Energy & GHG Emissions in Brampton: An Environmental Scan

By Ramsey Abdel.

Objective:

•A top-down environmental scan of major external forces affecting and overlapping with Brampton's approach towards a GHG Emissions and Clean Energy .

•A Brief exploration of PESTLE available data

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Overview: The Canadian Approach

Most greenhouse gases (GHGs) can be emitted by both natural processes and human activities.

Globally, almost 80% of GHG emissions from human sources come from the burning of fossil fuels and industrial processes.

In 2015, about 26% of Canada's total GHG emissions came from the oil and gas sector, 24% from transportation, 11% from electricity generation and 12% from buildings.

Canada aims to reduce its GHG emissions to 30% below its 2005 emission levels by 2030.

Some Environmental impacts

- Average annual temperatures are expected to increase
- Snow, sea ice and glacier coverage will decrease
- Future coastal-erosion rates will likely increase
- Heat waves are likely to increase in frequency and severity
- The increasing risk of deaths from dehydration and heat stroke
- The risk of water-, food-, vector- and rodent-borne diseases may increase
- Human health impacts are expected to place additional economic stress
- Damage to infrastructure (e.g., roads and bridges) caused by extreme weather

The Pan-Canadian Framework :

The Pan-Canadian Framework on Clean Growth and Climate Change is an extensive document that has been developed by the Canadian government in association with the eleven provinces to lay out a mitigation strategy as well as a pathway towards a clean economy.

Specific policies include:
Carbon pricing, with a federal benchmark calling a price starting at $10/tonne in 2018 and a $10/year increase until it reaches $50/tonne in 2022.

Support of clean technologies at early stage and their implementation at industrial scale. The plan seeks an increase of renewables in the electricity mix (currently at 80 %), a reduction in the reliance on diesel in local communities power generation, energy efficiency in new buildings and retrofitting.

The Federal Sustainable Development Strategy

A Strategy sets out the Government of Canada's sustainable development priorities, establishes goals and targets, and identifies actions to achieve them.

The 2016-2019 Strategy - Canada's third - outlines the actions toward sustainability that the Government will take in collaboration with partners within Canada and internationally.

As such, it supports the 2030 Agenda for Sustainable Development and its global sustainable development goals (SDGs). Some Goals are:

- **Effective action on climate change: low carbon economy**
- **Low Carbon Government**
- **Clean Growth:**
- **Modern & resilient infrastructure**
- **Clean Energy**
- **Healthy Coasts, lakes, lands, water & Environment**

In Ontario

O. Reg. 397/11: ENERGY CONSERVATION AND DEMAND MANAGEMENT PLANS
A required summary of the public agency's annual energy consumption and greenhouse gas emissions,

On or before July 1, 2019 and on or before every fifth anniversary thereafter, every public agency is required to be publish and made available under subsection

(1), the Energy Consumption and Greenhouse Gas Emission Template that is required to be submitted and published on or before July 1 of that year and the following information:

1. A description of current and proposed measures for conserving and otherwise reducing energy consumption and managing its demand for energy.

2. A revised forecast of the expected results of the current and proposed measures.

3. A report of the actual results achieved.

4. A description of any proposed changes to be made or forecasts it has made.

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City of Brampton: Grow Green Approach

Brampton Grow Green is the city's first Environmental Master Plan. It is an environmental sustainability plan that establishes strategic directions, actions and targets that will improve the environmental qualities of Brampton.

Grow Green Vision

Brampton is a community that will conserve, enhance and balance our natural and built environments to create a healthy, sustainable city. We will carry out our responsibilities to meet the needs of the present community without compromising the ability of future generations to meet their own needs.

Six Goals Plan

The City has set with its partners Six Goals that they will work to achieve:
Air, Water, Land, Energy, People & Waste.

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Energy & Green House Gas (GHG)

The **Region of Peel** reported that the **majority of its municipal energy use**, including electricity and natural gas consumption, falls under two program areas:
Water and wastewater treatment : representing 59% of all energy consumed
Buildings and facilities: representing 40%.

City of Brampton Initiatives:
•Tracking corporate energy use;
• Auditing corporate facilities;
•Developing facility-specific retrofit action plans; training facility operators;
•Promotion of efficiency standards and best practices;
•and monitoring outcomes.

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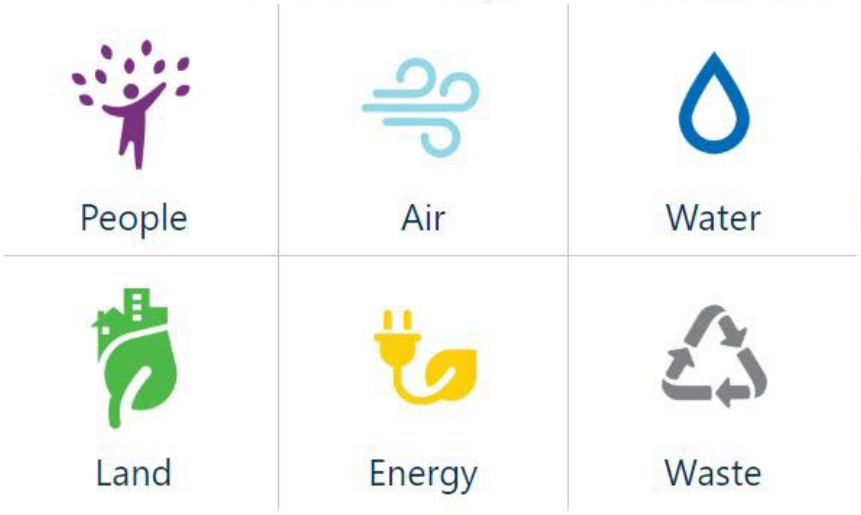
Current Achievements: (Strengths)

Implementation of 34 electric vehicle plug-in stations for corporate and community uses at 11 City-owned facilities;

Development of an Energy Conservation and Demand Management Plan for City-owned facilities;

Installation of solar power sources at Fire Station 205, Clark Transit Facility, Sandalwood Transit Facility, and Gore Meadows Recreation Centre.



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Grow Green Action Plan for Energy:

Completed Action: (Opportunities)

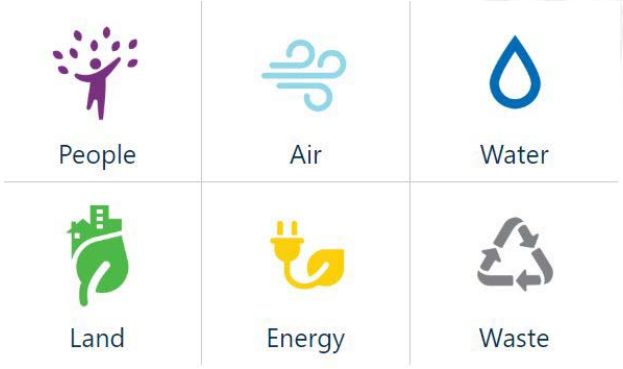
•Work with local distribution companies (Enbridge and Alectra) to develop a residential and ICI energy use database that can be used to track community energy use.

•Develop a Community Energy Map

•Explore partnership opportunities with renewable energy providers.

•Identify opportunities for alternative and renewable power sources at City buildings and facilities.

•Investigate public/private partnership opportunities to integrate Feed-in Tarrif (FIT) applications onto City buildings and facilities.



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Grow Green Action Plan for Energy:

Incomplete Actions: (Threats)

•Work with local distribution companies (Enbridge and Alectra) to revise utility bills to illustrate usage.

•Identify high-energy use communities and develop local action plans to reduce energy use.

•Develop a Residential Retrofit Program to assist homeowners with energy efficiency retrofits, including Local Improvement Charges.

•Develop a comprehensive education program about energy consumption and reduction.

•Develop a Renewable Energy Strategy for City buildings and facilities.

•Implement the Renewable Energy Strategy.

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Thoughts & Insights:

What are the mechanisms of research and data and how do they relate to policy and regulations in City of Brampton?

How enhanced information accessibility could improve policy development in City of Brampton?

How does immigration waves interrelate with the current city green grow strategy?

Recommendations:

As one of Brampton's initiatives is to track corporate energy use within a scope of PPP's, it is recommended to **improve quality and frequency of data** to be retrieved on monthly or even daily basis.

A transparent public manifestation of the mechanisms of research and data and how do they relate to policy and regulations in City of Brampton, in terms of:

- Domestic Vs. Federal Data
- Public Vs. Private
- Academic Vs. Non-Academic

Enhance the research activities through incentivizing the universities and research centers to have more diversified multi-source research outputs.

Unify/Harmonize the classification of the public and municipal facilities for research purposes.

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References

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4. City of Brampton Grow Green Action Plan: http://www.brampton.ca/EN/residents/GrowGreen/Pages/Energy.aspx
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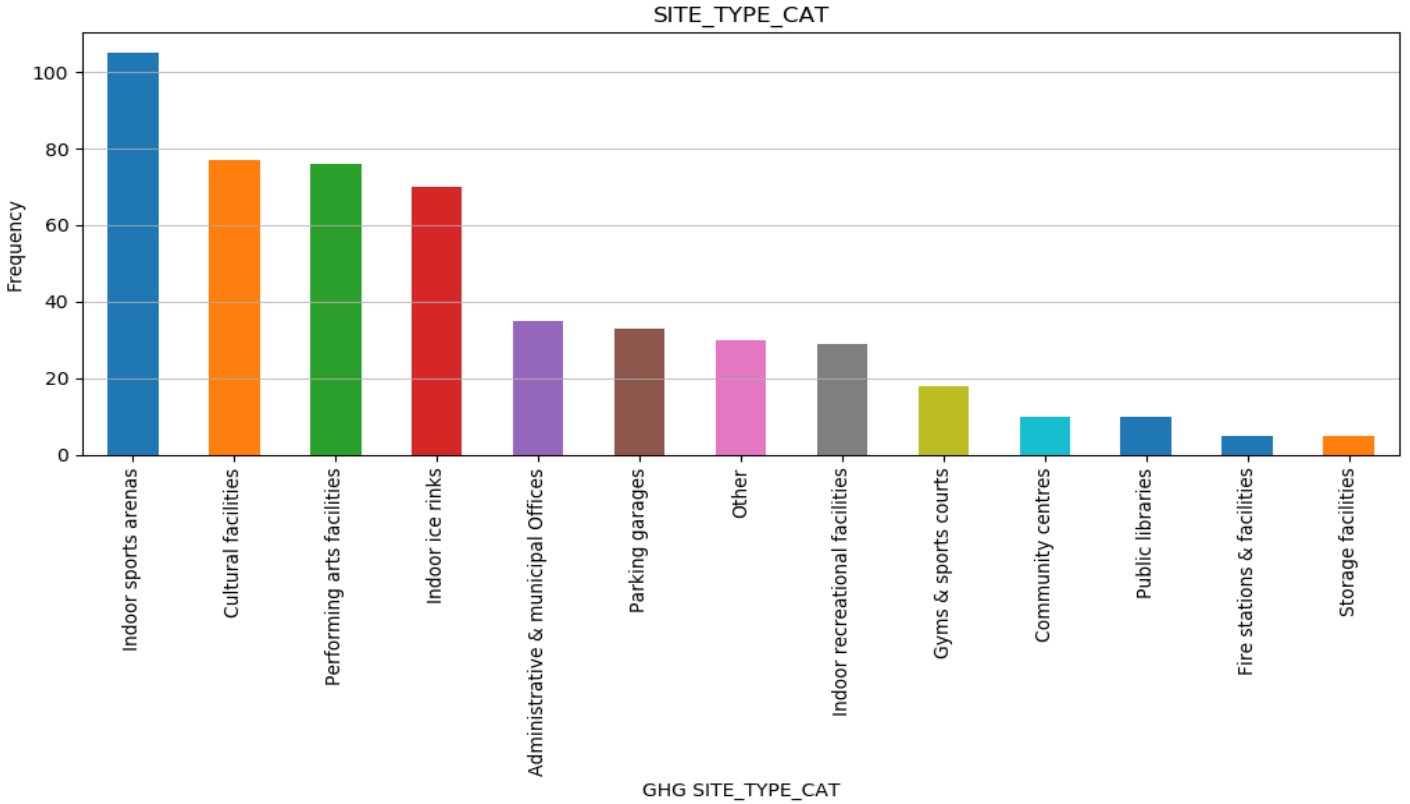
6. Implications of Changing Climate: https://www.nrcan.gc.ca/environment/resources/publications/impacts-adaptation/reports/assessments/2008/ch3/10325
7. Economic analysis of the Pan-Canadian Framework

Appendix:
Modeling , predications, and Visualization

Energy Consumption and Greenhouse Gas Emissions dataset (geohub)



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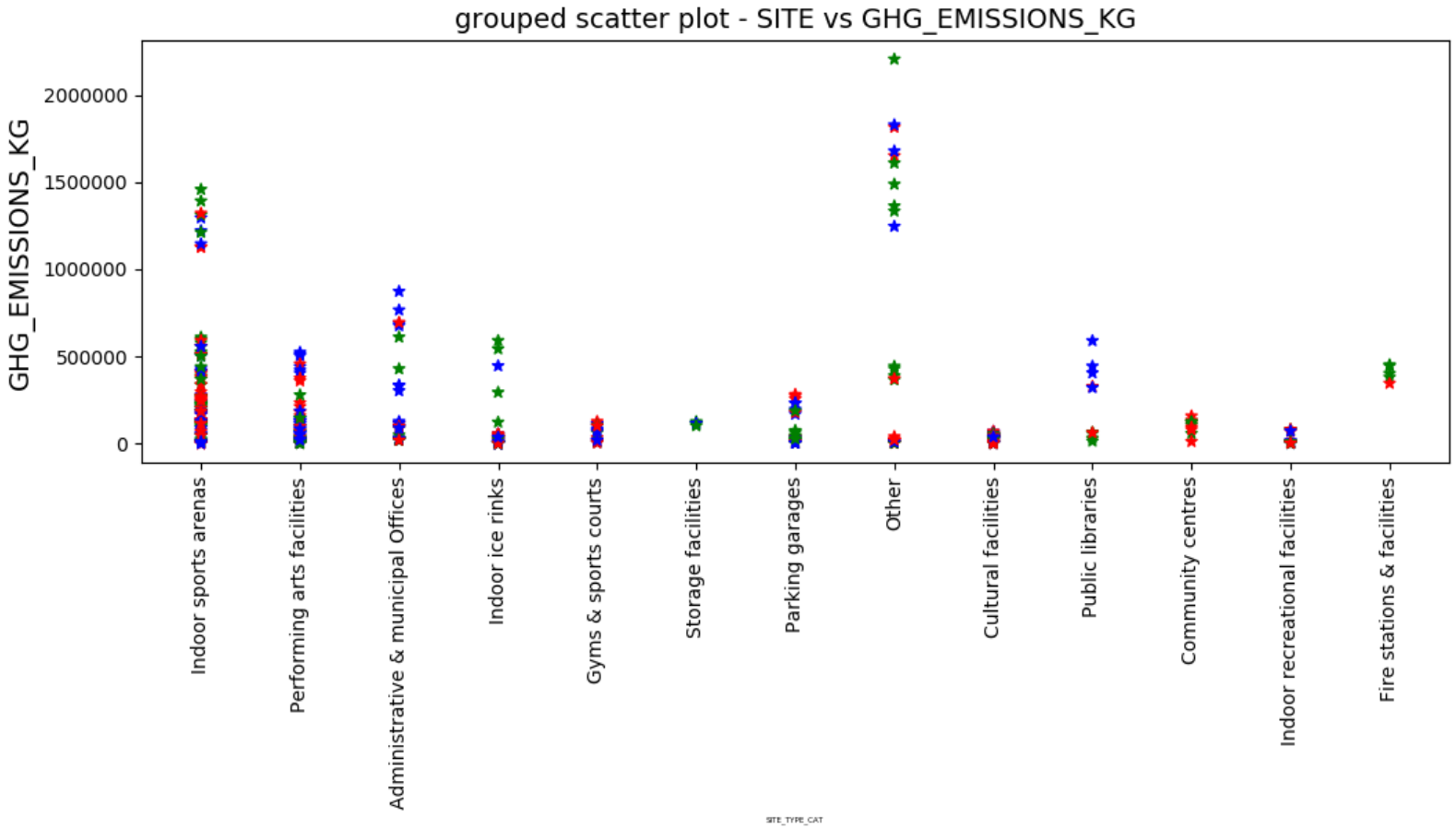

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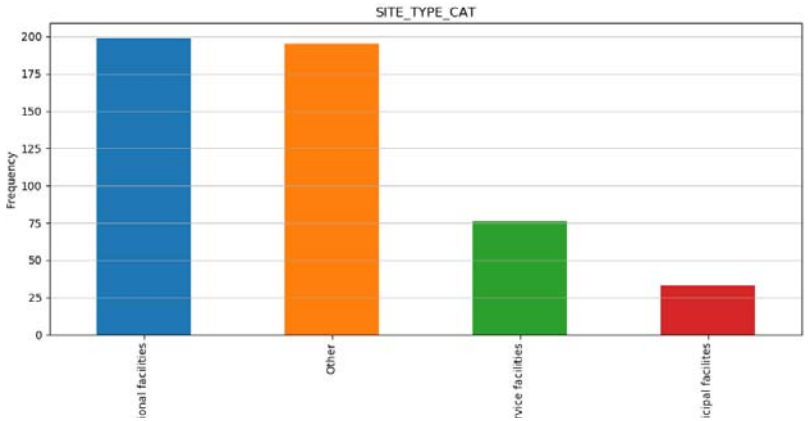

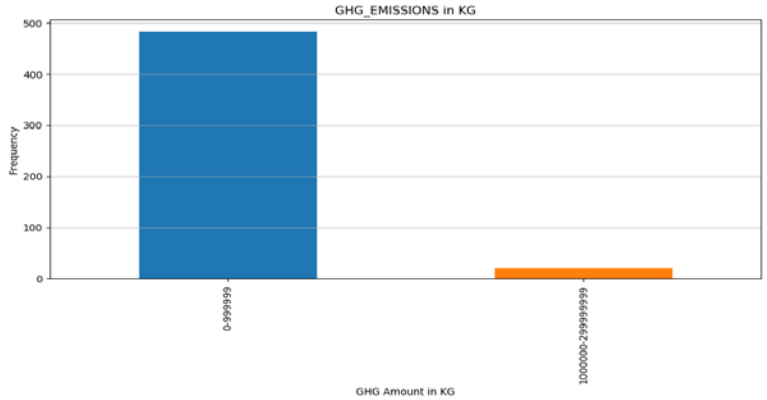

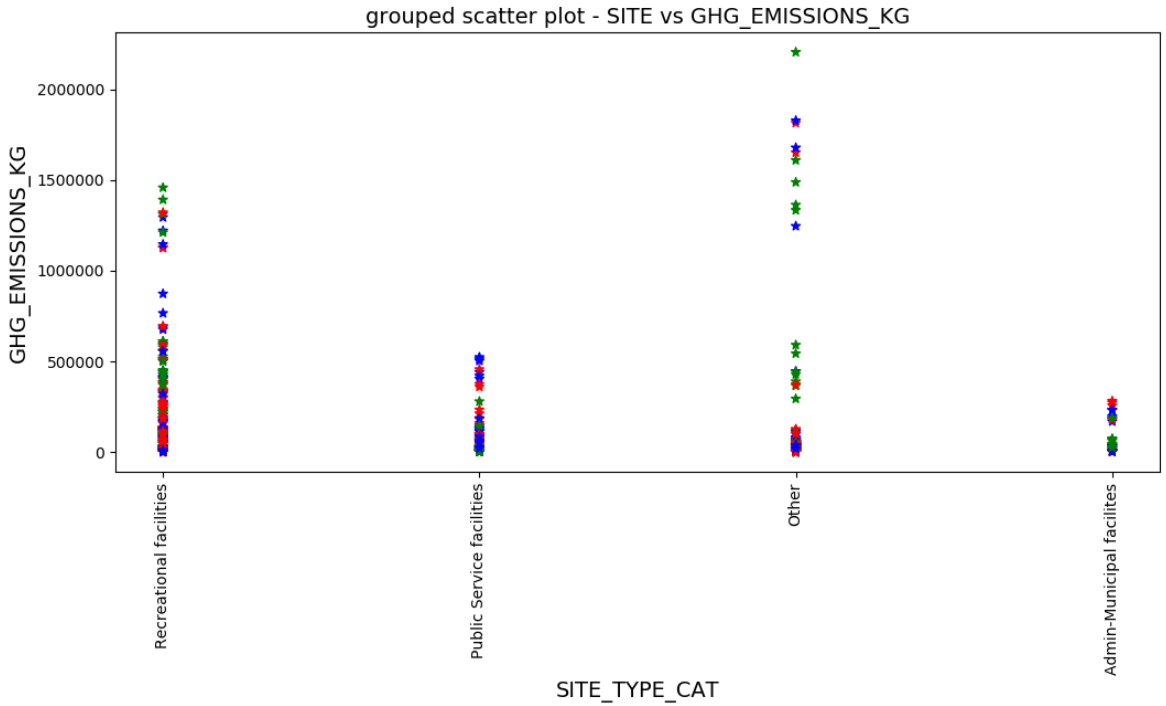

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corr - DataFrame

Index	INTERNAL_GROSS_AREA_SQ_FT	cWEEKLY_HOURS_OF_OPERATION	ELECTRICITY_KWH	NATURAL_GAS_M3	TOTAL_ENERGY_EKWH	_INTENSITY_EKWI	GHG_EMISSIONS_KG	GHG_INTENSITY_KG_SQ_FT	REPORT_YEA
INTERNAL_GRO...	1	0.155898	0.84233	0.771244	0.831319	0.00192983	0.79445	0.00572161	0.0274379
cWEEKLY_HOUR...	0.155898	1	0.0871241	0.157694	0.135592	0.240128	0.15062	0.101881	3.23643e-05
ELECTRICITY_...	0.84233	0.0871241	1	0.839699	0.938302	0.193711	0.880509	0.100677	-0.00641538
NATURAL_GAS_...	0.771244	0.157694	0.839699	1	0.975662	0.32248	0.995197	0.153357	-0.000124396
TOTAL_ENERGY...	0.831319	0.135592	0.938302	0.975662	1	0.283475	0.988817	0.135455	-0.00100556
ENERGY_INTEN...	0.00192983	0.240128	0.193711	0.32248	0.283475	1	0.31021	0.418472	-0.056587
GHG_EMISSION...	0.79445	0.15062	0.880509	0.995197	0.988817	0.31021	1	0.1733	-0.0188657
GHG_INTENSIT...	0.00572161	0.101881	0.100677	0.153357	0.135455	0.418472	0.1733	1	-0.543575
REPORT_YEAR	0.0274379	3.23643e-05	-0.00641538	-0.000124396	-0.00100556	-0.056587	-0.0188657	-0.543575	1

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OLS Regression Results

GHG_EMISSIONS_KG		R-squared:	0.268
OLS		Adj. R-squared:	0.251
Least Squares		F-statistic:	14.99
Sat, 27 Oct 2018		Prob (F-statistic):	6.27e-27
14:38:39		Log-Likelihood:	-6990.8
s:	503	AIC:	1.401e+04
	490	BIC:	1.406e+04
	12		
:	nonrobust		

	coef	std err	t	P>|t|	[0.025
	3.216e+05	2.6e+04	12.376	0.000	2.71e+05
.Storage facilities where equipment or vehicles are maintained, repaired, or stored]	-2.211e+05	4.01e+04	-5.512	0.000	-3e+05
.Public libraries]	-1.208e+05	5.2e+04	-2.324	0.021	-2.23e+05
.Cultural facilities]	-2.754e+05	4.11e+04	-6.703	0.000	-3.56e+05
.Administrative offices and related facilities, including municipal council chambers]	-2.626e+05	6.79e+04	-3.866	0.000	-3.96e+05
.Indoor ice rinks]	-2.074e+05	1.22e+05	-1.702	0.089	-4.47e+05
.Performing arts facilities]	-2.383e+05	5.31e+04	-4.484	0.000	-3.43e+05
.Indoor recreational facilities]	2.916e+05	5.51e+04	5.289	0.000	1.83e+05
.Gyms and indoor courts for playing tennis, basketball or other sports]	-2.899e+05	4e+04	-7.257	0.000	-3.68e+05
.Parking garages]	-9.025e+04	8.81e+04	-1.024	0.306	-2.63e+05
.Indoor sports arenas]	-2.209e+05	8.81e+04	-2.507	0.012	-3.94e+05
.Community centres]	-3.034e+05	5.59e+04	-5.432	0.000	-4.13e+05
.Fire stations and associated offices and facilities]	8.319e+04	1.22e+05	0.682	0.495	-1.56e+05

250.706		Durbin-Watson:	1.444
0.000		Jarque-Bera (JB):	1782.519
2.069		Prob(JB):	0.00
11.242		Cond. No.	11.5

rors assume that the covariance matrix of the errors is correctly specified.

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OLS Regression Results

Dep. Variable:	TOTAL_ENERGY_EKWH_Coded	R-squared:	0.903
Model:	OLS	Adj. R-squared:	0.901
Method:	Least Squares	F-statistic:	414.6
Date:	Sun, 28 Oct 2018	Prob (F-statistic):	2.14e-240
Time:	22:22:36	Log-Likelihood:	-197.93
No. Observations:	503	AIC:	419.9
Df Residuals:	491	BIC:	470.5
Df Model:	11		
Covariance Type:	nonrobust		

	coef	std err	t	P>|t|	[0.025	0.975]
Intercept	0.1045	0.042	2.468	0.014	0.021	0.188
GHG_EMISSIONS_CAT[T.1000000-299999999]	-0.0564	0.097	-0.580	0.562	-0.247	0.135
SITE_TYPE_CAT[T.Public Service facilities]	0.0342	0.051	0.673	0.501	-0.066	0.134
SITE_TYPE_CAT[T.Other]	-0.0418	0.045	-0.934	0.351	-0.130	0.046
SITE_TYPE_CAT[T.Admin-Municipal facilites]	0.1045	0.077	1.361	0.174	-0.046	0.255
INTERNAL_GROSS_AREA_CAT[T.10001-383505]	0.6431	0.052	12.350	0.000	0.541	0.745
WEEKLY_Operating_hrs_CAT[T.84-168]	0.0605	0.038	1.580	0.115	-0.015	0.136
ELECTRICITY_KWH_CAT[T.100000-999999]	0.4836	0.047	10.182	0.000	0.390	0.577
ELECTRICITY_KWH_CAT[T.1000000-5438610]	0.6530	0.077	8.470	0.000	0.502	0.804
NATURAL_GAS_CAT[T.10000-49999]	0.7162	0.041	17.521	0.000	0.636	0.796
NATURAL_GAS_CAT[T.50000-1038241]	1.5969	0.059	27.055	0.000	1.481	1.713
GHG_INTENSITY_CAT[T.20-137]	0.0966	0.045	2.146	0.032	0.008	0.185

Omnibus:	39.711	Durbin-Watson:	1.663
Prob(Omnibus):	0.000	Jarque-Bera (JB):	83.431
Skew:	0.455	Prob(JB):	7.64e-19
Kurtosis:	4.776	Cond. No.	9.71

Warnings:
[1] Standard Errors assume that the covariance matrix of the errors is correctly specified.

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