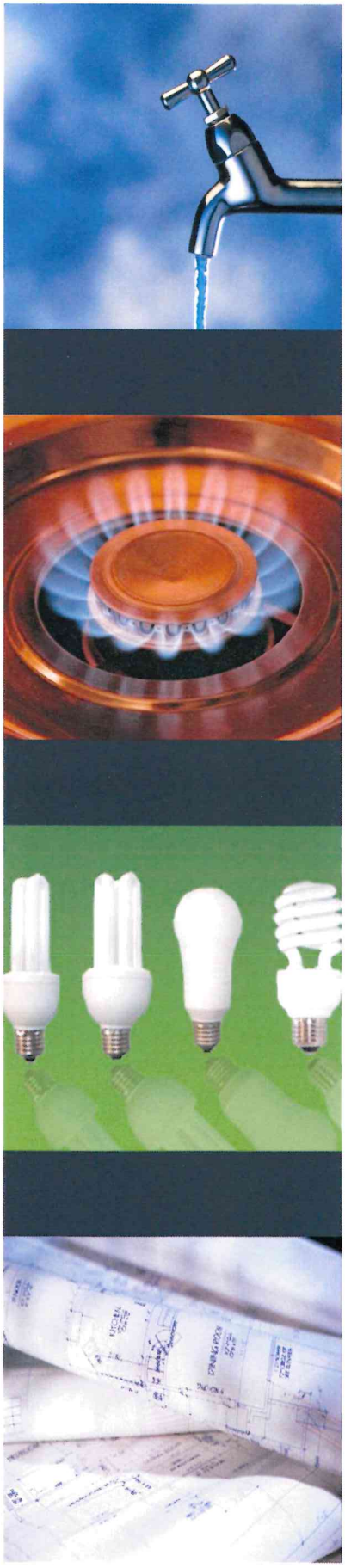

UTILITY ALLOWANCE STUDY

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
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PREPARED BY: NATIONAL FACILITY CONSULTANTS, INC.
1225 JOHNSON FERRY ROAD, SUITE 460
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NFC, INC.
THE PHA PROFESSIONALS™

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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

1225 JOHNSON FERRY ROAD, SUITE 460, MARIETTA, GEORGIA 30068-2727
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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)

OMB Approval No. 2577-0169 (7/31/2022)

Utility Allowance Schedule

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

LOCALITY/PHA	UNIT TYPE	DATE
Renton Housing Authority	**Duplex/Row/Townhouses**	**7/1/2023**

UTILITY OR SERVICE	MONTHLY DOLLAR ALLOWANCE					
	0-BR	1-BR	2-BR	3-BR	4-BR	5-BR
HEATING						
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
RANGE	$4	$4	$4	$4	$4	$4
OTHER: Natural Gas Basic Charge	$13	$13	$13	$13	$13	$13

ACTUAL FAMILY ALLOWANCES: (May be used by the family to compute allowance while searching for a unit.)

HEAD OF HOUSEHOLD

UNIT ADDRESS

NUMBER OF BEDROOMS

UTILITY OR SERVICE	PER MONTH
HEATING	$
AIR CONDITIONING	$
COOKING	$
OTHER ELECTRIC	$
WATER HEATING	$
WATER	$
SEWER	$
TRASH COLLECTION	$
REFRIGERATOR	$
RANGE	$
OTHER	$
TOTAL	$

OMB Approval No. 2577-0169 (7/31/2022)

Utility Allowance Schedule

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

LOCALITY/PHA	UNIT TYPE	DATE
Renton Housing Authority	**Flat/Garden/Multifamily (Low High-Rise)**	**7/1/2023**

UTILITY OR SERVICE	MONTHLY DOLLAR ALLOWANCE					
	0-BR	1-BR	2-BR	3-BR	4-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	$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
RANGE	$4	$4	$4	$4	$4	$4
OTHER: Natural Gas Basic Charge	$13	$13	$13	$13	$13	$13

ACTUAL FAMILY ALLOWANCES: (May be used by the family to compute allowance while searching for a unit.)	UTILITY OR SERVICE	PER MONTH
HEAD OF HOUSEHOLD	HEATING	$
	AIR CONDITIONING	$
UNIT ADDRESS	COOKING	$
	OTHER ELECTRIC	$
	WATER HEATING	$
	WATER	$
	SEWER	$
	TRASH COLLECTION	$
	REFRIGERATOR	$
	RANGE	$
NUMBER OF BEDROOMS	OTHER	$
	TOTAL	$

OMB Approval No. 2577-0169 (7/31/2022)

Utility Allowance Schedule

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

LOCALITY/PHA	UNIT TYPE	DATE
Renton Housing Authority	**Mobile Home**	**7/1/2023**

UTILITY OR SERVICE	MONTHLY DOLLAR ALLOWANCE					
	0-BR	1-BR	2-BR	3-BR	4-BR	5-BR
HEATING						
a. Natural Gas	$28	$32	$38	$44	$47	$55
b. Electric	$36	$42	$52	$62	$67	$80
c. Heat Pump	$20	$23	$29	$35	$37	$44
d. Fuel Oil	$86	$98	$118	$139	$148	$174
e. Propane	$53	$61	$72	$85	$90	$105
AIR CONDITIONING	$2	$3	$3	$4	$5	$6
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
RANGE	$4	$4	$4	$4	$4	$4
OTHER: Natural Gas Basic Charge	$13	$13	$13	$13	$13	$13

ACTUAL FAMILY ALLOWANCES: (May be used by the family to compute allowance while searching for a unit.)

HEAD OF HOUSEHOLD

UNIT ADDRESS

NUMBER OF BEDROOMS

UTILITY OR SERVICE	PER MONTH
HEATING	$
AIR CONDITIONING	$
COOKING	$
OTHER ELECTRIC	$
WATER HEATING	$
WATER	$
SEWER	$
TRASH COLLECTION	$
REFRIGERATOR	$
RANGE	$
OTHER	$
TOTAL	$

OMB Approval No. 2577-0169 (7/31/2022)

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	**Single Family**	**7/1/2023**

UTILITY OR SERVICE	MONTHLY DOLLAR ALLOWANCE					
	0-BR	1-BR	2-BR	3-BR	4-BR	5-BR
HEATING						
a. Natural Gas	$35	$41	$46	$53	$58	$62
b. Electric	$47	$57	$66	$78	$87	$93
c. Heat Pump	$26	$32	$37	$43	$48	$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	$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

ACTUAL FAMILY ALLOWANCES: (May be used by the family to compute allowance while searching for a unit.)	UTILITY OR SERVICE	PER MONTH
HEAD OF HOUSEHOLD	HEATING	$
	AIR CONDITIONING	$
UNIT ADDRESS	COOKING	$
	OTHER ELECTRIC	$
	WATER HEATING	$
	WATER	$
	SEWER	$
	TRASH COLLECTION	$
	REFRIGERATOR	$
	RANGE	$
NUMBER OF BEDROOMS	OTHER	$
	TOTAL	$

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
Electricity	Puget Sound Energy	Basic Charge (per month)	$7.49	$7.49	0.0%
		First 600 kWh (per kWh)			
		Total Energy Charge	$0.095631	$0.110228	
		Energy Exchange Credit	($0.006689)	($0.006689)	
		Total Other Charges and Credits	$0.007862	$0.007230	
		Total	**$0.096804**	**$0.110769**	**14.4%**
		Over 600 kWh (per kWh)			
		Total Energy Charge	$0.115462	$0.129645	
		Energy Exchange Credit	($0.006689)	($0.006689)	
		Total Other Charges and Credits	$0.007862	$0.007230	
		Total	**$0.116635**	**$0.130186**	**11.6%**
Gas	Puget Sound Energy	Basic Charge (per month)	$11.52	$12.50	8.5%
		All therms (per therm)			
		Total Delivery Charge	$0.492910	$0.535620	
		Total Cost of Gas	$0.489580	$0.730550	
		Other Natural Gas Charges and Credits	$0.020190	$0.028750	
		Total	**$1.002680**	**$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 Ferrellgas 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
Water	City of Renton	Basic Charge (per month)	$18.68	$18.68	0.0%
		Consumption Charge (per CCF)			
		0 - 500 CCFs per month	$2.69	$2.69	0.0%
		500 - 1000 CCFs per month	$3.62	$3.62	0.0%
		Over 1000 CCFs per month	$4.57	$4.57	0.0%
	Soos Creek Water and Sewer District	Basic Charge (per month)	$16.35	$17.66	8.0%
		Consumption Charge (per CCF)			
		0 - 500 CCFs per month	$2.17	$2.34	7.8%
		500 - 1000 CCFs per month	$4.25	$4.59	8.0%
		Over 1000 CCFs per month	$5.35	$5.78	8.0%
Sewer	City of Renton	Single Family (per month)	$31.74	$31.74	0.0%
		Other Users			
		Base Charge (per month)	$31.74	$31.74	0.0%
		Consumption Charge (per CCF)	$3.58	$3.58	0.0%
	Soos Creek Water and Sewer District	Sewer System Maintenance(per month)	$21.22	$22.92	8.0%
		King Co. Treatment Charge (per month)	$49.27	$52.11	5.8%
		Total Charge (per month)	**$70.49**	**$75.03**	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 degree-days, 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.

Dimensions	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:

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

$$\text{Gallons/Month} = \frac{25{,}000 \text{ BTUs} \times .65/\text{Hr} \times \text{Hours} \times 30 \text{ days/Month}}{95{,}500}$$

$$\text{kWh/Month} = \text{Hours/day} \times 2.5 \text{ kw} \times 30 \text{ days/Month}$$

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 Allowance**	
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**

Over 600 kWh	
Energy Charge	$0.108854 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	**$0.130186 per 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	$52.11 per month

Soos Creek - Water

Base Charge	$17.66 per month
Consumption 0 – 500 CF	$2.34 per CCF
500 – 1000 CF	$4.59 per CCF
1001 – 1500 CF	$5.78 per CCF

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

HEATING - NATURAL GAS

		Duplex			Garden			Mobile Home			Single Family		
Bedrooms	Sq. Ft.	Therms/ Month	Fan kWh/ Month	Cost per Month	Therms/ Month	Fan kWh/ Month	Cost per Month	Therms/ Month	Fan kWh/ Month	Cost per Month	Therms/ Month	Fan kWh/ Month	Cost per Month
0	400-550	18	22	$28	15	16	$22	18	25	$28	23	29	$35
1	500-700	21	25	$31	18	20	$27	21	29	$32	27	35	$41
2	700-900	24	30	$37	20	24	$30	25	36	$38	31	28	$46
3	1000-1200	27	24	$40	24	20	$35	29	36	$44	36	33	$53
4	1300-1500	31	28	$46	27	24	$40	31	39	$47	40	28	$58
5	1600-2000	34	31	$50	30	27	$44	37	46	$55	42	30	$62

Based on an average cost per therm of $1.29492

HEATING - ELECTRIC FURNACE

		Duplex			Garden			Mobile Home			Single Family		
Bedrooms	Sq. Ft.	kWh per Month	Fan kWh/ Month	Cost per Month	kWh per Month	Fan kWh/ Month	Cost per Month	kWh per Month	Fan kWh/ Month	Cost per Month	kWh per Month	Fan kWh/ Month	Cost per Month
0	400-550	296	10	$36	224	8	$27	293	12	$36	390	13	$47
1	500-700	341	12	$41	280	10	$34	344	14	$42	473	16	$57
2	700-900	411	14	$50	329	11	$40	424	17	$52	552	13	$66
3	1000-1200	465	11	$56	400	10	$48	515	17	$62	646	15	$78
4	1300-1500	551	13	$66	473	11	$57	552	18	$67	727	13	$87
5	1600-2000	604	14	$73	526	13	$63	658	22	$80	778	14	$93

Based on an average cost per kWh of $0.110769

HEATING - ELECTRIC HEAT PUMP

		Duplex			Garden			Mobile Home			Single Family		
Bedrooms	Sq. Ft.	kWh per Month	Fan kWh/ Month	Cost per Month	kWh per Month	Fan kWh/ Month	Cost per Month	kWh per Month	Fan kWh/ Month	Cost per Month	kWh per Month	Fan kWh/ Month	Cost per Month
0	400-550	165	4	$20	125	3	$15	164	4	$20	218	5	$26
1	500-700	191	4	$23	156	3	$19	192	5	$23	264	6	$32
2	700-900	230	5	$28	184	4	$22	237	6	$29	308	5	$37
3	1000-1200	260	4	$31	224	3	$27	288	6	$35	361	5	$43
4	1300-1500	308	5	$37	265	4	$32	309	6	$37	407	5	$48
5	1600-2000	337	5	$40	294	4	$35	368	8	$44	435	5	$52

Based on an average cost per kWh of $0.110769

Space Heating Consumption Levels and Cost Figures

HEATING - FUEL OIL												
		Duplex			Garden			Mobile Home			Single Family		
Bedrooms	Sq. Ft.	Gallons per Month	Fan kWh/ Month	Cost per Month	Gallons per Month	Fan kWh/ Month	Cost per Month	Gallons per Month	Fan kWh/ Month	Cost per Month	Gallons per Month	Fan kWh/ Month	Cost per Month
0	400-550	15	30	$86	12	23	$69	15	35	$86	19	40	$109
1	500-700	17	35	$97	15	29	$82	17	41	$98	23	48	$129
2	700-900	20	42	$114	17	34	$94	21	51	$118	26	39	$146
3	1000-1200	22	33	$126	20	29	$110	25	50	$139	30	46	$169
4	1300-1500	26	39	$146	23	34	$127	26	54	$148	34	39	$187
5	1600-2000	28	43	$158	25	38	$140	31	64	$174	36	42	$198

Based on an average cost per gallon of $5.12

HEATING - PROPANE												
		Duplex			Garden			Mobile Home			Single Family		
Bedrooms	Sq. Ft.	Gallons per Month	Fan kWh/ Month	Cost per Month	Gallons per Month	Fan kWh/ Month	Cost per Month	Gallons per Month	Fan kWh/ Month	Cost per Month	Gallons per Month	Fan kWh/ Month	Cost per Month
0	400-550	19	22	$53	16	16	$43	19	25	$53	24	29	$67
1	500-700	22	25	$60	18	20	$51	22	29	$61	29	35	$79
2	700-900	25	30	$70	21	24	$58	26	36	$72	33	28	$89
3	1000-1200	28	24	$77	25	20	$67	31	36	$85	38	33	$102
4	1300-1500	33	28	$89	29	24	$78	33	39	$90	42	28	$113
5	1600-2000	35	31	$96	31	27	$85	38	46	$105	44	30	$120

Based on an average cost per gallon of $2.474

Air-Conditioning Consumption Levels

Air Conditioning Consumption Levels and Cost Figures

AIR CONDITIONING										
		Duplex		**Garden**		**Mobile Home**		**Single Family**		
Bedrooms	Sq. Ft.	kWh per Year	Cost per Month	kWh per Year	Cost per Month	kWh per Year	Cost per Month	kWh per Year	Cost per Month	
0	400-550	222	$2	220	$2	202	$2	241	$2	
1	500-700	295	$3	294	$3	261	$3	324	$3	
2	700-900	376	$4	374	$4	324	$3	414	$4	
3	1000-1200	487	$5	488	$5	421	$4	535	$5	
4	1300-1500	618	$6	618	$6	517	$5	675	$7	
5	1600-2000	728	$7	728	$7	636	$6	792	$8	

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	400-550	7,363	10	240	221
1	500-700	10,432	10	240	295
2	700-900	13,789	10	240	375
3	1000-1200	18,386	10	240	486
4	1300-1500	23,762	10	240	615
5	1600-2000	28,467	10	240	728

Garden

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

Duplex

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

Air Conditioning Consumption Levels

Single

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

Mobile Home

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

High-Rise

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

Cooking Consumption Levels

Cooking Consumption Levels and Cost Figures

COOKING - NATURAL GAS

Bedrooms	Sq. Ft.	Therms per Month	Cost per Month
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

Bedrooms	Sq. Ft.	kWh per Month	Cost per Month
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

Bedrooms	Sq. Ft.	Gallons per Month	Cost per Month
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 ELECTRIC			
Bedrooms	Sq. Ft.	kWh per Month	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	67	21	4	17	2	171
1 BR	81	67	21	4	17	2	191
2 BR	108	67	21	4	21	4	224
3 BR	149	67	21	4	25	6	271
4 BR	189	67	21	4	29	8	309
5 BR	243	67	21	4	33	10	378
Typical Value		67	21	4	24		

Water Heater Consumption Levels

Domestic Hot Water Heating Consumption Levels and Cost Figures

DOMESTIC HOT WATER HEATING Natural Gas			
Bedrooms	Sq. Ft.	Therms per Month	Cost per Month
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 WATER HEATING Electricity			
Bedrooms	Sq. Ft.	kWh per Month	Cost per Month
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

DOMESTIC HOT WATER HEATING **Propane**			
Bedrooms	Sq. Ft.	Gallons per Month	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

DOMESTIC HOT WATER HEATING **Fuel Oil**			
Bedrooms	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

WATER, SEWER AND SANITATION										
		Water Costs				Sewer Costs				
NUMBER OF BEDROOMS	WATER CONSUMPTION	In - City of Renton	Soos Creek	Out - City of Renton	SEWER USAGE	In - City of Renton	Out - City of Renton	Soos Creek	SURFACE WATER	GARBAGE COLLECTION
0 BR	2	$24	$22	$36	2	$84	$126	$75	$16	$26
1 BR	4	$29	$26	$43	4	$84	$126	$75	$16	$26
2 BR	6	$34	$32	$51	6	$84	$126	$75	$16	$26
3 BR	9	$48	$49	$72	9	$84	$126	$75	$16	$26
4 BR	13	$64	$70	$96	13	$84	$126	$75	$16	$26
5 BR	17	$81	$92	$122	17	$84	$126	$75	$16	$26

Water, Sewer and Sanitation Consumption Levels and Cost Figures

Gross Water Consumption

Type	Occupants	Toilet	Shower	Dishes	Clothes	Cooking	Hands	Other	Gal/Day	Gal/Month	CCF/Month
0 BR	1.00	25.00	15.00	1.50	2.00	0.30	1.00	1.00	45.80	1,393	1.86
1 BR	2.00	50.00	30.00	3.00	4.00	0.60	2.00	2.00	91.60	2,786	3.72
2 BR	3.00	75.00	45.00	4.50	6.00	0.90	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	9.00	225.00	135.00	13.50	18.00	2.70	9.00	9.00	412.20	12,538	16.76

Type	Gallons	Times	Usage	
Toilet Flush	5	x	5	Flushes per person per day
Shower	15	x	1	Showers per person per day
Dishload	3	x	0.5	Dishloads per person per day
Laundry	10	x	0.2	Clothesloads per person per day
Meal	0.1	x	3	Meals per person per day
Handwashing	0.1	x	10	Handwashings per person per day
Other	1	x	1	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. Door Loss

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

5. Crack Loss Formulations

   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 Heating, Ventilating and Air Conditioning by George E. Clifford.

1. Calculation of Annual Heating Load

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

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) = 38.4
Heating Degree Days = 4376

Duplex

Dimensions	0	1	2	3	4	5
Perimeter Foot Length	67	75	85	92	104	109
Roof Area(SF)	500	625	800	950	1,200	1,325
Exterior Wall Area(SF)	454	392	428	458	500	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	60,000	60,000	60,000

Garden

Dimensions	0	1	2	3	4	5
Perimeter Foot Length	54	61	66	78	87	92
Roof Area(SF)	475	600	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	180
Crack Length of Doors	40	40	40	40	40	40
Size of heating system	42,000	42,000	42,000	60,000	60,000	60,000

Assumptions for Annual Heat Loss Calculations

High-Rise

Dimensions	0	1	2	3	4	5
Perimeter Foot Length	0	0	0	0	0	0
Roof Area(SF)	0	0	0	0	0	0
Exterior Wall Area(SF)	197	220	249	267	276	326
Window Area(SF)	45	58	73	100	122	136
Exterior Door Area(SF)	20	20	20	20	20	20
Crack Length of Windows	40	63	86	105	128	142
Crack Length of Doors	20	20	20	20	20	20
Size of heating system	42,000	42,000	42,000	60,000	60,000	60,000

Mobile Home

Dimensions	0	1	2	3	4	5
Perimeter Foot Length	89	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)	41	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	98	110	114	122	124	126
Roof Area(SF)	600	750	925	1,225	1,400	1,525
Exterior Wall Area(SF)	690	751	810	932	966	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	60,000	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	59	66
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	60,000	60,000	60,000

Minimum Standards	Coal	Electric	Heat Pump	Mobile Home	Natural Gas	Oil	Wood
Thermal Resistance	R-Value	R-Value	R-Value	R-Value	R-Value	R-Value	R-Value
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	6.99	9.01	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.

HEAT LOAD CALCULATION

Renton Housing Authority

HOUSING CHOICE VOUCHER

Unit Type:	Duplex	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:	85	ft.
Perimeter Factor:	17.24	Btuh/lf
Perimeter Heat Loss:	1463.03	Btuh
Roof Square Footage:	800	sq.ft.
Roof U-Value:	0.067	Btuh/F-sf
Roof Heat Loss:	2048.00	Btuh
Exterior Wall Area:	428	sq.ft.
Wall U-Value:	0.11	Btuh/F-sf
Wall Heat Loss:	1822.97	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	Btuh
Window Crack Length:	100	ft
Infiltration Loss Factor:	0.15	CFM / Lf
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:	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 Consumption:	4380	kBTU/yr
Heating Fuel? (Natural Gas, Electric, Propane)	Natural Gas	
Estimated Heating System Consumption:	**290**	**THERMS**
Heating System Fan? (yes or no)	Yes	
Heating Output:	27,300	Btuh
Fan Size:	400	Watts
Fan Operating Hours:	901	hours
Fan Energy:	**360**	**kWh**

HEAT LOAD CALCULATION

Renton Housing Authority

HOUSING CHOICE VOUCHER

Unit Type:	Garden	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:	66	ft.
Perimeter Factor:	17.24	Btuh/lf
Perimeter Heat Loss:	1140.45	Btuh
Roof Square Footage:	700	sq.ft.
Roof U-Value:	0.067	Btuh/F-sf
Roof Heat Loss:	1792.00	Btuh
Exterior Wall Area:	391	sq.ft.
Wall U-Value:	0.11	Btuh/F-sf
Wall Heat Loss:	1667.24	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	Btuh
Window Crack Length:	100	ft
Infiltration Loss Factor:	0.15	CFM / Lf
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:	7557.29	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:	**241**	**THERMS**
Heating System Fan? (yes or no)	Yes	
Heating Output:	27,300	Btuh
Fan Size:	400	Watts
Fan Operating Hours:	722	hours
Fan Energy:	**289**	**kWh**

HEAT LOAD CALCULATION

Renton Housing Authority

HOUSING CHOICE VOUCHER

Unit Type:	High-Rise	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:	0	ft.
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 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:	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:	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:	**146**	**THERMS**
Heating System Fan? (yes or no)	Yes	
Heating Output:	23,400	Btuh
Fan Size:	400	Watts
Fan Operating Hours:	435	hours
Fan Energy:	**174**	**kWh**

HEAT LOAD CALCULATION

Renton Housing Authority

HOUSING CHOICE VOUCHER

Unit Type:	Mobile Home	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	
Floor Square Footage:	550	ft.
Perimeter Factor:	2.30	Btuh/lf
Floor Heat Loss:	1265.00	Btuh
Roof Square Footage:	550	sq.ft.
Roof U-Value:	0.077	Btuh/F-sf
Roof Heat Loss:	1624.62	Btuh
Exterior Wall Area:	634	sq.ft.
Wall U-Value:	0.14	Btuh/F-sf
Wall Heat Loss:	3483.98	Btuh
Window Area:	78	sq.ft.
Window U-Value:	0.62	Btuh/F-sf
Window Heat Loss:	1857.02	Btuh
Door Area:	38	sq.ft.
Door U-Value:	0.58	Btuh/F-sf
Door Heat Loss:	846.34	Btuh
Window Crack Length:	65	ft
Infiltration Loss Factor:	0.15	CFM / Lf
Infiltration Loss:	404.35	Btuh
Door Crack Length:	40	ft
Infiltration Loss Factor:	0.15	CFM / Lf
Infiltration Loss:	248.83	Btuh
Total Apartment Heat Loss Rate:	9730.14	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:	**298**	**THERMS**
Heating System Fan? (yes or no)	Yes	
Heating Output:	23,400	Btuh
Fan Size:	400	Watts
Fan Operating Hours:	1,085	hours
Fan Energy:	**434**	**kWh**

HEAT LOAD CALCULATION

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	Btuh
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**	**THERMS**
Heating System Fan? (yes or no)	Yes	
Heating Output:	39,000	Btuh
Fan Size:	400	Watts
Fan Operating Hours:	846	hours
Fan Energy:	**338**	**kWh**

HEAT LOAD CALCULATION

Renton Housing Authority

HOUSING CHOICE VOUCHER

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

APARTMENT DATA:

Number of Stories Per Unit:	2	
Perimeter Linear Footage:	43	ft.
Perimeter Factor:	17.24	Btuh/lf
Perimeter Heat Loss:	746.60	Btuh
Roof Square Footage:	300	sq.ft.
Roof U-Value:	0.067	Btuh/F-sf
Roof Heat Loss:	768.00	Btuh
Exterior Wall Area:	585	sq.ft.
Wall U-Value:	0.11	Btuh/F-sf
Wall Heat Loss:	2492.74	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:	7266.73	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:	**233**	**THERMS**
Heating System Fan? (yes or no)	Yes	
Heating Output:	27,300	Btuh
Fan Size:	400	Watts
Fan Operating Hours:	694	hours
Fan Energy:	**278**	**kWh**

HEAT LOAD CALCULATION

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**

HEAT LOAD CALCULATION

Renton Housing Authority

HOUSING CHOICE VOUCHER

Unit Type:	Garden	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:	61	ft.
Perimeter Factor:	17.24	Btuh/lf
Perimeter Heat Loss:	1055.85	Btuh
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**

HEAT LOAD CALCULATION

Renton Housing Authority

HOUSING CHOICE VOUCHER

Unit Type:	High-Rise	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:	0	ft.
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:	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:	3280.36	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:	**1,716**	**kWh**
Heating System Fan? (yes or no)	Yes	
Heating Output:	34,200	Btuh
Fan Size:	400	Watts
Fan Operating Hours:	171	hours
Fan Energy:	**68**	**kWh**

HEAT LOAD CALCULATION

Renton Housing Authority

HOUSING CHOICE VOUCHER

Unit Type:	Mobile Home	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:	1	
Floor Square Footage:	550	sq. ft.
Perimeter Factor:	2.30	Btuh/lf
Floor Heat Loss:	1265.00	Btuh
Roof Square Footage:	550	sq.ft.
Roof U-Value:	0.077	Btuh/F-sf
Roof Heat Loss:	1624.62	Btuh
Exterior Wall Area:	634	sq.ft.
Wall U-Value:	0.14	Btuh/F-sf
Wall Heat Loss:	3483.98	Btuh
Window Area:	78	sq.ft.
Window U-Value:	0.62	Btuh/F-sf
Window Heat Loss:	1857.02	Btuh
Door Area:	38	sq.ft.
Door U-Value:	0.58	Btuh/F-sf
Door Heat Loss:	846.34	Btuh
Window Crack Length:	65	ft
Infiltration Loss Factor:	0.15	CFM / Lf
Infiltration Loss:	404.35	Btuh
Door Crack Length:	40	ft
Infiltration Loss Factor:	0.15	CFM / Lf
Infiltration Loss:	248.83	Btuh
Total Apartment Heat Loss Rate:	9730.14	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:	**5,089**	**kWh**
Heating System Fan? (yes or no)	Yes	
Heating Output:	34,200	Btuh
Fan Size:	400	Watts
Fan Operating Hours:	508	hours
Fan Energy:	**203**	**kWh**

HEAT LOAD CALCULATION

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:

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	Btuh
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:	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:	**6,618**	**KWH**
Heating System Fan? (yes or no)	Yes	
Heating Output:	57,000	Btuh
Fan Size:	400	Watts
Fan Operating Hours:	396	hours
Fan Energy:	**158**	**kWh**

HEAT LOAD CALCULATION

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	Btuh
Window Crack Length:	100	ft
Infiltration Loss Factor:	0.15	CFM / Lf
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.:	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:	**4,501**	**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**

HEAT LOAD CALCULATION

Renton Housing Authority

HOUSING CHOICE VOUCHER

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

APARTMENT DATA:

Number of Stories Per Unit:	1	
Perimeter Linear Footage:	85	ft.
Perimeter Factor:	17.24	Btuh/lf
Perimeter Heat Loss:	1463.03	Btuh
Roof Square Footage:	800	sq.ft.
Roof U-Value:	0.067	Btuh/F-sf
Roof Heat Loss:	2048.00	Btuh
Exterior Wall Area:	428	sq.ft.
Wall U-Value:	0.11	Btuh/F-sf
Wall Heat Loss:	1822.97	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	Btuh
Window Crack Length:	100	ft
Infiltration Loss Factor:	0.15	CFM / Lf
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:	9432.05	Btuh
Estimated Heating System Overall Efficiency:	170%	
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)	Heat Pump	
Estimated Heating System Consumption:	**2,757**	**KWH**
Heating System Fan? (yes or no)	Yes	
Heating Output:	63,000	Btuh
Fan Size:	400	Watts
Fan Operating Hours:	149	hours
Fan Energy:	**60**	**kWh**

HEAT LOAD CALCULATION

Renton Housing Authority

HOUSING CHOICE VOUCHER

Unit Type:	Garden	Heating Degree Days =	4376
Number of Bedrooms:	3	Design Temp. Diff.(F) =	38
Heating Fuel:	Heat Pump	Correction Factor (CD) =	0.62

APARTMENT DATA:

Number of Stories Per Unit:	1	
Perimeter Linear Footage:	78	ft.
Perimeter Factor:	17.24	Btuh/lf
Perimeter Heat Loss:	1345.95	Btuh
Roof Square Footage:	975	sq.ft.
Roof U-Value:	0.067	Btuh/F-sf
Roof Heat Loss:	2496.00	Btuh
Exterior Wall Area:	466	sq.ft.
Wall U-Value:	0.11	Btuh/F-sf
Wall Heat Loss:	1988.41	Btuh
Window Area:	120	sq.ft.
Window U-Value:	0.62	Btuh/F-sf
Window Heat Loss:	2856.96	Btuh
Door Area:	38	sq.ft.
Door U-Value:	0.58	Btuh/F-sf
Door Heat Loss:	846.34	Btuh
Window Crack Length:	120	ft
Infiltration Loss Factor:	0.15	CFM / Lf
Infiltration Loss:	746.50	Btuh
Door Crack Length:	40	ft
Infiltration Loss Factor:	0.15	CFM / Lf
Infiltration Loss:	248.83	Btuh
Total Apartment Heat Loss Rate:	9183.03	Btuh
Estimated Heating System Overall Efficiency:	170%	
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)	Heat Pump	
Estimated Heating System Consumption:	**2,684**	**KWH**
Heating System Fan? (yes or no)	Yes	
Heating Output:	90,000	Btuh
Fan Size:	400	Watts
Fan Operating Hours:	102	hours
Fan Energy:	**41**	**kWh**

HEAT LOAD CALCULATION

Renton Housing Authority

HOUSING CHOICE VOUCHER

Unit Type:	High-Rise	Heating Degree Days =	4376
Number of Bedrooms:	3	Design Temp. Diff.(F) =	38
Heating Fuel:	Heat Pump	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:	0.067	Btuh/F-sf
Roof Heat Loss:	0.00	Btuh
Exterior Wall Area:	267	sq.ft.
Wall U-Value:	0.11	Btuh/F-sf
Wall Heat Loss:	1138.06	Btuh
Window Area:	100	sq.ft.
Window U-Value:	0.62	Btuh/F-sf
Window Heat Loss:	2380.80	Btuh
Door Area:	20	sq.ft.
Door U-Value:	0.58	Btuh/F-sf
Door Heat Loss:	445.44	Btuh
Window Crack Length:	105	ft
Infiltration Loss Factor:	0.15	CFM / Lf
Infiltration Loss:	653.18	Btuh
Door Crack Length:	20	ft
Infiltration Loss Factor:	0.15	CFM / Lf
Infiltration Loss:	124.42	Btuh
Total Apartment Heat Loss Rate:	4741.90	Btuh
Estimated Heating System Overall Efficiency:	170%	
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)	Heat Pump	
Estimated Heating System Consumption:	**1,386**	**KWH**
Heating System Fan? (yes or no)	Yes	
Heating Output:	66,000	Btuh
Fan Size:	400	Watts
Fan Operating Hours:	72	hours
Fan Energy:	**29**	**kWh**

HEAT LOAD CALCULATION

Renton Housing Authority

HOUSING CHOICE VOUCHER

Unit Type:	Mobile Home	Heating Degree Days =	4376
Number of Bedrooms:	3	Design Temp. Diff.(F) =	38
Heating Fuel:	Heat Pump	Correction Factor (CD) =	0.62

APARTMENT DATA:

Number of Stories Per Unit:	1	
Floor Square Footage:	750	sq. ft.
Perimeter Factor:	2.30	Btuh/lf
Floor Heat Loss:	1725.00	Btuh
Roof Square Footage:	750	sq.ft.
Roof U-Value:	0.077	Btuh/F-sf
Roof Heat Loss:	2215.38	Btuh
Exterior Wall Area:	746	sq.ft.
Wall U-Value:	0.14	Btuh/F-sf
Wall Heat Loss:	4098.39	Btuh
Window Area:	92	sq.ft.
Window U-Value:	0.62	Btuh/F-sf
Window Heat Loss:	2190.34	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:	11821.94	Btuh
Estimated Heating System Overall Efficiency:	170%	
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)	Heat Pump	
Estimated Heating System Consumption:	**3,455**	**KWH**
Heating System Fan? (yes or no)	Yes	
Heating Output:	66,000	Btuh
Fan Size:	400	Watts
Fan Operating Hours:	179	hours
Fan Energy:	**72**	**kWh**

HEAT LOAD CALCULATION

Renton Housing Authority

HOUSING CHOICE VOUCHER

Unit Type:	Single Family	Heating Degree Days =	4376
Number of Bedrooms:	3	Design Temp. Diff.(F) =	38
Heating Fuel:	Heat Pump	Correction Factor (CD) =	0.62

APARTMENT DATA:

Number of Stories Per Unit:	1	
Perimeter Linear Footage:	122	ft.
Perimeter Factor:	17.24	Btuh/lf
Perimeter Heat Loss:	2103.52	Btuh
Roof Square Footage:	1225	sq.ft.
Roof U-Value:	0.067	Btuh/F-sf
Roof Heat Loss:	3136.00	Btuh
Exterior Wall Area:	932	sq.ft.
Wall U-Value:	0.11	Btuh/F-sf
Wall Heat Loss:	3972.56	Btuh
Window Area:	150	sq.ft.
Window U-Value:	0.62	Btuh/F-sf
Window Heat Loss:	3571.20	Btuh
Door Area:	38	sq.ft.
Door U-Value:	0.58	Btuh/F-sf
Door Heat Loss:	846.34	Btuh
Window Crack Length:	152	ft
Infiltration Loss Factor:	0.15	CFM / Lf
Infiltration Loss:	945.56	Btuh
Door Crack Length:	40	ft
Infiltration Loss Factor:	0.15	CFM / Lf
Infiltration Loss:	248.83	Btuh
Total Apartment Heat Loss Rate:	14824.01	Btuh
Estimated Heating System Overall Efficiency:	170%	
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)	Heat Pump	
Estimated Heating System Consumption:	**4,332**	**KWH**
Heating System Fan? (yes or no)	Yes	
Heating Output:	90,000	Btuh
Fan Size:	400	Watts
Fan Operating Hours:	164	hours
Fan Energy:	**66**	**kWh**

HEAT LOAD CALCULATION

Renton Housing Authority

HOUSING CHOICE VOUCHER

Unit Type:	Townhouse	Heating Degree Days =	4376
Number of Bedrooms:	2	Design Temp. Diff.(F) =	38
Heating Fuel:	Heat Pump	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	Btuh
Window Crack Length:	100	ft
Infiltration Loss Factor:	0.15	CFM / Lf
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:	170%	
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)	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**

HEAT LOAD CALCULATION

Renton Housing Authority

HOUSING CHOICE VOUCHER

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

APARTMENT DATA:

Number of Stories Per Unit:	1	
Perimeter Linear Footage:	85	ft.
Perimeter Factor:	17.24	Btuh/lf
Perimeter Heat Loss:	1463.03	Btuh
Roof Square Footage:	800	sq.ft.
Roof U-Value:	0.067	Btuh/F-sf
Roof Heat Loss:	2048.00	Btuh
Exterior Wall Area:	428	sq.ft.
Wall U-Value:	0.11	Btuh/F-sf
Wall Heat Loss:	1822.97	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	Btuh
Window Crack Length:	100	ft
Infiltration Loss Factor:	0.15	CFM / Lf
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:	9432.05	Btuh
Estimated Heating System Overall Efficiency:	55%	
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)	Fuel Oil	
Estimated Heating System Consumption:	**241**	**GALLONS**
Heating System Fan? (yes or no)	Yes	
Heating Output:	23,100	Btuh
Fan Size:	400	Watts
Fan Operating Hours:	1,259	hours
Fan Energy:	**504**	**kWh**

HEAT LOAD CALCULATION

Renton Housing Authority

HOUSING CHOICE VOUCHER

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

APARTMENT DATA:

Number of Stories Per Unit:	1	
Perimeter Linear Footage:	66	ft.
Perimeter Factor:	17.24	Btuh/lf
Perimeter Heat Loss:	1140.45	Btuh
Roof Square Footage:	700	sq.ft.
Roof U-Value:	0.067	Btuh/F-sf
Roof Heat Loss:	1792.00	Btuh
Exterior Wall Area:	391	sq.ft.
Wall U-Value:	0.11	Btuh/F-sf
Wall Heat Loss:	1667.24	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	Btuh
Window Crack Length:	100	ft
Infiltration Loss Factor:	0.15	CFM / Lf
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:	7557.29	Btuh
Estimated Heating System Overall Efficiency:	55%	
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)	Fuel Oil	
Estimated Heating System Consumption:	**200**	**GALLONS**
Heating System Fan? (yes or no)	Yes	
Heating Output:	23,100	Btuh
Fan Size:	400	Watts
Fan Operating Hours:	1,009	hours
Fan Energy:	**404**	**kWh**

HEAT LOAD CALCULATION

Renton Housing Authority

HOUSING CHOICE VOUCHER

Unit Type:	High-Rise	Heating Degree Days =	4376
Number of Bedrooms:	2	Design Temp. Diff.(F) =	38
Heating Fuel:	Fuel Oil	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:	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:	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 BTU/hr.:	500	BTU/hr.
Pilot Operating Hours:	8760	hrs/yr
Pilot Consumption:	4380	kBTU/yr
Heating Fuel? (Natural Gas, Electric, Propane)	Fuel Oil	
Estimated Heating System Consumption:	**118**	**GALLONS**
Heating System Fan? (yes or no)	Yes	
Heating Output:	19,800	Btuh
Fan Size:	400	Watts
Fan Operating Hours:	608	hours
Fan Energy:	**243**	**kWh**

HEAT LOAD CALCULATION

Renton Housing Authority

HOUSING CHOICE VOUCHER

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

APARTMENT DATA:

Number of Stories Per Unit:	1	
Floor Square Footage:	550	sq. ft.
Perimeter Factor:	2.30	Btuh/lf
Floor Heat Loss:	1265.00	Btuh
Roof Square Footage:	550	sq.ft.
Roof U-Value:	0.077	Btuh/F-sf
Roof Heat Loss:	1624.62	Btuh
Exterior Wall Area:	634	sq.ft.
Wall U-Value:	0.14	Btuh/F-sf
Wall Heat Loss:	3483.98	Btuh
Window Area:	78	sq.ft.
Window U-Value:	0.62	Btuh/F-sf
Window Heat Loss:	1857.02	Btuh
Door Area:	38	sq.ft.
Door U-Value:	0.58	Btuh/F-sf
Door Heat Loss:	846.34	Btuh
Window Crack Length:	65	ft
Infiltration Loss Factor:	0.15	CFM / Lf
Infiltration Loss:	404.35	Btuh
Door Crack Length:	40	ft
Infiltration Loss Factor:	0.15	CFM / Lf
Infiltration Loss:	248.83	Btuh
Total Apartment Heat Loss Rate:	9730.14	Btuh
Estimated Heating System Overall Efficiency:	55%	
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)	Fuel Oil	
Estimated Heating System Consumption:	**248**	**GALLONS**
Heating System Fan? (yes or no)	Yes	
Heating Output:	19,800	Btuh
Fan Size:	400	Watts
Fan Operating Hours:	1,515	hours
Fan Energy:	**606**	**kWh**

HEAT LOAD CALCULATION

Renton Housing Authority

HOUSING CHOICE VOUCHER

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

APARTMENT DATA:

Number of Stories Per Unit:	1	
Perimeter Linear Footage:	110	ft.
Perimeter Factor:	17.24	Btuh/lf
Perimeter Heat Loss:	1896.62	Btuh
Roof Square Footage:	750	sq.ft.
Roof U-Value:	0.067	Btuh/F-sf
Roof Heat Loss:	1920.00	Btuh
Exterior Wall Area:	751	sq.ft.
Wall U-Value:	0.11	Btuh/F-sf
Wall Heat Loss:	3200.45	Btuh
Window Area:	88	sq.ft.
Window U-Value:	0.62	Btuh/F-sf
Window Heat Loss:	2083.20	Btuh
Door Area:	38	sq.ft.
Door U-Value:	0.58	Btuh/F-sf
Door Heat Loss:	846.34	Btuh
Window Crack Length:	104	ft
Infiltration Loss Factor:	0.15	CFM / Lf
Infiltration Loss:	646.96	Btuh
Door Crack Length:	40	ft
Infiltration Loss Factor:	0.15	CFM / Lf
Infiltration Loss:	248.83	Btuh
Total Apartment Heat Loss Rate:	10842.40	Btuh
Estimated Heating System Overall Efficiency:	55%	
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)	Fuel Oil	
Estimated Heating System Consumption:	**273**	**GALLONS**
Heating System Fan? (yes or no)	Yes	
Heating Output:	23,100	Btuh
Fan Size:	400	Watts
Fan Operating Hours:	1,447	hours
Fan Energy:	**579**	**kWh**

HEAT LOAD CALCULATION

Renton Housing Authority

HOUSING CHOICE VOUCHER

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

APARTMENT DATA:

Number of Stories Per Unit:	2	
Perimeter Linear Footage:	43	ft.
Perimeter Factor:	17.24	Btuh/lf
Perimeter Heat Loss:	746.60	Btuh
Roof Square Footage:	300	sq.ft.
Roof U-Value:	0.067	Btuh/F-sf
Roof Heat Loss:	768.00	Btuh
Exterior Wall Area:	585	sq.ft.
Wall U-Value:	0.11	Btuh/F-sf
Wall Heat Loss:	2492.74	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:	7266.73	Btuh
Estimated Heating System Overall Efficiency:	55%	
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)	Fuel Oil	
Estimated Heating System Consumption:	**193**	**GALLONS**
Heating System Fan? (yes or no)	Yes	
Heating Output:	23,100	Btuh
Fan Size:	400	Watts
Fan Operating Hours:	970	hours
Fan Energy:	**388**	**kWh**

HEAT LOAD CALCULATION

Renton Housing Authority

HOUSING CHOICE VOUCHER

Unit Type:	Duplex	Heating Degree Days =	4376
Number of Bedrooms:	1	Design Temp. Diff.(F) =	38
Heating Fuel:	Propane	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:	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)	Propane	
Estimated Heating System Consumption:	**260**	**GALLONS**
Heating System Fan? (yes or no)	Yes	
Heating Output:	27,300	Btuh
Fan Size:	400	Watts
Fan Operating Hours:	748	hours
Fan Energy:	**299**	**kWh**

HEAT LOAD CALCULATION

Renton Housing Authority

HOUSING CHOICE VOUCHER

Unit Type:	Garden	Heating Degree Days =	4376
Number of Bedrooms:	3	Design Temp. Diff.(F) =	38
Heating Fuel:	Propane	Correction Factor (CD) =	0.62

APARTMENT DATA:

Number of Stories Per Unit:	1	
Perimeter Linear Footage:	78	ft.
Perimeter Factor:	17.24	Btuh/lf
Perimeter Heat Loss:	1345.95	Btuh
Roof Square Footage:	975	sq.ft.
Roof U-Value:	0.067	Btuh/F-sf
Roof Heat Loss:	2496.00	Btuh
Exterior Wall Area:	466	sq.ft.
Wall U-Value:	0.11	Btuh/F-sf
Wall Heat Loss:	1988.41	Btuh
Window Area:	120	sq.ft.
Window U-Value:	0.62	Btuh/F-sf
Window Heat Loss:	2856.96	Btuh
Door Area:	38	sq.ft.
Door U-Value:	0.58	Btuh/F-sf
Door Heat Loss:	846.34	Btuh
Window Crack Length:	120	ft
Infiltration Loss Factor:	0.15	CFM / Lf
Infiltration Loss:	746.50	Btuh
Door Crack Length:	40	ft
Infiltration Loss Factor:	0.15	CFM / Lf
Infiltration Loss:	248.83	Btuh
Total Apartment Heat Loss Rate:	9183.03	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)	Propane	
Estimated Heating System Consumption:	**297**	**GALLONS**
Heating System Fan? (yes or no)	Yes	
Heating Output:	39,000	Btuh
Fan Size:	400	Watts
Fan Operating Hours:	614	hours
Fan Energy:	**246**	**kWh**

HEAT LOAD CALCULATION

Renton Housing Authority

HOUSING CHOICE VOUCHER

Unit Type:	High-Rise	Heating Degree Days =	4376
Number of Bedrooms:	3	Design Temp. Diff.(F) =	38
Heating Fuel:	Propane	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:	0.067	Btuh/F-sf
Roof Heat Loss:	0.00	Btuh
Exterior Wall Area:	267	sq.ft.
Wall U-Value:	0.11	Btuh/F-sf
Wall Heat Loss:	1138.06	Btuh
Window Area:	100	sq.ft.
Window U-Value:	0.62	Btuh/F-sf
Window Heat Loss:	2380.80	Btuh
Door Area:	20	sq.ft.
Door U-Value:	0.58	Btuh/F-sf
Door Heat Loss:	445.44	Btuh
Window Crack Length:	105	ft
Infiltration Loss Factor:	0.15	CFM / Lf
Infiltration Loss:	653.18	Btuh
Door Crack Length:	20	ft
Infiltration Loss Factor:	0.15	CFM / Lf
Infiltration Loss:	124.42	Btuh
Total Apartment Heat Loss Rate:	4741.90	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)	Propane	
Estimated Heating System Consumption:	**175**	**GALLONS**
Heating System Fan? (yes or no)	Yes	
Heating Output:	28,600	Btuh
Fan Size:	400	Watts
Fan Operating Hours:	433	hours
Fan Energy:	**173**	**kWh**

HEAT LOAD CALCULATION

Renton Housing Authority

HOUSING CHOICE VOUCHER

Unit Type:	Mobile Home	Heating Degree Days =	4376
Number of Bedrooms:	3	Design Temp. Diff.(F) =	38
Heating Fuel:	Propane	Correction Factor (CD) =	0.62

APARTMENT DATA:

Number of Stories Per Unit:	1	
Floor Square Footage:	750	sq. ft.
Perimeter Factor:	2.30	Btuh/lf
Floor Heat Loss:	1725.00	Btuh
Roof Square Footage:	750	sq.ft.
Roof U-Value:	0.077	Btuh/F-sf
Roof Heat Loss:	2215.38	Btuh
Exterior Wall Area:	746	sq.ft.
Wall U-Value:	0.14	Btuh/F-sf
Wall Heat Loss:	4098.39	Btuh
Window Area:	92	sq.ft.
Window U-Value:	0.62	Btuh/F-sf
Window Heat Loss:	2190.34	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:	11821.94	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)	Propane	
Estimated Heating System Consumption:	**369**	**GALLONS**
Heating System Fan? (yes or no)	Yes	
Heating Output:	28,600	Btuh
Fan Size:	400	Watts
Fan Operating Hours:	1,078	hours
Fan Energy:	**431**	**kWh**

HEAT LOAD CALCULATION

Renton Housing Authority

HOUSING CHOICE VOUCHER

Unit Type:	Single Family	Heating Degree Days =	4376
Number of Bedrooms:	3	Design Temp. Diff.(F) =	38
Heating Fuel:	Propane	Correction Factor (CD) =	0.62

APARTMENT DATA:

Number of Stories Per Unit:	1	
Perimeter Linear Footage:	122	ft.
Perimeter Factor:	17.24	Btuh/lf
Perimeter Heat Loss:	2103.52	Btuh
Roof Square Footage:	1225	sq.ft.
Roof U-Value:	0.067	Btuh/F-sf
Roof Heat Loss:	3136.00	Btuh
Exterior Wall Area:	932	sq.ft.
Wall U-Value:	0.11	Btuh/F-sf
Wall Heat Loss:	3972.56	Btuh
Window Area:	150	sq.ft.
Window U-Value:	0.62	Btuh/F-sf
Window Heat Loss:	3571.20	Btuh
Door Area:	38	sq.ft.
Door U-Value:	0.58	Btuh/F-sf
Door Heat Loss:	846.34	Btuh
Window Crack Length:	152	ft
Infiltration Loss Factor:	0.15	CFM / Lf
Infiltration Loss:	945.56	Btuh
Door Crack Length:	40	ft
Infiltration Loss Factor:	0.15	CFM / Lf
Infiltration Loss:	248.83	Btuh
Total Apartment Heat Loss Rate:	14824.01	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)	Propane	
Estimated Heating System Consumption:	**451**	**GALLONS**
Heating System Fan? (yes or no)	Yes	
Heating Output:	39,000	Btuh
Fan Size:	400	Watts
Fan Operating Hours:	992	hours
Fan Energy:	**397**	**kWh**

HEAT LOAD CALCULATION

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 Consumption:	4380	kBTU/yr
Heating Fuel? (Natural Gas, Electric, Propane)	Propane	
Estimated Heating System Consumption:	**353**	**GALLONS**
Heating System Fan? (yes or no)	Yes	
Heating Output:	39,000	Btuh
Fan Size:	400	Watts
Fan Operating Hours:	753	hours
Fan Energy:	**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.

CALCULATIONS FOR DOMESTIC HOT WATER HEATERS

HOUSING CHOICE VOUCHER

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 Temperatu	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:	5,134	kBtu/yr
Total Energy Required:	9,849	kBtu/yr
Primary Fuel Required:	**141**	**Therms/Year**

CALCULATIONS FOR DOMESTIC HOT WATER HEATERS

HOUSING CHOICE VOUCHER

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 Temperatu	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:	7,701	kBtu/yr
Total Energy Required:	12,416	kBtu/yr
Primary Fuel Required:	**177**	**Therms/Year**

CALCULATIONS FOR DOMESTIC HOT WATER HEATERS

HOUSING CHOICE VOUCHER

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 Temperatu	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:	5,134	kBtu/yr
Total Energy Required:	6,345	kBtu/yr
Primary Fuel Required:	**1,859**	**kWh/Year**

CALCULATIONS FOR DOMESTIC HOT WATER HEATERS

HOUSING CHOICE VOUCHER

Fuel Type:	**Electricity**	
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 Temperatu	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:	7,701	kBtu/yr
Total Energy Required:	8,912	kBtu/yr
Primary Fuel Required:	**2,611**	**kWh/Year**

CALCULATIONS FOR DOMESTIC HOT WATER HEATERS

HOUSING CHOICE VOUCHER

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	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:	5,134	kBtu/yr
Total Energy Required:	9,849	kBtu/yr
Primary Fuel Required:	**147**	**Gallons/Year**

CALCULATIONS FOR DOMESTIC HOT WATER HEATERS

HOUSING CHOICE VOUCHER

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 Temperatu	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:	7,701	kBtu/yr
Total Energy Required:	12,416	kBtu/yr
Primary Fuel Required:	**186**	**Gallons/Year**

CALCULATIONS FOR DOMESTIC HOT WATER HEATERS

HOUSING CHOICE VOUCHER

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	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:	5,134	kBtu/yr
Total Energy Required:	9,849	kBtu/yr
Primary Fuel Required:	**101**	**Gallons/Year**

CALCULATIONS FOR DOMESTIC HOT WATER HEATERS
HOUSING CHOICE VOUCHER

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 Temperatu	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:	7,701	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.

COOLING LOAD CALCULATION

UNIT TYPE:	Duplex	Cooling Degree Days:	30
BEDROOM SIZE:	1 BR	Design Temperature Difference:	5

HEAT GAIN THROUGH THE ENVELOPE:

	Number of Stories:	1	
	Roof Square Footage:	625	sq.ft.
	Roof HTM:	0.33	Btu/h-sf
	Roof 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-sf
	Window Radiation:	42.5	Btu/h-sf
	Window 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:	610	Btu/h
	Total Heat Gain from Occupants:	1220	Btu/h
	Heat Gain from Appliances:	2400	Btu/h

TOTALS:

	Sensible Apartment Heat Gain Rate:	9493	Btu/h
	Duct Loss:	949	Btu/h
	Cooling Load Hours:	240	hrs/yr
	Cooling Fan Size:	185	Watts
	Annual Fan Consumption:	44	kWh
	SEER:	10	
	Total Room Load:	10443	Btu/h
	Annual Cooling Energy	**295**	**kWh**

COOLING LOAD CALCULATION

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-sf
Roof 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-sf
Window Radiation:	42.5	Btu/h-sf
Window Heat Gain:	4560	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:	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:	610	Btu/h
Total Heat Gain from Occupants:	1830	Btu/h
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/yr
Cooling Fan Size:	185	Watts
Annual Fan Consumption:	44	kWh
SEER:	10	
Total Room Load:	13741	Btu/h
Annual Cooling Energy	**374**	**kWh**

COOLING LOAD CALCULATION

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:	0	sq.ft.
	Roof HTM:	0.33	Btu/h-sf
	Roof Heat Gain:	0	Btu/h
	Exterior Wall Area:	249	sq.ft.
	Wall HTM:	1	Btu/h-sf
	Wall Heat Gain:	138	Btu/h
	Window Area:	73	sq.ft.
	Window HTM:	3	Btu/h-sf
	Window Radiation:	42.5	Btu/h-sf
	Window Heat Gain:	3329	Btu/h
	Door Area:	20	sq.ft.
	Door HTM:	3	Btu/h-sf
	Door Heat Gain:	58	Btu/h
INFILTRATION:			
Sensible:	ACH:	0.44	
	Above Ground Volume:	0	cu. Ft.
	Summer Infiltration CFM:	0	CFM
	Heat Gain:	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:	610	Btu/h
	Total Heat Gain from Occupants:	1830	Btu/h
	Heat Gain from Appliances:	2400	Btu/h
TOTALS:			
	Sensible Apartment Heat Gain Rate:	10670	Btu/h
	Duct Loss:	0	Btu/h
	Cooling Load Hours:	240	hrs/yr
	Cooling Fan Size:	185	Watts
	Annual Fan Consumption:	44	kWh
	SEER:	10	
	Total Room Load:	10670	Btu/h
	Annual Cooling Energy	**300**	**kWh**

COOLING LOAD CALCULATION

UNIT TYPE:	Mobile Home	Cooling Degree Days:	30
BEDROOM SIZE:	2 BR	Design Temperature Difference:	5

HEAT GAIN THROUGH THE ENVELOPE:

	Number of Stories:	1	
	Roof Square Footage:	550	sq.ft.
	Roof HTM:	0.38	Btu/h-sf
	Roof 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-sf
	Window Radiation:	42.5	Btu/h-sf
	Window 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/h
	Total Heat Gain from Occupants:	1830	Btu/h
	Heat 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:	185	Watts
	Annual Fan Consumption:	44	kWh
	SEER:	10	
	Total Room Load:	11655	Btu/h
	Annual Cooling Energy	**324**	**kWh**

COOLING LOAD CALCULATION

UNIT TYPE:	Single Family	Cooling Degree Days:	30
BEDROOM SIZE:	3 BR	Design Temperature Difference:	5

HEAT GAIN THROUGH THE ENVELOPE:

Number of Stories:	1	
Roof Square Footage:	1225	sq.ft.
Roof HTM:	0.33	Btu/h-sf
Roof 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-sf
Window Radiation:	42.5	Btu/h-sf
Window 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:	610	Btu/h
Total Heat Gain from Occupants:	3050	Btu/h
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/yr
Cooling Fan Size:	185	Watts
Annual Fan Consumption:	44	kWh
SEER:	10	
Total Room Load:	20438	Btu/h
Annual Cooling Energy	**535**	**kWh**

COOLING LOAD CALCULATION

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-sf
	Roof 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-sf
	Window Radiation:	42.5	Btu/h-sf
	Window Heat Gain:	5472	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:	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:	610	Btu/h
	Total Heat Gain from Occupants:	3050	Btu/h
	Heat Gain from Appliances:	2400	Btu/h
TOTALS:			
	Sensible Apartment Heat Gain Rate:	16714	Btu/h
	Duct Loss:	1671	Btu/h
	Cooling Load Hours:	240	hrs/yr
	Cooling Fan Size:	185	Watts
	Annual Fan Consumption:	44	kWh
	SEER:	10	
	Total Room Load:	18386	Btu/h
	Annual Cooling Energy	**486**	**kWh**