

BRIEFING

Subject: Facilities Energy Consumption & GHG Emissions

Presented to: Council

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This report is submitted for Council's information.

Background

With Council's new 2019-2022 Strategic Plan, the new Environmental Master Plan, and the forthcoming Renewable Energy Transition Roadmap, climate change mitigation has become an important priority for Council and administration. Municipal facilities emit approximately 4% of all greenhouse gas emissions¹ from Banff's built environment and are a key opportunity to reduce emissions while demonstrating the value of building and operating low-carbon buildings.

The purpose of this briefing is to provide Council with an update on the energy consumption and emissions from municipal facilities in 2018, and current/upcoming work in 2019.

Facilities Overview

The Town of Banff facilities portfolio includes all municipally-owned 1) buildings & streetlights, and 2) water services infrastructure. Utility service includes 67 electricity accounts and 25 natural gas accounts. For the purpose of energy performance monitoring these accounts are grouped into 40 separate facilities. Note that all 23 streetlight electricity accounts are here treated as a single facility.

To help distinguish large facilities from smaller ones, facilities are grouped into four 'Tiers' based on their energy consumption and emissions. All 40 facilities are listed in **Tables 1 and 2**, with Tier 1-3 facilities graphed separately in **Figures 1 and 2**.

Administration is using RETScreen – a performance analysis and forecasting tool developed by NRCan – to benchmark facility energy performance. RETScreen is very useful for predicting and verifying performance improvements from upgrades, spotting deviations from expected performance, and for setting realistic targets. The US EPA's web-based Energy Star Portfolio Manager was also used for a time but had limited capabilities and was not accessible during the prolonged U.S. government shutdown in Q1 2019.

It is worth highlighting that the facilities energy story is, in large part, one of **water**. Roughly 50% of energy use is dedicated to ice-making, extracting potable water from underground, pumping water and wastewater around the community, and treating it at the Wastewater Treatment Plant.

2018 Energy Consumption (Figure 3)

In 2018, facilities consumed a total of 7,387 MWh of electricity and 8,069 MWh of natural gas for a total consumption of 15,456 MWh. This is a 2.3% (358 MWh) decrease compared to 2017, which is mainly attributable to:

¹ Shortened to 'emissions' in this briefing

- 1) A 10% (282 MWh) drop in electricity consumption at the Wastewater Treatment Plant, partly due to ongoing process optimizations, and good performance from the new blowers
- 2) A 6.2% (90 MWh) drop in electricity use at Wells #3,4,5 due to reduced aquifer withdrawals, partly as a result of 18 water main leak repairs that were completed in 2017-2018

Potentially lower community water consumption might also be driving these decreases, although the data does not conclusively support this. The above decreases resulted in energy cost savings of more than \$25,000 and a 226 tonne decrease in emissions (4% of total facilities emissions) compared to 2017, so sustaining and adding to these gains should be a high priority.

The most notable increase relative to 2017 was a 19% increase in natural gas consumption at the Fire Hall, adding to a 29% increase seen last year relative to 2013-2016 averages. Similar increases have been observed at Fleet Transit/Services, Town Hall, and Ops Admin (see **Figure 4**). These do not appear to be weather related, so will be a focus of the energy audits in Q3/Q4 (see below).

2018 Greenhouse Gas Emissions

Facilities emissions in 2018 were 5,777 tonnes, a net decrease of 3% (181 tonnes) compared to 2017. Emissions from electricity consumption were 4,325 tonnes, with 1,452 tonnes from natural gas. This disparity reflects the fact that Alberta's electricity grid still depends on coal-fired electricity generation, and so has a high emissions intensity – more than three times higher than natural gas combustion. Electricity is also 3-5 times more expensive than natural gas on an energy basis.

For these reasons, reducing electricity consumption and switching to renewable electricity sources have a greater impact on emissions than reducing natural gas consumption. Similarly, switching from electricity to natural gas can reduce emissions and energy costs in some applications. These benefits must be weighed against becoming overly dependent on natural gas – a non-renewable resource.

Priorities for 2019

Facilities' focus for 2019 is to complete energy audits on all Tier 1 and 2 buildings, to be completed by third party energy consultants. The energy audit budget (\$125,000) was approved during 2019 Service Review. Administration has also applied to the Municipal Climate Change Action Centre for a \$10,000 grant to support the Fenlands energy audit. The following energy audits are scheduled:

Facility	Project Timing
Tier 1 - Fenlands Recreation Centre	June-July (awarded & in progress)
Tier 1 - Wastewater Treatment Plant	Q3
Tier 2 - Town Hall - Waste Transfer Station - Fire Hall - Fleet Transit/Services - Bear St. Parkade - Ops Admin, Wood Shop (budget permitting)	Q3/Q4 (will be managed as a single project)

A key audit outcome will be energy performance improvement **targets** for each facility that can be achieved via implementation of various energy conservation measures (ECMs). Some ECMs identified during the audits will be investment ready (e.g. lighting, boiler upgrades, etc.) whereas others may require additional feasibility work (e.g. plant upgrades, cogeneration).

The following capital projects are also progressing – some in collaboration with other departments:

- i. LED lighting upgrades in the curling arena at Fenlands (in 2019 Facilities budget)
- ii. Solar PV on the roof of the Waste Transfer Station (2019/2020)
 - Potential install in Q3/Q4 2019. Not in budget. Could draw on external funding and the environmental reserve.
- iii. Wood waste (biomass) district heating for the Operations Compound (2020)
 - Currently proceeding with environmental review while awaiting a federal funding decision “later in 2019”
- iv. Pre-feasibility analysis of cogeneration at the Wastewater Treatment Plant & Fenlands
 - Existing natural gas boilers at WWTP are old and inefficient, and are scheduled for replacement in 2020 – potentially with cogeneration units
 - Cogeneration could significantly reduce energy costs and emissions from ice-making
- v. Supporting Fleet Services’ installation of EV charging equipment at Fenlands, Fleet/Transit Services, and Ops Admin (2019)

Zero Investment Targets

Administration has identified performance targets for Tier 1 and 2 facilities that should be achievable through energy conservation alone – i.e. **zero investment targets** (see **Table 3**). These targets are close to the ‘personal best’ performance of each facility from the past 5 years, in some cases allowing for an increase in utilization/services. They describe a scenario where each facility achieves its ‘personal best’ in *every* year. If these targets were met consistently, the energy cost savings would be over \$37,000 per year compared to 2018, with emissions reductions of 194 tonnes.

Hitting these targets doesn’t depend on adopting obsessive conservation behaviours, but rather on following reasonable best practices such as:

- Ensure garage doors are always closed in cold weather, unless being used by vehicles
- Ensure HVAC set points and schedules are programmed correctly
- Ensure building automation systems are functioning and properly maintained
- Power down equipment when not in use (e.g. computers, coffee machines, space heaters)

To consistently achieve these targets administration should implement energy conservation programs, policies, and procedures throughout the organization – i.e. an energy management plan. Facilities is currently exploring options for implementing these types of measures.

Planning Context

Council's new 2019-2022 Strategic Plan has a much stronger emphasis on energy and greenhouse gas emissions than any earlier plan, including the following guiding statements and objectives:

- *A community-wide (Town corp. and community) greenhouse gas (GHGs) emissions inventory and plan are in place, and 2022 indicators show progress on track towards reducing GHG emissions to 30% below 2005 levels by 2030, and 80% by 2050 (pg. 18)*
- *A road map plan is completed, and projects initiated to achieve community 100% renewable energy by 2050 (pg. 18)*
- *Promote Town leadership and inspire corporate participation through a variety of efficiency and renewable projects that include fleet transition, building retrofits, and generation facilities (pg. 20)*

This direction from Council is underpinned by the objectives of the Banff Community Plan (2007), the Environmental Master Plan (2019), and the forthcoming Renewable Energy Transition Roadmap (summer 2019), which describe the community's priorities and goals for reducing energy consumption and greenhouse gas emissions. Municipal facilities have a central role to play in leading the community towards achieving these goals.

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Table 1 – 2018 energy consumption for buildings and streetlights, sorted by emissions

Tier	Building	Electricity	Gas	Total	GHG	GFA	EI
		<i>MWh</i>	<i>MWh</i>	<i>MWh</i>	<i>tonnes CO_{2e}</i>	<i>ft²</i>	<i>Emissions /1,000 ft²</i>
1	Fenlands Rec. Centre *	1298	2412	3710	1077	92,000	11.7
2	Fleet/Wood/Animal ¹	235	633	868	253	20,700	12.2
2	All Streetlights	391		391	237		
2	Waste Transfer Station	188	640	828	230	9,653	23.8
2	Fire Hall/Staff Accom.	126	720	846	206	8,374	23.9
2	Town Hall/Central Park *	217	387	604	191	24,600	7.8
2	Bear St. Parkade	86	551	637	152	87,740	1.7
3	552 Banff Ave.	23	304	327	69	12,042	5.7
3	Senior Centre	68	113	180	61	8,082	7.5
3	Ops Admin/Greenhouses	70	96	165	59	4,200	15.0
3	Library	68	79	148	56	8,082	6.9
4	Cougar St Staff Accom.	19	66	85	23	1,750	14.9
4	Rec. Grounds Washroom	16	29	45	15	862	19.7
4	Wolf St Washroom *	15	25	41	12	900	13.3
4	Middle Springs Cabin	5	40	45	10		
4	Carpentry Shop ³	12		12	7		
4	RRR Screw Auger ³	7		7	4		
4	Rec Ball Diamonds ³	2		2	1		
4	Mtn View Cemetery ³	1		1	1		
4	Welcome to Banff Sign ³	< 1		< 1	< 1		
4	210 Bear St. Special Events ³	< 1		< 1	< 1		
4	220 Bear St. Special Events ³	0		0	0		
	TOTAL	2847	6095	8942	2665		

¹ Fleet Transit/Services, Wood Shop, and Animal Shelter are combined because they share an electricity meter.

² Town Hall, Central Park Washroom, Lift Station, Gazebo are combined because they share an electricity meter.

³ These facilities are unheated or are outdoors.

* Solar PV generation is included in energy consumption, as are the associated GHG emissions reductions.

Tier 1 > 1000 MWh/year

Tier 2 = 500-1000 MWh/year

Tier 3 = 100-500 MWh/year

Tier 4 < 100 MWh/year

Table 2 – 2018 energy consumption for water services, sorted by emissions

Tier	Water Services Facility	Type	Electricity	Gas	Total	GHG
			<i>MWh</i>	<i>MWh</i>	<i>MWh</i>	<i>tonnes CO_{2e}</i>
1	Wastewater Treatment Plant	Sewer	2512	1808	4321	1852
1	Wells #3, 4, 5	Water	1368		1368	831
3	Muskat St. Lift Station	Sewer	148	0	148	90
3	Kootenay Pumphouse	Water	139		139	84
3	Middle Springs Res. & Pump	Water	100	54	154	71
4	Tunnel Mt. Pumphouse	Water	63	27	90	43
4	Hawk Ave. Heating Plant	Water	34	47	81	29
4	Tunnel Mt. Reservoir	Water	44		44	27
4	Cemetery Pumphouse	Water	45		45	27
4	Mountain Ave. Pumphouse	Water	25		25	15
4	Cougar St. Lift Station	Sewer	15		15	9
4	Rundle Springs Culvert	Storm	14		14	9
4	Middle Springs Booster Station	Water		38	38	7
4	Lynx Lift Station	Sewer	11		11	7
4	Rec. Grounds Lift Station	Sewer	9		9	5
4	Whiskey Creek Lift Station	Sewer	7		7	4
4	Sulphur Mt. Reservoir	Water	6		6	3
4	Glen-Rundle Culvert	Storm	0		0	0
	TOTAL		4540	1974	6515	3113

The Central Park Lift Station does not appear in this list because it is not separately metered for electricity or natural gas.

Approximately 19% of municipal electricity requirements is purchased in the form of Renewable Energy Certificates. The emissions benefits of this are included above.

Electricity emissions factor = 0.750 tonnes/MWh. Natural gas emissions factor = 0.180 tonnes/MWh. Emissions intensities should only be compared for buildings with similar functions.

Figure 1 – 2018 energy consumption by facility, Tiers 1-3.

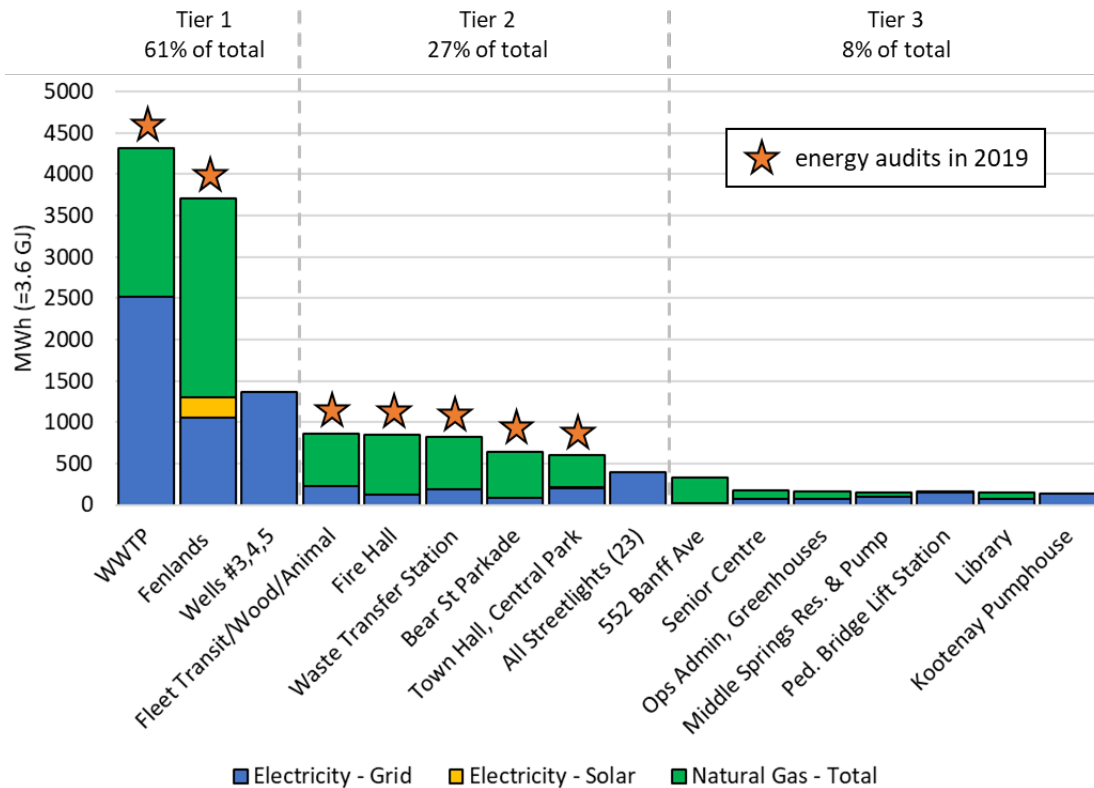


Figure 2 – 2018 emissions by facility, Tiers 1-3

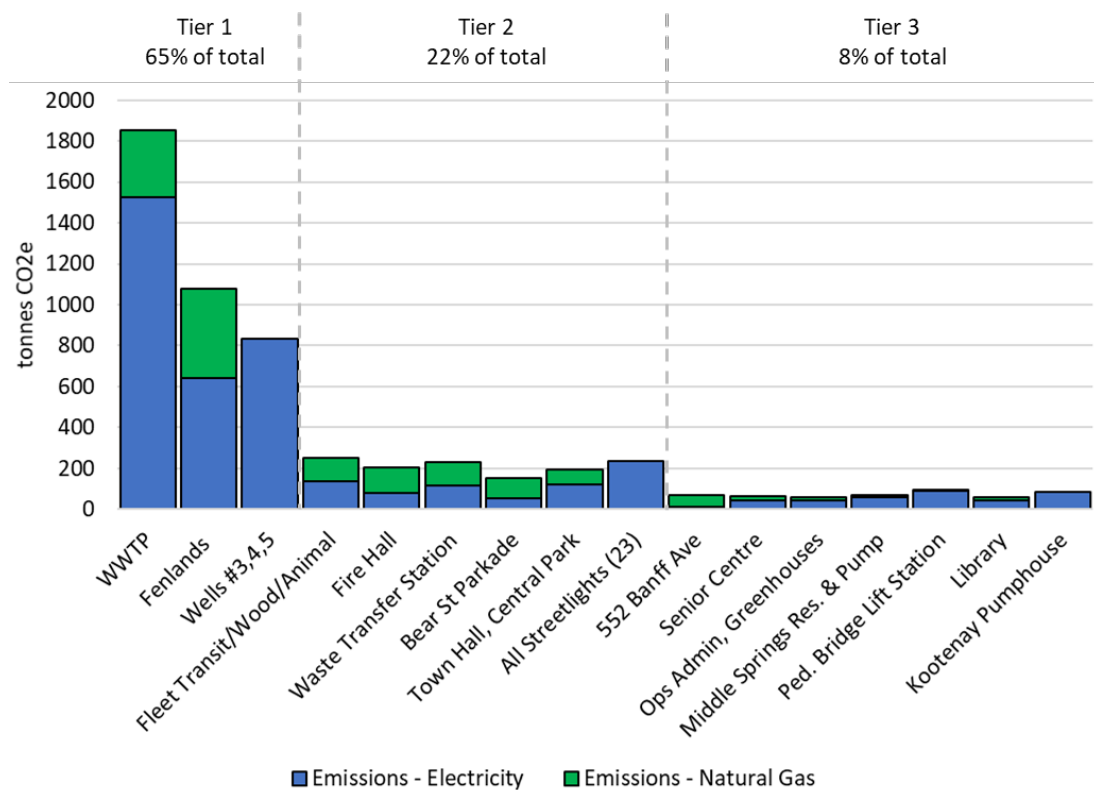


Figure 3 – Energy consumption by facility type, 2014-2018

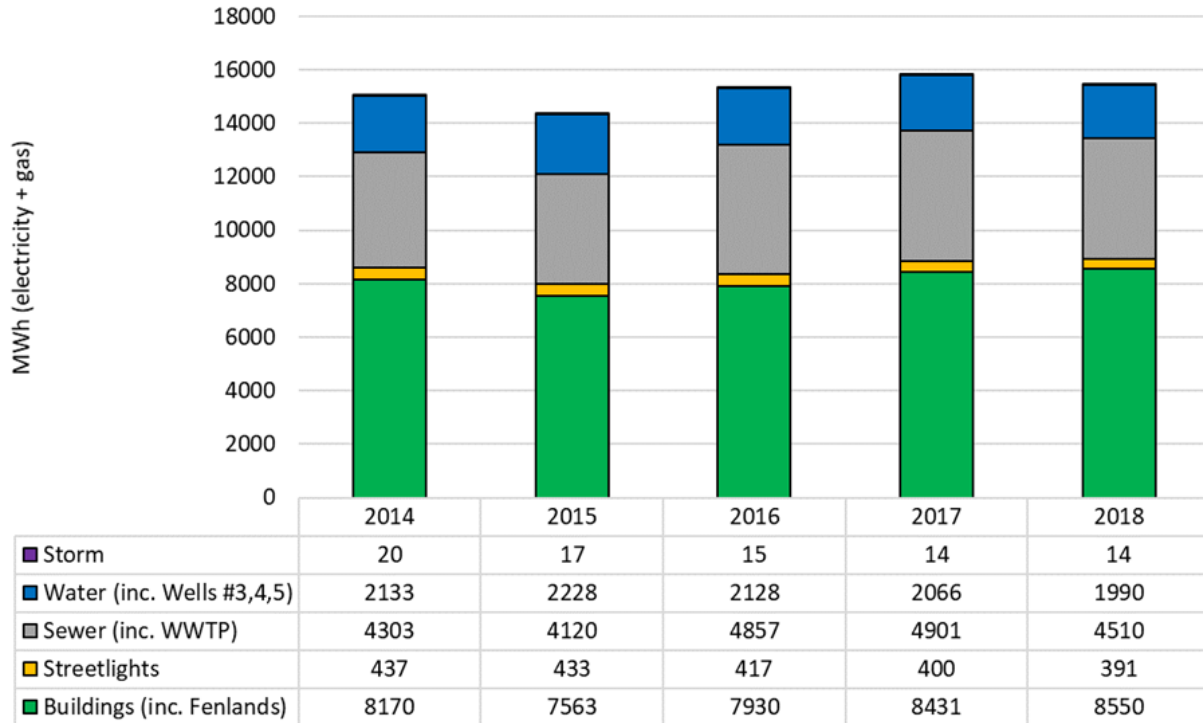


Figure 4 – Energy consumption from selected admin/operations buildings, 2014-2018

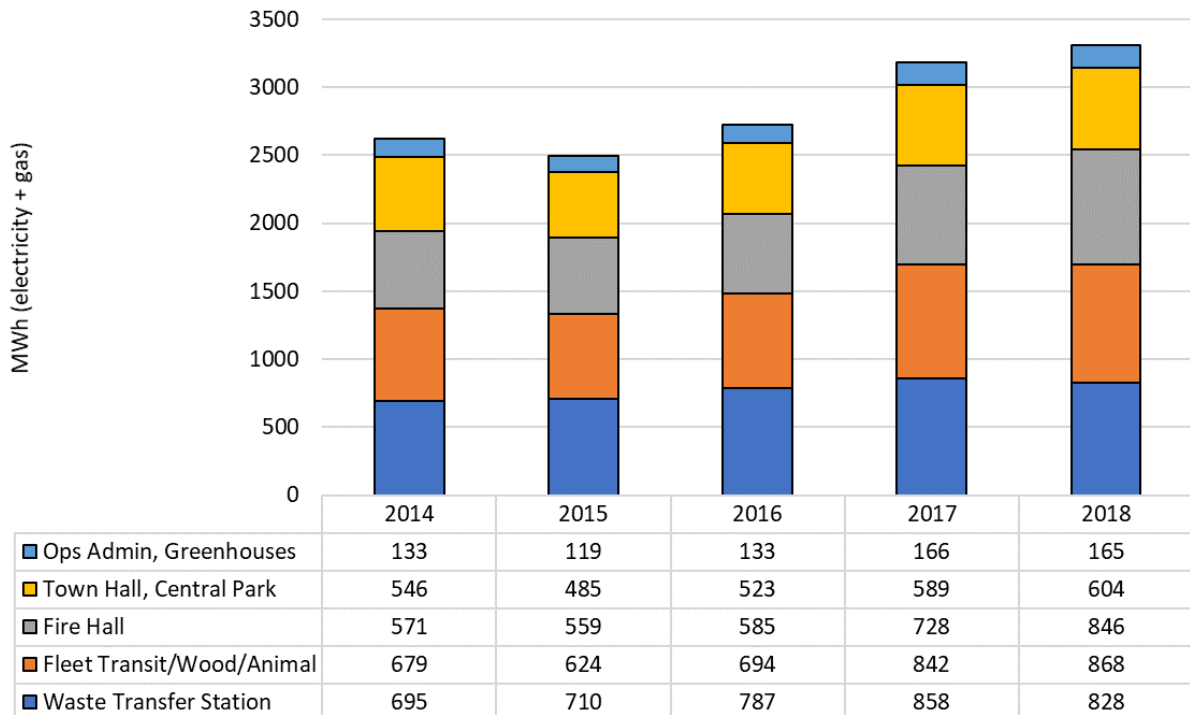


Table 3 – Zero investment targets for Tier 1 and 2 facilities, with annual savings

Units	2014-2018 ACTUAL ANNUAL CONSUMPTION				ZERO INVESTMENT TARGETS	ANNUAL SAVINGS vs. 2018		
	MIN	MAX	AVG	2018		Energy	Costs	GHG
	<i>MWh</i>	<i>MWh</i>	<i>MWh</i>	<i>MWh</i>	<i>MWh</i>	%	\$	tonnes
WWTP	4042	4718	4412	4321	4100	5%	\$12,346	74
Wells #3,4,5	1368	1551	1472	1368	1350	1%	\$1,549	10
Fenlands	3567	3893	3720	3710	3500	6%	\$8,281	43
Waste Transfer Station	695	858	776	828	750	9%	\$2,419	10
Fleet/Wood/Animal	624	868	741	868	750	14%	\$3,978	18
Fire Hall	559	846	658	846	700	17%	\$3,668	13
Bear St Parkade	610	769	668	637	600	6%	\$888	3
Town Hall/C.P.	485	604	549	604	500	17%	\$4,172	22
TOTALS	11949	14107	12996	13181	12250	7%	\$37,302	194

Assumes electricity - \$0.09/kWh, gas - \$4/GJ