



# Energy Conservation & Demand Management Plan 2024

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# 1. Regulatory Update

**O. Reg. 397/11: Conservation and Demand Management Plans** was introduced in 2013. Under this regulation, public agencies were required to report on energy consumption and greenhouse gas (GHG) emissions and develop Conservation and Demand Management (CDM) plans the following year.

Until recently, O. Reg. 397/11 was housed under the Green Energy Act, 2009 (GEA). On December 7, 2018, the Ontario government passed Bill 34, Green Energy Repeal Act, 2018. The Bill repealed the GEA and all its underlying Regulations, including O. Reg. 397/11. However, it re-enacted various provisions of the GEA under the Electricity Act, 1998.

As a result, the conservation and energy efficiency initiatives, namely CDM plans and broader public sector energy reporting, were re-introduced as amendments to the Electricity Act. The new regulation is now called **O. Reg. 507/18: Broader Public Sector: Energy Conservation and Demand Management Plans (ECDM)**.

As of January 1, 2019, O. Reg. 397/11 was replaced by O. Reg. 507/18, and BPS reporting and ECDM plans are under the Electricity Act, 1998 rather than the Green Energy Act, 2009.

As of February 23, 2023, O. Reg. 507/18 was replaced by **O. Reg. 25/23, and BPS reporting and ECDM Plans** are under the Electricity Act, 1998 rather than the Green Energy Act, 2009.

## 2. Executive Summary

The purpose of this Energy Conservation and Demand Management (ECDM) Plan from The City of Thunder Bay (COTB) is to outline specific actions and measures that will promote good stewardship of our environment and community resources in the years to come. The Plan will accomplish this, in part, by looking at future projections of energy consumption and reviewing past conservation measures.

In keeping with COTB's core values of efficiency, concern for the environment and financial responsibility, this ECDM outlines how COTB will reduce overall energy consumption, operating costs and greenhouse gas emissions. By following the measures outlined in this document, we will be able to provide compassionate service to more people in the community. This ECDM Plan is written in accordance with O. Reg. 25/23 of the recently amended Electricity Act, 1998.

Through past conservation and demand initiatives, COTB has achieved the following results since 2019:

- 17,517,158 kwh reduction in electricity use
- 1,610,742 m<sup>3</sup> reduction in natural gas use

Today, utility and energy related costs are a significant part of overall operating costs. In 2023:

- Energy Use Index (EUI) was 51.76 ekWh/sq.ft
- Energy-related emissions equaled 10,730 tCO<sub>2</sub>e

To obtain full value from energy management activities, COTB will take a strategic approach to fully integrate energy management into its business decision-making, policies, and operating procedures. This active management of energy-related costs and risks will provide a significant economic return and will support other key organizational objectives.

With this prominent focus on energy management, by implementing recommended initiatives, COTB can expect to achieve the following targets by their long-term goal, compared with 2023:

- -10% reduction in electricity consumption
- 43% reduction in natural gas consumption
- 34% reduction in GHG emissions

## City of Thunder Bay's Energy Performance and Path Forward

The results and the progress of the ECDM activities implemented over the past 5 years, and the projected impact of the new ECDM Plan is presented in the graph below.

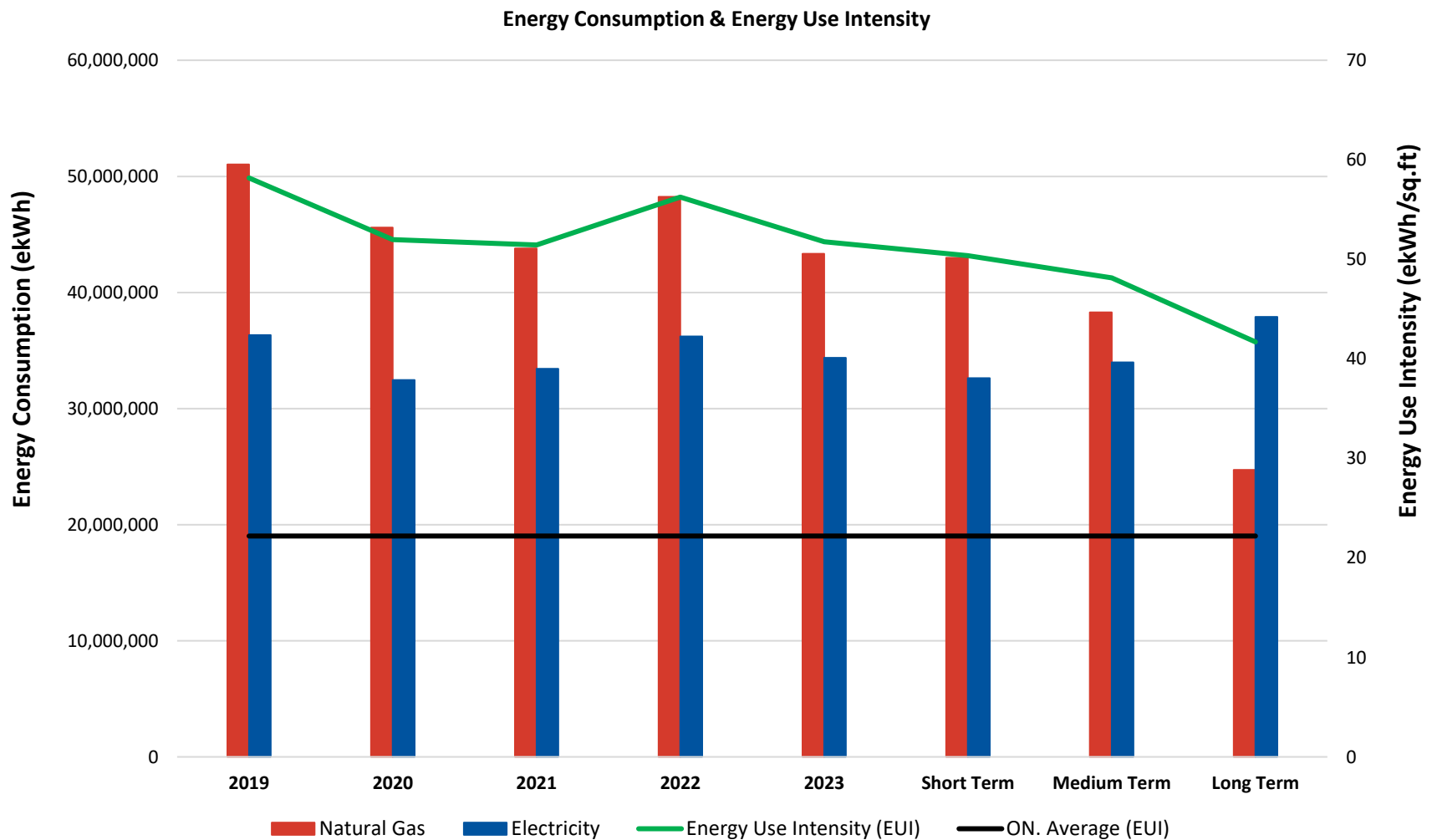


Figure 1. Energy Consumption Trends & Projections

### 3. About The City of Thunder Bay



Figure 2. COTB

Gateway to a region of over 500,000 sq. km of Canadian wilderness with over 150,000 lakes, rivers and streams – and home to about 120,000 residents, Thunder Bay, is the region's largest city and the largest on Lake Superior.

#### ***Our Vision: Maamawe, Growing Together***

All together (Maamawe), Thunder Bay will foster an inclusive city focused on service excellence and collaboration and provide opportunities for a high quality of life. We embrace and celebrate our diversity, which makes our community a vibrant and dynamic place to live and prosper.

#### ***Our Values***

Accountability, Continuous Improvement, Teamwork, Respect = A.C.T. with Respect

#### ***Our Promise***

We will improve the quality of life for people in Thunder Bay through tangible gains in: Truth & Reconciliation, Safety & Well-being, Growth, and Sustainability.

#### ***Our Strategic Directions & Goals***

- Maamawe - All together. We honour the truth and reconcile for the future.
- Safety and well-being. Our community is healthy, safe, and strong.
- Growth. We attract and retain new and diverse businesses and community members.
- Sustainability. We advance a thriving economy and environment.

## 4. Site-Wide Historical Analysis

### 4.1. Site-Wide Historical Energy Intensity

Energy Utilization Index (EUI) is a measure of how much energy a facility uses per square foot in a year. The following charts depicts COTB's facilities included in the energy utilization index analysis and overall energy intensity of COTB's buildings.

Site	2019	2020	2021	2022	2023
Corporate Administrative	22.21	17.25	17.76	21.01	20.52
Long Term Care Facility	56.13	55.59	65.03	62.65	58.58
Public Works Yards	43.88	34.97	32.12	32.28	31.71
Commercial Properties	23.25	18.99	18.43	20.93	17.11
EMS	27.21	26.05	28.78	29.95	27.12
Fire Services	31.42	29.16	28.52	29.11	27.09
Arenas	42.52	31.79	33.19	38.46	39.30
Aquatics	63.61	42.08	44.43	62.00	59.68
Community Centres	23.15	19.09	17.71	20.37	17.77
Daycare	38.69	46.33	50.33	53.35	41.65
Enforcement	40.25	41.98	48.41	43.40	42.81
Prince Arthurs Landing	22.38	18.73	20.17	23.47	23.46
Arena/Indoor Turf	-	-	-	-	-
Transit	33.52	30.47	29.51	27.98	26.66
WTP and WPCP	205.63	206.83	195.99	209.40	184.36
Police Station	41.34	37.48	33.86	35.48	31.59
Community Auditorium	22.21	17.25	17.76	21.01	20.52
Total	58.17	51.99	51.43	56.25	51.76

Table 1. Historic Energy Use Intensity



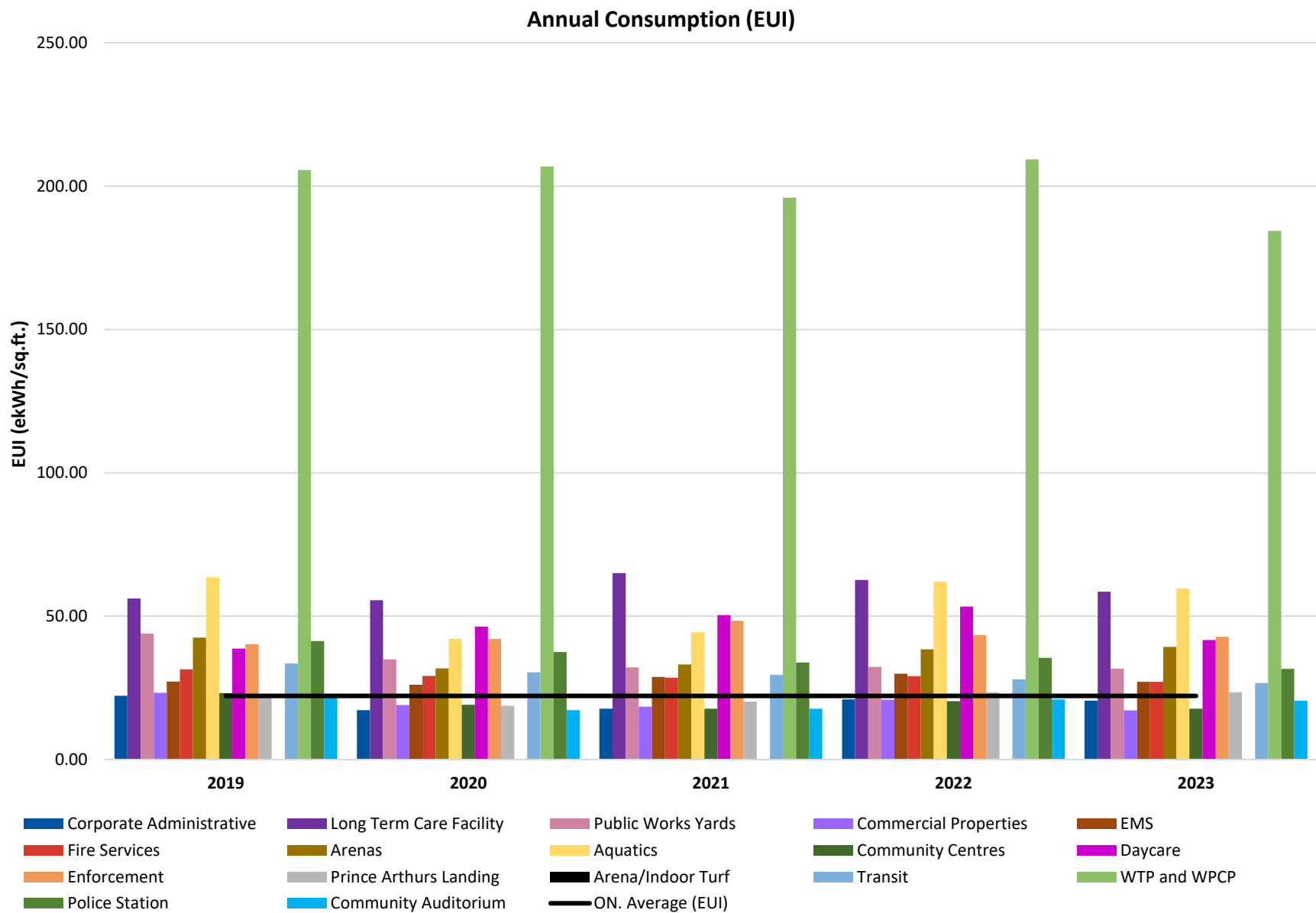


Figure 3. Historic Annual Energy Utilization Indices



## 4.2. Site-Wide Historical GHG Emissions

Greenhouse gas (GHG) emissions are expressed in terms of equivalent tonnes of Carbon Dioxide (tCO<sub>2</sub>e). The GHG emissions associated with a facility are dependent on the fuel source — for example, hydroelectricity produces fewer greenhouse gases than coal-fired plants, and light fuel oil produces fewer GHGs than heavy oil.

Electricity from the grid in Ontario is relatively “clean”, as the majority is derived from low-GHG nuclear power and hydroelectricity, and coal-fired plants have been phased out. Scope 1 (such as natural gas directly used in facilities), and Scope 2 (such as purchased electricity) consumptions have been converted to their equivalent tonnes of greenhouse gas emissions in the table below. Scope 1 represents the direct emissions from sources owned or controlled by the institution, and Scope 2 consists of indirect emissions from the consumption of purchased energy generated upstream from the institution.

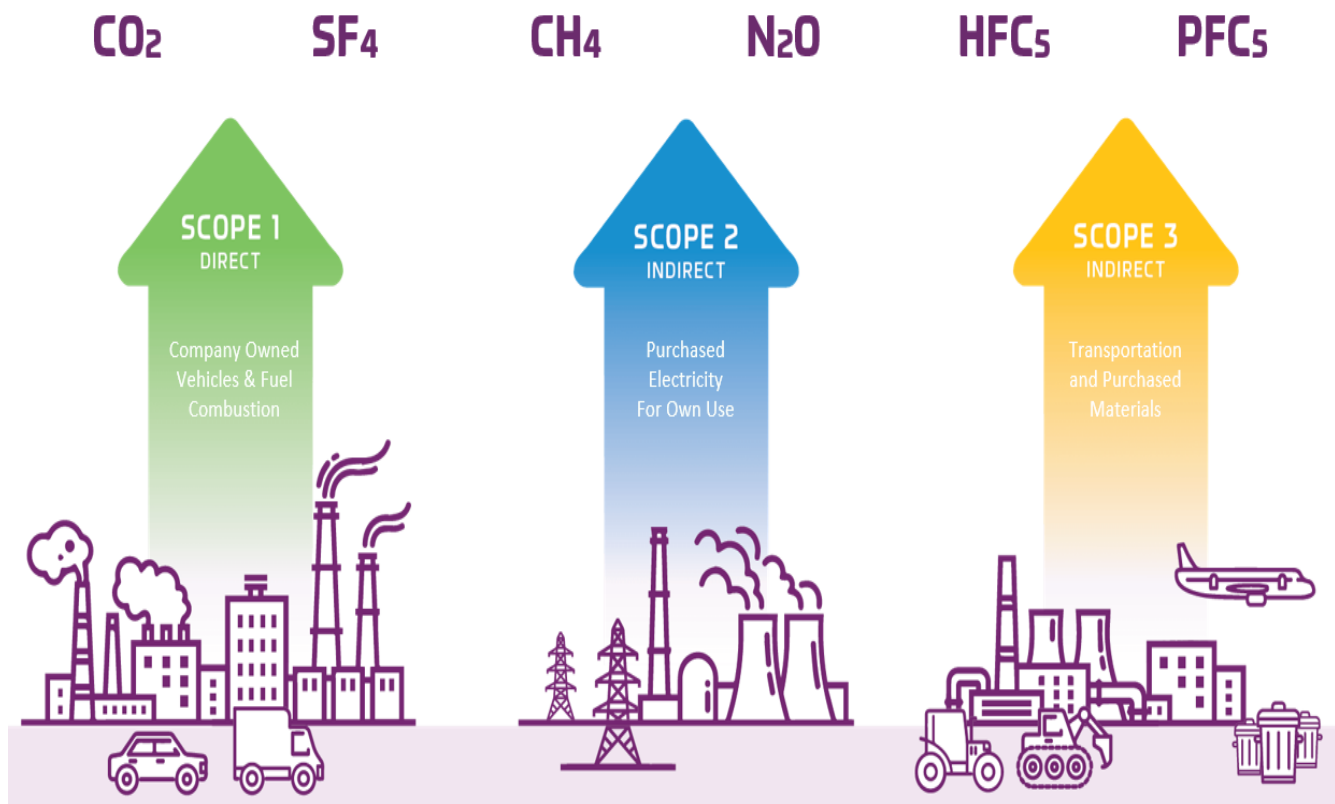


Figure 4. Examples of Scope 1 and 2

The greenhouse gas emissions for COTB have been tabulated and are represented in the table and graph below.

GHG Emissions (tCO <sub>2</sub> e)	2019	2020	2021	2022	2023
Natural Gas (scope 1)	9,282	8,294	7,967	8,777	7,884
Electricity (scope 2)	908	838	876	2,556	2,846
Total Scope 1 & 2 Emissions	10,190	9,132	8,843	11,333	10,730

Table 2. Historic Greenhouse Gas Emissions for all sites

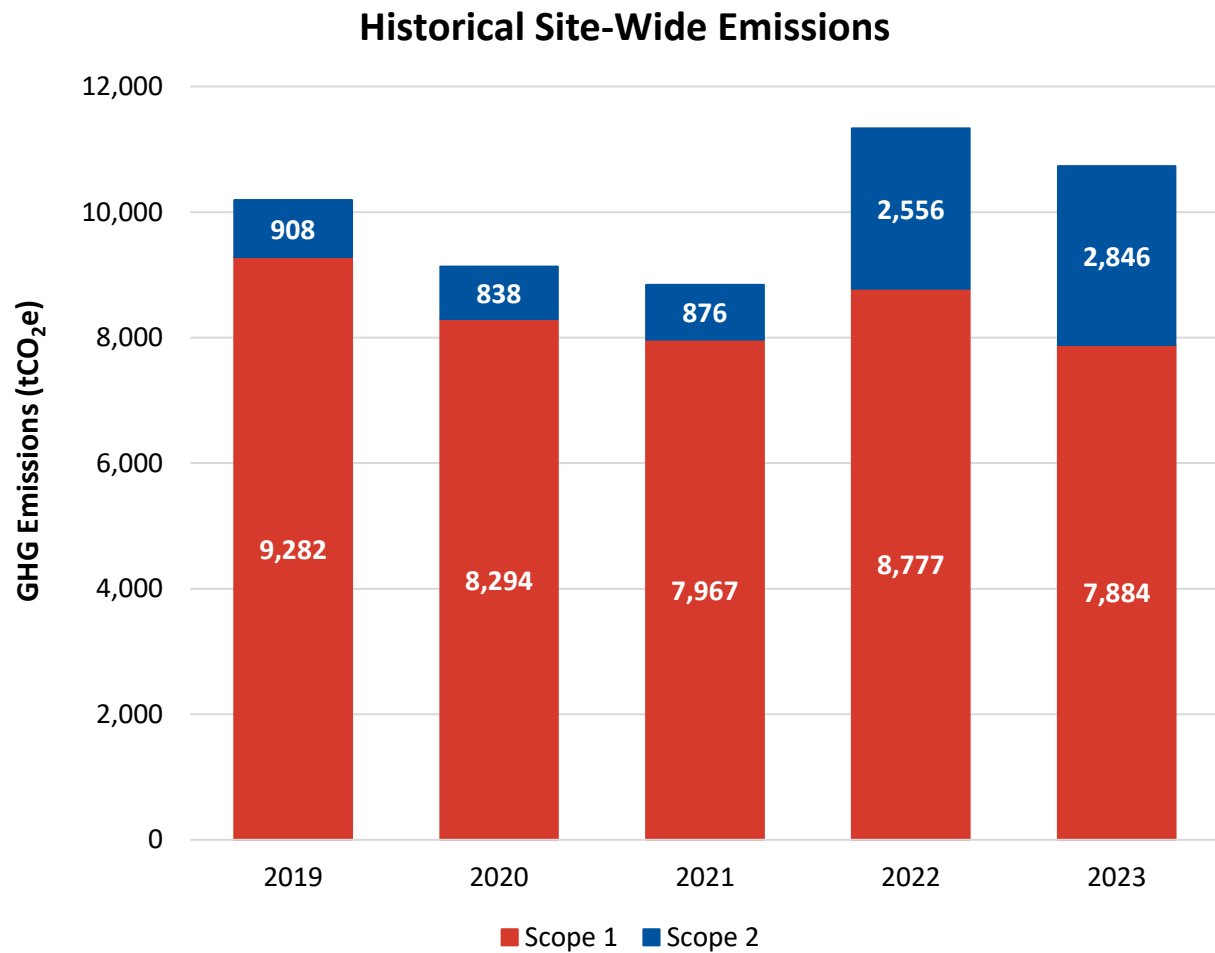


Figure 5. Historical GHG Emissions for all sites

### 4.3. Sustainability Strategies to Date

Over the previous years, COTB has undertaken various energy conservation and demand management measures. The summary of the main activities is shown in the following table.

Measure	Results
Pioneer Ridge and City Hall – boiler plant upgrades	<p>These measures resulted in more energy efficient and reliable operations, reductions in GHG emissions and reductions in energy use.</p> <p>1,610,742 m3 natural gas savings 17,517,158 kWh electricity savings</p>
Canada Games Complex – new BAS system, new boiler plant	
Front St Public Works Yard – new AHUs, Boilers and Controls	
FWG – HVAC upgrades	
Delaney – ice plant efficiencies	
Community Centres – upgrades to furnaces and DHW	
Baltimore St Police Station – new control systems	

*Table 3. Sustainability Strategies to Date*



*Figure 6. City Hall*

## 5. Site Type Analysis

The following section will provide data for each building type by sector for consumption, GHG and proposed energy conservation measures.

### 5.1. Utility Consumption Analysis

Utilities to the site are electricity and natural gas. The following table summarizes the accounts for each utility. Consumption for each respective utility has been adjusted to fit a regular calendar year (365 days).

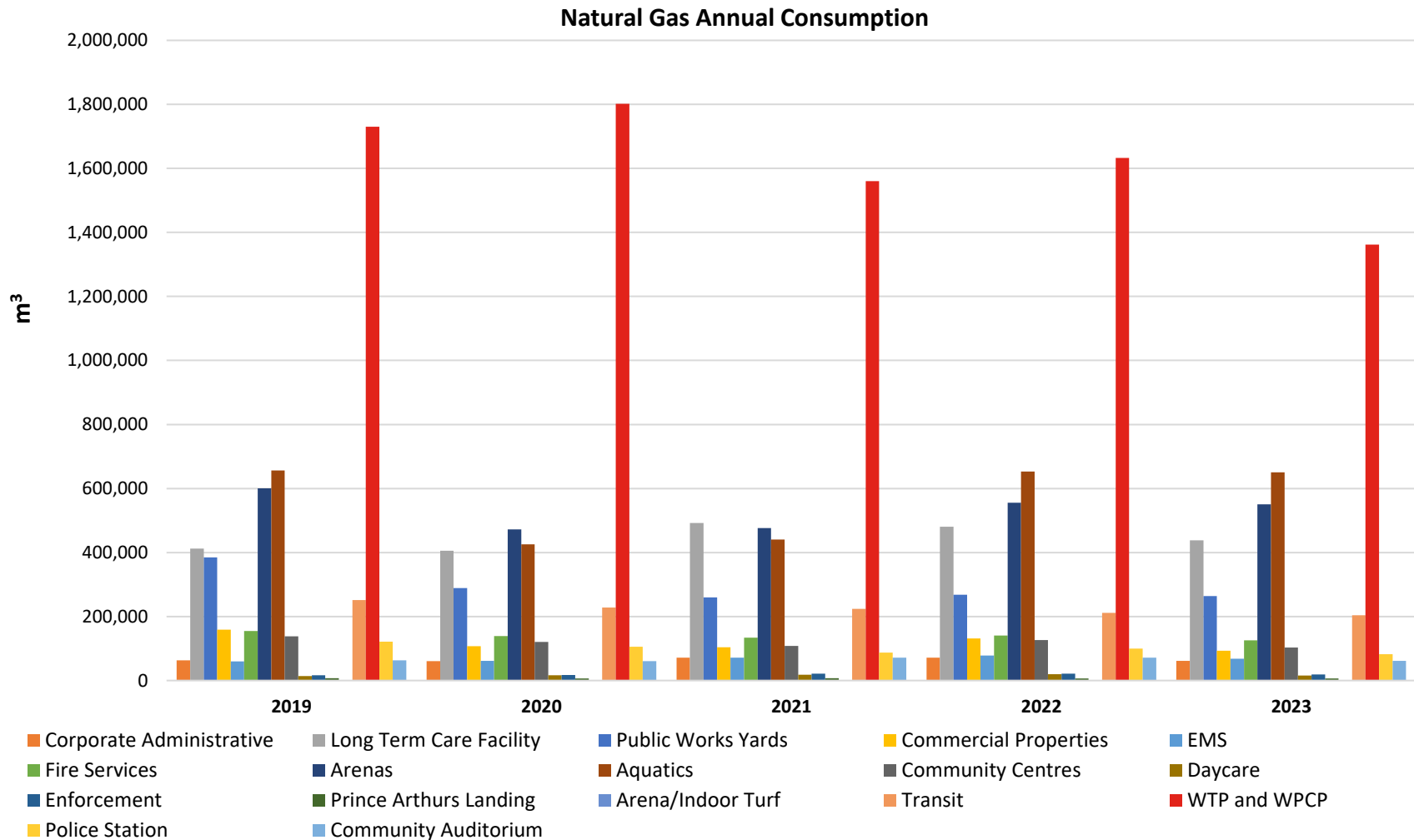


Figure 7. Historical Natural Gas Consumption

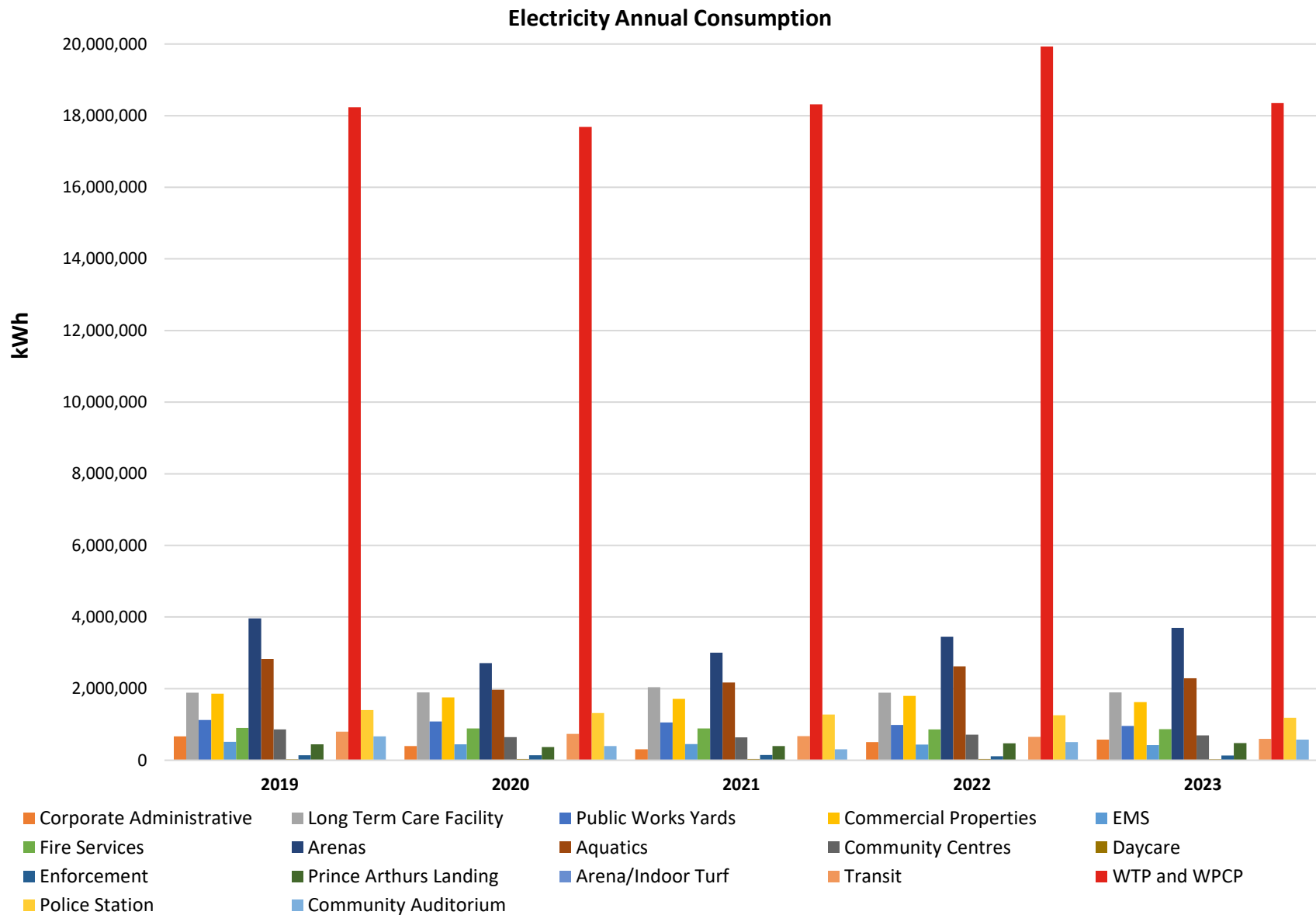


Figure 8. Historical Electricity Consumption

Natural Gas (m <sup>3</sup> )	2019	2020	2021	2022	2023
Corporate Administrative	63,372	60,214	71,833	71,619	61,733
Long Term Care Facility	412,510	405,881	492,056	480,894	437,862
Public Works Yards	384,448	288,899	259,380	267,751	263,988
Commercial Properties	158,986	107,458	103,596	131,831	92,972
EMS	59,607	61,326	71,829	77,858	67,729
Fire Services	154,638	139,171	134,226	140,876	125,207
Arenas	600,114	472,260	476,338	555,707	550,841
Aquatics	656,564	425,342	440,496	653,268	650,542
Community Centres	138,308	120,508	107,706	126,148	103,095
Daycare	13,781	16,810	18,330	19,507	15,335
Enforcement	16,350	17,298	21,131	21,087	18,906
Prince Arthurs Landing	7,395	6,719	7,092	6,828	6,363
Arena/Indoor Turf	0	0	0	0	0
Transit	251,211	227,768	223,827	211,306	203,757
WTP and WPCP	1,729,941	1,802,080	1,560,142	1,632,972	1,361,607
Police Station	121,497	105,734	87,473	99,610	82,243
Community Auditorium	63,372	60,214	71,833	71,619	61,733
<b>Total</b>	<b>4,832,098</b>	<b>4,317,684</b>	<b>4,147,288</b>	<b>4,568,881</b>	<b>4,103,913</b>

Electricity (kWh)	2019	2020	2021	2022	2023
Corporate Administrative	663,360	398,880	307,190	504,206	579,566
Long Term Care Facility	1,887,000	1,896,600	2,036,814	1,890,054	1,891,914
Public Works Yards	1,126,528	1,082,551	1,057,396	988,015	960,027
Commercial Properties	1,860,270	1,756,496	1,712,251	1,794,138	1,623,000
EMS	512,471	445,688	449,423	434,821	423,244
Fire Services	904,411	884,985	886,087	863,234	865,200
Arenas	3,959,236	2,710,937	3,006,457	3,444,352	3,699,215
Aquatics	2,830,913	1,968,201	2,169,283	2,619,391	2,291,312
Community Centres	863,088	643,093	640,370	712,121	694,698
Daycare	30,113	32,834	34,926	36,197	27,137
Enforcement	137,254	140,576	149,644	111,480	129,957
Prince Arthurs Landing	442,779	364,933	394,567	474,033	478,775
Arena/Indoor Turf	0	0	0	0	0
Transit	799,384	732,892	676,346	650,236	594,036
WTP and WPCP	18,234,516	17,686,038	18,316,344	19,928,736	18,349,146
Police Station	1,403,805	1,319,796	1,277,301	1,254,261	1,184,649
Community Auditorium	663,360	398,880	307,190	504,206	579,566
<b>Total</b>	<b>36,318,486</b>	<b>32,463,379</b>	<b>33,421,590</b>	<b>36,209,481</b>	<b>34,371,441</b>

Table 4. Historic Natural Gas & Electricity Consumption

## 5.2. GHG Emissions Analysis

The greenhouse gas emissions are calculated based on the energy consumption data analyzed in the following graphs and tables.

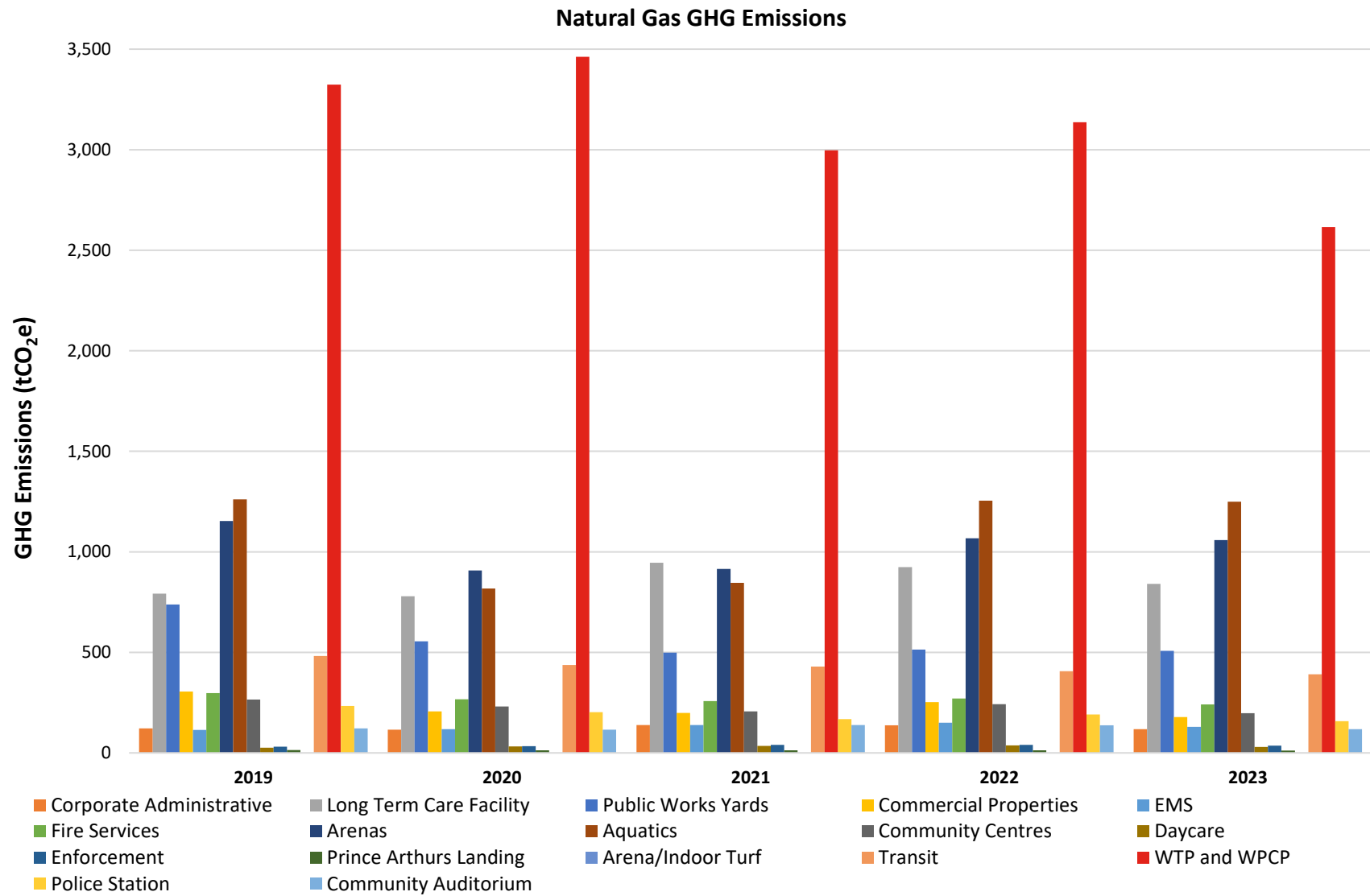


Figure 9. Historic Natural Gas GHG Emissions



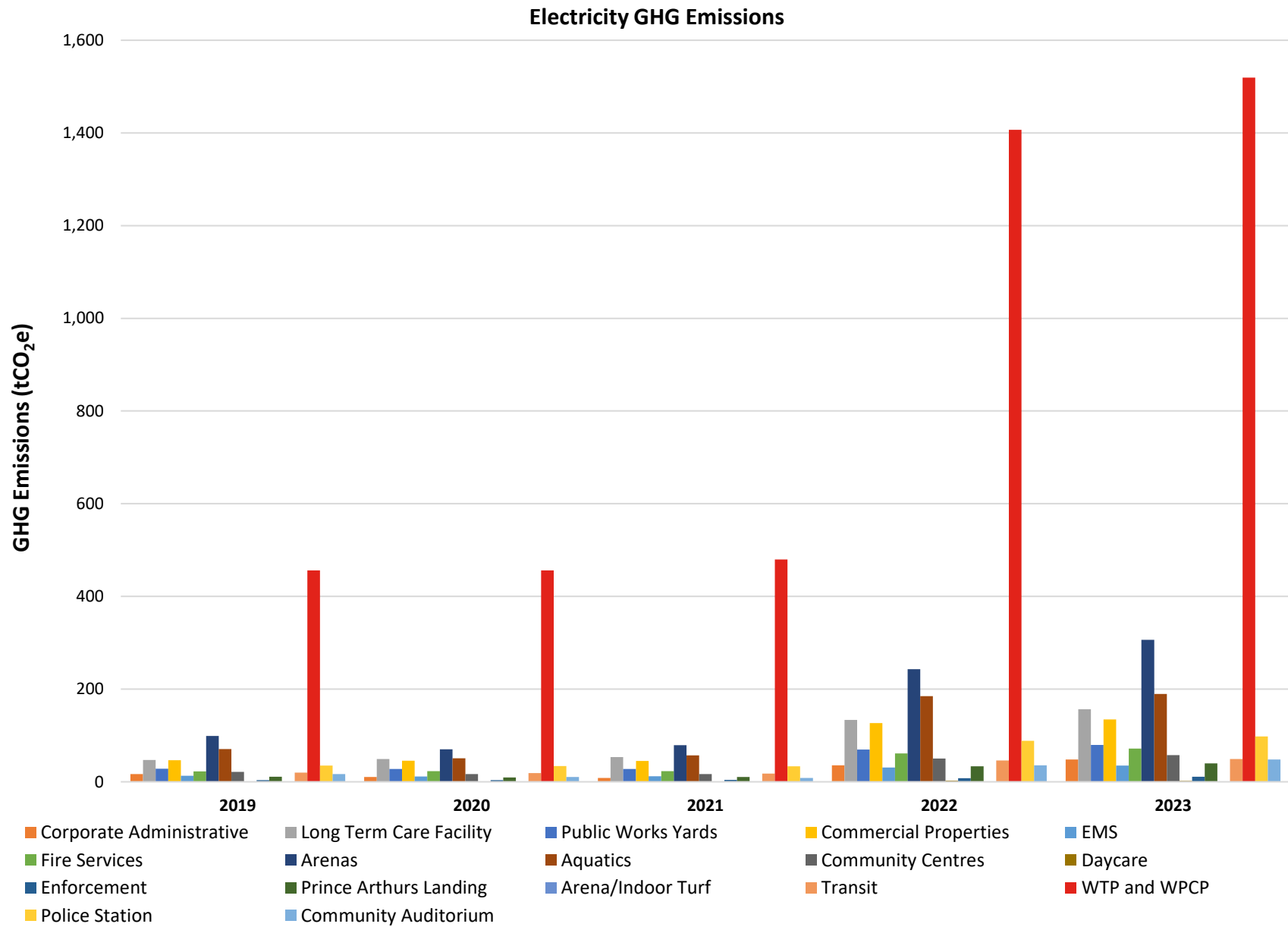


Figure 10. Historic Electricity GHG Emissions

Natural Gas GHG Emissions (tCO <sub>2</sub> e)	2019	2020	2021	2022	2023
Corporate Administrative	122	116	138	138	119
Long Term Care Facility	792	780	945	924	841
Public Works Yards	739	555	498	514	507
Commercial Properties	305	206	199	253	179
EMS	115	118	138	150	130
Fire Services	297	267	258	271	241
Arenas	1,153	907	915	1,068	1,058
Aquatics	1,261	817	846	1,255	1,250
Community Centres	266	231	207	242	198
Daycare	26	32	35	37	29
Enforcement	31	33	41	41	36
Prince Arthurs Landing	14	13	14	13	12
Arena/Indoor Turf	0	0	0	0	0
Transit	483	438	430	406	391
WTP and WPCP	3,323	3,462	2,997	3,137	2,616
Police Station	233	203	168	191	158
Community Auditorium	122	116	138	138	119
<b>Total</b>	<b>9,282</b>	<b>8,294</b>	<b>7,967</b>	<b>8,777</b>	<b>7,884</b>

Electricity GHG Emissions (tCO <sub>2</sub> e)	2019	2020	2021	2022	2023
Corporate Administrative	17	10	8	36	48
Long Term Care Facility	47	49	53	133	157
Public Works Yards	28	28	28	70	79
Commercial Properties	47	45	45	127	134
EMS	13	11	12	31	35
Fire Services	23	23	23	61	72
Arenas	99	70	79	243	306
Aquatics	71	51	57	185	190
Community Centres	22	17	17	50	58
Daycare	1	1	1	3	2
Enforcement	3	4	4	8	11
Prince Arthurs Landing	11	9	10	33	40
Arena/Indoor Turf	0	0	0	0	0
Transit	20	19	18	46	49
WTP and WPCP	456	456	480	1,407	1,519
Police Station	35	34	33	89	98
Community Auditorium	17	10	8	36	48
<b>Total</b>	<b>908</b>	<b>838</b>	<b>876</b>	<b>2,556</b>	<b>2,846</b>

Table 5. Historic Natural Gas & Electricity GHG Emissions

### 5.3. Required Conservation Measures

Our energy analysis has revealed several conservation strategies for the facility. The required energy saving initiatives are summarized in the table below outlining the targeted utilities. These measures will remain in place until a more efficient and cost-effective technology is found.

The City of Thunder Bay has outlined the below measures to match their short-, medium- and long-term goals. Short term is in the next 1 to 5 years, medium term is 6 to 10 years, and long term is 10+ years.

Site Category	Measure	Estimated Annual Savings			Project Cost (\$)	Simple Payback (Years)	Implementation Year
		Electricity (kWh)	Natural Gas (m3)	Cost (\$)			
Corporate Administrative	LED Lighting Retrofit	11,591	0	\$1,739	\$28,901	16.6	Short term
	Air Source Heat Pump for Domestic Hot Water with Electric Backup	-32,595	6,173	-\$2,420	\$324,000	N/A	Medium term
	BAS Recommissioning/Controls Upgrade	28,978	5,556	\$6,569	\$20,250	3.1	Short term
	Electrification of Heating System	-365,064	43,213	-\$37,474	\$1,620,000	N/A	Medium term
	Solar PV (Rooftop/Carport)	82,500	0	\$12,375	\$375,000	30.3	Long term
	Sub-total	-274,590	54,942	-\$19,211	\$2,368,151	-	-
Long Term Care Facility	BAS Recommissioning and Controls upgrade from pneumatic to DDC	94,596	65,679	\$40,461	\$540,000	13.3	Medium term
	LED Lighting Retrofit	136,218	-645	\$20,175	\$360,379	17.9	Short term
	Electrify Kitchen/Cafeteria Appliances	-462,382	43,786	-\$51,843	\$168,750	N/A	Medium term
	Electric Steam Humidifiers	-184,953	21,893	-\$18,986	\$48,600	N/A	Medium term
	VFD's on Air Handling Units Supply and Return Fans	13,136	0	\$1,970	\$13,500	6.9	Short term
	Carport Solar PV (199.2 kW)	253,500	0	\$38,025	\$1,095,600	28.8	Long term
	Sub-total	-149,886	130,714	\$29,803	\$2,226,829	-	-

<b>Public Works Yards</b>	LED Lighting Retrofit and lighting Controls Upgrade	10,800	0	\$1,620	\$22,964	14.2	Short term
	Replace Furnace with Dual Fuel Heat Pump Units	-195,140	36,958	-\$14,488	\$135,000	N/A	Medium term
	Replace Gas Fired Unit Heaters/Radiant Heaters with Electric Unit Heaters	-468,336	55,437	-\$48,075	\$270,000	N/A	Long term
	Air Source Heat Pump for Domestic Hot Water with Electric Backup	-139,386	26,399	-\$10,348	\$101,250	N/A	Long term
	Upgrade Building Envelopes for Garage Buildings	0	13,199	\$5,280	\$178,192	33.8	Medium term
	Air Source Heat Pumps for Space Heating and Ventilation	-209,078	39,598	-\$15,522	\$270,000	N/A	Long term
	Solar PV Rooftop 110 kW	121,000	0	\$18,150	\$242,000	13.3	Medium term
	<b>Sub-total</b>	<b>-880,140</b>	<b>171,592</b>	<b>-\$63,384</b>	<b>\$1,219,406</b>	<b>-</b>	<b>-</b>
<b>Commercial Properties</b>	Air Source Heat Pump for Domestic Hot Water with Electric Backup	-45,774	5,418	-\$4,699	\$121,500	N/A	Medium term
	Electrification of Heating System	-408,422	48,345	-\$41,925	\$1,350,000	N/A	Long term
	LED Lighting Retrofit	24,345	0	\$3,652	\$49,299	13.5	Medium term
	Solar PV (Rooftop) 115 kW	126,500	0	\$18,975	\$253,000	13.3	Long term
	BAS Recommissioning	81,150	6,043	\$14,590	\$68,937	4.7	Short term
	<b>Sub-total</b>	<b>-222,201</b>	<b>59,807</b>	<b>-\$9,407</b>	<b>\$1,842,735</b>	<b>-</b>	<b>-</b>
<b>EMS</b>	BAS Upgrade for Superior North EMS	58,766	7,357	\$11,758	\$362,118	30.8	Short term
	LED Lighting Retrofit	39,177	-185	\$5,802	\$79,899	13.8	Short term
	Replace Furnace with Dual Fuel Heat Pump Units	-28,799	5,454	-\$2,138	\$27,000	N/A	Long term
	Air Source Heat Pump for DHW with Electric Backup	-4,066	963	-\$225	\$13,500	N/A	Long term
	Electrify Heating Boilers	-280,366	33,187	-\$28,780	\$810,000	N/A	Long term
	<b>Sub-total</b>	<b>-215,288</b>	<b>46,776</b>	<b>-\$13,583</b>	<b>\$1,292,516</b>	<b>-</b>	<b>-</b>

Fire Services	LED lighting Retrofit and Controls Upgrades	25,956	0	\$3,893	\$44,677	11.5	Short term
	Replace Furnace with Dual Fuel Heat Pump Units	-26,642	6,307	-\$1,473	\$108,000	N/A	Long term
	Air Source Heat Pump for DHW with Electric Backup	-55,532	13,147	-\$3,071	\$162,000	N/A	Long term
	Install Mini Split Heat Pumps to Heat with Electric Baseboard as Backup	12,032	0	\$1,805	\$20,250	11.2	Medium term
	Replace NG Fired Radiant Heaters/Unit Heaters with Electric Radiant Heaters	-259,148	30,676	-\$26,602	\$216,000	N/A	Long term
	Solar PV (Rooftop/Carport), 200 kW	220,000	0	\$33,000	\$1,100,000	33.3	Long term
	Replace Existing Thermostats with BACNET Enabled Thermostats	43,260	6,260	\$8,993	\$47,250	5.3	Short term
	Electrify the Heating System	-129,574	30,676	-\$7,166	\$877,500	N/A	Long term
	Sub-total	-169,649	87,066	\$9,379	\$2,575,677	-	-
Arenas	Implement Ice Temperature Setback	365,122	0	\$33,573	\$27,500	0.8	Medium term
	Replace Old Compressor Motors	25,416	0	\$2,870	\$63,250	22.0	Long term
	Add VFD to Condenser Fans	27,907	0	\$2,857	\$13,750	4.8	Medium term
	Install Superheated Compressor Discharge Heat Recovery	0	76,208	\$34,294	\$384,313	11.2	Long term
	Replace Existing Thermostats with BACNET enabled Thermostats	80,768	14,148	\$14,729	\$238,838	16.2	Medium term
	Install ASHP with Electric Heater for Space Heating and Ventilation	-626,633	106,859	-\$34,156	\$2,025,375	N/A	Long term
	Implement Floating Condenser Pressure Control	609,800	0	\$58,151	\$103,125	1.8	Medium term
	Replace Desiccant Dehumidifier with Compression Dehumidifier	-282,280	57,104	-\$3,082	\$770,000	N/A	Long term
	Install Air to Water Heat Pump for DHW Preheat	-84,402	32,158	-\$15,078	\$1,564,750	N/A	Medium term
	Electrification of ICE Resurfacing Machine	-56,542	0	-\$594	\$515,625	N/A	Long term
	Install Rooftop Solar PV System	1,014,500	0	\$107,424	\$1,623,600	15.1	Medium term
	Install Carport Solar PV System	1,705,900	0	\$179,657	\$4,897,200	27.3	Long term

	Install Low Emissivity Ceiling	240,328	0	\$23,854	\$220,000	9.2	Medium term
	Install Air to Water Heat Pump for Space Heating	-1,169,312	166,670	-\$79,622	\$3,720,063	N/A	Long term
	Replace Existing Condenser with Spray Water on Demand	10,913	0	\$1,064	\$378,125	355.4	Medium term
	LED Lighting and Lighting Control Upgrades	2,073	0	\$253	\$76,175	301.1	Long term
	Convert Brine Loop to Variable Speed	42,484	0	\$5,311	\$42,625	8.0	Medium term
	Convert HW loop to Primary/Secondary Variable	4,006	0	\$431	\$33,000	76.6	Long term
	<b>Sub-total</b>	<b>1,910,048</b>	<b>453,147</b>	<b>\$331,936</b>	<b>\$16,697,314</b>	<b>-</b>	<b>-</b>
<b>Aquatics</b>	Solar Water Heater with Heat Pump for Pool Heating	-26,753	12,667	\$1,054	\$16,200	15.4	Medium term
	Pool Drain Heat Recovery	0	32,527	\$13,011	\$87,823	6.8	Long term
	Solar PV Rooftop	110,000	0	\$16,500	\$220,000	13.3	Long term
	Solar PV Carport	220,000	0	\$33,000	\$1,100,000	33.3	Long term
	LED Lighting Retrofit	5,210	0	\$782	\$10,551	13.5	Short term
	Electrify Pool Water Heaters	-2,747,889	325,271	-\$282,075	\$1,000,000	N/A	Long term
	<b>Sub-total</b>	<b>-2,439,432</b>	<b>370,465</b>	<b>-\$217,729</b>	<b>\$2,434,574</b>	<b>-</b>	<b>-</b>
<b>Community Centres</b>	LED Lighting Retrofit	13,026	0	\$1,954	\$22,420	11.5	Medium term
	Air Source Heat Pump for Domestic Hot Water with Electric Backup	-43,547	10,310	-\$2,408	\$178,200	N/A	Medium term
	Electrify NG Appliances	-43,547	5,155	-\$4,470	\$67,500	N/A	Medium term
	Replace Furnace with Dual Fuel Heat Pump Units	-161,942	30,671	-\$12,023	\$81,000	N/A	Medium term
	Solar PV	220,000	0	\$33,000	\$1,100,000	33.3	Medium term
	<b>Sub-total</b>	<b>-16,011</b>	<b>46,135</b>	<b>\$16,052</b>	<b>\$1,449,120</b>	<b>-</b>	<b>-</b>
<b>Daycare</b>	Air Source Heat Pump for Domestic Hot Water with Electric Backup	-9,716	2,300	-\$537	\$13,500	N/A	Medium term
	Install Dual Fuel Heat Pump System	-35,637	8,437	-\$1,971	\$40,500	N/A	Medium term
	<b>Sub-total</b>	<b>-45,353</b>	<b>10,737</b>	<b>-\$2,508</b>	<b>\$54,000</b>	<b>-</b>	<b>-</b>

<b>Enforcement</b>	Air Source Heat Pump for Domestic Hot Water with Electric Backup	-7,986	1,891	-\$442	\$13,500	N/A	Long term
	Install Dual Fuel Heat Pump System	-28,510	6,749	-\$1,577	\$27,000	N/A	Long term
	LED Lighting Retrofit	9,747	0	\$1,462	\$16,777	11.5	Long term
	Install BACNET enabled Thermostats	6,498	945	\$1,353	\$6,750	5.0	Long term
	Replace NG Fired MUA with Heat Pump MUA with Electric Backup	-14,974	2,836	-\$1,112	\$93,420	N/A	Long term
	<b>Sub-total</b>	<b>-35,225</b>	<b>12,421</b>	<b>-\$315</b>	<b>\$157,447</b>	<b>-</b>	<b>-</b>
<b>Prince Arthurs Landing</b>	Implement Floating Condenser Pressure Control	40,217	0	\$6,033	\$27,000	4.5	Short Term
	LED Lighting Retrofit	23,939	0	\$3,591	\$40,500	11.3	Short Term
	Add VFD to Condenser Fans	13,406	0	\$2,011	\$16,875	8.4	Medium term
	Implement Ice Temperature Setback	16,087	0	\$2,413	\$6,075	2.5	Short Term
	<b>Sub-total</b>	<b>93,648</b>	<b>0</b>	<b>\$14,047</b>	<b>\$90,450</b>	<b>-</b>	<b>-</b>
<b>Transit</b>	Air Source Heat Pump for Domestic Hot Water with Electric Backup	-77,460	18,338	-\$4,284	\$27,000	N/A	Medium Term
	Replace Old Rooftop Heating Air Heating Units with Heat Pump units with electric backup	-376,543	71,315	-\$27,955	\$405,000	N/A	Long term
	Carport 203 kW	258,000	0	\$38,700	\$1,116,500	28.9	Long term
	Electrify Unit Heaters	-774,603	91,691	-\$79,514	\$108,000	N/A	Long term
	<b>Sub-total</b>	<b>-970,607</b>	<b>181,344</b>	<b>-\$73,054</b>	<b>\$1,656,500</b>	<b>-</b>	<b>-</b>
<b>WTP and WPCP</b>	Install BAS System to control HVAC Equipment	69,431	43,148	\$27,674	\$253,125	9.1	Medium term
	Electric Domestic Water Heater on Demand	-30,376	3,596	-\$3,118	\$64,800	N/A	Medium term
	BAS Recommissioning	57,030	12,494	\$13,552	\$54,887	4.1	Medium term
	Solar PV Rooftop 130 kW Barepoint Water Treatment Plant	143,000	0	\$21,450	\$286,000	13.3	Long term
	Solar PV Rooftop 55kW Water Pollution Control Plant	60,500	0	\$9,075	\$151,250	16.7	Long term
	Ground Mount 500 kW Water Pollution Control Plant	550,000	0	\$82,500	\$1,375,000	16.7	Long term
	<b>Sub-total</b>	<b>849,585</b>	<b>59,238</b>	<b>\$151,133</b>	<b>\$2,185,062</b>	<b>14.5</b>	<b>-</b>



<b>Police Station</b>	BAS Recommissioning and added control	177,697	9,869	\$30,602	\$206,565	6.8	Short term
	Electrification of Heating System	-316,129	37,421	-\$32,451	\$1,012,500	N/A	Long term
	LED Lighting Retrofit	13,327	0	\$1,999	\$21,590	10.8	Short term
	Air Source Heat Pump for Domestic Hot Water with Electric Backup	-65,136	12,336	-\$4,836	\$81,000	N/A	Long term
	<b>Sub-total</b>	<b>-190,241</b>	<b>59,626</b>	<b>-\$4,686</b>	<b>\$1,321,656</b>	<b>-</b>	<b>-</b>
<b>Community Auditorium</b>	BAS Recommissioning and Pneumatic to DDC Controls Upgrade	40,570	9,260	\$9,789	\$158,589	16.2	Long term
	Air Source Heat Pump for Domestic Hot Water with Electric Backup	-26,076	6,173	-\$1,442	\$162,000	N/A	Long term
	55 kW Rooftop Solar PV	60,500	0	\$9,075	\$151,250	16.7	Long term
	350 kW Carport	269,500	0	\$40,425	\$1,925,000	47.6	Long term
	Replace Old Air Handling Units	28,978	4,321	\$6,075	\$3,240,000	533.3	Long term
	<b>Sub-total</b>	<b>373,472</b>	<b>19,755</b>	<b>\$63,923</b>	<b>\$5,636,839</b>	<b>-</b>	<b>-</b>
<b>TOTAL - ALL</b>		<b>-2,381,869</b>	<b>1,763,765</b>	<b>\$212,396</b>	<b>\$43,208,275</b>	<b>274.70</b>	<b>-</b>

Table 6. Required Conservation Measures

## 5.4. Utility Consumption Forecast

By implementing the energy conservation measures stated in the previous section, the forecasted electricity and natural gas use could be forecasted based on the utility savings generated from individual measures. The forecasted utility consumption is tabulated below. The percentage of change is based off the data from the baseline year of 2023.

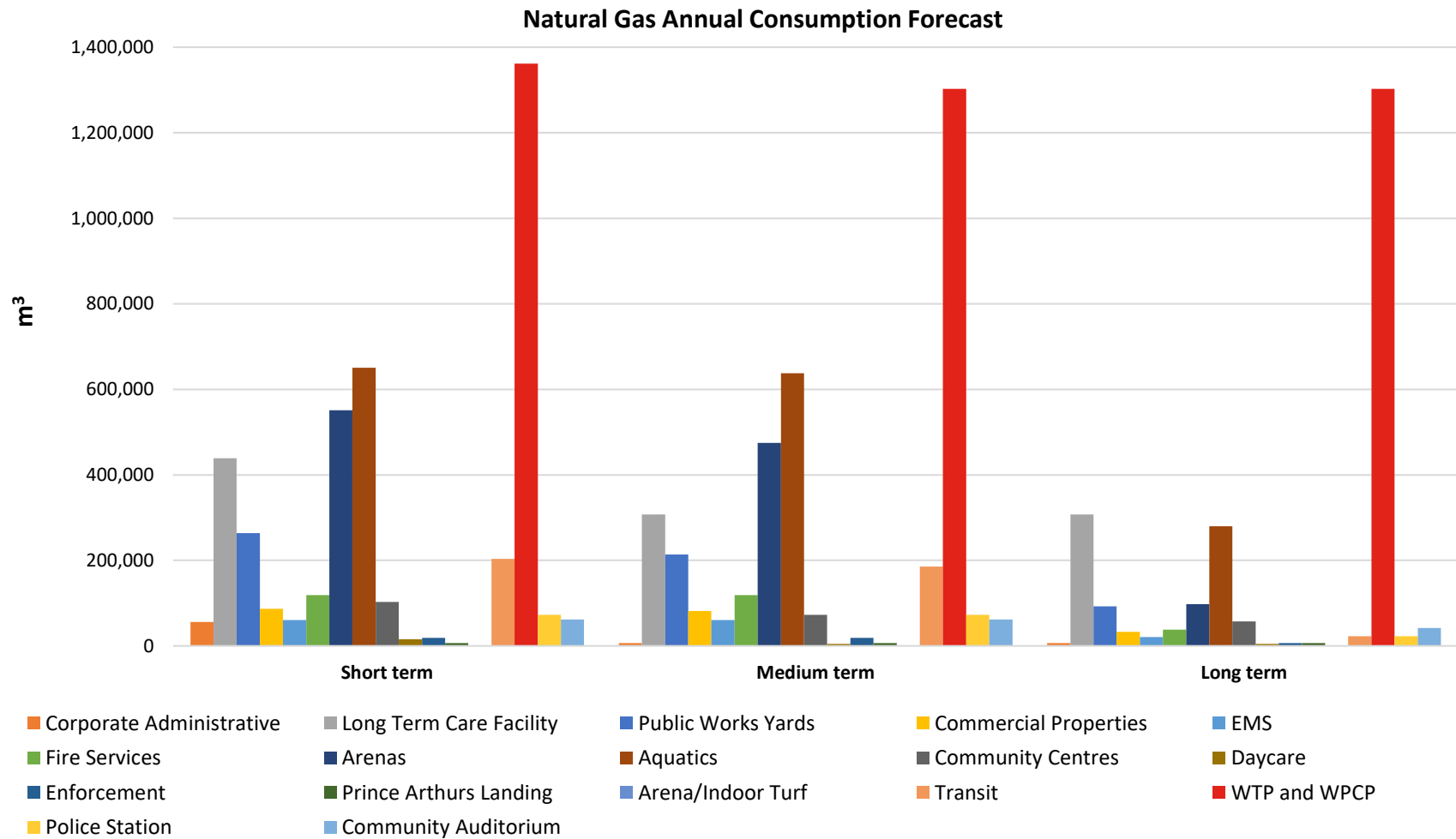


Figure 11. Natural Gas Consumption Forecast

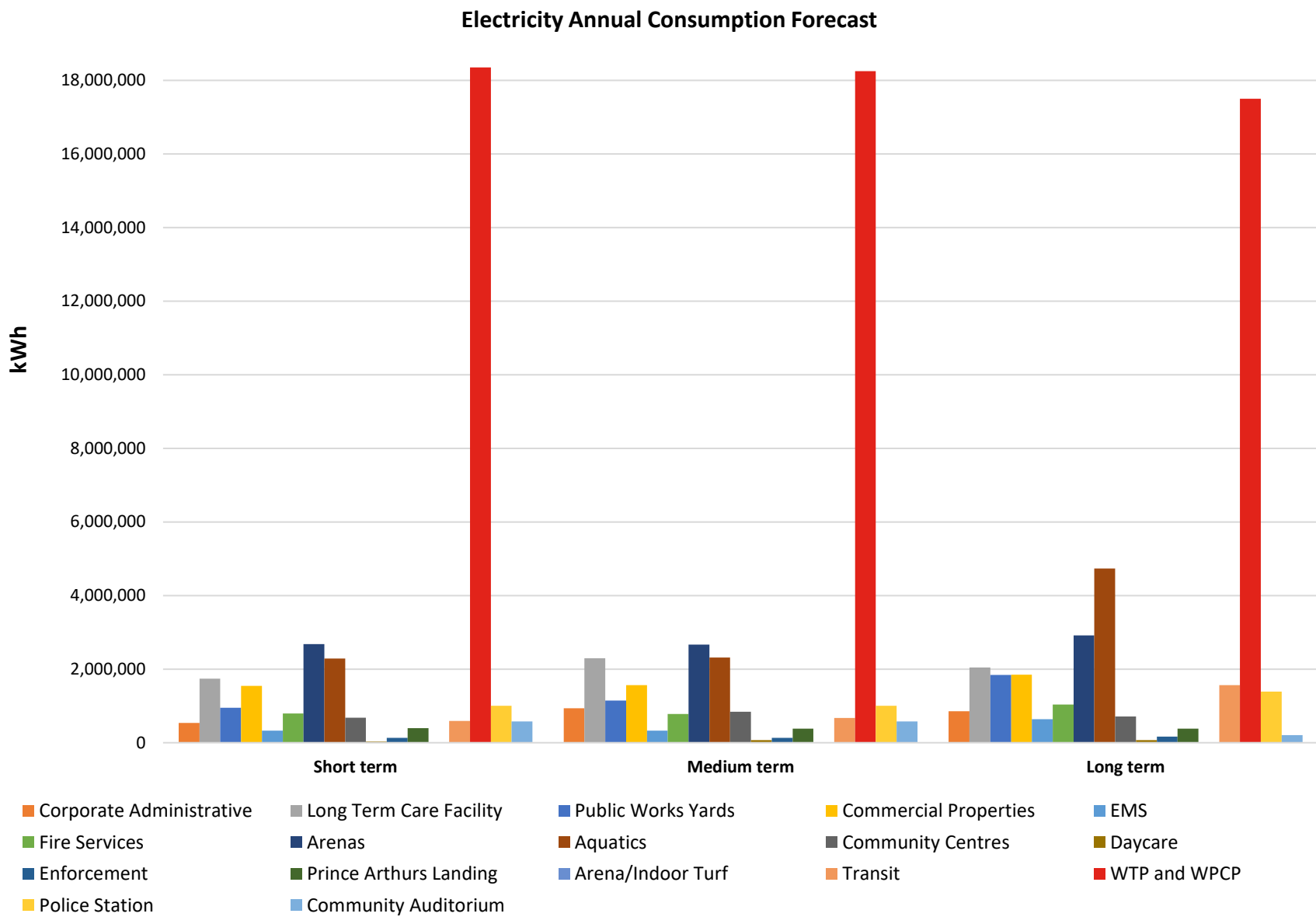


Figure 12. Electricity Consumption Forecast

Natural Gas (m <sup>3</sup> )	Short term	Medium term	Long term
Corporate Administrative	56,177	6,791	6,791
Long Term Care Facility	438,507	307,148	307,148
Public Works Yards	263,988	213,830	92,396
Commercial Properties	86,929	81,511	33,165
EMS	60,557	60,557	20,953
Fire Services	118,947	118,947	38,141
Arenas	550,841	474,633	97,694
Aquatics	650,542	637,875	280,077
Community Centres	103,095	72,424	56,960
Daycare	15,335	4,598	4,598
Enforcement	18,906	18,906	6,485
Prince Arthurs Landing	6,363	6,363	6,363
Arena/Indoor Turf	0	0	0
Transit	203,757	185,419	22,413
WTP and WPCP	1,361,607	1,302,369	1,302,369
Police Station	72,374	72,374	22,617
Community Auditorium	61,733	61,733	41,978
<b>Total</b>	<b>4,069,657</b>	<b>3,625,477</b>	<b>2,340,147</b>

Electricity (kWh)	Short term	Medium term	Long term
Corporate Administrative	538,997	936,656	854,156
Long Term Care Facility	1,742,560	2,295,300	2,041,800
Public Works Yards	949,227	1,144,367	1,840,167
Commercial Properties	1,541,850	1,563,279	1,845,201
EMS	325,301	325,301	638,532
Fire Services	795,984	783,952	1,034,849
Arenas	2,679,736	2,667,704	2,918,601
Aquatics	2,286,101	2,312,854	4,730,744
Community Centres	681,672	843,614	710,708
Daycare	27,137	72,490	72,490
Enforcement	129,957	129,957	165,181
Prince Arthurs Landing	398,532	385,126	385,126
Arena/Indoor Turf	0	0	0
Transit	594,036	671,496	1,564,643
WTP and WPCP	18,349,146	18,253,061	17,499,561
Police Station	1,006,952	1,006,952	1,388,217
Community Auditorium	579,566	579,566	206,094
<b>Total</b>	<b>32,626,754</b>	<b>33,971,675</b>	<b>37,896,071</b>

Table 7. Natural Gas & Electricity Consumption Forecast

## 5.5. GHG Emissions Forecast

The forecasted greenhouse gas emissions are calculated based on the forecasted energy consumption data analyzed in the previous section and are tabulated in the following table. The percentage of reduction is based off the data from the baseline year of 2023.

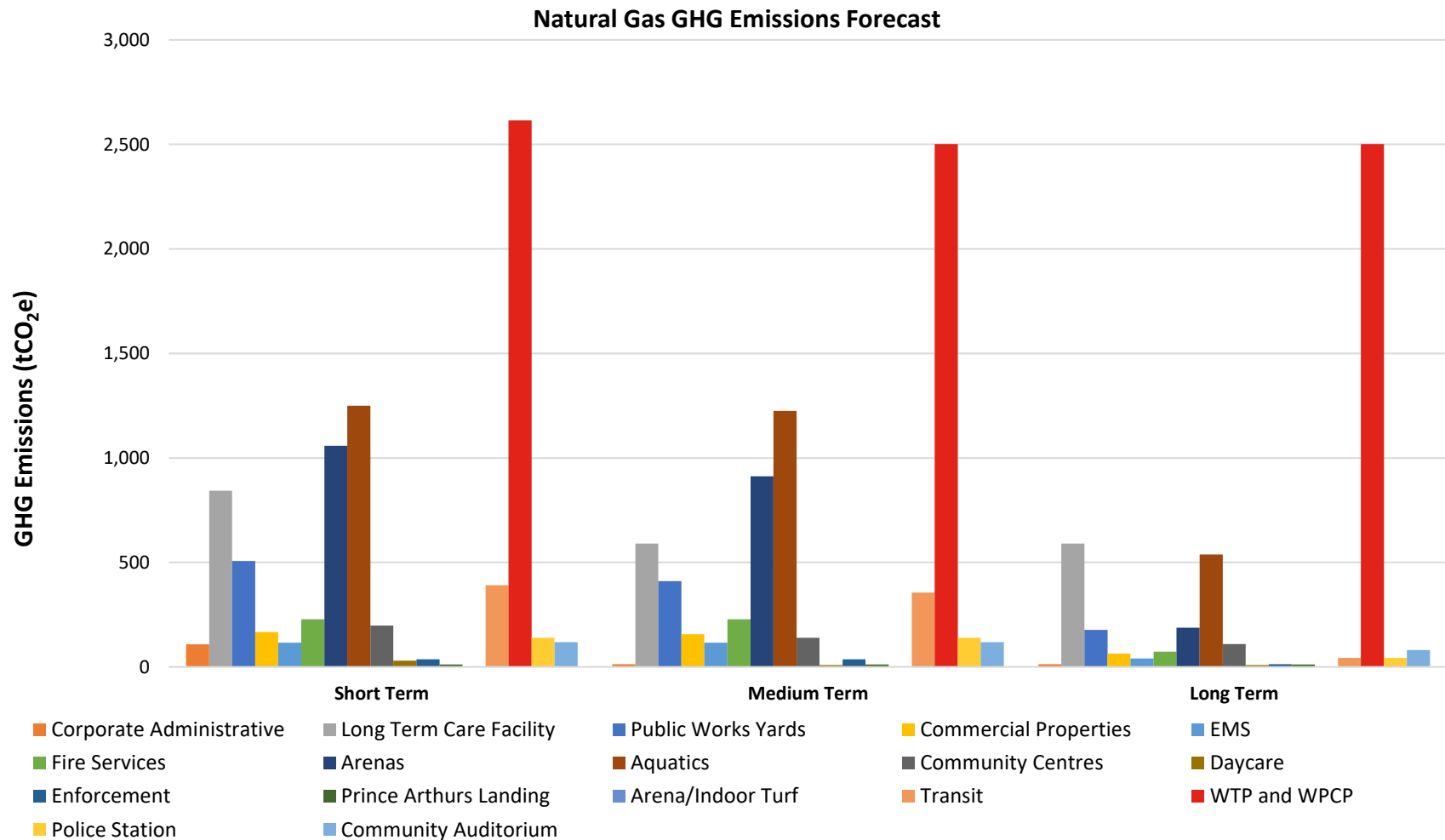


Figure 13. Natural Gas GHG Emissions Forecast

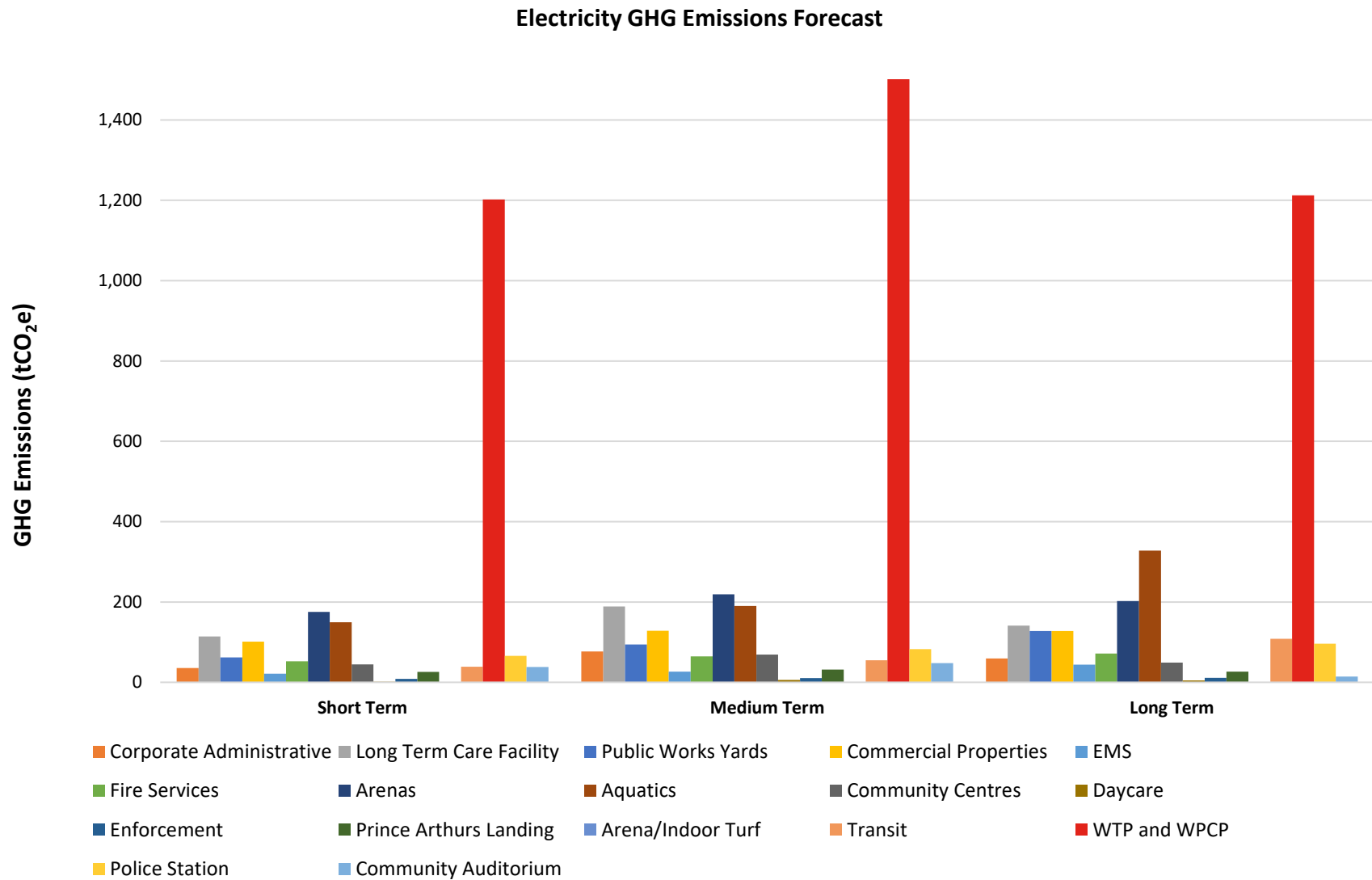


Figure 14. Electricity GHG Emissions Forecast

Natural Gas GHG Emissions (tCO <sub>2</sub> e)	Short Term	Medium Term	Long Term
Corporate Administrative	108	13	13
Long Term Care Facility	842	590	590
Public Works Yards	507	411	177
Commercial Properties	167	157	64
EMS	116	116	40
Fire Services	228	228	73
Arenas	1,058	912	188
Aquatics	1,250	1,225	538
Community Centres	198	139	109
Daycare	29	9	9
Enforcement	36	36	12
Prince Arthurs Landing	12	12	12
Arena/Indoor Turf	0	0	0
Transit	391	356	43
WTP and WPCP	2,616	2,502	2,502
Police Station	139	139	43
Community Auditorium	119	119	81
<b>Total</b>	<b>7,818</b>	<b>6,965</b>	<b>4,495</b>

Electricity GHG Emissions (tCO <sub>2</sub> e)	Short Term	Medium Term	Long Term
Corporate Administrative	35	77	59
Long Term Care Facility	114	189	141
Public Works Yards	62	94	128
Commercial Properties	101	129	128
EMS	21	27	44
Fire Services	52	64	72
Arenas	176	219	202
Aquatics	150	190	328
Community Centres	45	69	49
Daycare	2	6	5
Enforcement	9	11	11
Prince Arthurs Landing	26	32	27
Arena/Indoor Turf	0	0	0
Transit	39	55	108
WTP and WPCP	1,202	1,501	1,213
Police Station	66	83	96
Community Auditorium	38	48	14
<b>Total</b>	<b>2,137</b>	<b>2,794</b>	<b>2,626</b>

Table 8. Natural Gas & Electricity GHG Emissions Forecast



## 6. The City of Thunder Bay Outlook

### 6.1. Site-Wide Utility Consumption Forecast

By implementing the recommended measures stated in the previous section, in each respective site, COTB's projected electricity and natural gas use could be forecasted based on the utility savings generated from individual measures. The forecasted utility consumption is tabulated below. The percentage of change is based on the data from the baseline year of 2023.

Fuel	Short Term		Medium Term		Long Term	
	Units	% Change	Units	% Change	Units	% Change
Natural Gas (m <sup>3</sup> )	4,069,657	1%	3,625,477	12%	2,340,147	43%
Electricity (kWh)	32,626,754	5%	33,971,675	1%	37,896,071	-10%

Table 9. Forecast of Annual Utility Consumption for all sites

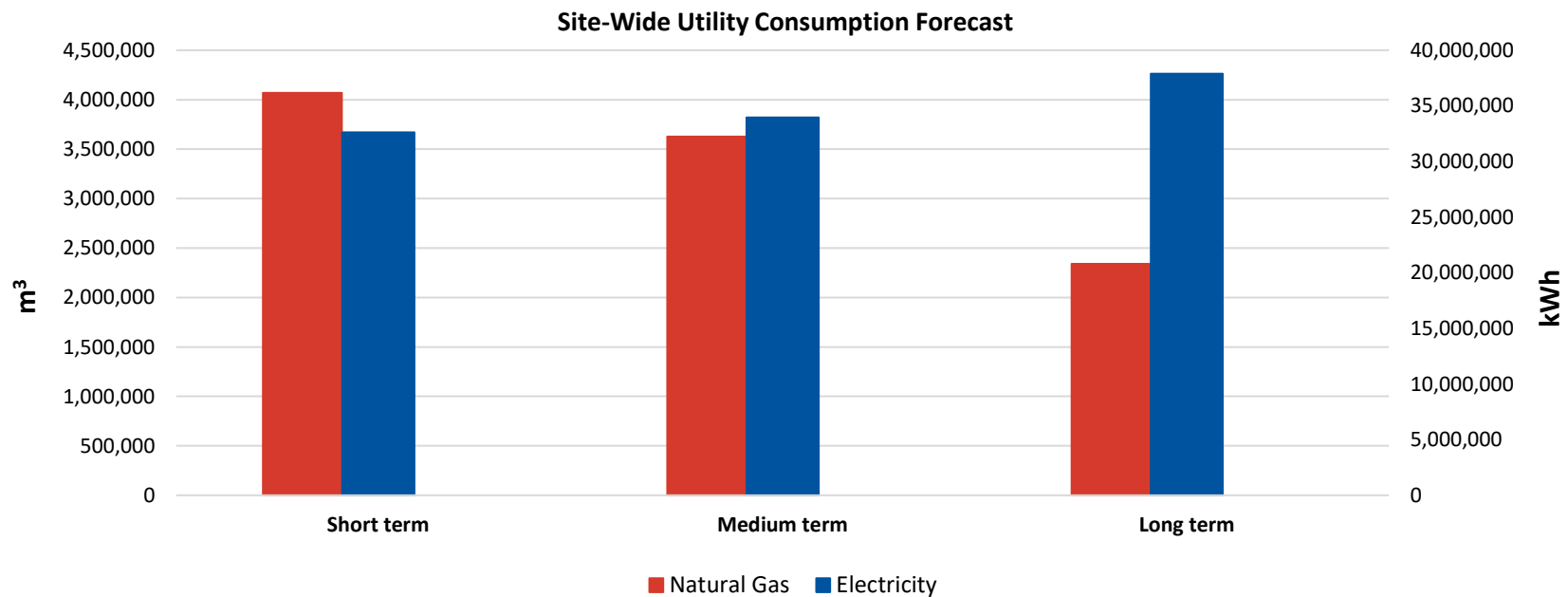


Figure 15. Forecast of Annual Energy Consumption for all sites

## 6.2. Site-Wide GHG Emissions Forecast

The organizational GHG emissions for COTB are calculated based on the forecasted Site-wide energy consumption data analyzed in the previous section and are tabulated in the following table. The percent reduction is based on the baseline year of 2023.

Utility Source (tCO <sub>2</sub> e)	Short Term	Medium term	Long Term
Natural Gas (Scope 1)	7,818	6,965	4,495
Electricity (Scope 2)	2,137	2,794	2,626
<b>Totals</b>	<b>9,955</b>	<b>9,759</b>	<b>7,122</b>
<b>Reduction from Baseline Year</b>	<b>7%</b>	<b>9%</b>	<b>34%</b>

Table 10. Forecast of Annual Greenhouse Gas Emissions for all sites

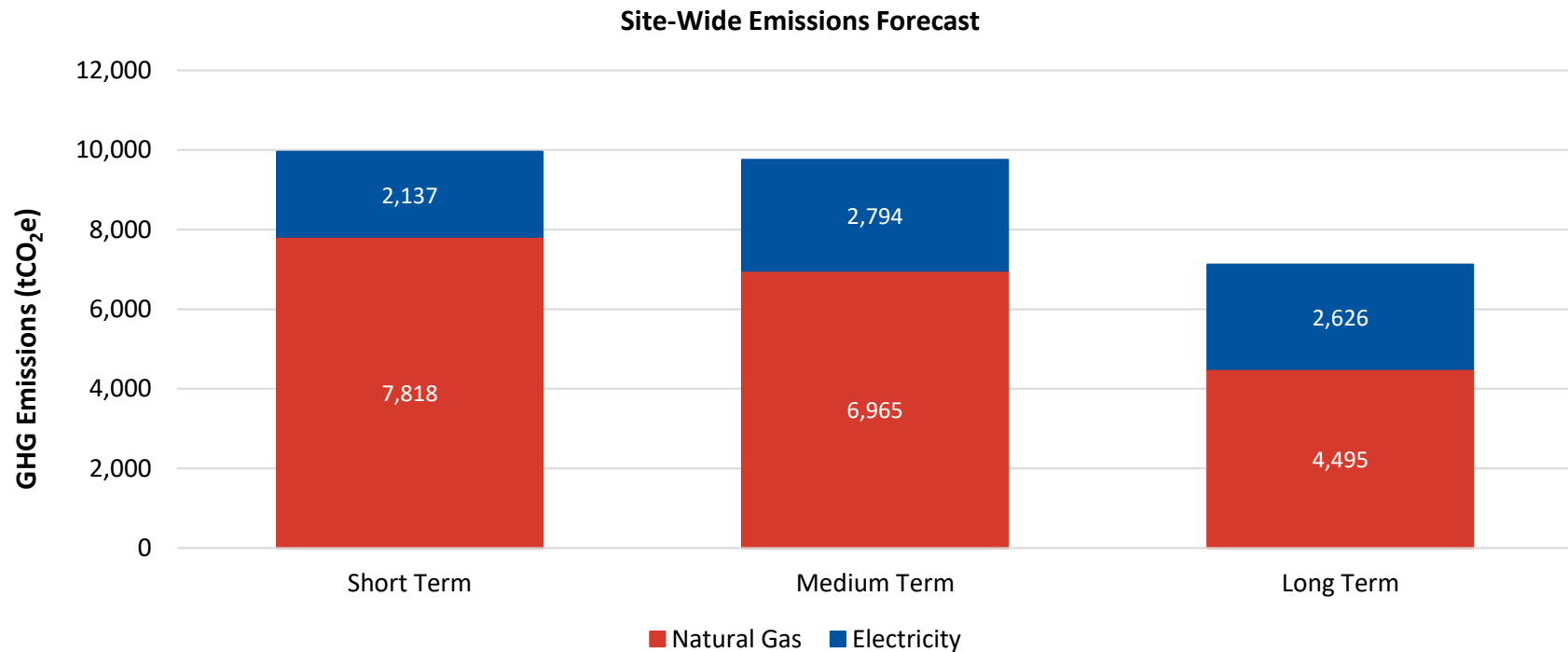


Figure 16. Forecast of Annual Greenhouse Gas Emissions for all sites

## 7. Closing Comments

Thank you to all who contributed to The City of Thunder Bay's Energy Conservation & Demand Management Plan. We consider our facilities an integral part of the local community. The key to this relationship is being able to use our facilities efficiently and effectively to maximize our ability to provide the highest quality of municipal services while integrating environmental stewardship into all aspects of facility operations.

As General Manager of the Infrastructure, Development & Operations Department, I provide my approval of this Plan.

X 

Kerri Marshall, General Manager  
Infrastructure, Development & Operations Department  
City of Thunder Bay

*This ECDM plan was created through a collaborative effort between The City of Thunder Bay and Blackstone Energy Services.*

## 8. Appendix

### 8.1. Glossary

Word	Abbreviation	Meaning
Baseline Year		A baseline is a benchmark that is used as a foundation for measuring or comparing current and past values.
Building Automation System	BAS	<i>Building automation</i> is the automatic centralized <i>control</i> of a <i>building's</i> heating, ventilation and air conditioning, lighting and other <i>systems</i> through a <i>building management system</i> or <i>building automation system</i> (BAS)
Carbon Dioxide	CO2	Carbon dioxide is a commonly referred to greenhouse gas that results, in part, from the combustion of fossil fuels.
Energy Usage Intensity	EUI	Energy usage intensity means the amount of energy relative to a buildings physical size typically measured in square feet.
Equivalent Carbon Dioxide	CO2e	CO2e provides a common means of measurement when comparing different greenhouse gases.
Greenhouse Gas	GHG	Greenhouse gas means a gas that contributes to the greenhouse effect by absorbing infrared radiation, e.g., carbon dioxide and chlorofluorocarbons.
Metric Tonnes	t	Metric tonnes are a unit of measurement. 1 metric tonne = 1000 kilograms
Net Zero		A net-zero energy building, is a <a href="#">building</a> with zero net <a href="#">energy consumption</a> , meaning the total amount of energy used by the building on an annual basis is roughly equal to the amount of <a href="#">renewable energy</a> created on the site,
Variable Frequency Drive	VFD	A variable frequency drive is a device that allows for the modulation of an electrical or mechanical piece of equipment.

## 8.2. Tables and Figures

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