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2011 and 2012 Energy Consumption and Greenhouse Gas Emission Plan

Ministry of Transportation Five Year Energy Conservation Strategy

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1.0 Energy Plan Overview and Summary

The Green Energy and Green Economy Act (GEA), along with the complimentary policy and regulations, were intended to reduce Ontario's carbon footprint by reducing greenhouse gasses and fostering a culture of conservation. Based on the fundamental principles that:

- Ministries make accountable choices for energy use, ensuring value for money;
- Ministries conserve energy and use energy efficiently; and
- Information is managed efficiently and effectively across ministries

The Ontario Facilities Energy Reporting Directive, which became effective January 1, 2013, demonstrates leadership in that regard, and sets out certain requirements. One such requirement holds that each custodial ministry – ministries that manage government owned facilities - track and publicly report their energy consumption and greenhouse gas emissions in those facilities (referred to as Target Class Facilities).

Target Class Facilities are a subset of all government-owned facilities that have been identified as having energy conservation potential. The energy and water consumption at Target Class Facilities is required to be reported to both MOI and publicly as a requirement of the Directive. Reporting is to be done at the building level within each facility. In MTO's case the Target Class facilities are those that make up the Truck Inspection Station network.

Provincial Ministries are required to post their Energy Consumption and Greenhouse Gas Emission Plan on an annual basis. The first energy consumption report covered the 2006 baseline year through 2010. That is followed by this second report covering 2011 & 2012. Beginning in 2014, ministries will post plans annually for the previous year only.

Five Year Energy Conservation Strategy

The objective of MTO's strategy is to outline progress and frame strategies to achieve energy conservation targets in our Target Class facilities.
As with the Ontario Public Service (OPS) in general, MTO is faced with the challenge of reducing emissions while improving performance and customer satisfaction within our managed portfolio.

2.0 Description of the Managed Portfolio

Program Background

On any given day, over 100,000 trucks travel Ontario's highways. It is the role of the Ministry of Transportation's Commercial Vehicle Enforcement Program to monitor the condition of those vehicles and, when necessary, take corrective action. One method of accomplishing this task is through vehicle inspections. Ministry enforcement staff perform the inspections for the most part, at one of 34[1] Truck Inspection Stations (TIS).

Truck Inspection Stations are found at various highway locations in Ontario. Vehicles are subject

to safety checks (of brakes, lights, couplings for example) and their loads checked for weight, height, length, width and axle spacing. Driver licences are also checked for validity and proper class of licence for the vehicle.

[1]The Truck Inspection Station network is made up of 34 sites. The Plan addresses 29 of those locations. One of the sites (Alfred) is a municipal asset and falls outside the scope. Similarly, the 407 site is outside of the scope given that all operational costs are managed by 407 ETR. The remaining 3 sites (Bowmanville and Trafalgar North & South) are not metered. That will change in the case of Bowmanville when the site is relocated.

In 2012, MTO conducted 94,000 truck inspections 64,686 of which were conducted at Truck Inspection Stations. Of that number, 55,289 (85.5%) were carried out at the sites captured in the plan. Although progress is being made, the trucking industry continues to require oversight. 21,500 unsafe trucks/trailers/drivers were removed from Ontario's highways in 2012.

Program Operations

In 2009, the ministry completed work on a Strategic Enforcement Plan. The purpose of the Plan was to maximize the strategic and operational effectiveness of the Enforcement Program, focussing on the (then) 36 existing Truck Inspection Stations (TIS) across the Province. Extensive analysis using Provincial Highway criteria such as: Traffic Counts, Points of Entry, High Volume Corridors, Major Trade Corridors and Regional Priorities, were used to prioritize the strategic value of each Truck Inspection Station. The Plan was also linked to the Ministry's long-term Capital Investment Plan.

The review identified opportunities to use resources more efficiently without compromising truck safety by analyzing all existing TISs and prioritizing them based on strategic value. Through that analysis the ministry has identified seven high priority TISs which, as funding becomes available, are being converted to larger Commercial Vehicle Inspection Facilities (CVIF), where the ministry will maximize staffing resources and capital funding. Staff will be transferred from less strategically critical sites to these new priority sites enabling MTO to operate more hours through a 24 hour period.

Both of these initiatives, (the 24 hour operations and the considerably larger CVIF sites) will impact energy consumption however the Ministry has taken that into consideration during the design phase of the planning.

Commercial Vehicle Inspection Facilities (CVIF)

The old-style inspection stations have become obsolete. Prior to the 1990s, the primary focus of these stations was weighing vehicles. Since that time, enforcement has shifted to focusing on driver and mechanical fitness, requiring more space for inspections and detention.

The new state-of-the-art inspection facilities constructed or being constructed now sit on (approximately) a 3-hectare site and are equipped with new technologies such as licence plate readers and a queue management system that will prevent back-ups onto Highway 401. The sites include booths for officers to be stationed outside, recessed inspection lanes, 12 truck bays, and a large triage area allowing effective screening, and inspections on those vehicles that have a higher likelihood of non compliance. Employee safety has been enhanced in the building and inspection lanes, including more functional and efficient work space for officers to conduct their duties and improved illumination - including increased lighting for officer safety and better visibility for night time inspections.

To lessen the impact of the increased illumination and decrease maintenance requirements, (given their longer life) more efficient LED lighting is being installed on bollards and pole mounted luminaires.

Geothermal heating and cooling was provided for the heating and cooling systems of both buildings. Foyers were designed into the floor-plan to minimize airflow on exterior doors

Buildings are pre-ducted from outside (small electrical manholes) underground into the electrical room to facilitate future solar panel installation; permitting maximum sizing of solar panels as ground mount units.

3.0 Reporting Framework

Fuel Types

Ministries are required to report GHG emissions (tonnes eCO2 is the common measurement). Emissions at MTO Target Class Facilities are derived from a variety of energy fuel types:

- Electricity
- Natural Gas
- Propane

Each fuel type emits different levels of emissions. Some fuel types burn cleaner than others. Some are burned on-site (such as natural gas) while electricity is generated remotely and distributed to the site. Although it is impossible to accurately depict the direct emissions for each individual site, Environment Canada provides guidance in the form of Emission Factors (EF) that can be used to estimate a building's emissions on fuel consumption. IO has a diverse portfolio which reports on all of these fuel types. Electricity remains the largest energy type consumed, followed by natural gas.

GHG Calculations

Energy use by a building results in the emission of greenhouse gases. Each of the energy types has a defined amount of greenhouse gas that is released per unit of energy consumed. In the case of a fuel that is consumed within the building (such as burning natural gas or fuel oil to heat a building), carbon dioxide (and other greenhouse gases) is released as a direct output of the combustion process. In the case of energy that is sourced from the electricity grid or from a district energy plant (hot water and steam), it is the processes that are used in the creation and transmission of those utilities that releases GHG. This GHG output is expressed as an emission factor for that particular utility or energy type.

To calculate GHG, the consumption needs to be first converted to the common unit for the energy type. Once this has been done the consumption is multiplied by the emission factor to get the resultant GHG.

Utility Consumption x Emission Factor = GHG emissions

Example

To calculate GHG emissions for 5000 litres of propane:

5000 litres x 0.001544 t eCO2/litre = 7.72 tonnes eCO2

4.0 Portfolio Performance

MTO Target Class Facility Progress Report

GHG Reporting			
Reporting Entity & Utility	**Total GHG Emissions 2011 (tonnes eCO2)**	**Total GHG Emissions 2012 (tonnes eCO2)**	**% Change**

Electricity	191.67	183.861	- 4.7
Natural Gas	95.249605	94.462591	- 0.9
Propane	24.81146	11.60995	- 46.8
Portfolio TOTAL	311.73147	289.93344	-7

Energy Intensity

In order to quantify energy usage, specifically as it pertains to the Target Class Facilities, an Energy Intensity calculation was developed and introduced in the previous years' report. The calculation provided a mechanism through which energy usage could be measured against the delivery of one of the key functions of the program (i.e. vehicle inspections).

Energy Consumed (ekwh as the common measurement) / Number of Inspections = Intensity

See **Appendix 6.3** for annual Energy Intensity Figures.

5.0 Energy Consumption Strategies

The Ministry of Transportation's vision is to be a world leader in moving people and goods safely, efficiently and sustainably to support a globally competitive economy and a high quality of life.[2]

[2]Sustainability inSight, an innovative strategy for Ontario's Ministry of Transportation focused on social, environmental and economic sustainability.

Conservation

MTO is faced with the challenge of reducing emissions while improving the performance of the managed portfolio. Highway safety is of paramount concern so it is not anticipated that the number of Truck Inspection Stations will decrease. Conversely there is every expectation that the strategic plan to grow the Commercial Vehicle Inspection Facilities network will proceed on schedule. Considerably larger facilities and longer working hours will challenge any goal to substantially reduce energy consumption. However, the Ministry has repeatedly demonstrated a proactive approach to achieving that goal.

In 2010 and 2011, MTO invested $162,000 in renewable energy devices at two Truck Inspection Stations. In 2010, a 6 kilowatt windmill/solar panel system was installed at the Sarnia Truck Inspection Station and in 2011 a 10kw rooftop solar panel system was installed at the Windsor Truck Inspection Station. In addition, there has been a considerable focus on the inclusion of energy conservation features on new TIS/CVIF installations, including the use of energy efficient lighting, including LED lights. Experience to date indicates that the LED fixtures use half as much energy as conventional lighting and instead of re-lamping the lights every 4 years it is estimated that it will now be at least 15 years before the fixture itself needs to be replaced. Geothermal heating and cooling pumps have also been installed and the preparatory work included facilitating for the future installation of solar panels.

Long Term Planning

Based on the fundamental principles that:

- Ministries make accountable choices for energy use, ensuring value for money;
- Ministries conserve energy and use energy efficiently; and
- Information is managed efficiently and effectively across ministries

The Ministry of Transportation plans to deliver a strategy to review the existing alternate energy generation initiative with a view to its possible expansion.

The Ministry of Transportation's key stakeholders will continue to promote energy conservation in our facilities.

The Ministry of Transportation will develop and manage a data collection and reporting processes for energy to enable it to meet its requirements under the Green Energy Act and associated directives.

Communication and Awareness

The Ministry of Transportation has proactively implemented a variety of communication methods to increase employee awareness of greening initiatives in its facilities.

MTO has conducted seven annual ministry-wide Energy Awareness Contests directed at increasing employee awareness of energy conservation

- There are a number of 'Green Teams' established throughout the ministry to promote greening strategies and initiatives
- MTO is an active participant in Earth Day and has a formal documented inter-ministerial program named 'Sustainability inSight' which supports and encourages employee engagement in energy management.

Download Report data - PDF (239 KB)

6.0 Appendices

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6.5 Annual Energy Consumption by Energy Type

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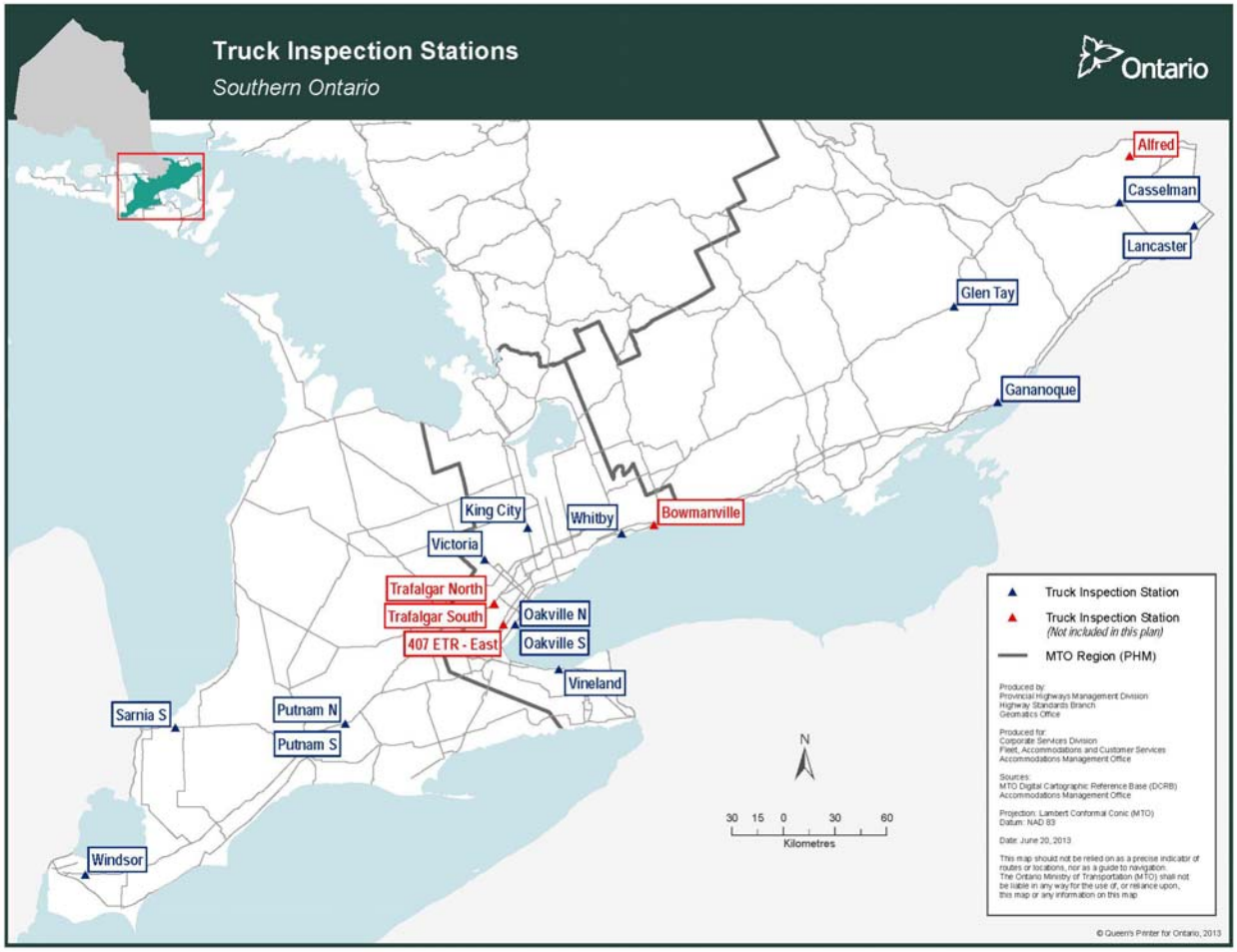
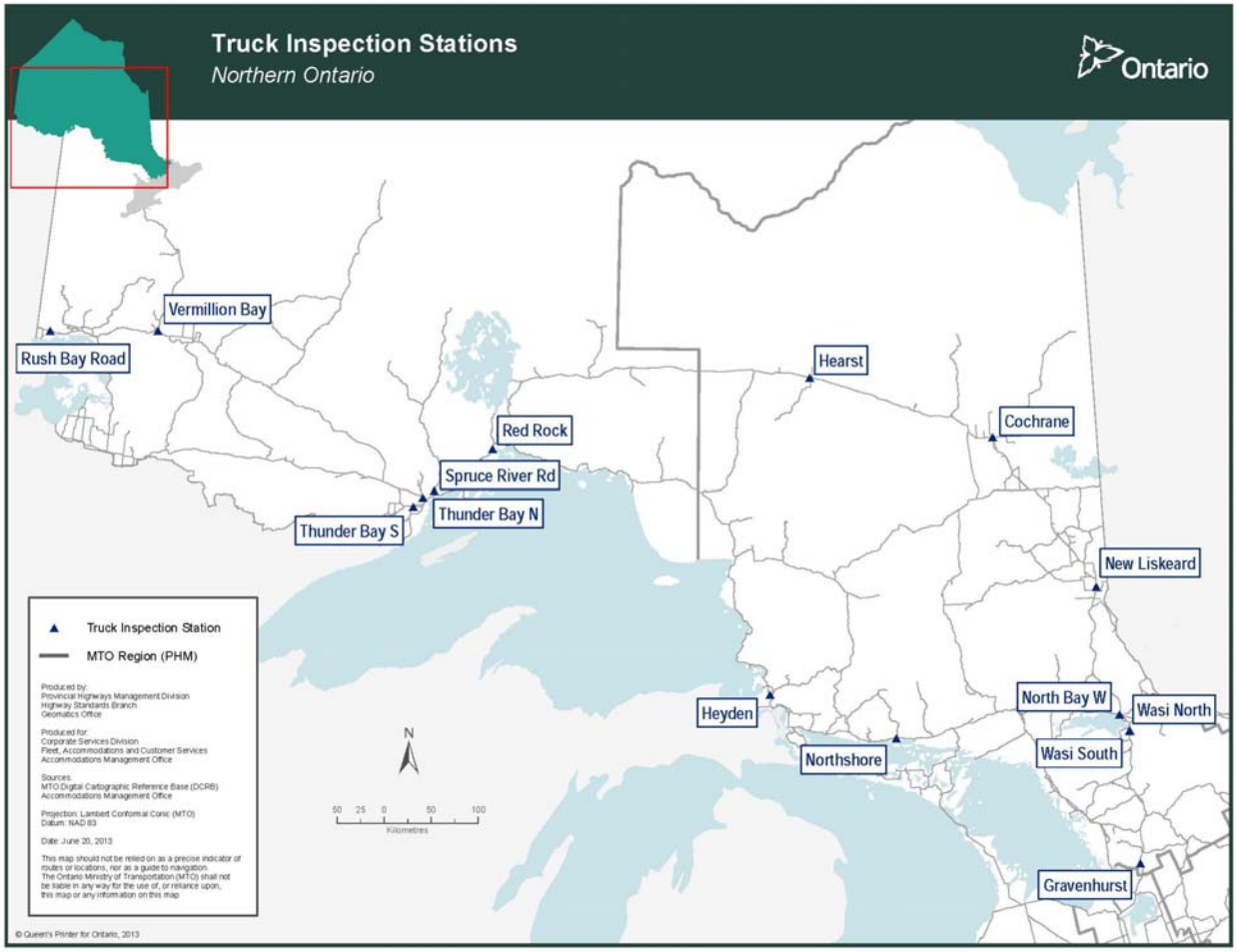
6.8 Geothermal or Earth Energy Systems

6.1 TIS Locations – Southern Ontario



6.2 TIS Locations – Northern Ontario



6.3 Annual Energy Consumption Overview By Year

2011

Total # of Safety Inspections	Current Emission Factor	Energy Type	Annual Total Consumption	Energy Consumed (ekWh)	GHG Emissions (total)	GHG Intensity	Energy Intensity
56020	0.0001	Electricity	1916704	1916704	191.67	0.00342	34.214638
	0.001901	Natural Gas	50105	517055.76	95.249	0.00170	9.2298422
	0.001544	Propane	16069.6	118736.7	24.8110	0.00044	3.369095
		Water	1283				
		TOTALS:					
				2552496.4	311.73147	0.00556	45.564021

2012

Total # of Safety Inspections	Current Emission Factor	Energy Type	Annual Total Consumption	Energy Consumed (ekWh)	GHG Emissions (total)	GHG Intensity	Energy Intensity
55289	0.0001	Electricity	1838609	1838609	183.861	0.00332	33.254517
	0.001901	Natural Gas	49691	512783.51	94.462	0.00170	9.2746027
	0.001544	Propane	7519.4	55560.09	11.6095	0.00020	1.0049032
		Water	1581				
		TOTALS:					
				2406952.6	289.93344	0.00524	43.534023

6.4 Annual Energy Consumption Overview By Location

Location	Hwy	Electricity eKWh		Propane L		Natural Gas m³		Water	
		2011	2012	2011	2012	2011	2012	2011	2012
Windsor	401	247779	227404	5196	2009			420	468
Sarnia S	402	199128	178628	3698.8	3801.3			116	144
Putnam N	401	105882	137309	5652.4	1709.1				
Putnam S	401	84909	11635	1522.4	0				
Vineland	QEW	99134	113727			1792	1566		
Oakville N	QEW	129359	118065			528	440		
Oakville S	QEW	88150	93856			528	440		
Victoria	10	40533	45179						
Whitby	401	50323	46159			2351	2076	263	245
King City	400	55553	60718						
Bowmanville[1]	401								
Gananoque	401	67262	58783						
Glen Tay	7	27709	42699						
Alfred	17								
Casselman	417	42700	67853						
Lancaster	401	9957	11289			3017	4846		
Heyden	17	38705	33750						
Cochrane	11	40964	41425			41889	40323		
New Liskeard	11	15840	25068						
Northshore	17	48627	52891						
Hearst	11	13158	12274					484	724
Red Rock	17	72835	81222						
Spruce River	527	31339	12274						
Thunder Bay N	102	25491	21477						
Thunder Bay S	11/17	4	0						
Vermillion Bay	17	21981	25289						
Gravenhurst	11	18102	14791						
Rush Bay Rd	17	24840	25025						
North Bay W	17	9002	10375						
Wasi North	17	169040	118193						
Wasi South	17	138390	151251						
Trafalgar North	401								
Trafalgar South	401								
407 W	407								
TOTAL		567518	797775	16069.6	7519.4	50105	49691	1283	1581

[1] Locations highlighted in red are either out of scope (Alfred & 407W) or not metered separately from highway

6.5 Annual Energy Consumption/GHG by Energy Type

Figure 1. Consumption in eKWh by Energy Type

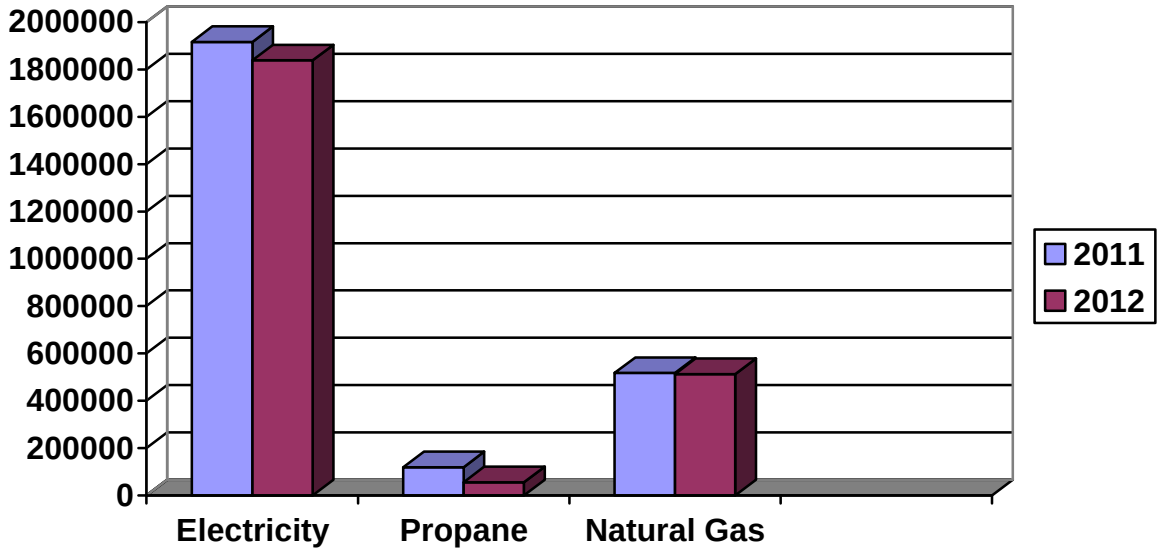
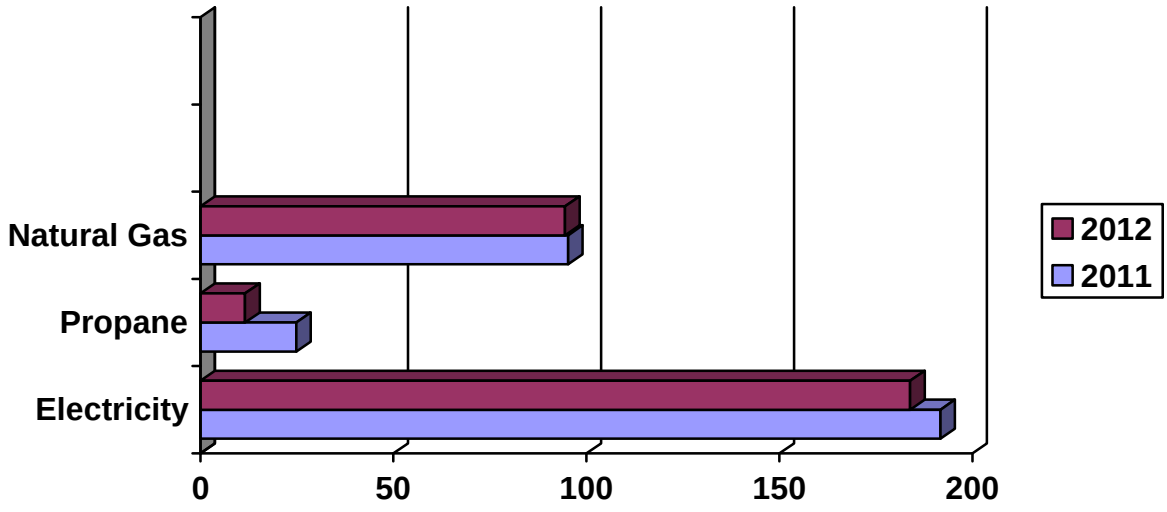


Figure 2. GHG in tonnes eCO2 by Energy Type



6.6 Annual Inspections By Location

	Total		Applicable	
Location	**2011**	**2012**	**2011**	**2012**
Windsor	5741	5907	5741	5907
Sarnia S	2927	2366	2927	2366
Putnam N	7453	9344	7453	9344
Putnam S	1986	589	1986	589
Vineland	5908	5535	5908	5535
Oakville N	1401	1619	1401	1619
Oakville S	2470	2741	2470	2741
Victoria	1120	869	1120	869
Whitby	4658	5115	4658	5115
King City	3120	3947	3120	3947
Bowmanville	2688	3179		
Gananoque	1887	1936	1887	1936
Glen Tay	83	212	83	212
Alfred	39	53		
Casselman	1446	1922	1446	1922
Lancaster	6929	5315	6929	5315
Heyden	1190	901	1190	901
Cochrane	1100	1140	1100	1140
New Liskeard	169	171	169	171
Northshore	952	678	952	678
Hearst	29	71	29	71
Red Rock	692	425	692	425
Spruce River	69	28	69	28
Thunder Bay N	941	1415	941	1415
Thunder Bay S	482	750	482	750
Vermillion Bay	192	86	192	86
Gravenhurst	353	485	353	485
Rush Bay Rd	136	58	136	58
North Bay W	354	216	354	216
Wasi North	1412	751	1412	751
Wasi South	820	697	820	697
Trafalgar North	2748	2372		
Trafalgar South	3530	3410		
407 W	1523	436		
TOTAL	66548	64739	56020	55289

6.7 Intensity By Location

	GHG Intensity		Energy Intensity	
Location	2011	2012	2011	2012
Windsor	0.0057134	0.0043749	49.847017	41.010378
Sarnia S	0.0087543	0.0100304	77.368658	87.369157
Putnam N	0.0025916	0.0017519	19.810414	16.046379
Putnam S	0.005459	0.0019754	48.417856	19.75382
Vineland	0.0022546	0.0025925	19.909689	23.466531
Oakville N	0.0099498	0.0078091	96.22246	75.729188
Oakville S	0.0039755	0.0037293	37.897436	35.89805
Victoria	0.003619	0.005199	36.190179	51.989643
Whitby	0.0020398	0.001674	16.012025	13.212545
King City	0.0017805	0.0015383	17.805449	15.383329
Bowmanville				
Gananoque	0.0035645	0.0030363	35.644939	30.36312
Glen Tay	0.0333843	0.020141	333.84337	201.41038
Alfred				
Casselman	0.002953	0.0035303	29.529737	35.30333
Lancaster	0.0009714	0.0019457	5.9302589	11.532837
Heyden	0.0032525	0.0037458	32.52521	37.45838
Cochrane	0.0761158	0.0708741	430.21383	401.34733
New Liskeard	0.0093728	0.0146596	93.727811	146.59649
Northshore	0.0051079	0.007801	51.078782	78.010324
Hearst	0.0453724	0.0172873	453.72414	172.87324
Red Rock	0.0105253	0.0191111	105.25289	191.11059
Spruce River	0.0454188	0.0438357	454.18841	438.35714
Thunder Bay N	0.0027089	0.0015178	27.089267	15.178092
Thunder Bay S	0.0082988	0	0.0082988	0
Vermillion Bay	0.0114484	0.0294058	114.48438	294.05814
Gravenhurst	0.005128	0.0030497	51.280453	30.496907
Rush Bay Rd	0.0182647	0.0431466	182.64706	431.46552
North Bay W	0.0025429	0.0048032	25.429379	48.032407
Wasi North	0.0119717	0.0157381	119.71671	157.38083
Wasi South	0.0168768	0.0217003	168.76829	217.00287
Trafalgar North				
Trafalgar South				
407 W				
TOTAL	0.0031562	0.0033614	21.480015	24.708687

6.8 Geothermal or Earth Energy Systems

Overview

Earth energy comes mainly from absorbed solar energy and conducted heat from the earth's molten interior, both stored in the *overburden*, rock and water of the earth. Below a certain depth, ground temperature is relatively constant all year long. Groundwater flowing through pores and fractures in soil or bedrock also has similar constant temperatures. Furthermore, surface water bodies, such as a river, pond or lake, generally exhibit less temperature fluctuation than occurs with air temperatures. Surface waters, the ground and groundwater are warmer than air temperature in winter and cooler than air in summer.

An *earth energy system* uses the temperature differences to warm or cool buildings or other structures. *Earth energy systems* are a heating and cooling system for buildings or structures that use a fluid to exchange heat with the ground or water.

An *earth energy system* is part of a heating, ventilation and air conditioning system (HVAC) for a building or structure. A typical *earth energy system* is comprised of three main components: the outside loop; the heat pump unit; and, the building's heating or cooling unit. Generally, an *earth energy system* works as follows: in the winter, the outside loop obtains heat from the soil, rock, groundwater or surface water. Heat in the outside loop is transferred to a refrigerant in the heat pump unit. Heat is then dissipated from the heat pump's refrigerant into the building's heating or cooling unit. The reverse occurs during summer. Heat from inside the building is extracted from the building's heating or cooling circuit. This heat is transferred to a refrigerant in the heat pump unit. Heat is then transferred to the outside loop and is released into the ground or surface water.

Closed Loop Earth Energy Systems

The outside loop of a closed *earth energy system* consists of a continuous *sealed* underground or submerged loop of tubes through which a *heat transfer fluid* passes and returns to the heat pump unit. The *heat transfer fluid* typically consists of a mixture of water, antifreeze, corrosion inhibitors and other additives. Common antifreezes used in a heat transfer system are denatured ethanol, propylene glycol and ethylene glycol. To reduce corrosion and increase lubrication, additives such as corrosion inhibitors or mineral oils are added to the *heat transfer fluid*. In the ground or surface water, heat moves between the *heat transfer fluid* and the soil, rock or water. The *heat transfer fluid* circulates back to the heat pump where the heat exchanges between the tube that contains the *heat transfer fluid* and the tube that contains the refrigerant in the heat pump unit. Generally, the outside loops for a closed loop system are installed in one of two configurations: vertical or horizontal.

Horizontal Closed Loop

In a horizontal system, the *tubing* is often installed into horizontal trenches that are typically excavated to a depth of 1 to 2.5 m depth below the ground surface. In some cases, a larger excavation is created to place coiled *tubing* into the ground. Once the *tubing* is placed into the excavation, the area is backfilled, initially with a material that will not puncture the *tubing*.

Source: Technical Bulletin, Earth Energy Systems in Ontario, Prepared by: Ontario Ministry of the Environment March 2013