		4300	KB i O/yi
	Heating Fu	iel? (Natural Gas, El	ectric, Propane)	Fuel Oil	
		Heating System Con		248	GALLONS
		stem Fan? (yes or no	o)	Yes	
	Heating O	utput:		19,800	
	Fan Size:				Watts
		ting Hours:		1,515	
	Fan Energy	y:		606	kWh

Renton Housing Authority

HOUSING CHOICE VOUCHER

		HOUSING CI	HOICE VOUCHE	R	
Unit Type: Number of Bed Heating Fuel:	drooms:	Single Family l Fuel Oil	Design Ter	egree Days = mp. Diff.(F) = Factor (CD) =	4376 38 0.62
APARTMENT	DATA:				
		Stories Per Unit:		1	
	Perimeter 1	Linear Footage:		110	ft.
	Perimeter 1	Factor:		17.24	Btuh/lf
	Perimeter l	Heat Loss:		1896.62	Btuh
	Roof Squa	re Footage:		750	sq.ft.
	Roof U-Va				Btuh/F-sf
	Roof Heat			1920.00	
	Exterior W	Inll Amon		751	Φ
	Wall U-Va				sq.ft.
	Wall Heat				Btuh/F-sf
	wan neat	LOSS.		3200.45	Blun
	Window A			88	sq.ft.
	Window U			0.62	Btuh/F-sf
	Window H	leat Loss:		2083.20	Btuh
	Door Area	•		38	sq.ft.
	Door U-Va	alue:			Btuh/F-sf
	Door Heat	Loss:		846.34	Btuh
	Window C	rack Length:		104	ft
		Loss Factor:			CFM / Lf
	Infiltration	Loss:		646.96	
	Door Crac	k I enoth:		40	A
		Loss Factor:			CFM / Lf
	Infiltration			248.83	
	Total Apar	tment Heat Loss Ra	***	10842.40	Dtub
	_	Heating System Ove		55%	
		rilot? (yes or no)	ian Efficiency.	Yes	
	Pilot BTU	_			BTU/hr.
		ating Hours:			hrs/yr
	Pilot Cons	-			kBTU/yr
		•			KD i O/yi
	_	iel? (Natural Gas, El		Fuel Oil	
		Heating System Con	•		GALLONS
		stem Fan? (yes or ne	0)	Yes	-
	Heating O	utput:		23,100	
	Fan Size:				Watts
	Fan Opera	ting Hours:		1,447	hours
	E. M. 40 E. 40 C			270	A * \$ / E.

579 kWh

Fan Energy:

Renton Housing Authority

HOUSING CHOICE VOUCHER

Unit Type:	Townhouse	Heating Degree Days =	4376
Number of Bedroon		Design Temp. Diff. $(F) =$	38
Heating Fuel:	Fuel Oil	Correction Factor (CD) =	0.62
APARTMENT DA	TA:		
	nber of Stories Per Unit:	2	
Peri	meter Linear Footage:	43	ft.
Peri	meter Factor:	17.24	Btuh/lf
Peri	meter Heat Loss:	746.60	Btuh
Roo	f Square Footage:	300	sq.ft.
	of U-Value:		Btuh/F-sf
Roo	of Heat Loss:	768.00	
Evte	erior Wall Area:	505	~~ A
	Il U-Value:		sq.ft. Btuh/F-sf
	I Heat Loss:	2492.74	
	idow Area:		sq.ft.
	idow U-Value:		Btuh/F-sf
Win	idow Heat Loss:	1666.56	Btuh
Doo	or Area:	38	sq.ft.
	or U-Value:	0.58	Btuh/F-sf
Doo	or Heat Loss:	846.34	Btuh
Win	dow Crack Length:	80	ft
Infil	Itration Loss Factor:	0.15	CFM / Lf
Infil	tration Loss:	497.66	Btuh
Doo	or Crack Length:	40	ft
Infil	Itration Loss Factor:	0.15	CFM / Lf
Infil	tration Loss:	248.83	Btuh
Tota	al Apartment Heat Loss Ra	ite: 7266.73	Btuh
Esti	mated Heating System Ove	erall Efficiency: 55%	
Star	nding Pilot? (yes or no)	Yes	
	t BTU/hr.:		BTU/hr.
	t Operating Hours:		hrs/yr
Pilo	t Consumption:	4380	kBTU/yr
Hea	ting Fuel? (Natural Gas, E	lectric, Propane) Fuel Oil	
Esti	mated Heating System Con	nsumption: 193	GALLONS
	ting System Fan? (yes or r	Yes	
	ting Output:	23,100	Btuh
	Size:		Watts
	Operating Hours:		hours
Ean	Energy	200	1-XX/L

388 kWh

Fan Energy:

Renton Housing Authority HOUSING CHOICE VOUCHER

Unit Type:	Duplex	Heating Degree Days =	4376
Number of Bedroom		Design Temp. Diff. $(F) =$	38
Heating Fuel:	Propane	Correction Factor (CD) =	0.62
APARTMENT DAT	ГА:		
	nber of Stories Per Unit:	1	
	meter Linear Footage:	75	
	meter Factor:		Btuh/lf
Peri	meter Heat Loss:	1293.15	Btuh
Roo	f Square Footage:	625	sq.ft.
	f U-Value:		Btuh/F-sf
Roo	f Heat Loss:	1600.00	Btuh
Exte	erior Wall Area:	392	sq.ft.
Wal	l U-Value:		Btuh/F-sf
Wal	l Heat Loss:	1670.86	Btuh
Win	dow Area:	70	sq.ft.
Win	dow U-Value:		Btuh/F-sf
Win	dow Heat Loss:	1666.56	Btuh
Doo	r Area:	38	sq.ft.
Doo	r U-Value:		Btuh/F-sf
Doo	r Heat Loss:	846.34	Btuh
Win	dow Crack Length:	80	ft
Infil	tration Loss Factor:	0.15	CFM / Lf
Infil	tration Loss:	497.66	Btuh
Doo	r Crack Length:	40	ft
	tration Loss Factor:		CFM / Lf
Intil	tration Loss:	248.83	Btuh
Tota	l Apartment Heat Loss Ra	te: 7823.40	Btuh
	mated Heating System Ove	rall Efficiency: 65%	1
	ding Pilot? (yes or no)	Yes	
	t BTU/hr.:		BTU/hr.
	t Operating Hours:		hrs/yr
Pilo	t Consumption:	4380	kBTU/yr
	ting Fuel? (Natural Gas, El		
	mated Heating System Con		GALLONS
	ting System Fan? (yes or no		
	ting Output:	27,300	
	Size:		Watts
	Operating Hours:		hours
ran	Energy:	299	kWh

Renton Housing Authority

HOUSING CHOICE VOUCHER

	HOUSING CF	IOICE VOUCHER	
Unit Type: Number of Bedro Heating Fuel:	Garden oms: 3 Propane	Heating Degree Days = Design Temp. Diff.(F) = Correction Factor (CD) =	4376 38 0.62
APARTMENT D	ATA:		
	umber of Stories Per Unit:	1	
	erimeter Linear Footage:	78	
	erimeter Factor:		Btuh/lf
Pe	erimeter Heat Loss:	1345.95	
R	oof Square Footage:	975	sq.ft.
	oof U-Value:		Btuh/F-sf
Re	oof Heat Loss:	2496.00	
E	kterior Wall Area:	466	sq.ft.
W	all U-Value:		Btuh/F-sf
W	all Heat Loss:	1988.41	Btuh
W	indow Area:	120	sq.ft.
W	indow U-Value:		Btuh/F-sf
W	indow Heat Loss:	2856.96	Btuh
D	oor Area:	38	sq.ft.
D	oor U-Value:		Btuh/F-sf
D	oor Heat Loss:	846.34	Btuh
W	indow Crack Length:	120	ft
In	filtration Loss Factor:	0.15	CFM / Lf
In	filtration Loss:	746.50	Btuh
D	oor Crack Length:	40	ft
	filtration Loss Factor:	0.15	CFM / Lf
In	filtration Loss:	248.83	Btuh
	otal Apartment Heat Loss Rat		Btuh
	stimated Heating System Over	•	
	anding Pilot? (yes or no)	Yes	
	lot BTU/hr.:		BTU/hr.
	lot Operating Hours:		hrs/yr
Pi	lot Consumption:	4380	kBTU/yr
	eating Fuel? (Natural Gas, Ele	- · · · · · · · · · · · · · · · · · · ·	
	stimated Heating System Cons	•	GALLONS
	eating System Fan? (yes or no		
	eating Output:	39,000	
Fa	ın Size:	400	Watts

614 hours

246 kWh

Fan Operating Hours:

Fan Energy:

Renton Housing Authority

HOUSING CHOICE VOUCHER

		HOUSING	CHOICE	VOUCHER		
Unit Type:		High-Rise		Heating Degree	Days =	4376
Number of Bed	lrooms:	3		Design Temp. D		38
Heating Fuel:		Propane		Correction Factor	or (CD) =	0.62
APARTMENT	· DATA·					
2 M 2 MC IVILIVI		Stories Per Unit:			1	
		Linear Footage:				ft.
	Perimeter l					Btuh/lf
	Perimeter l	Heat Loss:			0.00	
	Roof Squa	re Footage:			0	sq.ft.
	Roof U-Va	-				Btuh/F-sf
	Roof Heat				0.00	
	Extenion U	7011 A mon.			267	. 0
	Exterior W Wall U-Va					sq.ft. Btuh/F-sf
	Wall Heat				1138.06	
	wan neat	L033.			1136.00	Diun
	Window A	rea:			100	sq.ft.
	Window U				0.62	Btuh/F-sf
	Window H	eat Loss:			2380.80	Btuh
	Door Area	:			20	sq.ft.
	Door U-Va	ılue:			0.58	Btuh/F-sf
	Door Heat	Loss:			445.44	Btuh
	Window C	rack Length:			105	ft
	Infiltration	Loss Factor:			0.15	CFM / Lf
	Infiltration	Loss:			653.18	Btuh
	Door Crack	k Length:			20	ft
		Loss Factor:			0.15	CFM / Lf
	Infiltration	Loss:			124.42	Btuh
	Total Apar	tment Heat Loss	Rate:		4741.90	Btuh
		Heating System (Overall Eff	ficiency:	65%	
	_	ilot? (yes or no)			Yes	
	Pilot BTU/					BTU/hr.
	_	ating Hours:				hrs/yr
	Pilot Consi	umption:			4380	kBTU/yr
		el? (Natural Gas,			Propane	
		Heating System (on:	175	GALLONS
		stem Fan? (yes o	r no)		Yes	
	Heating Ou	ıtput:			28,600	
	Fan Size:					Watts
	Fan Operat	_				hours
	Han Hagra	,,,			172	Ir AA/ In

173 kWh

Fan Energy:

Renton Housing Authority HOUSING CHOICE VOUCHER

Unit Type: Number of Bedroon Heating Fuel:	Mobile Home ns: 3 Propane	Heating Degree Days = Design Temp. Diff.(F) = Correction Factor (CD) =	4376 38 0.62
APARTMENT DAT	TA: nber of Stories Per Unit:	1	
Floo	or Square Footage:	750	sq. ft.
Peri	meter Factor:	2.30	Btuh/lf
Floo	or Heat Loss:	1725.00	Btuh
Roo	f Square Footage:	750	sq.ft.
	f U-Value:	0.077	Btuh/F-sf
Roo	f Heat Loss:	2215.38	Btuh
Exte	erior Wall Area:	746	sq.ft.
	l U-Value:	0.14	Btuh/F-sf
Wal	l Heat Loss:	4098.39	Btuh
Win	dow Area:	92	sq.ft.
	dow U-Value:	0.62	Btuh/F-sf
Win	dow Heat Loss:	2190.34	Btuh
Doo	r Area:	38	sq.ft.
Doo	r U-Value:	0.58	Btuh/F-sf
Doo	r Heat Loss:	846.34	Btuh
Win	dow Crack Length:	80	ft
	tration Loss Factor:	0.15	CFM / Lf
Infil	tration Loss:	497.66	Btuh
	r Crack Length:	40	
	tration Loss Factor:		CFM / Lf
Intil	tration Loss:	248.83	Btuh
	al Apartment Heat Loss Ra		Btuh
	mated Heating System Ove	•	
	ding Pilot? (yes or no)	Yes	
	t BTU/hr.:		BTU/hr.
	t Operating Hours: t Consumption:		hrs/yr
PHO	i Consumption:	4380	kBTU/yr
	ting Fuel? (Natural Gas, El		
	mated Heating System Con		GALLONS
	ting System Fan? (yes or n		
	ting Output: Size:	28,600	
	Operating Hours:	1,078	Watts
	Energy:		kWh
i dii	2	431	r. ** !!

Renton Housing Authority

HOUSING CHOICE VOUCHER

Unit Type:		Single Family		Heating Degree Days	; =	4376
Number of Bed	drooms:	3		Design Temp. Diff.(I	?) =	38
Heating Fuel:		Propane		Correction Factor (C		0.62
APARTMENT	`DATA:			(-	-,	3.132
	Number of	f Stories Per Unit:			1	
	Perimeter	Linear Footage:			122	ft.
	Perimeter	•		1		Btuh/lf
	Perimeter	Heat Loss:			3.52	
	Roof Squa	re Footage:			1225	sq.ft.
	Roof U-Va	alue:				Btuh/F-sf
	Roof Heat	Loss:		313	86.00	Btuh
	Exterior W	/all Area:			932	sq.ft.
	Wall U-Va	ılue:			0.11	Btuh/F-sf
	Wall Heat	Loss:		397	72.56	Btuh
	Window A	rea:			150	sq.ft.
	Window U	J-Value:			0.62	Btuh/F-sf
	Window H	leat Loss:		357	1.20	Btuh
	Door Area	:			38	sq.ft.
	Door U-Va	alue:				Btuh/F-sf
	Door Heat	Loss:		84	16.34	Btuh
	Window C	rack Length:			152	ft
	Infiltration	Loss Factor:			0.15	CFM / Lf
	Infiltration	Loss:		94	15.56	Btuh
	Door Crac	k Length:			40	ft
		Loss Factor:			0.15	CFM / Lf
	Infiltration	Loss:		24	18.83	Btuh
	-	rtment Heat Loss Ra			24.01	Btuh
		Heating System Ove	erall Ef	ficiency:	65%	
	_	rilot? (yes or no)			Yes	
	Pilot BTU				500	BTU/hr.
		ating Hours:			8760	hrs/yr
	Pilot Cons	umption:			4380	kBTU/yr
	_	iel? (Natural Gas, E		. ,	opane	
		Heating System Cor		ion:		GALLONS
		stem Fan? (yes or n	0)		Yes	
	Heating O	utput:		39	0,000	Btuh
	Fan Size:				400	Watts
	-	ting Hours:			992	hours
	Fan Energ	y:			397	kWh

Renton Housing Authority HOUSING CHOICE VOUCHER

Unit Type:	Townhouse	Heating Degree Days =	4376
Number of Bedrooms:	4	Design Temp. Diff.(F) =	38
Heating Fuel:	Propane	Correction Factor (CD) =	0.62

APARTMENT DATA:

Number of Stories Per Unit:	2	
Perimeter Linear Footage:	59	ft.
Perimeter Factor:	17.24	Btuh/lf
Perimeter Heat Loss:	1010.90	Btuh

Roof Square Footage:	550	sq.ft.
Roof U-Value:	0.067	Btuh/F-sf
Roof Heat Loss:	1408.00	Btuh

Exterior Wall Area:	745	sq.ft.
Wall U-Value:	0.11	Btuh/F-sf
Wall Heat Loss:	3175.84	Btuh

Window Area:	155	sq.ft.
Window U-Value:	0.62	Btuh/F-sf
Window Heat Loss:	3690.24	Btuh

Door Area:	38	sq.ft.
Door U-Value:	0.58	Btuh/F-sf
Door Heat Loss:	846.34	Btuh

Window Crack Length:	140	ft
Infiltration Loss Factor:	0.15	CFM / Lf

Infiltration Loss: 870.91 Btuh

Door Crack Length:	40	ft
Infiltration Loss Factor:	0.15	CFM / Lf
Infiltration Loss:	248.83	Btuh

Total Apartment Heat Loss Rate:	11251.06 Btuh
Estimated Heating System Overall Efficiency:	65%
Standing Pilot? (yes or no)	Yes
Pilot BTU/hr.:	500 BTU/hr.
Pilot Operating Hours:	8760 hrs/yr

Pilot Operating Hours:

Pilot Consumption:

8760 hrs/yr
4380 kBTU/yr

Heating Fuel? (Natural Gas Flectric Propage)

Propage

Propane Propane
ion: 353 GALLONS
Yes
39,000 Btuh
400 Watts
753 hours
301 kWh

APPENDIX C. - DHWH TABLES

Back-Up Calculations - DHWH Tables

DHWH Tables

The following section contains the back-up calculation tables for the domestic hot water heaters. The Renton Housing Authority expects HCV residents to have natural gas, electric, propane or fuel oil water heaters. Therefore, this section has a table for each bedroom size with each type of hot water heater. Hot water usage depends on the number of occupants and the size of the tank, and it does not depend on the type of housing unit. Therefore, all tenants in various types of housing units are assumed to consume the same amount of hot water.

Fuel Type:	Natural Gas	
Number of Bedrooms:	1	Bedrooms
Estimated Number of Occupants:	2	Occupants
Estimated Consumption Rate:	13	Gallons/Occupant/Day
Specific Heat of Water:	1.00	Btu/lb/F
Specific Volume of Water:	62.32	lb/cf
Volume Conversion:	7.48	gal/cf
Heuristic Exponent:	0.68	
Estimated Service Water Inlet Temperatur	55	F
Hot Water Supply Temperature:	120	F
Delta T:	65	F
Calender Schedule:	365	days/yr
Daily Schedule:	24	hrs/day
Total Operating Hours:	8,760	hrs/yr
Estimated Air Temperature At Tank:	72	F
Estimated Tank Size:	40	gal
Assumed Tank Insulation (R-Value):	8.00	F-sf-hr/Btu
R-Value of Shell Plus Air:	0.62	F-sf-hr/Btu
Estimated System Efficiency:	70%	
Assumed Standing Pilot?	yes	
Pilot Consumption Rate:	400	Btu/hr
Fuel Type:	Natural Gas	
Pilot Consumption:	3,504	kBtu/yr
Total Energy Lost:	1,211	kBtu/yr
Consumption Energy Required:	<u>5,134</u>	kBtu/yr
Total Energy Required:	9,849	kBtu/yr
Primary Fuel Required:	141	Therms/Year

Fuel Type:	Natural Gas	
Number of Bedrooms:	2	Bedrooms
Estimated Number of Occupants:	3	Occupants
Estimated Consumption Rate:	13	Gallons/Occupant/Day
Specific Heat of Water:	1.00	Btu/lb/F
Specific Volume of Water:	62.32	lb/cf
Volume Conversion:	7.48	gal/cf
Heuristic Exponent:	0.68	
Estimated Service Water Inlet Temperatur	55	F
Hot Water Supply Temperature:	120	F
Delta T:	65	F
Calender Schedule:	365	days/yr
Daily Schedule:	24	hrs/day
Total Operating Hours:	8,760	hrs/yr
Estimated Air Temperature At Tank:	72	F
Estimated Tank Size:	40	gal
Assumed Tank Insulation (R-Value):	8.00	F-sf-hr/Btu
R-Value of Shell Plus Air:	0.62	F-sf-hr/Btu
Estimated System Efficiency:	70%	
Assumed Standing Pilot?	yes	
Pilot Consumption Rate:	400	Btu/hr
Fuel Type:	Natural Gas	
Pilot Consumption:	3,504	kBtu/yr
Total Energy Lost:	1,211	kBtu/yr
Consumption Energy Required:	<u>7,701</u>	kBtu/yr
Total Energy Required:	12,416	kBtu/yr
Primary Fuel Required:	177	Therms/Year

Fuel Type:	Electricity	
Number of Bedrooms:	1	Bedrooms
Estimated Number of Occupants:	2	Occupants
Estimated Consumption Rate:	13	Gallons/Occupant/Day
Specific Heat of Water:	1.00	Btu/lb/F
Specific Volume of Water:	62.32	lb/cf
Volume Conversion:	7.48	gal/cf
Heuristic Exponent:	0.68	
Estimated Service Water Inlet Temperatur	55	F
Hot Water Supply Temperature:	120	F
Delta T:	65	F
Calender Schedule:	365	days/yr
Daily Schedule:	24	hrs/day
Total Operating Hours:	8,760	hrs/yr
Estimated Air Temperature At Tank:	72	F
Estimated Tank Size:	40	gal
Assumed Tank Insulation (R-Value):	8.00	F-sf-hr/Btu
R-Value of Shell Plus Air:	0.62	F-sf-hr/Btu
Estimated System Efficiency:	100%	
Assumed Standing Pilot?	no	
Pilot Consumption Rate:	400	Btu/hr
Fuel Type:	Electricity	
Pilot Consumption:		kBtu/yr
Total Energy Lost:	1,211	kBtu/yr
Consumption Energy Required:	<u>5,134</u>	kBtu/yr
Total Energy Required:	6,345	kBtu/yr
Primary Fuel Required:	1,859	kWh/Year

Fuel Type:	Electricity
------------	-------------

Primary Fuel Required:

ruci Type.	Liectricity	
Number of Bedrooms:	2	Bedrooms
Estimated Number of Occupants:	3	Occupants
Estimated Consumption Rate:	13	Gallons/Occupant/Day
Specific Heat of Water:	1.00	Btu/lb/F
Specific Volume of Water:	62.32	lb/cf
Volume Conversion:	7.48	gal/cf
Heuristic Exponent:	0.68	
Estimated Service Water Inlet Temperatur	55	F
Hot Water Supply Temperature:	120	F
Delta T:	65	F
Calender Schedule:	365	days/yr
Daily Schedule:	24	hrs/day
Total Operating Hours:	8,760	hrs/yr
Estimated Air Temperature At Tank:	72	F
Estimated Tank Size:	40	gal
Assumed Tank Insulation (R-Value):	8.00	F-sf-hr/Btu
R-Value of Shell Plus Air:	0.62	F-sf-hr/Btu
Estimated System Efficiency:	100%	
Assumed Standing Pilot?	no	
Pilot Consumption Rate:	400	Btu/hr
Fuel Type:	Electricity	
Pilot Consumption:		kBtu/yr
Total Energy Lost:	1,211	kBtu/yr
Consumption Energy Required:	<u>7,701</u>	kBtu/yr
Total Energy Required:	8,912	kBtu/yr
16		

2,611 kWh/Year

Fuel Type:	Propane	
Number of Bedrooms:	1	Bedrooms
Estimated Number of Occupants:	2	Occupants
Estimated Consumption Rate:	13	Gallons/Occupant/Day
Specific Heat of Water:	1.00	Btu/lb/F
Specific Volume of Water:	62.32	lb/cf
Volume Conversion:	7.48	gal/cf
Heuristic Exponent:	0.68	
Estimated Service Water Inlet Temperatu	1 55	F
Hot Water Supply Temperature:	120	F
Delta T:	65	F
Calender Schedule:	365	days/yr
Daily Schedule:	24	hrs/day
Total Operating Hours:	8,760	hrs/yr
Estimated Air Temperature At Tank:	72	F
Estimated Tank Size:	40	gal
Assumed Tank Insulation (R-Value):	8.00	F-sf-hr/Btu
R-Value of Shell Plus Air:	0.62	F-sf-hr/Btu
Estimated System Efficiency:	70%	
Assumed Standing Pilot?	yes	
Pilot Consumption Rate:	400	Btu/hr
Fuel Type:	Propane	
Pilot Consumption:	3,504	kBtu/yr
Total Energy Lost:	1,211	kBtu/yr
Consumption Energy Required:	<u>5,134</u>	kBtu/yr
Total Energy Required:	9,849	kBtu/yr

147 Gallons/Year

Primary Fuel Required:

Fuel Type:	Propane	
Number of Bedrooms:	2	Bedrooms
Estimated Number of Occupants:	3	Occupants
Estimated Consumption Rate:	13	Gallons/Occupant/Day
Specific Heat of Water:	1.00	Btu/lb/F
Specific Volume of Water:	62.32	lb/cf
Volume Conversion:	7.48	gal/cf
Heuristic Exponent:	0.68	
Estimated Service Water Inlet Temperatur	55	F
Hot Water Supply Temperature:	120	F
Delta T:	65	F
Calender Schedule:	365	days/yr
Daily Schedule:	24	hrs/day
Total Operating Hours:	8,760	hrs/yr
Estimated Air Temperature At Tank:	72	F
Estimated Tank Size:	40	gal
Assumed Tank Insulation (R-Value):	8.00	F-sf-hr/Btu
R-Value of Shell Plus Air:	0.62	F-sf-hr/Btu
Estimated System Efficiency:	70%	
Assumed Standing Pilot?	yes	
Pilot Consumption Rate:	400	Btu/hr
Fuel Type:	Propane	
Pilot Consumption:	3,504	kBtu/yr
Total Energy Lost:	1,211	kBtu/yr
Consumption Energy Required:	<u>7,701</u>	kBtu/yr
Total Energy Required:	12,416	kBtu/yr
Primary Fuel Required:	186	Gallons/Year

Fuel Type:	Fuel Oil	
Number of Bedrooms:	1	Bedrooms
Estimated Number of Occupants:	2	Occupants
Estimated Consumption Rate:	13	Gallons/Occupant/Day
Specific Heat of Water:	1.00	Btu/lb/F
Specific Volume of Water:	62.32	lb/cf
Volume Conversion:	7.48	gal/cf
Heuristic Exponent:	0.68	
Estimated Service Water Inlet Temperatu	n 55	F
Hot Water Supply Temperature:	120	F
Delta T:	65	F
Calender Schedule:	365	days/yr
Daily Schedule:	24	hrs/day
Total Operating Hours:	8,760	hrs/yr
Estimated Air Temperature At Tank:	72	F
Estimated Tank Size:	40	gal
Assumed Tank Insulation (R-Value):	8.00	F-sf-hr/Btu
R-Value of Shell Plus Air:	0.62	F-sf-hr/Btu
Estimated System Efficiency:	70%	
Assumed Standing Pilot?	yes	
Pilot Consumption Rate:	400	Btu/hr
Fuel Type:	Fuel Oil	
Pilot Consumption:	3,504	kBtu/yr
Total Energy Lost:	1,211	kBtu/yr
Consumption Energy Required:	<u>5,134</u>	kBtu/yr
Total Energy Required:	9,849	kBtu/yr
Primary Fuel Required:	101	Gallons/Year

Fuel Type:	Fuel Oil	
Number of Bedrooms:	2	Bedrooms
Estimated Number of Occupants:	3	Occupants
Estimated Consumption Rate:	13	Gallons/Occupant/Day
Specific Heat of Water:	1.00	Btu/lb/F
Specific Volume of Water:	62.32	lb/cf
Volume Conversion:	7.48	gal/cf
Heuristic Exponent:	0.68	
Estimated Service Water Inlet Temperatur	55	F
Hot Water Supply Temperature:	120	F
Delta T:	65	F
Calender Schedule:	365	days/yr
Daily Schedule:	24	hrs/day
Total Operating Hours:	8,760	hrs/yr
Estimated Air Temperature At Tank:	72	F
Estimated Tank Size:	40	gal
Assumed Tank Insulation (R-Value):	8.00	F-sf-hr/Btu
R-Value of Shell Plus Air:	0.62	F-sf-hr/Btu
Estimated System Efficiency:	70%	
Assumed Standing Pilot?	yes	
Pilot Consumption Rate:	400	Btu/hr
Fuel Type:	Fuel Oil	
Pilot Consumption:	3,504	kBtu/yr
Total Energy Lost:	1,211	kBtu/yr
Consumption Energy Required:	<u>7,701</u>	kBtu/yr
Total Energy Required:	12,416	kBtu/yr
Primary Fuel Required:	128	Gallons/Year

APPENDIX D. - COOLING LOAD TABLES

Back-Up Calculations - Cooling Load Tables

Cooling Load Tables

The following section contains the back-up calculations for the cooling loads for each bedroom size of each housing type. The cooling load determines how many btu/hr are needed to cool the unit to the desired design temperature.

UNIT TYPE: Duplex Cooling Degree Days: 30

BEDROOM SIZE: 1 BR Design Temperature Difference: 5

HEAT GAIN THROUGH THE ENVELOPE:

Number of Stories:

Roof Square Footage:625 sq.ft.Roof HTM:0.33 Btu/h-sfRoof Heat Gain:208 Btu/h

Exterior Wall Area: 392 sq.ft.
Wall HTM: 1 Btu/h-sf
Wall Heat Gain: 218 Btu/h

Window Area:70 sq.ft.Window HTM:3 Btu/h-sfWindow Radiation:42.5 Btu/h-sfWindow Heat Gain:3192 Btu/h

 Door Area:
 38 sq.ft.

 Door HTM:
 3 Btu/h-sf

 Door Heat Gain:
 110 Btu/h

INFILTRATION:

Sensible: ACH: 0.44

Above Ground Volume: 5000 cu. Ft. Summer Infiltration CFM: 37 CFM Heat Gain: 202 Btu/h

Latent: Grains Difference: 0

Heat Gain: 0 Btu/h

OUTSIDE AIR:

Sensible and Latent Heat Gain: 1943 Btu/h

OCCUPANTS:

Number of Occupants: 2

Heat gain per person:

Total Heat Gain from Occupants:

Heat Gain from Appliances:

610 Btu/h
1220 Btu/h
2400 Btu/h

TOTALS:

Sensible Apartment Heat Gain Rate: 9493 Btu/h
Duct Loss: 949 Btu/h

Cooling Load Hours:240 hrs/yrCooling Fan Size:185 WattsAnnual Fan Consumption:44 kWhSEER:10Total Room Load:10443 Btu/h

Annual Cooling Energy 295 kWh

UNIT TYPE: Garden Cooling Degree Days: 30

BEDROOM SIZE: 2 BR Design Temperature Difference: 5

HEAT GAIN THROUGH THE ENVELOPE:

Number of Stories: 1

Roof Square Footage:700 sq.ft.Roof HTM:0.33 Btu/h-sfRoof Heat Gain:233 Btu/h

Exterior Wall Area: 391 sq.ft.
Wall HTM: 1 Btu/h-sf
Wall Heat Gain: 217 Btu/h

Window Area:100 sq.ft.Window HTM:3 Btu/h-sfWindow Radiation:42.5 Btu/h-sfWindow Heat Gain:4560 Btu/h

Door Area:38 sq.ft.Door HTM:3 Btu/h-sfDoor Heat Gain:110 Btu/h

INFILTRATION:

Sensible: ACH: 0,44

Above Ground Volume: 5600 cu. Ft.
Summer Infiltration CFM: 41 CFM
Heat Gain: 226 Btu/h

Latent: Grains Difference: 0

Heat Gain: 0 Btu/h

OUTSIDE AIR:

Sensible and Latent Heat Gain: 2915 Btu/h

OCCUPANTS:

Number of Occupants: 3

Heat gain per person:

Total Heat Gain from Occupants:

Heat Gain from Appliances:

2400 Btu/h

TOTALS:

Sensible Apartment Heat Gain Rate: 12492 Btu/h
Duct Loss: 1249 Btu/h

Cooling Load Hours:240 hrs/yrCooling Fan Size:185 WattsAnnual Fan Consumption:44 kWhSEER:10Total Room Load:13741 Btu/h

Annual Cooling Energy 374 kWh

UNIT TYPE:

High-Rise

Cooling Degree Days:

30

BEDROOM SIZE:

2 BR

Design Temperature Difference:

5

HEAT GAIN THROUGH THE ENVELOPE:

Number of Stories:

1

Roof Square Footage: Roof HTM:

0 sq.ft. 0.33 Btu/h-sf 0 Btu/h

Exterior Wall Area: Wall HTM: Wall Heat Gain:

Roof Heat Gain:

249 sq.ft. 1 Btu/h-sf

Window Area: Window HTM: 138 Btu/h

Window HTM: Window Radiation: Window Heat Gain: 73 sq.ft. 3 Btu/h-sf 42.5 Btu/h-sf 3329 Btu/h

Door Area: Door HTM: Door Heat Gain: 20 sq.ft. 3 Btu/h-sf 58 Btu/h

INFILTRATION:

Sensible:

ACH:

0.44

Above Ground Volume: Summer Infiltration CFM: Heat Gain:

0 cu. Ft. 0 CFM 0 Btu/h

Latent:

Grains Difference:

0

Heat Gain:

0 Btu/h

OUTSIDE AIR:

Sensible and Latent Heat Gain:

2915 Btu/h

OCCUPANTS:

Number of Occupants:

3

Heat gain per person: Total Heat Gain from Occupants: Heat Gain from Appliances: 610 Btu/h 1830 Btu/h 2400 Btu/h

TOTALS:

Sensible Apartment Heat Gain Rate:

10670 Btu/h

Duct Loss:

0 Btu/h

Cooling Load Hours: Cooling Fan Size: Annual Fan Consumption: 240 hrs/yr 185 Watts 44 kWh

SEER: Total Room Load: 10 10670 Btu/h

Annual Cooling Energy

300 kWh

UNIT TYPE: Mobile Home Cooling Degree Days: 30

BEDROOM SIZE: 2 BR Design Temperature Difference: 5

HEAT GAIN THROUGH THE ENVELOPE:

Number of Stories:

Roof Square Footage:550 sq.ft.Roof HTM:0.38 Btu/h-sfRoof Heat Gain:212 Btu/h

Exterior Wall Area: 634 sq.ft.
Wall HTM: 1 Btu/h-sf
Wall Heat Gain: 454 Btu/h

Window Area:78 sq.ft.Window HTM:3 Btu/h-sfWindow Radiation:42.5 Btu/h-sfWindow Heat Gain:3557 Btu/h

 Door Area:
 38 sq.ft.

 Door HTM:
 3 Btu/h-sf

 Door Heat Gain:
 110 Btu/h

INFILTRATION:

Sensible: ACH: 0.44

Above Ground Volume: 4400 cu. Ft.
Summer Infiltration CFM: 32 CFM
Heat Gain: 178 Btu/h

Latent: Grains Difference: 0

Heat Gain: 0 Btu/h

OUTSIDE AIR:

Sensible and Latent Heat Gain: 2915 Btu/h

OCCUPANTS:

Number of Occupants: 3

Heat gain per person:610 Btu/hTotal Heat Gain from Occupants:1830 Btu/hHeat Gain from Appliances:2400 Btu/h

TOTALS:

Sensible Apartment Heat Gain Rate: 11655 Btu/h
Duct Loss: 0 Btu/h

Cooling Load Hours: 240 hrs/yr

Cooling Fan Size:

Annual Fan Consumption:

SEER:

10

Total Room Load:

11655 Btu/h

Annual Cooling Energy 324 kWh

UNIT TYPE: Single Family Cooling Degree Days: 30

BEDROOM SIZE: 3 BR Design Temperature Difference: 5

HEAT GAIN THROUGH THE ENVELOPE:

Number of Stories:

Roof Square Footage:1225 sq.ft.Roof HTM:0.33 Btu/h-sfRoof Heat Gain:408 Btu/h

Exterior Wall Area: 932 sq.ft.
Wall HTM: 1 Btu/h-sf
Wall Heat Gain: 517 Btu/h

Window Area:150 sq.ft.Window HTM:3 Btu/h-sfWindow Radiation:42.5 Btu/h-sfWindow Heat Gain:6840 Btu/h

 Door Area:
 38 sq.ft.

 Door HTM:
 3 Btu/h-sf

 Door Heat Gain:
 110 Btu/h

INFILTRATION:

Sensible: ACH: 0.44

Above Ground Volume: 9800 cu. Ft.
Summer Infiltration CFM: 72 CFM
Heat Gain: 396 Btu/h

Latent: Grains Difference: 0

Heat Gain: 0 Btu/h

OUTSIDE AIR:

Sensible and Latent Heat Gain: 4858 Btu/h

OCCUPANTS:

Number of Occupants: 5

Heat gain per person:

Total Heat Gain from Occupants:

Heat Gain from Appliances:

2400 Btu/h

TOTALS:

Sensible Apartment Heat Gain Rate: 18580 Btu/h
Duct Loss: 1858 Btu/h

Cooling Load Hours:240 hrs/yrCooling Fan Size:185 WattsAnnual Fan Consumption:44 kWhSEER:10Total Room Load:20438 Btu/h

Annual Cooling Energy 535 kWh

UNIT TYPE: Townhouse Cooling Degree Days: 30

BEDROOM SIZE: 3 BR Design Temperature Difference: 5

HEAT GAIN THROUGH THE ENVELOPE:

Number of Stories: 2

Roof Square Footage:450 sq.ft.Roof HTM:0.33 Btu/h-sfRoof Heat Gain:150 Btu/h

Exterior Wall Area: 691 sq.ft.
Wall HTM: 1 Btu/h-sf
Wall Heat Gain: 383 Btu/h

Window Area:120 sq.ft.Window HTM:3 Btu/h-sfWindow Radiation:42.5 Btu/h-sfWindow Heat Gain:5472 Btu/h

Door Area:38 sq.ft.Door HTM:3 Btu/h-sfDoor Heat Gain:110 Btu/h

INFILTRATION:

Sensible: ACH: 0.44

Above Ground Volume: 7200 cu. Ft.
Summer Infiltration CFM: 53 CFM
Heat Gain: 291 Btu/h

Latent: Grains Difference: 0

Heat Gain: 0 Btu/h

OUTSIDE AIR:

Sensible and Latent Heat Gain: 4858 Btu/h

OCCUPANTS:

Number of Occupants: 5

Heat gain per person:

Total Heat Gain from Occupants:

Heat Gain from Appliances:

610 Btu/h

2400 Btu/h

TOTALS:

Sensible Apartment Heat Gain Rate: 16714 Btu/h

Duct Loss: 1671 Btu/h

Cooling Load Hours:240 hrs/yrCooling Fan Size:185 WattsAnnual Fan Consumption:44 kWhSEER:10Total Room Load:18386 Btu/h

Annual Cooling Energy 486 kWh