

UTILITY ALLOWANCE STUDY

FEBRUARY 2022

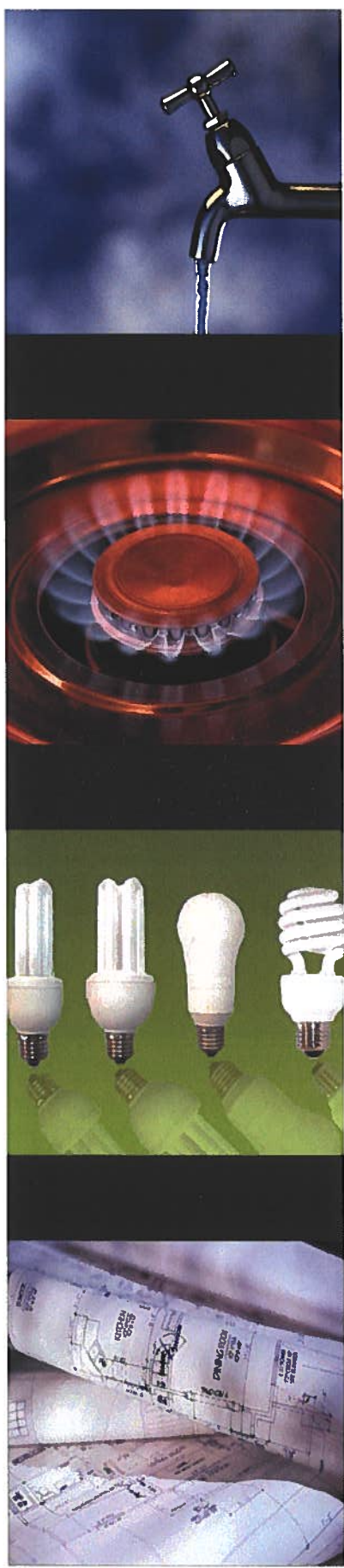
HOUSING CHOICE VOUCHER PROGRAM

RENTON HOUSING AUTHORITY

**MR. MARK GROPPER
EXECUTIVE DIRECTOR
RENTON HOUSING AUTHORITY
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February 20, 2022

Mr. Mark Gropper
Executive Director
Renton Housing Authority
2900 NE 10th Street
Renton, Washington 98056

Dear Mr. Gropper:

Enclosed please find a *final* copy of the 2022 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.

All of the utility rates increased since the previous update was completed in February 2021. Propane and fuel oil saw the largest increases at 20.6% and 15.4%, respectively. The electric rate increased 5.7% while natural gas increased 8.9%. The water and sewer rates increased between 2.0% and 10.9% depending upon the provider. A table comparing the current rates to those used in the 2021 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 Bart Lewis or myself at (770) 977-4134.

Sincerely,

W. Sawyer Shirley, P. E.
President
National Facility Consultants, Inc.

WSS/bkl

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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, 2022.

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, Garden Style, High-Rise, Mobile Home, Single Family, and Townhouse units. The fuel types studied for each unit type and size are natural gas, electricity, fuel oil, and propane. Allowances were also developed for water, sewer and sanitation service. Additionally, allowances were developed for various pieces of medical equipment to allow the Authority to increase the Utility Allowances for disabled persons who require supplementary utility consumption.

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

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

**HCV UTILITY ALLOWANCES (FORM HUD
52667)**

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

Utility Allowance Schedule

LOCALITY/PHA		UNIT TYPE					DATE
Renton Housing Authority		Duplex					7/1/2022
UTILITY OR SERVICE	MONTHLY DOLLAR ALLOWANCE						
	0-BR	1-BR	2-BR	3-BR	4-BR	5-BR	
HEATING							
a. Natural Gas	\$22	\$25	\$30	\$32	\$37	\$40	
b. Electric	\$32	\$37	\$45	\$51	\$60	\$66	
c. Heat Pump	\$18	\$21	\$25	\$28	\$33	\$36	
d. Fuel Oil	\$61	\$68	\$80	\$88	\$103	\$111	
e. Propane	\$55	\$62	\$73	\$80	\$93	\$101	
AIR CONDITIONING	\$2	\$3	\$3	\$4	\$5	\$6	
COOKING							
a. Natural Gas	\$6	\$6	\$8	\$8	\$9	\$9	
b. Electric	\$9	\$10	\$12	\$12	\$13	\$14	
c. Propane	\$16	\$17	\$20	\$22	\$24	\$25	
OTHER ELECTRIC	\$25	\$28	\$31	\$36	\$40	\$47	
WATER HEATING							
a. Natural Gas	\$9	\$12	\$16	\$22	\$29	\$36	
b. Electric	\$9	\$16	\$22	\$35	\$49	\$63	
c. Fuel Oil	\$23	\$31	\$39	\$55	\$72	\$89	
d. Propane	\$24	\$33	\$41	\$59	\$77	\$95	
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	\$20	\$24	\$30	\$46	\$65	\$85	
SEWER							
a. In - City of Renton	\$81	\$81	\$81	\$81	\$81	\$81	
b. Out - City of Renton	\$122	\$122	\$122	\$122	\$122	\$122	
c. Soos Creek	\$70	\$70	\$70	\$70	\$70	\$70	
SURFACE WATER	\$16	\$16	\$16	\$16	\$16	\$16	
TRASH COLLECTION	\$24	\$24	\$24	\$24	\$24	\$24	
REFRIGERATOR	\$5	\$5	\$5	\$5	\$5	\$5	
RANGE	\$4	\$4	\$4	\$4	\$4	\$4	
OTHER: Natural Gas Basic Charge	\$12	\$12	\$12	\$12	\$12	\$12	
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		\$	

**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		Garden					7/1/2022
UTILITY OR SERVICE	MONTHLY DOLLAR ALLOWANCE						
	0-BR	1-BR	2-BR	3-BR	4-BR	5-BR	
HEATING							
a. Natural Gas	\$18	\$21	\$25	\$28	\$32	\$36	
b. Electric	\$25	\$31	\$36	\$44	\$51	\$57	
c. Heat Pump	\$14	\$17	\$20	\$24	\$29	\$32	
d. Fuel Oil	\$48	\$58	\$66	\$77	\$90	\$98	
e. Propane	\$44	\$53	\$60	\$70	\$81	\$89	
AIR CONDITIONING	\$2	\$3	\$3	\$4	\$5	\$6	
COOKING							
a. Natural Gas	\$6	\$6	\$8	\$8	\$9	\$9	
b. Electric	\$9	\$10	\$12	\$12	\$13	\$14	
c. Propane	\$16	\$17	\$20	\$22	\$24	\$25	
OTHER ELECTRIC	\$25	\$28	\$31	\$36	\$40	\$47	
WATER HEATING							
a. Natural Gas	\$9	\$12	\$16	\$22	\$29	\$36	
b. Electric	\$9	\$16	\$22	\$35	\$49	\$63	
c. Fuel Oil	\$23	\$31	\$39	\$55	\$72	\$89	
d. Propane	\$24	\$33	\$41	\$59	\$77	\$95	
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	\$20	\$24	\$30	\$46	\$65	\$85	
SEWER							
a. In - City of Renton	\$81	\$81	\$81	\$81	\$81	\$81	
b. Out - City of Renton	\$122	\$122	\$122	\$122	\$122	\$122	
c. Soos Creek	\$70	\$70	\$70	\$70	\$70	\$70	
SURFACE WATER	\$16	\$16	\$16	\$16	\$16	\$16	
TRASH COLLECTION	\$24	\$24	\$24	\$24	\$24	\$24	
REFRIGERATOR	\$5	\$5	\$5	\$5	\$5	\$5	
RANGE	\$4	\$4	\$4	\$4	\$4	\$4	
OTHER: Natural Gas Basic Charge	\$12	\$12	\$12	\$12	\$12	\$12	
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		\$	

Utility Allowance Schedule

LOCALITY/PHA		UNIT TYPE					DATE
Renton Housing Authority		High-Rise					7/1/2022
UTILITY OR SERVICE		MONTHLY DOLLAR ALLOWANCE					
		0-BR	1-BR	2-BR	3-BR	4-BR	5-BR
HEATING							
a. Natural Gas		\$12	\$13	\$15	\$17	\$19	\$20
b. Electric		\$13	\$16	\$19	\$23	\$26	\$29
c. Heat Pump		\$7	\$9	\$10	\$13	\$14	\$16
d. Fuel Oil		\$30	\$34	\$39	\$45	\$50	\$55
e. Propane		\$28	\$32	\$36	\$42	\$46	\$50
AIR CONDITIONING		\$2	\$2	\$3	\$3	\$4	\$5
COOKING							
a. Natural Gas		\$6	\$6	\$8	\$8	\$9	\$9
b. Electric		\$9	\$10	\$12	\$12	\$13	\$14
c. Propane		\$16	\$17	\$20	\$22	\$24	\$25
OTHER ELECTRIC		\$25	\$28	\$31	\$36	\$40	\$47
WATER HEATING							
a. Natural Gas		\$9	\$12	\$16	\$22	\$29	\$36
b. Electric		\$9	\$16	\$22	\$35	\$49	\$63
c. Fuel Oil		\$23	\$31	\$39	\$55	\$72	\$89
d. Propane		\$24	\$33	\$41	\$59	\$77	\$95
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		\$20	\$24	\$30	\$46	\$65	\$85
SEWER							
a. In - City of Renton		\$81	\$81	\$81	\$81	\$81	\$81
b. Out - City of Renton		\$122	\$122	\$122	\$122	\$122	\$122
c. Soos Creek		\$70	\$70	\$70	\$70	\$70	\$70
SURFACE WATER		\$16	\$16	\$16	\$16	\$16	\$16
TRASH COLLECTION		\$24	\$24	\$24	\$24	\$24	\$24
REFRIGERATOR		\$5	\$5	\$5	\$5	\$5	\$5
RANGE		\$4	\$4	\$4	\$4	\$4	\$4
OTHER: Natural Gas Basic Charge		\$12	\$12	\$12	\$12	\$12	\$12
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		\$

Utility Allowance Schedule

LOCALITY/PHA		UNIT TYPE					DATE
Renton Housing Authority		Mobile Home					7/1/2022
UTILITY OR SERVICE		MONTHLY DOLLAR ALLOWANCE					
		0-BR	1-BR	2-BR	3-BR	4-BR	5-BR
HEATING							
a. Natural Gas		\$23	\$26	\$31	\$36	\$38	\$45
b. Electric		\$32	\$38	\$47	\$57	\$61	\$72
c. Heat Pump		\$18	\$21	\$26	\$31	\$33	\$40
d. Fuel Oil		\$61	\$69	\$83	\$98	\$104	\$122
e. Propane		\$55	\$63	\$75	\$88	\$94	\$110
AIR CONDITIONING							
		\$2	\$2	\$3	\$4	\$4	\$5
COOKING							
a. Natural Gas		\$6	\$6	\$8	\$8	\$9	\$9
b. Electric		\$9	\$10	\$12	\$12	\$13	\$14
c. Propane		\$16	\$17	\$20	\$22	\$24	\$25
OTHER ELECTRIC							
		\$25	\$28	\$31	\$36	\$40	\$47
WATER HEATING							
a. Natural Gas		\$9	\$12	\$16	\$22	\$29	\$36
b. Electric		\$9	\$16	\$22	\$35	\$49	\$63
c. Fuel Oil		\$23	\$31	\$39	\$55	\$72	\$89
d. Propane		\$24	\$33	\$41	\$59	\$77	\$95
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		\$20	\$24	\$30	\$46	\$65	\$85
SEWER							
a. In - City of Renton		\$81	\$81	\$81	\$81	\$81	\$81
b. Out - City of Renton		\$122	\$122	\$122	\$122	\$122	\$122
c. Soos Creek		\$70	\$70	\$70	\$70	\$70	\$70
SURFACE WATER							
		\$16	\$16	\$16	\$16	\$16	\$16
TRASH COLLECTION							
		\$24	\$24	\$24	\$24	\$24	\$24
REFRIGERATOR							
		\$5	\$5	\$5	\$5	\$5	\$5
RANGE							
		\$4	\$4	\$4	\$4	\$4	\$4
OTHER: Natural Gas Basic Charge							
		\$12	\$12	\$12	\$12	\$12	\$12
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		\$

Utility Allowance Schedule

LOCALITY/PHA		UNIT TYPE					DATE
Renton Housing Authority		Single Family					7/1/2022
UTILITY OR SERVICE		MONTHLY DOLLAR ALLOWANCE					
		0-BR	1-BR	2-BR	3-BR	4-BR	5-BR
HEATING							
a. Natural Gas		\$28	\$34	\$37	\$43	\$47	\$50
b. Electric		\$43	\$52	\$60	\$70	\$79	\$84
c. Heat Pump		\$24	\$29	\$33	\$39	\$44	\$47
d. Fuel Oil		\$77	\$91	\$103	\$119	\$131	\$139
e. Propane		\$70	\$82	\$93	\$107	\$118	\$126
AIR CONDITIONING		\$2	\$3	\$4	\$5	\$6	\$7
COOKING							
a. Natural Gas		\$6	\$6	\$8	\$8	\$9	\$9
b. Electric		\$9	\$10	\$12	\$12	\$13	\$14
c. Propane		\$16	\$17	\$20	\$22	\$24	\$25
OTHER ELECTRIC		\$25	\$28	\$31	\$36	\$40	\$47
WATER HEATING							
a. Natural Gas		\$9	\$12	\$16	\$22	\$29	\$36
b. Electric		\$9	\$16	\$22	\$35	\$49	\$63
c. Fuel Oil		\$23	\$31	\$39	\$55	\$72	\$89
d. Propane		\$24	\$33	\$41	\$59	\$77	\$95
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		\$20	\$24	\$30	\$46	\$65	\$85
SEWER							
a. In - City of Renton		\$81	\$81	\$81	\$81	\$81	\$81
b. Out - City of Renton		\$122	\$122	\$122	\$122	\$122	\$122
c. Soos Creek		\$70	\$70	\$70	\$70	\$70	\$70
SURFACE WATER		\$16	\$16	\$16	\$16	\$16	\$16
TRASH COLLECTION		\$24	\$24	\$24	\$24	\$24	\$24
REFRIGERATOR		\$5	\$5	\$5	\$5	\$5	\$5
RANGE		\$4	\$4	\$4	\$4	\$4	\$4
OTHER: Natural Gas Basic Charge		\$12	\$12	\$12	\$12	\$12	\$12
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		\$

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		Townhouse					7/1/2022
UTILITY OR SERVICE	MONTHLY DOLLAR ALLOWANCE						
	0-BR	1-BR	2-BR	3-BR	4-BR	5-BR	
HEATING							
a. Natural Gas	\$20	\$24	\$27	\$29	\$33	\$38	
b. Electric	\$29	\$35	\$41	\$46	\$53	\$61	
c. Heat Pump	\$16	\$19	\$23	\$26	\$30	\$34	
d. Fuel Oil	\$55	\$64	\$74	\$81	\$92	\$105	
e. Propane	\$51	\$58	\$67	\$74	\$84	\$95	
AIR CONDITIONING	\$2	\$3	\$3	\$4	\$5	\$6	
COOKING							
a. Natural Gas	\$6	\$6	\$8	\$8	\$9	\$9	
b. Electric	\$9	\$10	\$12	\$12	\$13	\$14	
c. Propane	\$16	\$17	\$20	\$22	\$24	\$25	
OTHER ELECTRIC	\$25	\$28	\$31	\$36	\$40	\$47	
WATER HEATING							
a. Natural Gas	\$9	\$12	\$16	\$22	\$29	\$36	
b. Electric	\$9	\$16	\$22	\$35	\$49	\$63	
c. Fuel Oil	\$23	\$31	\$39	\$55	\$72	\$89	
d. Propane	\$24	\$33	\$41	\$59	\$77	\$95	
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	\$20	\$24	\$30	\$46	\$65	\$85	
SEWER							
a. In - City of Renton	\$81	\$81	\$81	\$81	\$81	\$81	
b. Out - City of Renton	\$122	\$122	\$122	\$122	\$122	\$122	
c. Soos Creek	\$70	\$70	\$70	\$70	\$70	\$70	
SURFACE WATER	\$16	\$16	\$16	\$16	\$16	\$16	
TRASH COLLECTION	\$24	\$24	\$24	\$24	\$24	\$24	
REFRIGERATOR	\$5	\$5	\$5	\$5	\$5	\$5	
RANGE	\$4	\$4	\$4	\$4	\$4	\$4	
OTHER: Natural Gas Basic Charge	\$12	\$12	\$12	\$12	\$12	\$12	
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	\$22
Nebulizer	2	75	5	\$1
Electric Hospital Bed	0.2	200	1	\$1
Alternating Pressure Pad	24	70	51	\$5
Low Air-Loss Mattress	24	120	88	\$9
Power Wheelchair/Scooter	3	360	33	\$4
CPAP Machine	10	30	9	\$1

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
February-2022

Utility	Provider	Type of Charge	February 2021 Rate**	February 2022 Rate	Percent Change		
Electricity	Puget Sound Energy	Basic Charge (per month)	\$7.49	\$7.49	0.0%		
		<i>First 600 kWh (per kWh)</i>					
		Energy Charge	\$0.093071	\$0.091344			
		Revenue Decoupling Adj. Mechanism	\$0.000000	(\$0.000417)			
		Rev. Decoup. Adj. Mech. (Supp. Rate A)	\$0.000314	\$0.000314			
		Electric Conservation Service Rider	\$0.004659	\$0.003825			
		Energy Exchange Credit	(\$0.007386)	(\$0.006689)			
		Power Cost Adjustment	\$0.000000	\$0.003314			
		Power Cost Adjustment (Supplemental Rate)	\$0.002135	\$0.002135			
		Federal Wind Power Credit	(\$0.001440)	(\$0.001391)			
		Temporary Federal Income Tax Rate Credit	(\$0.000061)	\$0.000000			
		Renewable Energy Credit	(\$0.000043)	(\$0.000021)			
		Expedited Rate Filing Rate Adj.	\$0.000000	\$0.000000			
		Excess Deferred Income Tax	(\$0.003016)	\$0.000850			
		Property Tax Tracker	\$0.003209	\$0.003072			
		Low Income Program	\$0.001064	\$0.001352			
		Excess Deferred Income Tax Reversals	(\$0.000884)	(\$0.000884)			
		Total	\$0.091622	\$0.096804	5.7%		
				<i>Remaining kWh (per kWh)</i>			
				Energy Charge	\$0.113277	\$0.111175	
				Revenue Decoupling Adj. Mechanism	\$0.000000	(\$0.000417)	
				Rev. Decoup. Adj. Mech. (Supp. Rate A)	\$0.000314	\$0.000314	
				Electric Conservation Service Rider	\$0.004659	\$0.003825	
				Energy Exchange Benefit	(\$0.007386)	(\$0.006689)	
				Power Cost Adjustment	\$0.000000	\$0.003314	
				Power Cost Adjustment (Supplemental Rate)	\$0.002135	\$0.002135	
				Federal Wind Power Credit	(\$0.001440)	(\$0.001391)	
		Temporary Federal Income Tax Rate Credit	(\$0.000061)	\$0.000000			
		Renewable Energy Credit	(\$0.000043)	(\$0.000021)			
		Expedited Rate Filing Rate Adj.	\$0.000000	\$0.000000			
		Excess Deferred Income Tax	(\$0.003016)	\$0.000850			
		Property Tax Tracker	\$0.003209	\$0.003072			
		Low Income Program	\$0.001064	\$0.001352			
		Excess Deferred Income Tax Reversals	(\$0.000884)	(\$0.000884)			
		Total	\$0.111828	\$0.116635	4.3%		

Renton Housing Authority
Housing Choice Voucher Program
Utility Rate Comparison
February-2022

Utility	Provider	Type of Charge	February 2021 Rate**	February 2022 Rate	Percent Change
Gas	Puget Sound Energy	Basic Charge (per month)	\$11.52	\$11.52	0.0%
		<i>All therms (per therm)</i>			
		Delivery Charge	\$0.428570	\$0.419640	
		Low Income Program	\$0.007010	\$0.003650	
		Property Tax Tracker	\$0.019710	\$0.022750	
		Excess Deferred Income Tax	(\$0.013880)	\$0.003140	
		Temporary Federal Income Tax Rate Credit	(\$0.000680)	\$0.000000	
		Expedited Rate Filing Rate Adj.	\$0.000000	\$0.000000	
		Revenue Decoupling Adj. Mechanism	\$0.012320	\$0.022520	
		Cost Recovery Mechanism Pipeline Repl.	\$0.017700	\$0.022580	
		Cost of Gas	\$0.381290	\$0.463400	
		Deferred Account Adjustment	\$0.023320	\$0.001230	
		Deferred Account Adjustment (Supp. Rate A)	\$0.000000	\$0.000000	
		Deferred Account Adjustment (Supp. Rate B)	\$0.024950	\$0.024950	
		Gas Conservation Program Charge	\$0.021790	\$0.020190	
Excess Deferred Income Tax Reversals	(\$0.001370)	(\$0.001370)			
Total		\$0.920730	\$1.002680	8.9%	
Fuel Oil	Genesee Energy and All Discount Heating Oils	Average Consumption Charge (per gallon)	\$2.990	\$3.450	15.4%
Propane	Suburban and Ferrellgas Propane	Average Consumption Charge (per gallon)	\$2.09	\$2.52	20.6%

Renton Housing Authority
Housing Choice Voucher Program
Utility Rate Comparison
February-2022

Utility	Provider	Type of Charge	February 2021 Rate**	February 2022 Rate	Percent Change
Water	City of Renton	Basic Charge (per month)	\$18.31	\$18.68	2.0%
		<i>Consumption Charge (per CCF)</i>			
		0 - 500 CCFs per month	\$2.64	\$2.69	1.9%
		500 - 1000 CCFs per month	\$3.55	\$3.62	2.0%
Water	Soos Creek Water and Sewer District	Over 1000 CCFs per month	\$4.48	\$4.57	2.0%
		Basic Charge (per month)	\$15.88	\$16.35	3.0%
		<i>Consumption Charge (per CCF)</i>			
		0 - 500 CCFs per month	\$2.00	\$2.17	8.5%
Sewer	City of Renton	500 - 1000 CCFs per month	\$4.10	\$4.25	3.7%
		Over 1000 CCFs per month	\$5.15	\$5.35	3.9%
		Single Family (per month)	\$31.12	\$31.74	2.0%
		<i>Other Users</i>			
Sewer	Soos Creek Water and Sewer District	Base Charge (per month)	\$31.12	\$31.74	2.0%
		Consumption Charge (per CCF)	\$3.51	\$3.58	2.0%
		Sewer System Maintenance(per month)	\$19.14	\$21.22	10.9%
		King Co. Treatment Charge (per month)	\$47.37	\$49.27	4.0%
Sewer	King County	Total Charge (per month)	\$66.51	\$70.49	6.0%
		Single Family (per month)	\$47.37	\$49.27	4.0%
		Surface Water	City of Renton	Monthly Charge	\$15.45
Sanitation	City of Renton	Monthly Charge	\$23.53	\$24.00	2.0%

*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

Area of ceiling
Area of net exterior wall
Area of windows
Area of doors
Crack length of windows and doors
Perimeter foot length

Thermal Characteristics

R-value of ceiling
R-value of walls
R-value of windows
R-value of doors
Infiltration factor
(windows/doors)
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
<i>1st 600 kWh</i>	
Energy Charge	\$0.091344 per kWh
Revenue Decoupling Adj. Mechanism	(\$0.000417) per kWh
Revenue Decoupling Adj. Mechanism (Supplemental Rate A)	\$0.000314 per kWh
Electric Conservation Service Rider	\$0.003825 per kWh
Energy Exchange Credit	(\$0.006689) per kWh
Power Cost Adjustment	\$0.003314 per kWh
Power Cost Adjustment (Supplemental Rate)	\$0.002135 per kWh
Federal Wind Power Credit	(\$0.001391) per kWh
Temporary Federal Income Tax Credit	\$0.000000 per kWh
Renewable Energy Credit	(\$0.000021) per kWh
Expedited Rate Filing Adjustment	\$0.000000 per kWh
Excess Deferred Income Tax	\$0.000850 per kWh
Property Tax Tracker	\$0.003072 per kWh
Low Income Program	\$0.001352 per kWh
<u>Excess Deferred Income Tax Reversals</u>	<u>(\$0.000884) per kWh</u>
Total Rate	\$0.096804 per kWh

<i>All remaining kWh</i>	
Energy Charge	\$0.111175 per kWh
Revenue Decoupling Adj. Mechanism	(\$0.000417) per kWh
Revenue Decoupling Adj. Mechanism (Supplemental Rate A)	\$0.000314 per kWh
Electric Conservation Service Rider	\$0.003825 per kWh
Energy Exchange Credit	(\$0.006689) per kWh
Power Cost Adjustment	\$0.003314 per kWh
Power Cost Adjustment (Supplemental Rate)	\$0.002135 per kWh
Federal Wind Power Credit	(\$0.001391) per kWh
Temporary Federal Income Tax Credit	\$0.000000 per kWh
Renewable Energy Credit	(\$0.000021) per kWh
Expedited Rate Filing Adjustment	\$0.000000 per kWh
Excess Deferred Income Tax	\$0.000850 per kWh
Property Tax Tracker	\$0.003072 per kWh
Low Income Program	\$0.001352 per kWh
<u>Excess Deferred Income Tax Reversals</u>	<u>(\$0.000884) per kWh</u>
Total Rate	\$0.116635 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	\$11.52 per month
Delivery Charge	\$0.419640 per therm
Low Income Program	\$0.003650 per therm
Property Tax Tracker	\$0.022750 per therm
Expedited Rate Adjustment	\$0.000000 per therm
Revenue Decoupling Adj. Mechanism	\$0.022520 per therm
Cost Recovery Mechanism Pipeline Repl.	\$0.022580 per therm
Gas Cost	\$0.463400 per therm
Deferred Account Adjustment	\$0.001230 per therm
Gas Conservation Program Charge	\$0.020190 per therm
Excess Deferred Income Tax	\$0.003140 per therm
Temporary Federal Income Tax Adjustment	\$0.000000 per therm
Deferred Account Adjustment (Supp. Rate A)	\$0.000000 per therm
Deferred Account Adjustment (Supp. Rate B)	\$0.024950 per therm
<u>Excess Deferred Income Tax Reversals</u>	<u>(\$0.001370) per therm</u>
Total Charge	\$1.002680 per therm

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
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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	\$49.27 per month
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Soos Creek - Water

Base Charge	\$16.35 per month
Consumption 0 – 500 CF	\$2.17 per CCF
500 – 1000 CF	\$4.25 per CCF
1001 – 1500 CF	\$5.35 per CCF

Soos Creek - Sewer

Maintenance of the Sewer System	\$21.22 per month
King County Treatment Charge	\$49.27 per month
Total Sewer Charges	\$70.49 per month

Sanitation

<i>City of Renton</i>	\$24.00 per month
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SPACE HEATING CONSUMPTION LEVELS

Space Heating Consumption Levels and Cost Figures

HEATING - NATURAL GAS													
Bedrooms	Sq. Ft.	Duplex		Garden		High-Rise		Mobile Home		Single Family		Townhouse	
		Therms/ Month	Fan kWh/ Month	Therms/ Month	Fan kWh/ Month	Therms/ Month	Fan kWh/ Month	Therms/ Month	Fan kWh/ Month	Therms/ Month	Fan kWh/ Month	Therms/ Month	Fan kWh/ Month
0	400-550	19	22	15	17	10	11	19	26	24	30	17	20
1	500-700	21	26	18	21	11	13	21	30	28	36	20	24
2	700-900	25	31	21	25	12	15	26	37	32	29	23	28
3	1000-1200	28	32	24	21	14	15	30	37	37	34	26	22
4	1300-1500	32	37	28	25	16	17	32	40	41	29	29	26
5	1600-2000	35	40	31	28	17	19	38	48	44	31	33	30
			Cost per Month		Cost per Month		Cost per Month		Cost per Month		Cost per Month		Cost per Month
			\$22		\$18		\$12		\$23		\$24		\$28
			\$25		\$21		\$13		\$26		\$34		\$34
			\$30		\$25		\$15		\$31		\$37		\$37
			\$32		\$28		\$17		\$36		\$43		\$43
			\$37		\$32		\$19		\$38		\$47		\$47
			\$40		\$36		\$20		\$45		\$50		\$50

Based on an average cost per therm of \$1.002680

HEATING - ELECTRIC FURNACE													
Bedrooms	Sq. Ft.	Duplex		Garden		High-Rise		Mobile Home		Single Family		Townhouse	
		kWh per Month	Fan kWh/ Month	kWh per Month	Fan kWh/ Month	kWh per Month	Fan kWh/ Month	kWh per Month	Fan kWh/ Month	kWh per Month	Fan kWh/ Month	kWh per Month	Fan kWh/ Month
0	400-550	306	10	232	8	123	5	304	12	404	14	274	9
1	500-700	353	12	290	10	148	6	357	14	489	17	328	11
2	700-900	426	15	341	12	176	7	439	18	571	14	388	13
3	1000-1200	482	12	415	10	214	7	534	17	669	16	438	11
4	1300-1500	571	14	490	12	246	8	572	19	753	14	508	12
5	1600-2000	625	15	544	13	274	9	682	22	806	14	583	14
			Cost per Month		Cost per Month		Cost per Month		Cost per Month		Cost per Month		Cost per Month
			\$32		\$25		\$13		\$32		\$43		\$43
			\$37		\$31		\$16		\$38		\$52		\$52
			\$45		\$36		\$19		\$47		\$60		\$60
			\$51		\$44		\$23		\$57		\$70		\$70
			\$60		\$51		\$26		\$61		\$79		\$79
			\$66		\$57		\$29		\$72		\$84		\$84

Based on an average cost per kWh of \$0.096804

HEATING - ELECTRIC HEAT PUMP													
Bedrooms	Sq. Ft.	Duplex		Garden		High-Rise		Mobile Home		Single Family		Townhouse	
		kWh per Month	Fan kWh/ Month	kWh per Month	Fan kWh/ Month	kWh per Month	Fan kWh/ Month	kWh per Month	Fan kWh/ Month	kWh per Month	Fan kWh/ Month	kWh per Month	Fan kWh/ Month
0	400-550	171	4	130	3	69	2	170	4	226	5	153	3
1	500-700	197	4	162	4	83	2	199	5	274	6	183	4
2	700-900	238	5	191	4	99	3	245	6	319	5	217	5
3	1000-1200	269	4	232	4	120	2	298	6	374	6	245	4
4	1300-1500	319	5	274	4	137	3	320	7	421	5	284	4
5	1600-2000	349	5	304	5	153	3	381	8	450	5	326	5
			Cost per Month		Cost per Month		Cost per Month		Cost per Month		Cost per Month		Cost per Month
			\$18		\$14		\$7		\$18		\$24		\$16
			\$21		\$17		\$9		\$21		\$29		\$19
			\$25		\$20		\$10		\$26		\$33		\$23
			\$28		\$24		\$13		\$31		\$39		\$26
			\$33		\$29		\$14		\$33		\$44		\$30
			\$36		\$32		\$16		\$40		\$47		\$34

Based on an average cost per kWh of \$0.096804

Space Heating Consumption Levels and Cost Figures

HEATING - FUEL OIL															
Bedrooms	Sq. Ft.	Duplex		Garden		High-Rise		Mobile Home		Single Family		Townhouse		Cost per Month	
		Gallons per Month	Fan kWh/ Month	Gallons per Month	Fan kWh/ Month	Gallons per Month	Fan kWh/ Month	Gallons per Month	Fan kWh/ Month	Gallons per Month	Fan kWh/ Month	Gallons per Month	Fan kWh/ Month		
0	400-550	16	31	13	24	8	15	16	36	20	41	14	28	\$77	\$55
1	500-700	18	36	15	30	9	18	18	42	23	50	17	33	\$91	\$64
2	700-900	21	43	17	35	10	21	21	52	27	41	19	40	\$103	\$74
3	1000-1200	23	34	20	30	12	21	25	52	31	48	21	31	\$119	\$81
4	1300-1500	27	41	24	35	13	24	27	56	35	40	24	36	\$131	\$92
5	1600-2000	29	45	26	39	14	27	32	66	37	43	27	42	\$139	\$105

Based on an average cost per gallon of \$3.45

HEATING - PROPANE															
Bedrooms	Sq. Ft.	Duplex		Garden		High-Rise		Mobile Home		Single Family		Townhouse		Cost per Month	
		Gallons per Month	Fan kWh/ Month	Gallons per Month	Fan kWh/ Month	Gallons per Month	Fan kWh/ Month	Gallons per Month	Fan kWh/ Month	Gallons per Month	Fan kWh/ Month	Gallons per Month	Fan kWh/ Month		
0	400-550	20	22	16	17	10	11	20	26	25	30	18	20	\$70	\$51
1	500-700	22	26	19	21	12	13	22	30	29	36	21	24	\$82	\$58
2	700-900	26	31	22	25	13	15	27	37	34	29	24	28	\$93	\$67
3	1000-1200	29	25	26	21	15	15	32	37	39	34	27	22	\$107	\$74
4	1300-1500	34	29	29	25	17	17	34	40	43	29	30	26	\$118	\$84
5	1600-2000	37	32	32	28	18	19	39	48	46	31	34	30	\$126	\$95

Based on an average cost per gallon of \$2.52

AIR-CONDITIONING CONSUMPTION LEVELS

Air Conditioning Consumption Levels and Cost Figures

AIR CONDITIONING													
Bedrooms	Sq. Ft.	Duplex		Garden		High-Rise		Mobile Home		Single Family		Townhouse	
		kWh per Year	Cost per Month	kWh per Year	Cost per Month	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	193	\$2	202	\$2	241	\$2	221	\$2
1	500-700	295	\$3	294	\$3	246	\$2	261	\$2	324	\$3	295	\$3
2	700-900	376	\$3	374	\$3	300	\$3	324	\$3	414	\$4	375	\$3
3	1000-1200	487	\$4	488	\$4	406	\$3	421	\$4	535	\$5	486	\$4
4	1300-1500	618	\$5	618	\$5	506	\$4	517	\$4	675	\$6	615	\$5
5	1600-2000	728	\$6	728	\$6	598	\$5	636	\$5	792	\$7	728	\$6

Based on an average cost per kWh of \$0.096804

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

Based on an average cost per therm of \$1.002680

COOKING - ELECTRIC					
<u>Bedrooms</u>	<u>Sq. Ft.</u>	<u>kWh per Month</u>	<u>Cost per Month</u>		
0	400-550	90	\$9		
1	500-700	94	\$10		
2	700-900	113	\$12		
3	1000-1200	120	\$12		
4	1300-1500	131	\$13		
5	1600-2000	135	\$14		

Based on an average cost per kWh of \$0.096804

COOKING - PROPANE					
<u>Bedrooms</u>	<u>Sq. Ft.</u>	<u>Gallons per Month</u>	<u>Cost per Month</u>		
0	400-550	6	\$16		
1	500-700	6	\$17		
2	700-900	8	\$20		
3	1000-1200	8	\$22		
4	1300-1500	9	\$24		
5	1600-2000	9	\$25		

Based on an average cost per gallon of \$2.52

OTHER ELECTRIC CONSUMPTION LEVELS

Other Electric Consumption Levels and Cost Figures

OTHER ELECTRIC				
<u>Bedrooms</u>	<u>Sq. Ft.</u>	<u>kWh per Month</u>	<u>Cost per Month</u>	
0	400-550	171	\$25	
1	500- 700	191	\$28	
2	700-900	224	\$31	
3	1000-1200	271	\$36	
4	1300 -1500	309	\$40	
5	1600-2000	378	\$47	

Costs are based on an average of \$0.096804 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			
<u>Bedrooms</u>	<u>Sq. Ft.</u>	<u>Therms per Month</u>	<u>Cost per Month</u>
0	400-550	9	\$9
1	500-600	12	\$12
2	700-900	15	\$16
3	1000-1200	21	\$22
4	1300 -1500	28	\$29
5	1600-2000	34	\$36

Based on an average cost per therm of \$1.002680

DOMESTIC HOT WATER HEATING			
Electricity			
<u>Bedrooms</u>	<u>Sq. Ft.</u>	<u>kWh per Month</u>	<u>Cost per Month</u>
0	400-550	92	\$9
1	500-600	155	\$16
2	700-900	218	\$22
3	1000-1200	343	\$35
4	1300 -1500	478	\$49
5	1600-2000	611	\$63

Based on an average cost per kWh of \$0.096804

Domestic Hot Water Heating Consumption Levels and Cost Figures

DOMESTIC HOT WATER HEATING			
Propane			
<u>Bedrooms</u>	<u>Sq. Ft.</u>	<u>Gallons per Month</u>	<u>Cost per Month</u>
0	400-550	9	\$24
1	500-600	12	\$33
2	700-900	16	\$41
3	1000-1200	22	\$59
4	1300 -1500	29	\$77
5	1600-2000	36	\$95

Based on an average cost per gallon of \$2.52

DOMESTIC HOT WATER HEATING			
Fuel Oil			
<u>Bedrooms</u>	<u>Sq. Ft.</u>	<u>Gallons per Month</u>	<u>Cost per Month</u>
0	400-550	6	\$23
1	500-600	8	\$31
2	700-900	11	\$39
3	1000-1200	15	\$55
4	1300 -1500	20	\$72
5	1600-2000	24	\$89

Based on an average cost per gallon of \$3.45

WATER AND SEWER CONSUMPTION LEVELS

Water, Sewer and Sanitation Consumption Levels and Cost Figures

Consumption Levels and Cost Figures

WATER, SEWER AND SANITATION										
NUMBER OF BEDROOMS	WATER CONSUMPTION	<u>Water Costs</u>			<u>Sewer Costs</u>				<u>SURFACE WATER</u>	<u>GARBAGE COLLECTION</u>
		In - City of Renton	<u>Soos Creek</u>	Out - City of Renton	<u>SEWER USAGE</u>	In - City of Renton	Out - City of Renton	<u>Soos Creek</u>		
0 BR	2	\$24	\$20	\$36	2	\$81	\$122	\$70	\$16	\$24
1 BR	4	\$29	\$24	\$43	4	\$81	\$122	\$70	\$16	\$24
2 BR	6	\$34	\$30	\$51	6	\$81	\$122	\$70	\$16	\$24
3 BR	9	\$48	\$46	\$72	9	\$81	\$122	\$70	\$16	\$24
4 BR	13	\$64	\$65	\$96	13	\$81	\$122	\$70	\$16	\$24
5 BR	17	\$81	\$85	\$122	17	\$81	\$122	\$70	\$16	\$24

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	Flushes per person per day
Shower	15	x	Showers per person per day
Dishload	3	x	Dishloads per person per day
Laundry	10	x	Clothesloads per person per day
Meal	0.1	x	Meals per person per day
Handwashing	0.1	x	Handwashings per person per day
Other	1	x	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

$$(\text{Roof Area}) \times (\text{Roof/Ceiling "U" Factor}) \times \text{Delta T} = \text{Btuh}$$

2. Wall Loss

$$(\text{Wall Area}) \times (\text{Wall "U" Factor}) \times \text{Delta T} = \text{Btuh}$$

3. Window Loss

$$(\text{Window Area}) \times (\text{Window "U" Factor}) \times \text{Delta T} = \text{Btuh}$$

4. Door Loss

$$(\text{Door Area}) \times (\text{Door "U" Factor}) \times \text{Delta T} = \text{Btuh}$$

5. Crack Loss Formulations

Crack Method for Windows and Doors Wind Velocity - 15 mph

$$\text{Crack Infiltration Factor (CFM/LF)} \times \text{Crack Length (LF)} \times \text{Delta T(F)} \times 1.08 \text{ BTUH-F/CFM}$$

6. Perimeter Heat Loss

$$(\text{Exterior Perimeter Foot Length}) \times (\text{Perimeter Factor}) = \text{Btuh}$$

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

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

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, part 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 4532 based on data for Seattle, Washington.
- Cooling Degree-Day Value is 192 based on data for Seattle, Washington.

Assumptions for Annual Heat Loss Calculations

Global Data

Design Temp. Diff.(F) = 38.4
 Heating Degree Days = 4532

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

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 =	4532
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:	299 THERMS
Heating System Fan? (yes or no)	Yes
Heating Output:	27,300 Btuh
Fan Size:	400 Watts
Fan Operating Hours:	933 hours
Fan Energy:	373 kWh

HEAT LOAD CALCULATION

Renton Housing Authority

HOUSING CHOICE VOUCHER

Unit Type:	Garden	Heating Degree Days =	4532
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:	248 THERMS
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:	High-Rise	Heating Degree Days =	4532
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:	149 THERMS
Heating System Fan? (yes or no)	Yes
Heating Output:	23,400 Btuh
Fan Size:	400 Watts
Fan Operating Hours:	451 hours
Fan Energy:	180 kWh

HEAT LOAD CALCULATION

Renton Housing Authority

HOUSING CHOICE VOUCHER

Unit Type:	Mobile Home	Heating Degree Days =	4532
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:	307 THERMS
Heating System Fan? (yes or no)	Yes
Heating Output:	23,400 Btuh
Fan Size:	400 Watts
Fan Operating Hours:	1,123 hours
Fan Energy:	449 kWh

HEAT LOAD CALCULATION

Renton Housing Authority

HOUSING CHOICE VOUCHER

Unit Type:	Single Family	Heating Degree Days =	4532
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:	386 THERMS
Heating System Fan? (yes or no)	Yes
Heating Output:	39,000 Btuh
Fan Size:	400 Watts
Fan Operating Hours:	877 hours
Fan Energy:	351 kWh

HEAT LOAD CALCULATION

Renton Housing Authority

HOUSING CHOICE VOUCHER

Unit Type:	Townhouse	Heating Degree Days =	4532
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:	240 THERMS
Heating System Fan? (yes or no)	Yes
Heating Output:	27,300 Btuh
Fan Size:	400 Watts
Fan Operating Hours:	719 hours
Fan Energy:	288 kWh

HEAT LOAD CALCULATION

Renton Housing Authority

HOUSING CHOICE VOUCHER

Unit Type:	Duplex	Heating Degree Days =	4532
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:	4,237 KWH
Heating System Fan? (yes or no)	Yes
Heating Output:	39,900 Btuh
Fan Size:	400 Watts
Fan Operating Hours:	362 hours
Fan Energy:	145 kWh

HEAT LOAD CALCULATION

Renton Housing Authority

HOUSING CHOICE VOUCHER

Unit Type:	Garden	Heating Degree Days =	4532
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:	3,479 kWh
Heating System Fan? (yes or no)	Yes
Heating Output:	39,900 Btuh
Fan Size:	400 Watts
Fan Operating Hours:	298 hours
Fan Energy:	119 kWh

HEAT LOAD CALCULATION

Renton Housing Authority

HOUSING CHOICE VOUCHER

Unit Type:	High-Rise	Heating Degree Days =	4532
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:	1,777 kWh
Heating System Fan? (yes or no)	Yes
Heating Output:	34,200 Btuh
Fan Size:	400 Watts
Fan Operating Hours:	177 hours
Fan Energy:	71 kWh

HEAT LOAD CALCULATION

Renton Housing Authority

HOUSING CHOICE VOUCHER

Unit Type:	Mobile Home	Heating Degree Days =	4532
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:	5,270 kWh
Heating System Fan? (yes or no)	Yes
Heating Output:	34,200 Btuh
Fan Size:	400 Watts
Fan Operating Hours:	526 hours
Fan Energy:	210 kWh

HEAT LOAD CALCULATION

Renton Housing Authority

HOUSING CHOICE VOUCHER

Unit Type:	Single Family	Heating Degree Days =	4532
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:	6,854 KWH
Heating System Fan? (yes or no)	Yes
Heating Output:	57,000 Btuh
Fan Size:	400 Watts
Fan Operating Hours:	410 hours
Fan Energy:	164 kWh

HEAT LOAD CALCULATION

Renton Housing Authority

HOUSING CHOICE VOUCHER

Unit Type:	Townhouse	Heating Degree Days =	4532
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:	4,661 KWH
Heating System Fan? (yes or no)	Yes
Heating Output:	39,900 Btuh
Fan Size:	400 Watts
Fan Operating Hours:	399 hours
Fan Energy:	160 kWh

HEAT LOAD CALCULATION

Renton Housing Authority

HOUSING CHOICE VOUCHER

Unit Type:	Duplex	Heating Degree Days =	4532
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:	2,855 KWH
Heating System Fan? (yes or no)	Yes
Heating Output:	63,000 Btuh
Fan Size:	400 Watts
Fan Operating Hours:	155 hours
Fan Energy:	62 kWh

HEAT LOAD CALCULATION

Renton Housing Authority

HOUSING CHOICE VOUCHER

Unit Type:	Garden	Heating Degree Days =	4532
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:	2,779 KWH
Heating System Fan? (yes or no)	Yes
Heating Output:	90,000 Btuh
Fan Size:	400 Watts
Fan Operating Hours:	105 hours
Fan Energy:	42 kWh

HEAT LOAD CALCULATION

Renton Housing Authority

HOUSING CHOICE VOUCHER

Unit Type:	High-Rise	Heating Degree Days =	4532
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:	1,435 KWH
Heating System Fan? (yes or no)	Yes
Heating Output:	66,000 Btuh
Fan Size:	400 Watts
Fan Operating Hours:	74 hours
Fan Energy:	30 kWh

HEAT LOAD CALCULATION

Renton Housing Authority

HOUSING CHOICE VOUCHER

Unit Type:	Mobile Home	Heating Degree Days =	4532
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:	3,578 KWH
Heating System Fan? (yes or no)	Yes
Heating Output:	66,000 Btuh
Fan Size:	400 Watts
Fan Operating Hours:	185 hours
Fan Energy:	74 kWh

HEAT LOAD CALCULATION

Renton Housing Authority

HOUSING CHOICE VOUCHER

Unit Type:	Single Family	Heating Degree Days =	4532
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:	4,487 KWH
Heating System Fan? (yes or no)	Yes
Heating Output:	90,000 Btuh
Fan Size:	400 Watts
Fan Operating Hours:	170 hours
Fan Energy:	68 kWh

HEAT LOAD CALCULATION

Renton Housing Authority

HOUSING CHOICE VOUCHER

Unit Type:	Townhouse	Heating Degree Days =	4532
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:	2,605 KWH
Heating System Fan? (yes or no)	Yes
Heating Output:	63,000 Btuh
Fan Size:	400 Watts
Fan Operating Hours:	141 hours
Fan Energy:	56 kWh

HEAT LOAD CALCULATION

Renton Housing Authority

HOUSING CHOICE VOUCHER

Unit Type:	Duplex	Heating Degree Days =	4532
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:	249 GALLONS
Heating System Fan? (yes or no)	Yes
Heating Output:	23,100 Btuh
Fan Size:	400 Watts
Fan Operating Hours:	1,304 hours
Fan Energy:	522 kWh

HEAT LOAD CALCULATION

Renton Housing Authority

HOUSING CHOICE VOUCHER

Unit Type:	Garden	Heating Degree Days =	4532
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:	206 GALLONS
Heating System Fan? (yes or no)	Yes
Heating Output:	23,100 Btuh
Fan Size:	400 Watts
Fan Operating Hours:	1,045 hours
Fan Energy:	418 kWh

HEAT LOAD CALCULATION

Renton Housing Authority

HOUSING CHOICE VOUCHER

Unit Type:	High-Rise	Heating Degree Days =	4532
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:	121 GALLONS
Heating System Fan? (yes or no)	Yes
Heating Output:	19,800 Btuh
Fan Size:	400 Watts
Fan Operating Hours:	630 hours
Fan Energy:	252 kWh

HEAT LOAD CALCULATION

Renton Housing Authority

HOUSING CHOICE VOUCHER

Unit Type:	Mobile Home	Heating Degree Days =	4532
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:	256 GALLONS
Heating System Fan? (yes or no)	Yes
Heating Output:	19,800 Btuh
Fan Size:	400 Watts
Fan Operating Hours:	1,569 hours
Fan Energy:	628 kWh

HEAT LOAD CALCULATION

Renton Housing Authority

HOUSING CHOICE VOUCHER

Unit Type:	Single Family	Heating Degree Days =	4532
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:	281 GALLONS
Heating System Fan? (yes or no)	Yes
Heating Output:	23,100 Btuh
Fan Size:	400 Watts
Fan Operating Hours:	1,499 hours
Fan Energy:	600 kWh

HEAT LOAD CALCULATION

Renton Housing Authority

HOUSING CHOICE VOUCHER

Unit Type:	Townhouse	Heating Degree Days =	4532
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:	199 GALLONS
Heating System Fan? (yes or no)	Yes
Heating Output:	23,100 Btuh
Fan Size:	400 Watts
Fan Operating Hours:	1,004 hours
Fan Energy:	402 kWh

HEAT LOAD CALCULATION

Renton Housing Authority

HOUSING CHOICE VOUCHER

Unit Type:	Duplex	Heating Degree Days =	4532
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:	267 GALLONS
Heating System Fan? (yes or no)	Yes
Heating Output:	27,300 Btuh
Fan Size:	400 Watts
Fan Operating Hours:	774 hours
Fan Energy:	310 kWh

HEAT LOAD CALCULATION

Renton Housing Authority

HOUSING CHOICE VOUCHER

Unit Type:	Garden	Heating Degree Days =	4532
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:	306 GALLONS
Heating System Fan? (yes or no)	Yes
Heating Output:	39,000 Btuh
Fan Size:	400 Watts
Fan Operating Hours:	636 hours
Fan Energy:	254 kWh

HEAT LOAD CALCULATION

Renton Housing Authority

HOUSING CHOICE VOUCHER

Unit Type:	High-Rise	Heating Degree Days =	4532
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:	180 GALLONS
Heating System Fan? (yes or no)	Yes
Heating Output:	28,600 Btuh
Fan Size:	400 Watts
Fan Operating Hours:	448 hours
Fan Energy:	179 kWh

HEAT LOAD CALCULATION

Renton Housing Authority

HOUSING CHOICE VOUCHER

Unit Type:	Mobile Home	Heating Degree Days =	4532
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:	380 GALLONS
Heating System Fan? (yes or no)	Yes
Heating Output:	28,600 Btuh
Fan Size:	400 Watts
Fan Operating Hours:	1,117 hours
Fan Energy:	447 kWh

HEAT LOAD CALCULATION

Renton Housing Authority

HOUSING CHOICE VOUCHER

Unit Type:	Single Family	Heating Degree Days =	4532
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:	465 GALLONS
Heating System Fan? (yes or no)	Yes
Heating Output:	39,000 Btuh
Fan Size:	400 Watts
Fan Operating Hours:	1,027 hours
Fan Energy:	411 kWh

HEAT LOAD CALCULATION

Renton Housing Authority

HOUSING CHOICE VOUCHER

Unit Type:	Townhouse	Heating Degree Days =	4532
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:	364 GALLONS
Heating System Fan? (yes or no)	Yes
Heating Output:	39,000 Btuh
Fan Size:	400 Watts
Fan Operating Hours:	779 hours
Fan Energy:	312 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 Temperature:	55 F
Hot Water Supply Temperature:	120 F
Delta T:	65 F
Calendar Schedule:	365 days/yr
Daily Schedule:	24 hrs/day
Total Operating Hours:	8,760 hrs/yr
Estimated Air Temperature At Tank:	72 F
Estimated Tank Size:	40 gal
Assumed Tank Insulation (R-Value):	8.00 F-sf-hr/Btu
R-Value of Shell Plus Air:	0.62 F-sf-hr/Btu
Estimated System Efficiency:	70%
Assumed Standing Pilot?	yes
Pilot Consumption Rate:	400 Btu/hr
Fuel Type:	Natural Gas
Pilot Consumption:	3,504 kBtu/yr
Total Energy Lost:	1,211 kBtu/yr
Consumption Energy Required:	<u>5,134</u> kBtu/yr
Total Energy Required:	9,849 kBtu/yr
Primary Fuel Required:	141 Therms/Year

**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 Temperature:	55 F
Hot Water Supply Temperature:	120 F
Delta T:	65 F
Calendar Schedule:	365 days/yr
Daily Schedule:	24 hrs/day
Total Operating Hours:	8,760 hrs/yr
Estimated Air Temperature At Tank:	72 F
Estimated Tank Size:	40 gal
Assumed Tank Insulation (R-Value):	8.00 F-sf-hr/Btu
R-Value of Shell Plus Air:	0.62 F-sf-hr/Btu
Estimated System Efficiency:	70%
Assumed Standing Pilot?	yes
Pilot Consumption Rate:	400 Btu/hr
Fuel Type:	Natural Gas
Pilot Consumption:	3,504 kBtu/yr
Total Energy Lost:	1,211 kBtu/yr
Consumption Energy Required:	<u>7,701</u> kBtu/yr
Total Energy Required:	12,416 kBtu/yr
Primary Fuel Required:	177 Therms/Year

**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 Temperature:	55 F
Hot Water Supply Temperature:	120 F
Delta T:	65 F
Calendar Schedule:	365 days/yr
Daily Schedule:	24 hrs/day
Total Operating Hours:	8,760 hrs/yr
Estimated Air Temperature At Tank:	72 F
Estimated Tank Size:	40 gal
Assumed Tank Insulation (R-Value):	8.00 F-sf-hr/Btu
R-Value of Shell Plus Air:	0.62 F-sf-hr/Btu
Estimated System Efficiency:	100%
Assumed Standing Pilot?	no
Pilot Consumption Rate:	400 Btu/hr
Fuel Type:	Electricity
Pilot Consumption:	kBtu/yr
Total Energy Lost:	1,211 kBtu/yr
Consumption Energy Required:	<u>5,134</u> kBtu/yr
Total Energy Required:	6,345 kBtu/yr
Primary Fuel Required:	1,859 kWh/Year

**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 Temperature:	55 F
Hot Water Supply Temperature:	120 F
Delta T:	65 F
Calendar Schedule:	365 days/yr
Daily Schedule:	24 hrs/day
Total Operating Hours:	8,760 hrs/yr
Estimated Air Temperature At Tank:	72 F
Estimated Tank Size:	40 gal
Assumed Tank Insulation (R-Value):	8.00 F-sf-hr/Btu
R-Value of Shell Plus Air:	0.62 F-sf-hr/Btu
Estimated System Efficiency:	100%
Assumed Standing Pilot?	no
Pilot Consumption Rate:	400 Btu/hr
Fuel Type:	Electricity
Pilot Consumption:	kBtu/yr
Total Energy Lost:	1,211 kBtu/yr
Consumption Energy Required:	<u>7,701</u> kBtu/yr
Total Energy Required:	8,912 kBtu/yr
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 Temperature:	55 F
Hot Water Supply Temperature:	120 F
Delta T:	65 F
Calendar Schedule:	365 days/yr
Daily Schedule:	24 hrs/day
Total Operating Hours:	8,760 hrs/yr
Estimated Air Temperature At Tank:	72 F
Estimated Tank Size:	40 gal
Assumed Tank Insulation (R-Value):	8.00 F-sf-hr/Btu
R-Value of Shell Plus Air:	0.62 F-sf-hr/Btu
Estimated System Efficiency:	70%
Assumed Standing Pilot?	yes
Pilot Consumption Rate:	400 Btu/hr
Fuel Type:	Propane
Pilot Consumption:	3,504 kBtu/yr
Total Energy Lost:	1,211 kBtu/yr
Consumption Energy Required:	<u>5,134</u> kBtu/yr
Total Energy Required:	9,849 kBtu/yr
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 Temperature:	55 F
Hot Water Supply Temperature:	120 F
Delta T:	65 F
Calendar Schedule:	365 days/yr
Daily Schedule:	24 hrs/day
Total Operating Hours:	8,760 hrs/yr
Estimated Air Temperature At Tank:	72 F
Estimated Tank Size:	40 gal
Assumed Tank Insulation (R-Value):	8.00 F-sf-hr/Btu
R-Value of Shell Plus Air:	0.62 F-sf-hr/Btu
Estimated System Efficiency:	70%
Assumed Standing Pilot?	yes
Pilot Consumption Rate:	400 Btu/hr
Fuel Type:	Propane
Pilot Consumption:	3,504 kBtu/yr
Total Energy Lost:	1,211 kBtu/yr
Consumption Energy Required:	<u>7,701</u> kBtu/yr
Total Energy Required:	12,416 kBtu/yr
Primary Fuel Required:	186 Gallons/Year

**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 Temperature:	55 F
Hot Water Supply Temperature:	120 F
Delta T:	65 F
Calendar Schedule:	365 days/yr
Daily Schedule:	24 hrs/day
Total Operating Hours:	8,760 hrs/yr
Estimated Air Temperature At Tank:	72 F
Estimated Tank Size:	40 gal
Assumed Tank Insulation (R-Value):	8.00 F-sf-hr/Btu
R-Value of Shell Plus Air:	0.62 F-sf-hr/Btu
Estimated System Efficiency:	70%
Assumed Standing Pilot?	yes
Pilot Consumption Rate:	400 Btu/hr
Fuel Type:	Fuel Oil
Pilot Consumption:	3,504 kBtu/yr
Total Energy Lost:	1,211 kBtu/yr
Consumption Energy Required:	<u>5,134</u> kBtu/yr
Total Energy Required:	9,849 kBtu/yr
Primary Fuel Required:	101 Gallons/Year

**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 Temperature:	55 F
Hot Water Supply Temperature:	120 F
Delta T:	65 F
Calendar Schedule:	365 days/yr
Daily Schedule:	24 hrs/day
Total Operating Hours:	8,760 hrs/yr
Estimated Air Temperature At Tank:	72 F
Estimated Tank Size:	40 gal
Assumed Tank Insulation (R-Value):	8.00 F-sf-hr/Btu
R-Value of Shell Plus Air:	0.62 F-sf-hr/Btu
Estimated System Efficiency:	70%
Assumed Standing Pilot?	yes
Pilot Consumption Rate:	400 Btu/hr
Fuel Type:	Fuel Oil
Pilot Consumption:	3,504 kBtu/yr
Total Energy Lost:	1,211 kBtu/yr
Consumption Energy Required:	<u>7,701</u> kBtu/yr
Total Energy Required:	12,416 kBtu/yr
Primary Fuel Required:	128 Gallons/Year

APPENDIX D. - COOLING LOAD TABLES

Back-Up Calculations – Cooling Load Tables

Cooling Load Tables

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

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
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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