ENERGY AND WATER AUDIT

ROSEWOOD VILLAGE, RICHMOND, BC

JANUARY 2019

3 EXISTING ENERGY AND WATER PERFORMANCE

3.1 ANNUAL ENERGY AND WATER COSTS

Rosewood Village is supplied with energy and water from the following sources:

- Electricity from BC Hydro, the local electricity utility, and
- Natural Gas from Fortis BC, the local natural gas utility.
- Water from the City of Richmond, the local water provider.

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The following table outlines the annual energy, electricity, gas, carbon and water usages for the different metered categories at Rosewood Village for the most recent 12 months. Note that townhouse natural gas consumption and water bills could not be made available due to privacy considerations; therefore, these usages are calculated based on energy modeling, equipment capacities, and estimated usage patterns.

Table 1 - BASELINE DATA (OCTOBER 2017- SEPTEMBER 2018)

Utility	Consumption	Equivalent Consumption	Average Unit Cost	Cost	GHG (tons)
Electricity (Common)	69,559 kWh	69,559 kWh	0.11 $/kWh	$7,864	0.8
Electricity (Tenant)	737,051 kWh	737,051 kWh	0.10 $/kWh	$76,642	8.1
Natural Gas (Common)	3,761 GJ	1,044,731 ekWh	8.50 $/GJ	$31,981	194.3
Natural Gas (Tenant)	3,222 GJ	895,007 ekWh	10.29 $/GJ	$33,151	166.5
Water	20,113 m^3	N/A	1.18 $/$m^3$	$23,648	-
Total Equiv. Energy Consumption		**2,850,845 ekWh**	**Total Cost**	**$434,286**	**369.7**

APPENDIX

B BUILDING DESCRIPTION

APPENDIX B

BUILDING DESCRIPTION

The Rosewood Village comprises of three building types as summarized below:

BUILDING DETAILS

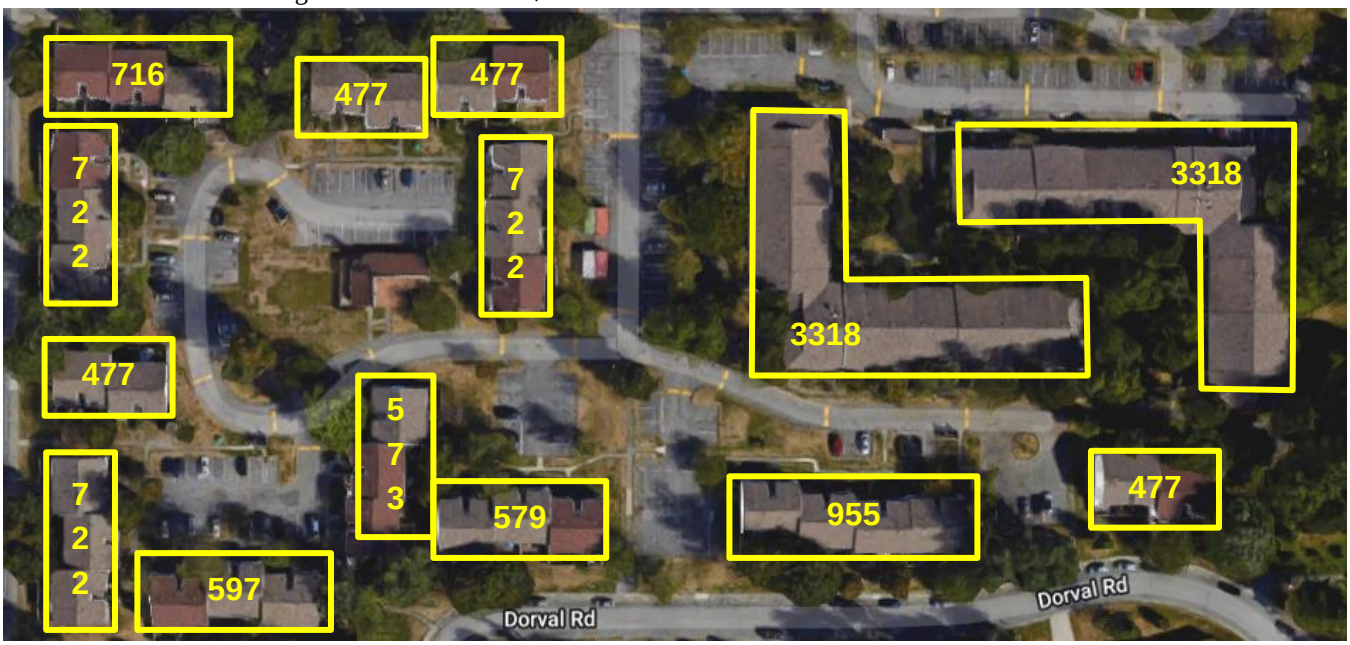
Name and Address	Rosewood Village- 8220, 8240, 8260, and 8280 No.2 Road, Richmond
Year Constructed	1975
Envelope	Floor: Slab on grade with foam insulation Walls: Wood frame with 2 x 4 framing and batt insulation, vapour barrier and gypsum board Roofs: 2 x 6 rafters with blown insulation, vapour barrier and gypsum board

BUILDING FLOOR AREA AND UNITS SUMMARY

BUILDING ADDRESS	BUILDING TYPE	NUMBER OF STOREY	NUMBER OF UNITS	1-BR	2-BR	3-BR	NUMBER OF OCCUPANTS
8220	Apartment	2	36	16	20	-	56
8240	Apartment	2	36	16	20	-	56
8260	Office	1	-	-	-	-	-
8280	Townhouse	2	66	-	-	66	165
TOTAL		**-**	**138**	**32**	**40**	**66**	**310**

SITE PLAN AND FLOOR AREAS

Numbers shown below are gross floor areas in m^2.



APPENDIX B

SYSTEM DESCRIPTION

The following tables summarizes the building systems for apartments, townhouses, and office building:

SYSTEM	APARTMENT
Controls	– Each unit in the apartment has individual thermostat control.
Space Heating	– Space heating is provided by hydronic baseboard system served by central gas-fired condensing boilers with modulating MatriX burner located in the mechanical room. The boilers are new and replaced in 2014. – Make: VITADENS 200-W – Model: B2HA 80 – Quantity: 4 in each apartment building – Capacity: 178,000 btu/hr (IBR) – Efficiency: 92% – Storage Tank – Rheem ST-120 (115 US gallons)- #2 in each apartment building. – The hydronic hot water loop is a primary/secondary loop system. The primary loop is circulated by dedicated 1/6HP constant speed pumps (P1 to P4) for each boiler. The secondary loop is circulated by 1.25HP variable speed pumps (P5 and P6) which operate lead/lag.
Space Cooling	– No cooling
Ventilation	– No dedicated mechanical system is present for ventilation. The fresh outdoor air is introduced manually through operable windows.
Domestic Hot Water	– Domestic hot water is provided by the central boiler as used for the space heating.
Domestic Cold Water	– City fed, at city water pressure – Water fixtures primarily consist of: – Toilets: 1.6 GPF – Lavatory faucets: 1.5 and 2.2 GPM – Showers: 2.5 GPM – Kitchen faucets: 2.2 GPM – Washers are provided by the tenants and therefore excluded from our inventory
Interior and Exterior Lighting	– Interior lighting – 4ft T8 32W fluorescent luminaire in kitchen and bathrooms. – 13W, 23W, and 26W CFL fixtures in entrance, hallways, dinning, and stairs – Exterior lighting – 13W and 26W CFL in porch, patio and exterior wall. – 10% of all the fixtures are replaced to LED's
Receptacle Equipment's	– Standard refrigerator is provided by BC housing – Make: Danby, Frigidaire, GE and Westinghouse – Year: Mostly between 2004 and 2018. Few of them were from 1994 – Capacity: Between 11 and 17 cubic feet – Electric stove range – Make: Danby, Frigidaire, Kelvinator and Westinghouse – Year: Mostly between 2004 and 2018. Few of them were from 1993 and 1997 – Kitchen exhaust fan – Make: BROAN BP-10 – Airflows: 180-210 cfm – Washers and dryer are provided by the tenants and therefore excluded from our inventory.

APPENDIX B

SYSTEM	TOWNHOUSES
Controls	– Each townhouse has thermostat control for the furnace
Space Heating	– Space heating is provided by the gas furnace ducted to the room and the air supplied by discharge grille. – Make: KEEPRITE (some townhomes have LENNOX G8 furnace) – Model: GDE0775B12A1 – Quantity:1 in each townhouse
Space Cooling	– No cooling
Ventilation	– No dedicated mechanical system is present for ventilation. The fresh outdoor air is introduced manually through operable windows and through the bathroom operation of exhaust fan.
Domestic Hot Water	– Each townhouse has an electric hot water which 98% efficient. – Make: JJJ John Wood Pro Series – Model: JW50SDE1 – Quantity: 1 – Power: 3000W
Domestic Cold Water	– City fed, at city water pressure – Water fixtures primarily consist of: – Toilets: 1.6 GPF – Lavatory faucets: 1.5 and 2.2 GPM – Showers: 2.5 GPM – Kitchen faucets: 2.2 GPM – Washers are provided by the tenants and therefore excluded from our inventory
Interior and Exterior Lighting	– Interior lighting – 4ft T8 32W fluorescent luminaire in kitchen and bathrooms. – 13W, 23W, and 26W CFL fixtures in entrance, hallways, dinning, and stairs – Exterior lighting – Combination of 13W CFL and 60W incandescent bulbs in porch, patio and exterior wall – 10% of all the fixtures are replaced to LED's
Receptacle Equipment's	– Standard refrigerator is provided by BC housing. – Make: Danby, Frigidaire, GE and Westinghouse – Year: Mostly between 2004 and 2018. Few of them were from 1994. – Capacity: Between 11 and 17 cubic feet. – Electric stove range is provided by BC housing. – Make: Danby, Frigidaire, Kelvinator and Westinghouse – Year: Mostly between 2004 and 2018. Few of them were from 1993 and 1997. – Kitchen exhaust fan – Make: BROAN BP-100 – Airflows: 180-210 cfm – Washers and dryer are provided by the tenants and therefore excluded from our inventory.

APPENDIX B

SYSTEM	OFFICE BUILDING
Controls	– Office wall mounted thermostat control.
Space Heating	– Natural Gas Furnace – Make: Rheem – Model: R96TA1001621MSA – Input rating: 199,000 btu/hr (max.) – AFUE: 95%
Space Cooling	– Air source Heat pump, nameplate ratings couldn't be read due to fencing for theft prevention.
Ventilation	– No dedicated mechanical system is present for ventilation. The fresh outdoor air is introduced manually through operable windows.
Domestic Hot Water	– Natural gas instantaneous water heater – Make: Navien – Capacity: 4.85 GPM – Efficiency: 95%
Domestic Cold Water	– City fed, at city water pressure – Water fixtures primarily consist of: – Toilets: 1.6 GPF – Lavatory faucets: 1.5 and 2.2 GPM – Showers: 2.5 GPM – Kitchen faucets: 2.2 GPM
Interior and Exterior Lighting	– Interior Lighting – Main office space is provided by 2 x 4ft T8 32W fluorescent lamps. – Storage, bathrooms, and kitchen space are installed with a 9W and 13W LED lamps. – Exterior Parking Lighting – High Pressure Sodium (HPS) lamps of 150W and 250W – Controlled by photocell
Receptacle Equipment's	– Standard refrigerator, electric stove and washer and dryer is provided by BC housing. – 5 x desktop computers

APPENDIX

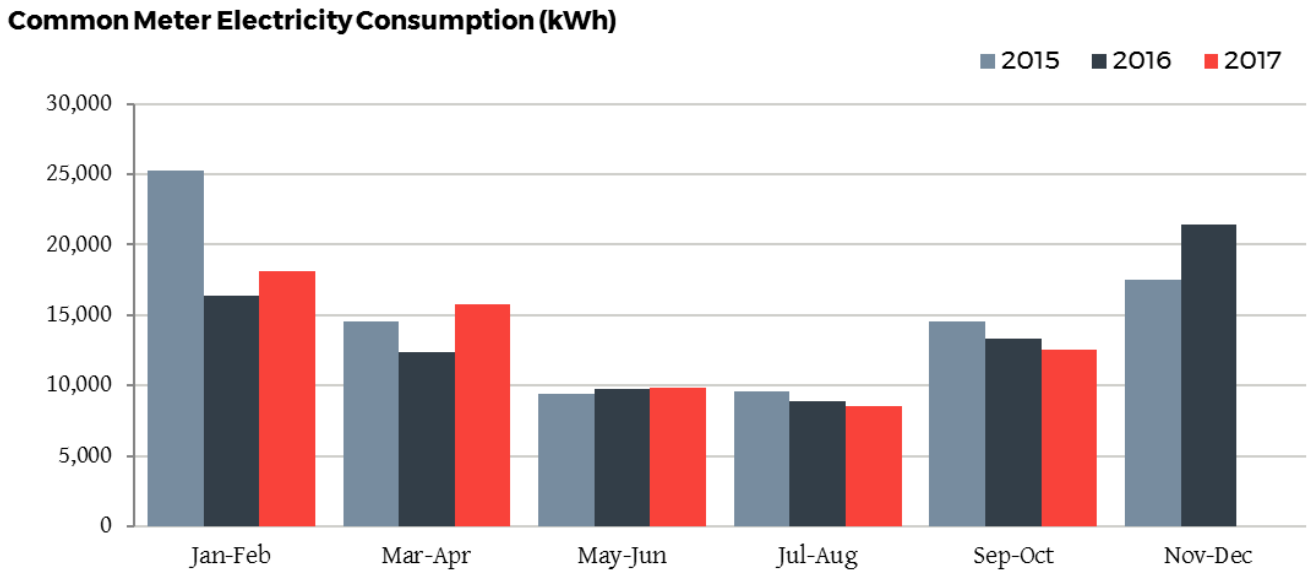
C UTILITY DATA

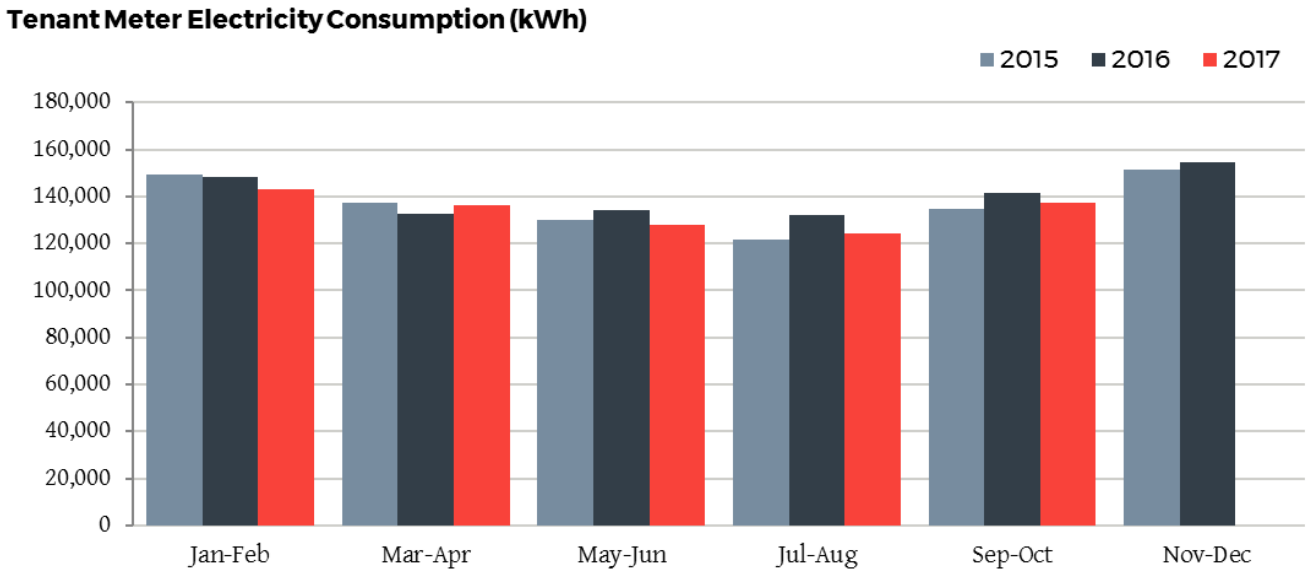
APPENDIX C

UTILITY DATA

ELECTRICITY

BC Hydro supplies electricity to the site and invoices from January 2015 to October 2017 were analyzed for this assessment. The following graph shows the electricity consumption of Rosewood Village common and tenant consumption during this period. Common areas have shown a slight reduction in consumption over the years with higher usage during the winter periods due to increased exterior lighting runtimes controlled via photocells. Tenant usage shows relatively consistent consumption throughout the year with slightly higher consumption during the colder periods since domestic hot water is heated electrically. Overall tenant consumption has remained relatively consistent over the years.



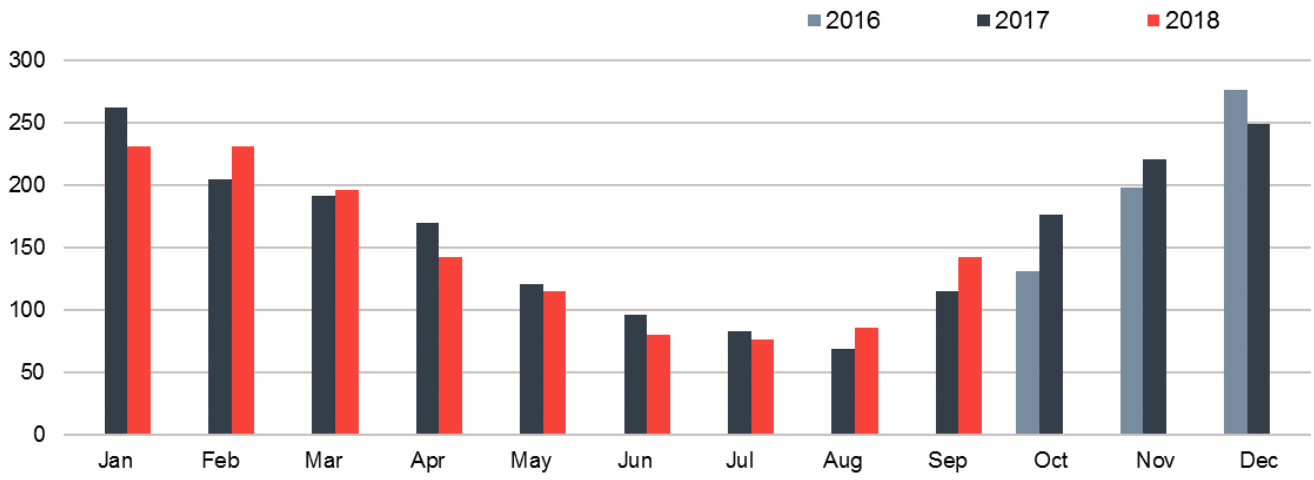


APPENDIX C

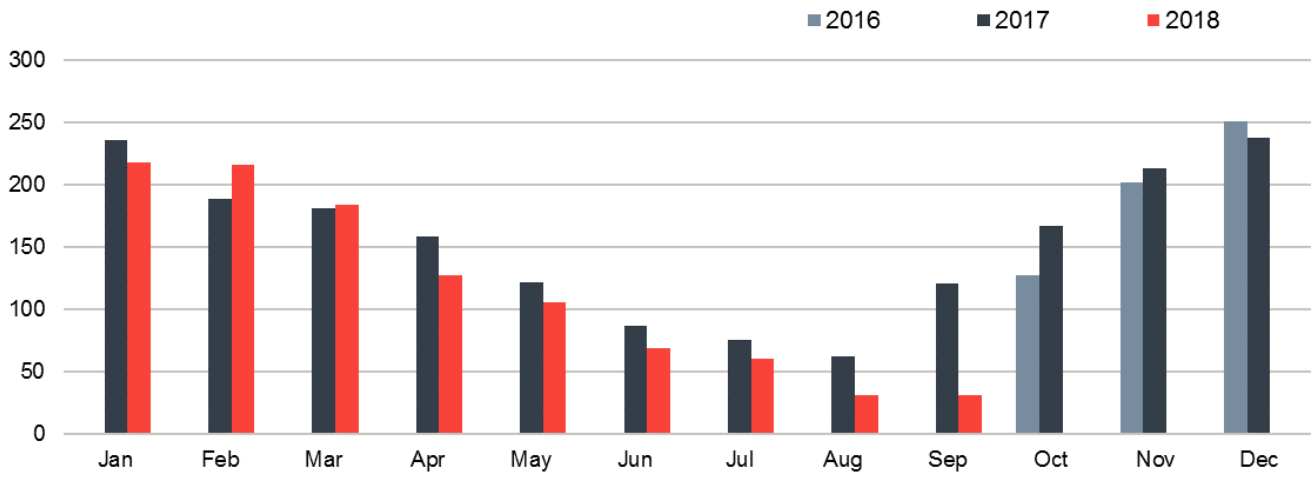
NATURAL GAS

Fortis BC supplies natural gas to the site, and invoices from October 2016 to September 2018 were analyzed for this assessment. Analysis is carried out individually for the two apartments and the office building. No natural gas invoices were provided for townhouses due to privacy issues. All three buildings have shown consistent consumption, with variations within typical annual tolerances.

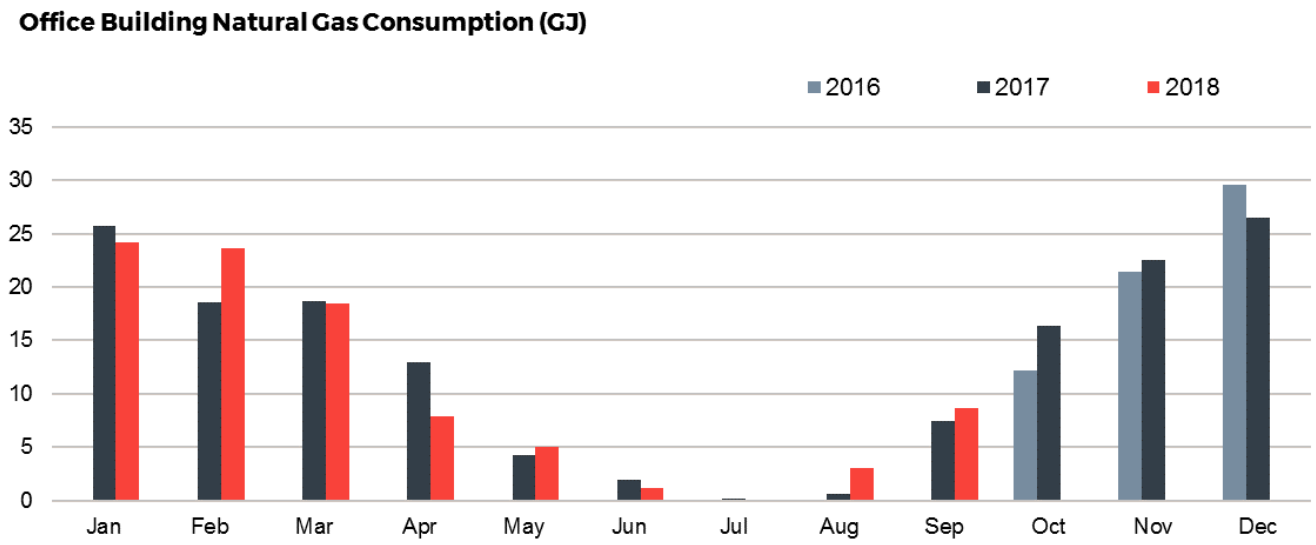
Apartment 8220 Natural Gas Consumption (GJ)



Apartment 8280 Natural Gas Consumption (GJ)



APPENDIX C


Office Building Natural Gas Consumption (GJ)
2016
2017
2018
35
30
25
20
15
10
5
0
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec

APPENDIX

D END-USE BREAKDOWN

APPENDIX D

END-USE BREAKDOWN

The following graph shows the estimated energy end use breakdown for the Rosewood Village Site. This serves to illustrate the magnitude of energy used by the different systems. Space heating constitutes a significant portion of the site's energy usage due to the construction of these 1975 buildings which have higher envelope thermal losses and infiltration. High usage is also attributed to plug loads which include the electric stove and refrigerators. Domestic hot water also contributes significantly to energy usage but it is inline with typical residential building usages.

ELECTRICTY BREAKDOWN	CONSUMPTION (EKWH)	EUI (KWH/M^2)	% OF TOTAL ENERGY	% OF TOTAL ELECTRICAL	COST ($)	% OF TOTAL COST
Fans	9,018	0.6	0%	1%	$ 945	1%
Pumps	19,605	1.4	1%	2%	$ 2,054	1%
Townhouse DHW	446,633	31.4	16%	55%	$ 46,792	31%
Cooling	1,349	0.1	0%	0%	$ 141	0%
Lighting	106,498	7.5	4%	13%	$ 11,157	7%
Plug Loads	223,507	15.7	8%	28%	$ 23,416	16%
Subtotal	***806,610***	***56.7***	***29%***	***100%***	***$ 84,506***	***56%***

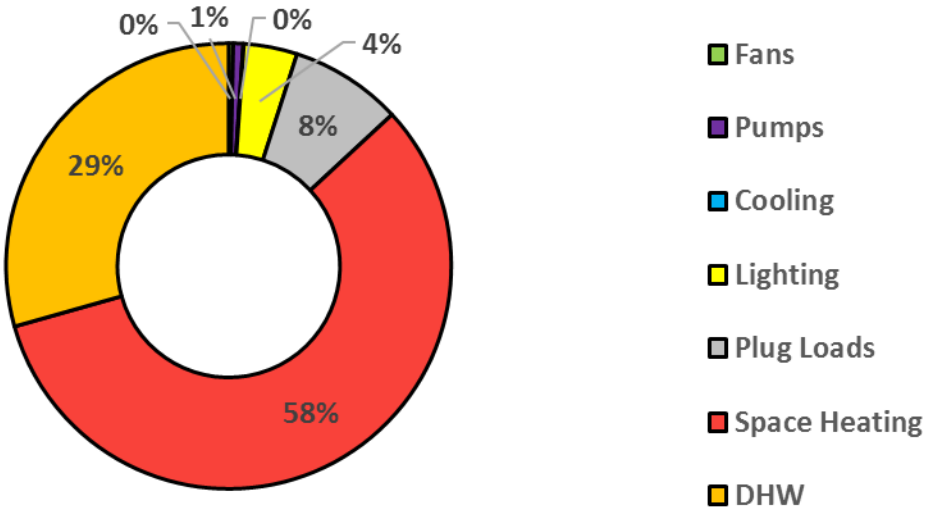
NATURAL GAS BREAKDOWN	CONSUMPTION (GJ)	EUI (KWH/M^2)	% OF TOTAL ENERGY	% OF TOTAL GAS	COST ($)	% OF TOTAL COST
Apartment Heating	2,319	45.3	23%	33%	$ 19,722	13%
Apartment DHW	1,284	25.1	13%	18%	$ 10,918	7%
Townhouse Heating	3,222	62.9	33%	46%	$ 33,151	22%
Office Space Heating	146	2.8	1%	2%	$ 1,239	1%
Office DHW	12	0.2	0%	0%	$ 102	0%
Subtotal	***6,983***	***136.4***	***71%***	***100%***	***$ 65,132***	***44%***

WATER BREAKDOWN	CONSUMPTION (M3)	WUI (M^3/M^2)	% OF TOTAL WATER	COST ($)
Toilets	3,085	0.2	15%	$ 3,628
Showers	7,664	0.5	38%	$ 9,012
Kitchen Faucets	3,379	0.2	17%	$ 3,973
Washroom Faucets	3,553	0.2	18%	$ 4,178
Washers	2,431	0.2	12%	$ 2,858
Subtotal	***20,113***	***1.4***	***100%***	***$ 23,648***

APPENDIX D

ENERGY END-USE BREAKDOWN

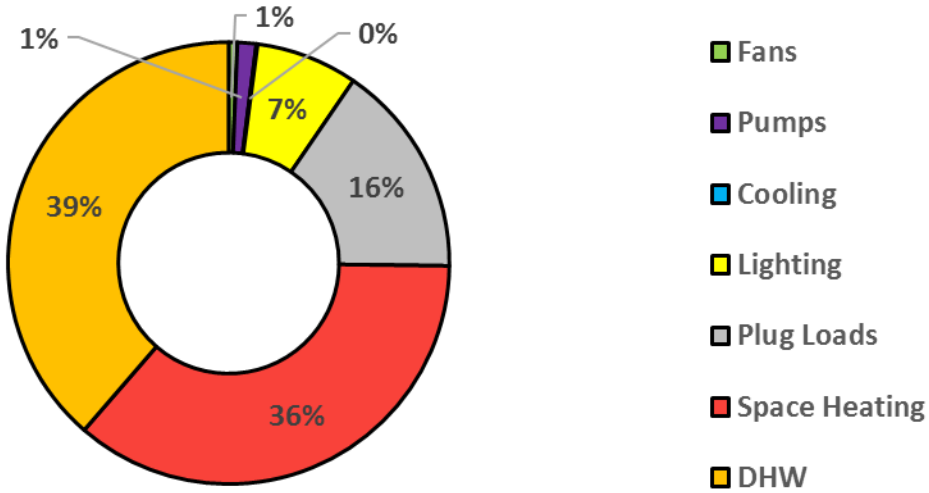
Space heating contributes to 58% of the overall site usage, while domestic hot water constitutes 29%. Neither of the buildings onsite have a central ventilation system and therefore fan consumption is negligible. Circulation pumps are only utilized at the apartment central boiler plants. Plug loads include cooking equipment, refrigerators, laundry machine and dryer, the consumption of which are all paid for by the tenants.



ENERGY COST BREAKDOWN

An estimated energy cost breakdown follows. Comparison of this figure with the energy use breakdown figure above illustrates the energy cost differences between electricity and natural gas. Electricity is approximately 3 times more expensive than natural gas, per kWh.

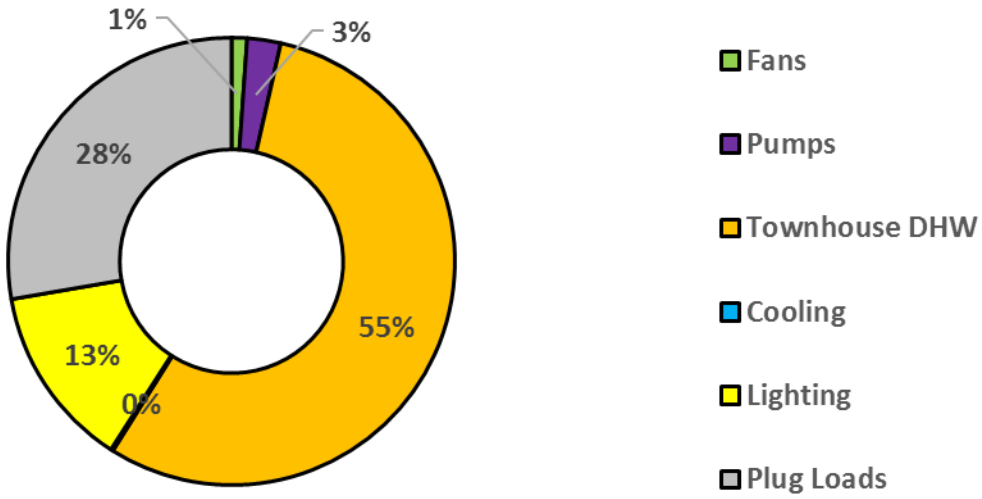
Domestic hot water heating is the dominant cost category since townhouses have electric domestic hot water heating.



APPENDIX D

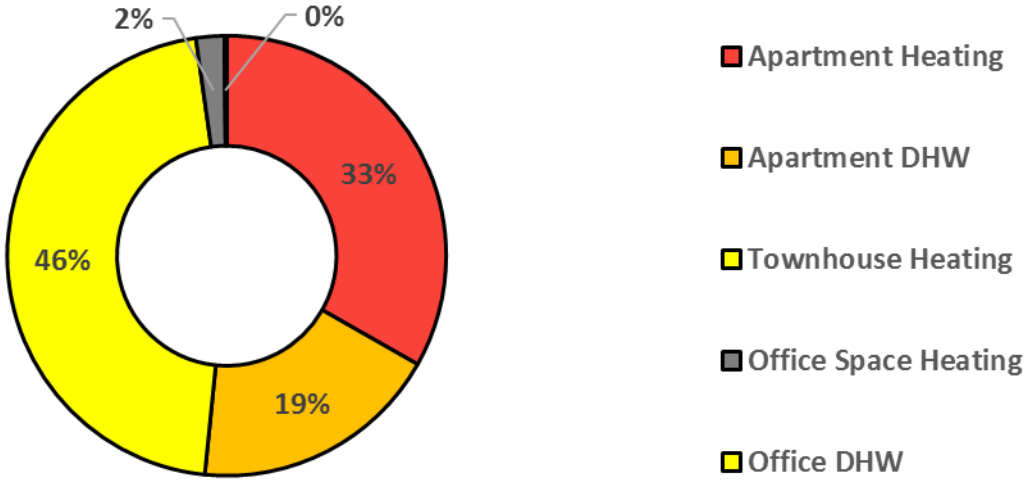
ELECTRICITY ENERGY BREAKDOWN

A consumption end use breakdown for electricity is shown below. Townhouse domestic hot water heating is the highest category, followed by plug loads which include electric stoves, refrigerators, laundry machine, and dryers as the key contributors.



NATURAL GAS ENERGY BREAKDOWN

A consumption end use breakdown for natural gas is shown below. Natural gas use is dominated by space heating due to old envelope construction with high heat loss and infiltration. Apartment space heating usage is determined through analysis of natural gas utility bills by extracting the weather dependant portion of gas consumption, the remaining weather independent portion is attributed to domestic hot water heating.



Original PUMA data

Year	Month	Electrical		Fuel Total			Energy Total	
		Consumption	Cost2	Consumption		Cost2	Consumption	Cost2
		kWh	$	GJ	ekWh	$	ekWh	$
2015	January	90,053	9,791	231	64,083	2,202	154,137	11,993
	February	79,545	8,651	363	100,960	3,479	180,506	12,129
	March	84,357	9,304	369	102,397	3,274	186,754	12,578
	April	77,696	8,745	295	82,019	2,472	159,714	11,217
	May	74,588	8,476	211	58,703	1,831	133,291	10,307
	June	67,671	7,718	136	37,658	1,229	105,329	8,948
	July	66,779	7,633	109	30,173	1,011	96,952	8,645
	August	65,529	7,498	127	35,232	1,155	100,760	8,652
	September	68,034	7,780	183	50,739	1,588	118,773	9,367
	October	74,795	8,565	284	79,004	2,442	153,799	11,007
	November	79,238	9,091	380	105,680	3,201	184,918	12,292
	December	89,803	10,351	481	133,556	3,770	223,360	14,121
	Overall:	**918,089**	**103,603**	**3,169**	**880,203**	**27,654**	**1,798,292**	**131,256**
2016	January	87,724	10,127	460	127,797	3,478	215,521	13,605
	February	79,181	9,148	376	104,395	2,862	183,576	12,010
	March	79,837	9,323	358	99,441	2,639	179,277	11,962
	April	74,417	8,815	264	73,224	1,883	147,640	10,697
	May	74,218	8,843	203	56,380	1,504	130,599	10,348
	June	69,917	8,337	172	47,707	1,292	117,625	9,630
	July	70,427	8,413	146	40,685	1,145	111,112	9,558
	August	70,716	8,435	135	37,515	1,055	108,231	9,490
	September	72,158	8,639	193	53,589	1,541	125,746	10,180
	October	77,675	9,310	272	75,634	2,206	153,309	11,516
	November	80,258	9,183	356	98,989	2,834	179,247	12,017
	December	88,899	9,479	506	140,599	3,988	229,498	13,468
	Overall:	**925,428**	**108,053**	**3,441**	**955,954**	**26,428**	**1,881,382**	**134,482**
2017	January	88,281	9,172	521	144,794	4,132	233,075	13,304
	February	77,351	8,005	430	119,401	3,421	196,752	11,426
	March	81,876	8,545	420	116,732	3,343	198,608	11,889
	April	75,694	7,985	342	95,107	2,748	170,801	10,733
	May	73,605	7,762	275	76,463	2,243	150,068	10,006

	June	66,766	7,015	203	56,294	1,689	123,060	8,705
	July	68,225	7,164	164	45,570	1,404	113,796	8,568
	August	68,373	7,174	144	39,968	1,251	108,341	8,425
	September	69,867	7,319	195	54,261	1,632	124,128	8,952
	October	76,063	7,981	318	88,426	2,569	164,490	10,550
	November	76,719	8,476	388	107,907	3,095	184,626	11,572
	December	84,997	10,174	461	128,013	3,469	213,010	13,643
	Overall:	**907,817**	**96,775**	**3,863**	**1,072,939**	**30,996**	**1,980,756**	**127,771**
2018	January	85,535	10,485	455	126,348	3,330	211,883	13,815
	February	75,552	9,285	413	114,836	3,027	190,388	12,312
	March	78,921	9,798	431	119,789	3,167	198,710	12,965
	April	72,874	9,157	328	91,166	2,444	164,040	11,601
	May	72,461	9,152	240	66,599	1,833	139,060	10,985
	June	67,005	8,503	174	48,408	1,372	115,413	9,874
	July	67,971	8,629	140	38,907	1,140	106,877	9,768
	August	67,245	8,532	98	27,118	861	94,363	9,393
	September	67,816	8,578	107	29,812	943	97,628	9,521
	October	73,764	9,311	317	87,958	2,367	161,722	11,678
	November	51,020	6,440	434	120,527	3,162	171,547	9,602
	December	12,439	1,567	165	45,770	1,212	58,209	2,779
	Overall:	**792,603**	**99,437**	**3,302**	**917,237**	**24,857**	**1,709,841**	**124,294**

ECM 01: Install air source heat pump for townhouses

Townhouses are heated by a gas-fired furnace which provide recirculated air throughout the building.

The furnaces are at the end of its service life and scheduled to be replaced.

Total ECM cost: $490,000

ECM 02: Upgrade wall cavity insulation and add exterior insulation

Current wall construction were at the Townhouses, Apartment, and Office Building are of two types, both have an estimated
effective R-value of 8 which is below current standards.

Total ECM cost: $793,000