GREENHOUSE GAS INVENTORY REPORT

for

Peterborough Golf & Country Club

Reporting Period 2018 - 2020

Green Economy Peterborough

GreenUP

Overview

Peterborough Golf & Country Club has made a commitment to take climate action through its participation in the Green Economy Peterborough network. Quantifying your greenhouse gas (GHG) emissions is the first step in your journey to setting and achieving your GHG reduction goals. Green Economy Canada has developed your initial GHG inventory following the World Resource Institute's GHG Protocol Corporate Accounting Standard.

GHG Inventory Context

This section details the parameters that were set for your GHG inventory, established with three of the core principles of the GHG Protocol in mind — consistency, completeness and relevance.

Consolidation Approach:	Operational Control
The operational control approach is a commonly used method where a company accounts for 100% of the GHG emissions from operations over which it has the ability to direct the day-to-day operations; this is standard procedure for inventories produced by Green Economy Canada.	
Geographic Constraint:	Greater Peterborough Area
Following the specified Consolidation Approach, these are the elements of your organization and its activities that will be included in the inventory.	
Number of Facilities:	3
See Appendix 2 for more detailed information.	
Reporting Period:	2018-2020
The reporting period was chosen based on the availability of your organization's data, reaching back to an ideal maximum of three years.	
GHG Emission Scopes Included:	Scope 1, 2, 3
Following the GHG Protocol, emissions under Scopes 1 and 2 are required. While Scope 3 emissions are optional, the emissions that are material to your operations were included to give a representative view of your organization's emissions.	
GHG Emission Sources Included:	
Scope 1 - Direct Emissions	Stationary Combustion (Natural Gas, Propane), Mobile Combustion (Gasoline, Diesel), Fertilizer (Direct Soil Emissions), Fugitive (CO_2)
Scope 2 - Indirect Emissions	Electricity
Scope 3 - Other Indirect Emissions	Water, Waste, Fertilizer (Production)

Total GHG Emissions

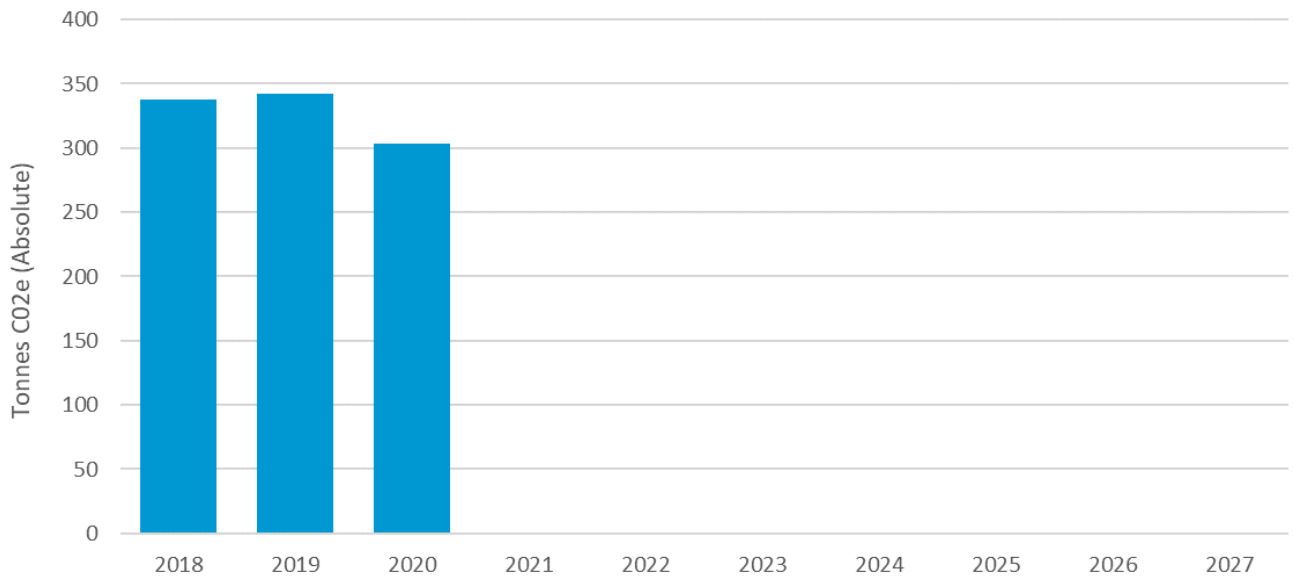
Using three years worth of historical data provided, your GHG emissions, measured in metric tonnes of carbon dioxide equivalent (tCO2e), are as follows:

Table 1: Total GHG Emissions by Year

	2018*	2019	2020
Total Emissions (tCO2e)	**338.19**	**342.66**	**303.80**

*Recommended Base Year

Figure 1: Total GHG Emissions by Year



Your organization's emissions are relatively steady throughout the reporting period, with a slight decrease in 2020 that is likely due to the impact of COVID-19 on your business activities.

Base Year Recommendation

A base year is a reference point in the past to compare your future years' emissions against. Your base year will be the point in time from which you set a GHG reduction target. It should be a year for which the data is reliable, complete, and representative of your organization's 'business-as-usual' activities.

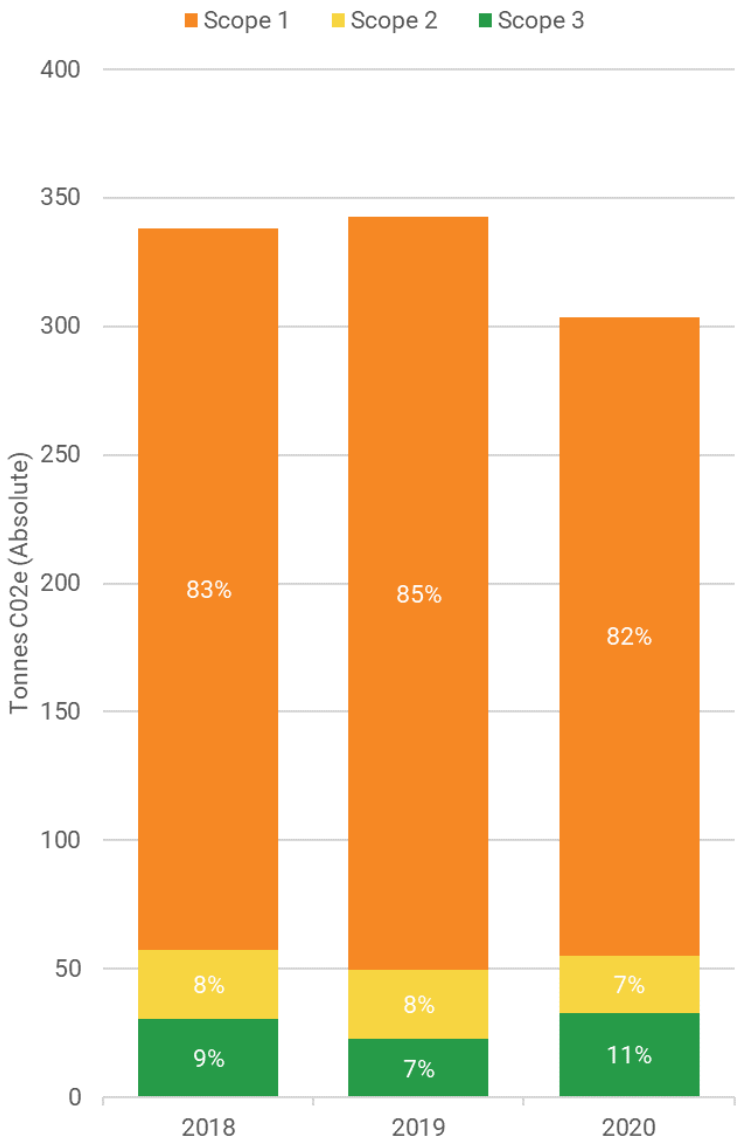
While it is ultimately up to you to decide, we recommend choosing **2018 as your base year**, which would set **your base year emissions at 338.19 tCO2e**.

In making your final decision, you should also consider whether there are any additional anomalies or business considerations not reflected here that would warrant a different base year selection.

GHG Emissions by Scope

This graph presents your organization's GHG emissions data by scope and shows the trends of how each scope's emissions have grown or declined over time. The percentages in the following figure are relative to the total GHG emissions for the given year.

Figure 2: GHG Emissions by Scope by Year



Scope 1 - Direct Emissions, which originate from sources you own or have control over, make up the large majority of your organization's emission each year. Scope 2 - Indirect Emissions associated with purchased electricity and Scope 3 - Other Indirect Emissions from your value chain both have similarly small proportions.The next section provides a breakdown of how your emission sources have changed over the time period of data provided.

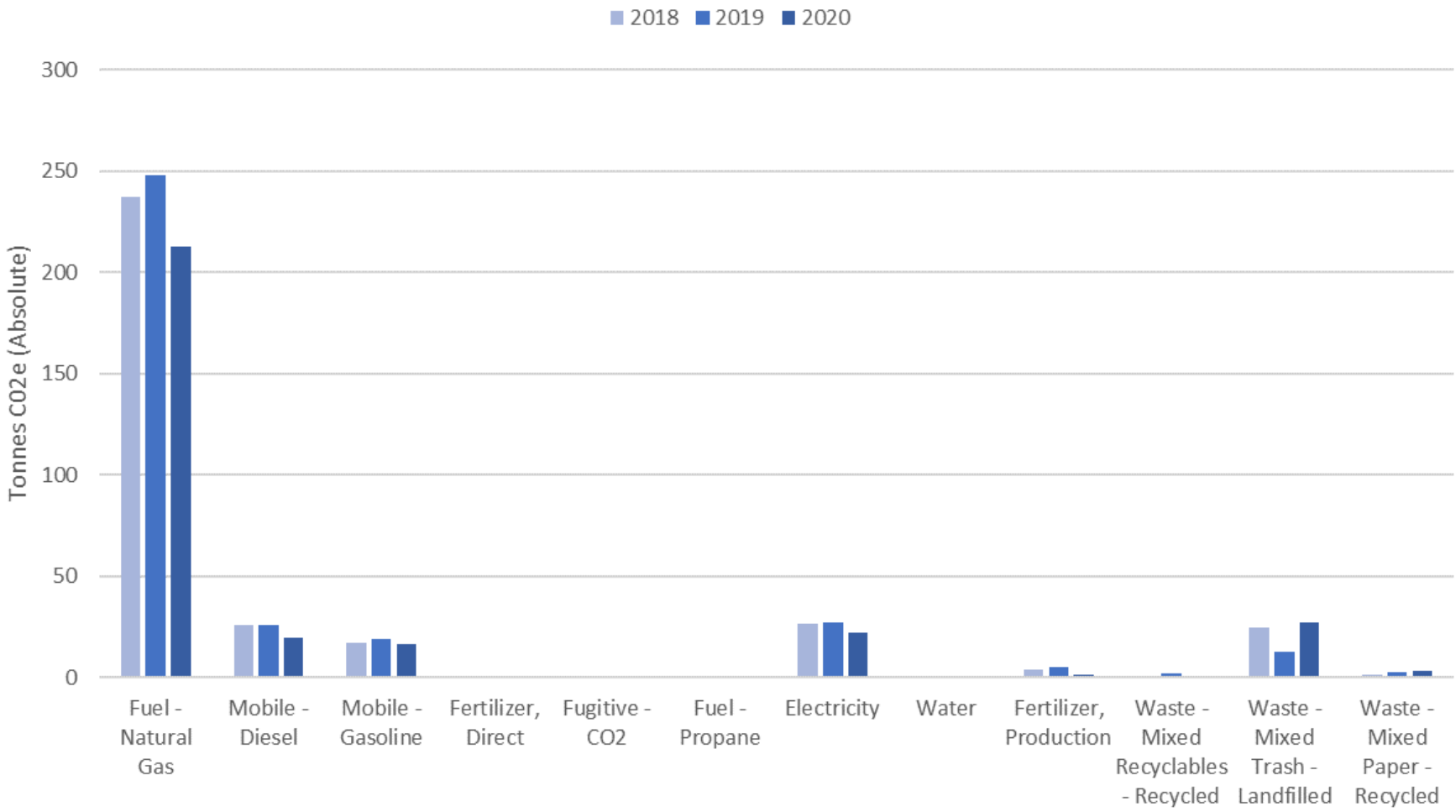
GHG Emissions by Source

The following table and figure provide a comparison of GHG emissions in the three most recent years for all emission sources across all scopes in tCO2e (see Appendix 1 for GHG emission percentages by source).

Table 2: GHG Emissions by Source by Year

	2018	2019	2020
Scope 1 - Direct Emissions (tCO2e)	**280.68**	**292.74**	**248.45**
Fuel - Natural Gas	237.46	247.70	212.69
Mobile - Diesel	25.95	25.90	19.43
Mobile - Gasoline	17.24	19.09	16.32
Fertilizer, Direct Soil Emissions	0.03	0.05	0.01
Fugitive - CO2	0.14	0.14	0.14
Fuel - Propane	0.03	0.03	0.03
Scope 2 - Indirect Emissions (tCO2e)	**26.81**	**27.04**	**22.18**
Electricity	26.81	27.04	22.18
Scope 3 - Other Indirect Emissions (tCO2e)	**30.53**	**22.72**	**33.01**
Water	0.11	0.09	0.06
Fertilizer, Production	3.85	5.12	1.69
Waste - Mixed Recyclables - Recycled	0.09	2.23	0.70
Waste - Mixed Trash - Landfilled	24.95	12.78	27.03
Waste - Mixed Paper - Recycled	1.54	2.50	3.53
Total Emissions (tCO2e)	**338.03**	**342.50**	**303.64**

Figure 3: GHG Emissions by Source by Year



Key Reduction Opportunities: Largest to Smallest Emission Sources

In this section, we have listed your emissions sources from largest to smallest based on 2020 data, provided some details about each source, and presented potential emission reduction strategies.

1. **Natural Gas: 70% of Total Emissions**
   These emissions mainly result from the combustion of natural gas in the HVAC systems that provide space and water heating for your buildings, primarily the Clubhouse.

   Reduction Strategies: Ideas are presented in the Trends in Natural Gas Consumption.

2. **Waste - Mixed MSW (Municipal Solid Waste) - Landfilled: 9% of Total Emissions**
   These emissions are the result of landfilling the waste. Landfilling emissions include transport to landfill, equipment used at the landfill, and emissions caused by the breakdown of waste.

   Reduction Strategies: Behavioural initiatives to decrease waste generation and increase recycling rates, as well as introducing composting service to divert organic waste from the landfill. Additionally, you can reduce food and product packaging at the source through vendor contracts or couple the composting service with compostable packaging where packaging requirements are still needed.

3. **Electricity: 7% of Total Emissions**
   Your organization's GHG emissions from electricity are related to the generation assets that power Ontario's grid. Ontario's generation capacity is relatively low-carbon with 74% of generation coming from low-carbon sources like nuclear, hydroelectric, and renewables and the remaining 26% from natural gas and oil. To reduce emissions from activities that use electricity, the focus should be placed on reducing use/consumption and then improving energy efficiency.

   Reduction Strategies: Ideas are presented in the Trends in Electricity Consumption section. Additionally, purchasing renewable energy credits (RECs), which allows you to support renewable energy projects and claim the carbon reduction.

4. **Mobile - Diesel: 6% of Total Emissions**
   The emissions are derived from the mobile combustion of diesel fuel in your fleet of Kubota equipment, tractors, and greens equipment

   Reduction Strategies: Reducing/optimizing equipment use, eliminating unnecessary idling, and choosing a more fuel-efficient or alternative fuel-powered model when the vehicles need replacement.

5. **Mobile - Gasoline: 5% of Total Emissions**
   The emissions are derived from the mobile combustion of gasoline fuel in your fleet of gas-powered golf carts and equipment.

   Reduction Strategies: Reducing/optimizing equipment use, eliminating unnecessary idling, choosing more fuel-efficient or electric models when the vehicles need replacement.

6. **Waste - Mixed Paper - Recycling: 1% of Total Emissions**
   These emissions account for the paper sent for local recycling. Emissions under this category result from transport to recycling facilities and sorting of recycled materials.

   Reduction Strategies: Switching to electronic recordkeeping and encouraging employees to use less paper in your office.

7. **Fertilizer, Production: 0.6% of Total Emissions**
   This accounts for the upstream greenhouse gas emissions for synthetic fertilizer production. This is not a key reduction opportunity, but we have still included some strategies below.

   Reduction Strategies: Consider advanced turf management practices like controlled-release fertilizers and strategic fertilizer application timing.

8. **Waste - Mixed Recyclables - Recycled: 0.2% of Total Emissions**
   These emissions account for the mixed recyclables sent for local recycling. Emissions under this category result from transport to recycling facilities and sorting of recycled materials.

   Reduction Strategies: Reducing waste that is destined for this stream can decrease emissions in this category. However, your organization can achieve greater overall emissions reductions by diverting waste destined for the landfill to the recycling stream.

9. **Fugitive - CO2: 0.04% of Total Emissions**
   These direct carbon dioxide emissions are from the CO_2 purchased for beverages in the Clubhouse. This is not a key reduction opportunity.

10. **Water: 0.02% of Total Emissions**
    These emissions are associated with the delivery and treatment of the water consumed in your facilities. This is not a key reduction opportunity, but we have included some strategies below.

    Reduction Strategies: Reducing water consumption in buildings can be achieved by installing low-flow aerators and encouraging more conscious use of water. Some measures for reducing water usage on your grounds are presented here.

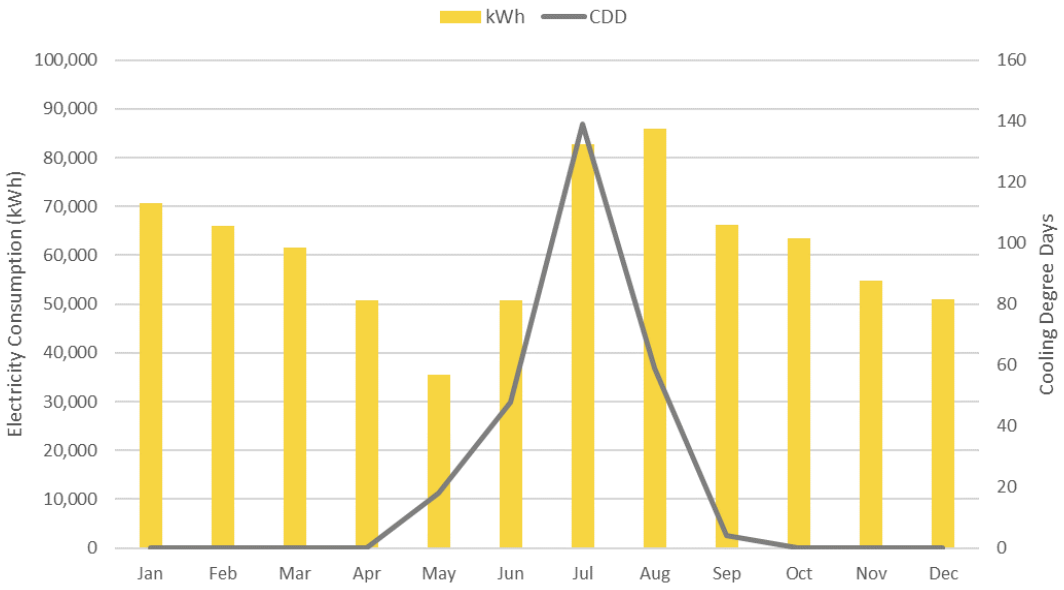
11. **Fuel - Propane: 0.01% of Total Emissions**
    This category of emissions results from the combustion of propane. This is not a key reduction opportunity.

12. **Fertilizer, Direct Soil Emissions: 0.004% of Total Emissions**
    This accounts for the nitrous oxide (N_2O, a powerful GHG) emissions that are released from nitrogen fertilizers in the soil.This is not a key reduction opportunity, but strategies outlined for *Fertilizer, Production* above are relevant for this source as well.

Trends in Electricity Consumption

The following figure offers insight into the relationship between electricity consumption and weather trends. This can help identify opportunities for reducing electricity consumption in facilities.

Figure 4: Total Electricity Consumption and Cooling Demand (2019)



Electricity usage in institutional and commercial facilities is typically related to cooling, lighting, electronics and appliances. The weather has an impact on our electricity consumption for cooling as we typically use more energy on hotter days when the demand for cooling is greater. The electricity consumption for other purposes like lighting, electronics, and appliances is not directly impacted by the weather and is instead connected to staff usage patterns.

When we analyze the electricity consumption throughout the year against with weather trends — represented by the CDD[1] (cooling degree day) line — we see a correlation in the summer months, another peak in the winter months, and significant baseline consumption across the entire year. **This suggests your electricity consumption is a mix of both weather and non-weather dependent purposes. It is worth exploring all measures that can reduce electricity consumption.**

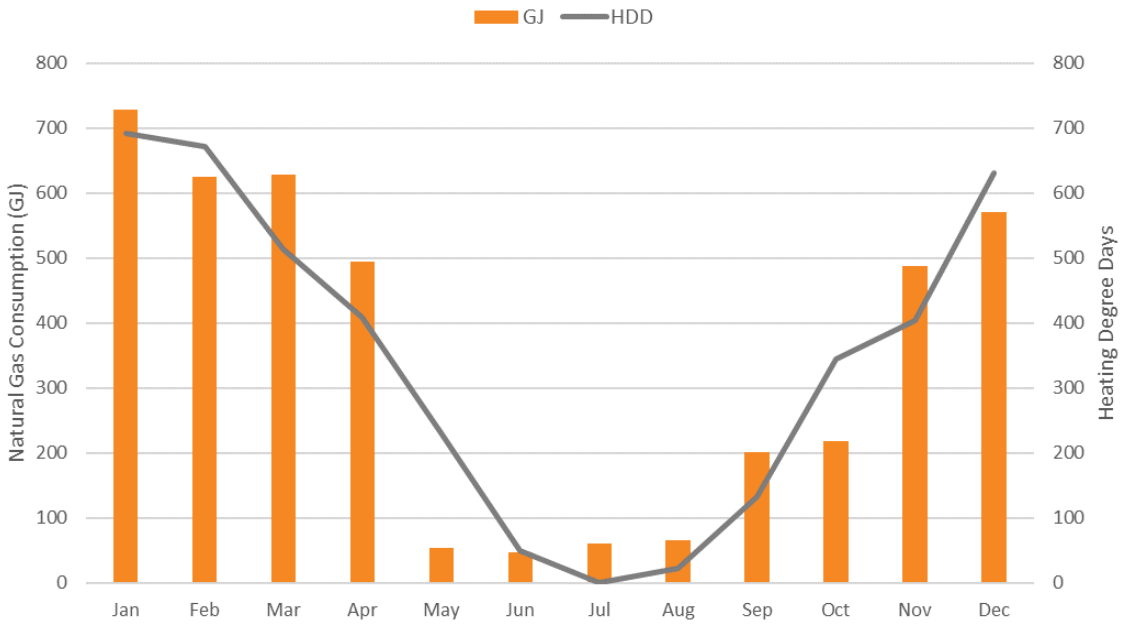
In terms of space cooling measures, energy efficiency/conservation measures such as regular equipment tune-ups or thermostat resets can be implemented. HVAC equipment can also be upgraded to more efficient models at the time of replacement. In terms of lighting, electronics, and appliances, energy efficiency/conservation measures such as lighting retrofits, using energy-saver modes on electronics, buying energy-efficient appliances, and changing behaviours can be implemented. For pumps, consider reducing runtime with timers or optimizing pumping with variable frequency drives.

[1] Cooling degree days (CDDs) are measures designed to quantify the demand for energy needed to cool buildings. They are the number of degrees that a day's average temperature is above 18°C.

Trends in Natural Gas Consumption

The following figure offers insight into the relationship between natural gas consumption and weather trends. This can help identify opportunities for reducing natural gas consumption in facilities.

Figure 5: Total Natural Gas Consumption and Heating Demand (2019)



Natural gas usage in institutional and commercial buildings is typically related to space heating, domestic hot water (DHW), and other operational processes. Space heating demand fluctuates throughout the year, depending on the weather, while the consumption for DHW and other operational processes is not typically correlated to the weather and more dependent on occupancy or productivity.

When we analyze your total natural gas consumption throughout the year against with weather trends — represented by the HDD[2] (heating degree day) line — we see a very strong correlation. **This suggests that most of the natural gas consumption is for weather-dependent purposes such as space heating.**

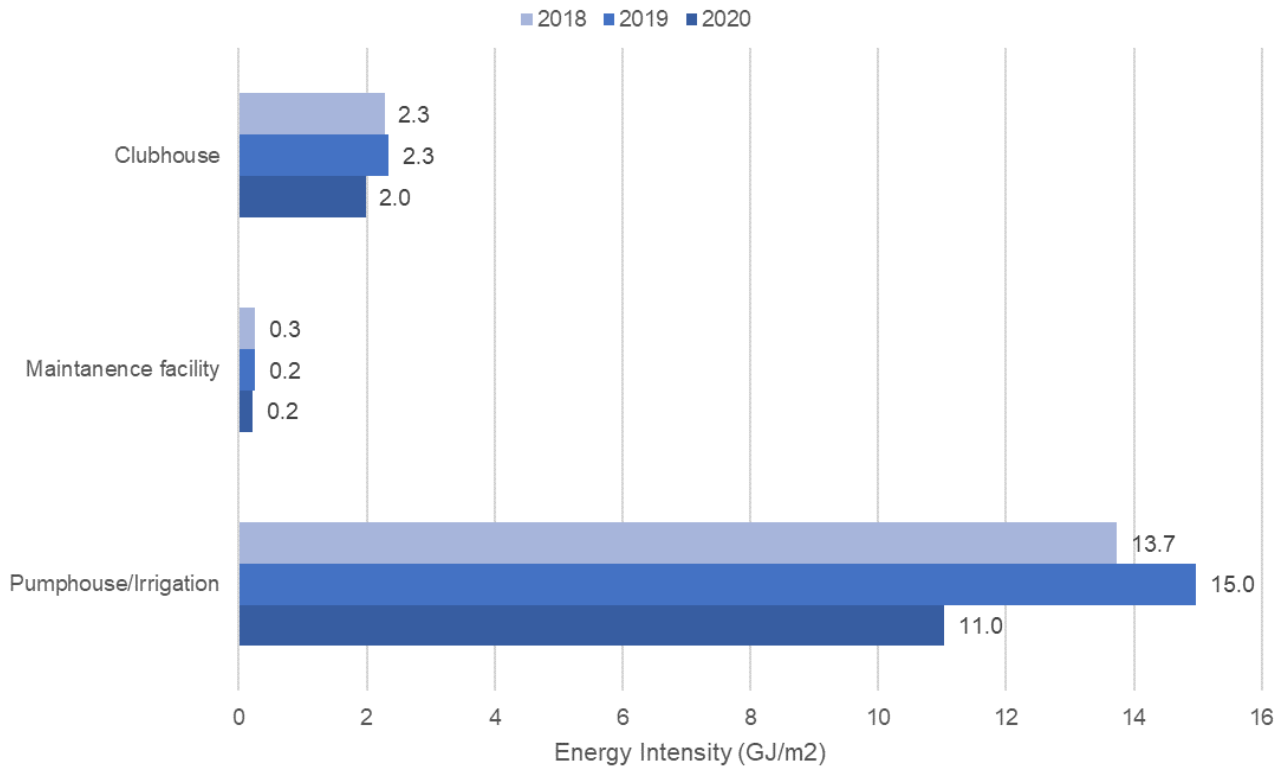
Accordingly, HVAC equipment that provides space heating — like furnaces, boilers, rooftop units, and make-up air units — should be prioritized for energy efficiency/conservation measures such as regular tune-ups, installing smart thermostats, and upgrading to more efficient models at the time of replacement. Additional no-cost/low-cost measures include weather stripping and window sealing to reduce drafts and air leakage. Given natural gas is your largest source of emissions, actions in this area can make a significant impact in reducing your organization's overall emissions.

[2] Heating degree days (HDDs) are measures designed to quantify the demand for energy needed to heat buildings. They are the number of degrees that a day's average temperature is below 18°C.

Building Performance

The following figure shows the energy intensity for each of your facilities over time. Energy intensity is a measure of energy consumption — both natural gas and electricity — of a facility per unit of area. This allows a more equitable comparison of facilities of different sizes to help inform decisions on which facilities should be prioritized for energy reduction initiatives. Generally, a lower energy intensity indicates a more sustainable building.

Figure 6: Multi-Year Energy Intensity by Facility



Since your facilities serve very different purposes, comparing them against one another is not particularly useful. Notably in the Pumphouse, the pumps are significant users of electricity while the Pumphouse is a small building, which is why the energy intensity is so high. However, looking at the trends at each facility, the decrease in 2020 that is likely from COVID-19 as previously mentioned is seen at all three facilities. Consider if any of the changes made in response to the pandemic that have influenced energy usage can be maintained to continue benefiting from the emission reductions.

Appendices

Appendix 1: Percentage of GHG Emissions by Source by Year

	2018	2019	2020
Scope 1 - Direct Emissions	**83.0%**	**85.5%**	**81.8%**
Fuel - Natural Gas	70.2%	72.3%	70.0%
Mobile - Diesel	7.7%	7.6%	6.4%
Mobile - Gasoline	5.1%	5.6%	5.4%
Fertilizer, Direct Soil Emissions	0.01%	0.01%	0.004%
Fugitive - CO2	0.04%	0.04%	0.04%
Fuel - Propane	0.01%	0.01%	0.01%
Scope 2 - Indirect Emissions	**7.9%**	**7.9%**	**7.3%**
Electricity	7.9%	7.9%	7.3%
Scope 3 - Other Indirect Emissions	**9.0%**	**6.6%**	**10.9%**
Water	0.03%	0.03%	0.02%
Fertilizer, Production	1.1%	1.5%	0.6%
Waste - Mixed Recyclables - Recycled	0.03%	0.7%	0.2%
Waste - Mixed Trash - Landfilled	7.4%	3.7%	8.9%
Waste - Mixed Paper - Recycled	0.5%	0.7%	1.2%
Total Emissions	**100.0%**	**100.0%**	**100.0%**

Appendix 2: Facilities List

Facility Label	Name	Total Building Area (m2)	Total Occupied Area (m2)
Facility 1	Clubhouse	3,334	3,334
Facility 2	Maintenance facility	372	372
Facility 3	Pumphouse/Irrigation	14	14

Appendix 3: Facilities Energy Details

	Natural Gas (GJ)			Electricity (kWh)		
Name	**2018**	**2019**	**2020**	**2018**	**2019**	**2020**
Facility 1	4,592	4,797	4,112	835,058	837,820	692,752
Facility 2	74	70	67	5,931	5,983	4,155
Facility 3	-	-	-	53,429	58,235	42,963

Appendix 4: Scope 2 Electricity Details

Your Scope 2 emissions reflected in the report were calculated using the **market-based method**. The market-based method considers average emission factors for the electricity grids that provide your electricity and takes into account your renewable energy credit (REC) purchases (if applicable). The location-based method does not include REC purchases.

	2018	**2019**	**2020**
Scope 2 Electricity Emissions			
Location-Based Method (tCO2e)	26.81	27.04	22.18
Market-Based Method (tCO2e)	26.81	27.04	22.18
REC Details			
RECs Purchased (MWh)	-	-	-
REC Carbon Reduction (tCO2e)	-	-	-

Appendix 5: Scope 3 Detail Chart

The table below provides details for each of your Scope 3 emission sources.

	2018	2019	2020
Water			
Water used (m^3)	5,072	4,220	2,841
Fertilizer, Production			
18-3-18 (% of Scope 3 fertilizer emissions)	19%	15%	42%
43-0-0 (% of Scope 3 fertilizer emissions)	41%	30%	0%
25-0-12 (% of Scope 3 fertilizer emissions)	41%	54%	40%
7-3-3 (% of Scope 3 fertilizer emissions)	0%	0%	18%
Waste			
Waste - Mixed Paper - Recycled (kg)	19,925*	3,516*	45,711*
Waste - Mixed Trash - Landfilled (kg)	35,925*	2,994*	38,918*
Waste - Mixed Recyclables - Recycled (kg)	909*	963*	7,059*

*Waste mass totals do not include flat rate services, however their associated emissions are included in the emissions calculations