



Energy Consumption & Greenhouse Gas Emission Report

Prepared by the
**Ministry of Infrastructure and
Infrastructure Ontario**

MOI/IO Five Year (2006-2010)
Energy Conservation Strategy
& Enterprise-Wide Summary



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1.0 MINISTRY OF INFRASTRUCTURE PORTFOLIO - OVERVIEW & SUMMARY

In 2009, the Provincial Government made a commitment to reduce its greenhouse gas (GHG) emissions; specifically:

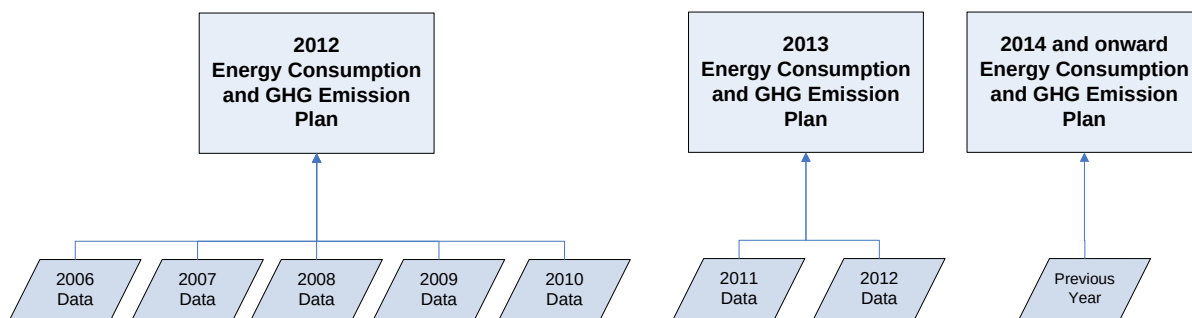
- A 19% reduction by end of 2014 over 2006 baseline
- A 27% reduction by end of 2020 over 2006 baseline

The Ministry of Infrastructure (MOI) owned real estate portfolio, managed by Infrastructure Ontario (IO), makes up the majority of the targeted provincial GHG emissions; and as such, assumes a significant responsibility in achieving the targeted reductions.

2006 - 2010 Energy Consumption and GHG Emission Plans:

Provincial Ministries are required to post their energy plans on an annual basis.

The first energy consumption report covers the 2006 baseline year through 2010, followed by a second report covering 2011 & 2012. In 2014, ministries will post plans annually for the previous year only.



Five Year Energy Conservation Strategy:

The objectives of this strategy document are to:

- Outline progress and strategies to meet and exceed Ontario Public Service (OPS) GHG reduction targets across the MOI owned built environment.
- Establish a baseline, methodology and a framework to achieve energy conservation targets across the IO managed portfolio.
- Achieve GHG emission reduction goals set for 2014 and 2020.

IO is faced with the challenge of reducing emissions while maintaining performance and customer satisfaction within its managed portfolio. This strategy will focus on activities and actions designed to improve operational efficiency that will result in reductions in electricity, fuel, and steam consumption, which will ultimately lower GHG emissions and utility costs.

2.0 DESCRIPTION OF THE MANAGED PORTFOLIO

IO's total managed real estate portfolio includes approximately 50 million square feet of buildings and structures, encompassing approximately 850 core buildings. By removing leased buildings and structures such as warehouses, sheds, and other low impact assets, IO has identified its highest energy

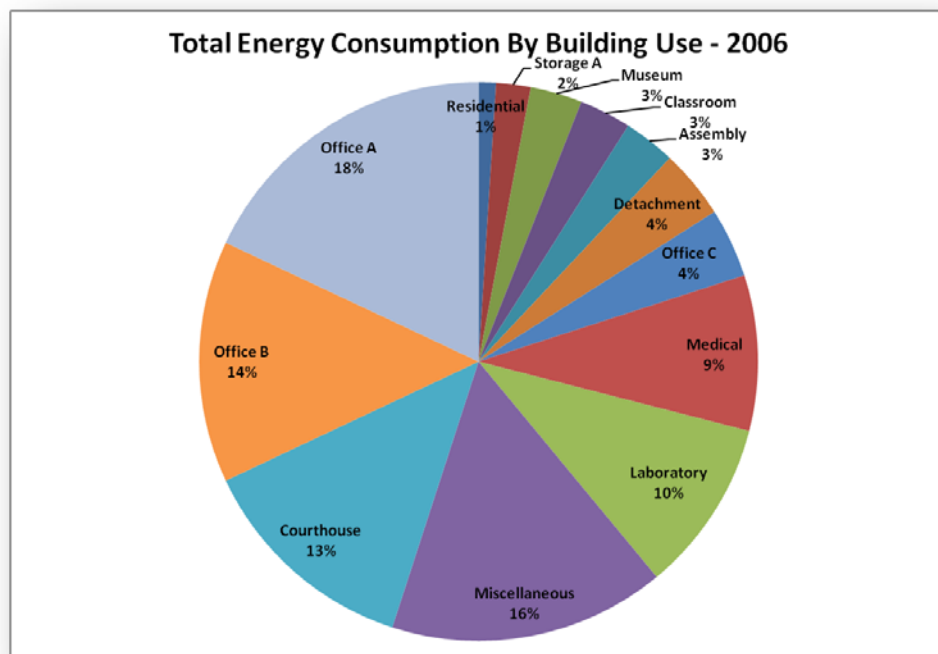
use buildings constitute a comparatively small subset of its manage portfolio. Specifically, 20% of buildings in the portfolio are responsible for 80% of total energy consumption.

IO's managed portfolio is spread throughout the province, consisting of various usage types including, but not limited to the following:

- **Courthouse** - Buildings consisting of courtrooms, holding cells, and office space.
- **Service Detachment** - Emergency operation's home base facilities, also policing home base facilities.
- **Data Centre** - Where at least 80% of the facility is used for extensive technology in an environmentally controlled and secured area.
- **Laboratory** - Buildings used for experimental studies and/or testing and/or research and which require special purpose improvements.
- **Office** - General administration of program delivery.
- **Other** - The Ontario Science Centre.

Figure 2-1 represents an approximate total energy allocation across the entire managed portfolio for the 2006 year.

Figure 2-1



Age:

More than 50% of the assets in IO's portfolio are over 40 years old. These assets require significant capital investment in order to adequately maintain operations. In addition, these assets are more likely to be high energy users, with aging structures and equipment, employing outdated materials, methods and technologies. Many of IO's older buildings are important for heritage and cultural reasons, adding additional layers of management complexity.

Program Use and Operations:

Each building type operates differently, thereby presenting unique energy efficiency challenges. For example, courthouses operate during the day with rigid operating requirements, while data centres operate around the clock. Further, courthouses have high security implications for retrofits while office buildings are influenced by occupant and program requirements.

Building Equipment:

Among operational equipment, each building has its own unique Heating Ventilation and Air-conditioning (HVAC) equipment, fuel, automation systems, etc. that create a challenge for program-wide initiatives. An office building in Ottawa could use natural gas to heat, whereas Queen's Park uses district steam. Some sites could use propane while others consume fuel oil. Electricity could be consumed by thousands of pieces of equipment at a single site.

3.0 TARGET & REPORTING - BASELINE, METHODOLOGY, FRAMEWORK

Overview of the 2006 Baseline

457 IO managed buildings have been included in the 2006 baseline which represents 96% of all energy fuel consumption.

Methodology:

The list of buildings included for the 2006 GHG baseline (attached in the appendix) was established based on differentiation between *Target vs. Non-Target Class Facilities*. MOI in collaboration with IO and ministries identified both 'target class facilities' and 'non-target class facilities'. The reason for this distinction is because in the past, all building types and assets (including street lighting, communication towers, etc.) were included in government targets and it was not practical or advisable to conserve in all instances. Therefore, the 'non-target class' facilities category was created to include government operations whereby conserving energy in specific facilities/operations poses a direct health and safety risk to the public or operations or there were no more opportunities of scale.

Fuel Types:

Ministries are required to report GHG emissions (tonnes eCO₂). For IO, emissions are derived from a variety of energy fuel types, such as:

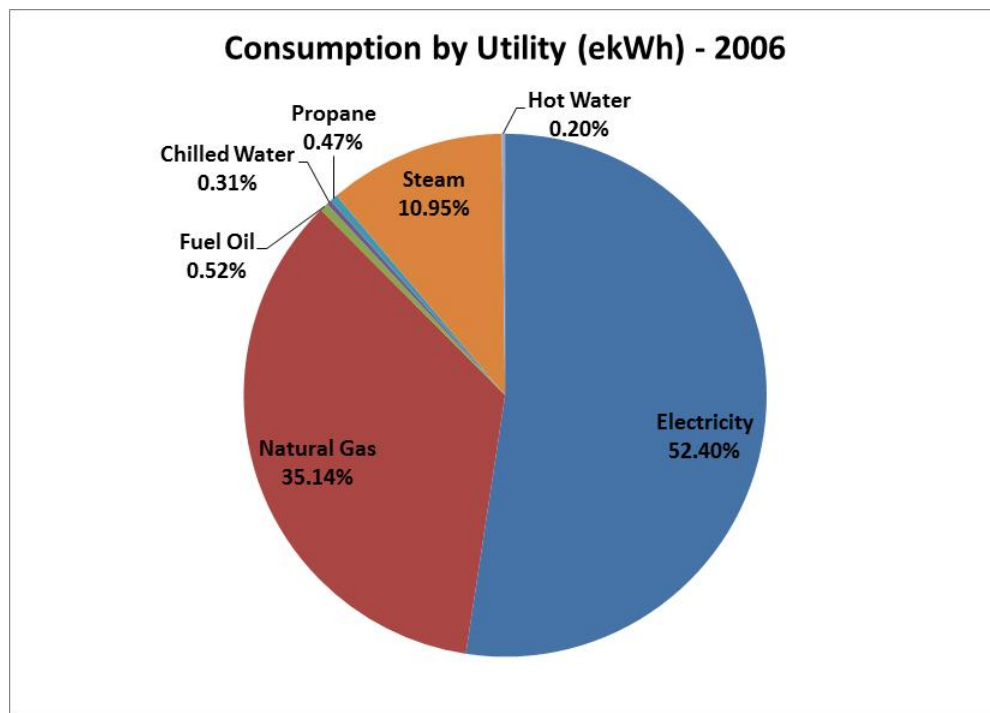
- Electricity
- Natural Gas
- Fuel Oil (2)
- Propane
- Steam
- Hot water
- Chilled Water

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. Note:

Diesel is not considered part of the reporting requirements and is not included in the final emission reporting.

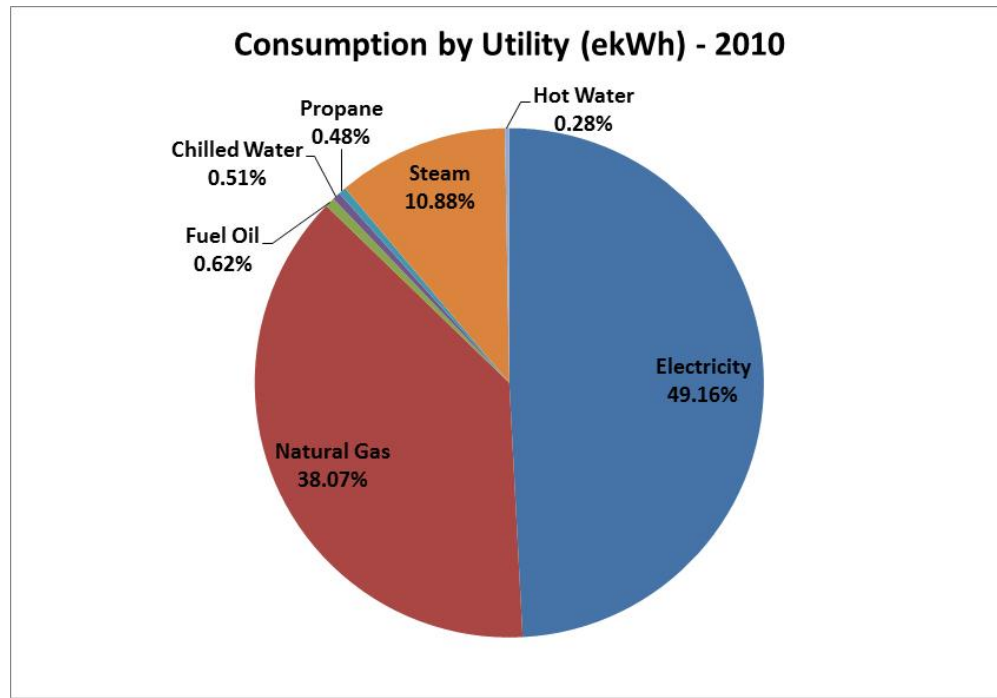
The diagram below (Figure 3-1) illustrates target class building energy consumption, by energy source during the 2006 baseline year. Electricity remains the largest energy type consumed, followed by natural gas and steam. The other energy sources individually represent less than 1% of the total portfolio energy consumption.

Figure 3-1



Comparatively, Figure 3.2 below illustrates the same target class building energy consumption, by energy source during the 2010 reporting year. Electricity remains the largest energy type consumed, followed by natural gas and steam. The other energy sources individually represent less than 1% of the total portfolio energy consumption.

Figure 3-2



Greenhouse 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 GHGs for 25 gallons of fuel oil:

Step 1: Convert to common unit (optional)

The common unit of fuel oil is liters.

25 gallons of fuel oil x 3.78541178 litres/gallon = 94.64 litres

Step 2: Calculate GHG emissions

94.64 litres x 0.002912 t eCO₂/litre = 0.2756 t eCO₂

4.0 PORTFOLIO PERFORMANCE & BENCHMARKING

MOI/IO Target Class Facility Progress Report:
GHG Reporting

Reporting Entity & Utility	Total GHG Emissions 2006 (tonnes eCO ₂)	Total GHG Emissions 2010 (tonnes eCO ₂)	% Change
Electricity	62,447	38,436	-38
Natural Gas	40,062	41,504	4
Fuel Oil	829	944	14
Chilled Water	16	24	56
Propane	640	629	-2
Steam	15,847	15,051	-5
Hot Water	14	18	31
IO Portfolio TOTAL	119,855	96,606	-19

MOI/IO Target Class Facility Progress Report:
Consumption by Utility

IO Portfolio	Total Energy Consumed 2006 (ekWh)	Total Energy Consumed 2010 (ekWh)	% Change
Electricity	326,707,245	293,091,560	-10
Natural Gas	219,065,505	226,950,778	4
Fuel Oil	3,221,390	3,670,299	14
Chilled Water	1,956,641	3,043,114	56
Propane	2,936,024	2,885,824	-2
Steam	68,283,720	64,852,864	-5
Hot Water	1,262,590	1,651,667	31
Total	623,433,115	596,146,106	-4

Identifying performance trends requires reviewing both emissions and consumption related to each fuel type. Overall, IO managed facilities have achieved a 19% total reduction in GHGs between 2006 and 2010. The majority of this reduction was realised through electricity savings and positive changes to its emission factor. Specifically, this rational is summarized as follows:

1. **The government's electricity reduction target:** The Provincial Government set a target for IO to reduce electricity consumption across its managed portfolio by 20% between 2002 and 2012.

During this time MOI has allocated a budget for IO to implement strategies and programs to achieve this target.

2. **Greener electricity grid (coal-fired generation phase-out):** The Provincial Government has been phasing out all of the coal-fired generation in the province. Other forms of low GHG emission generators such as hydro, wind, nuclear, etc. have made up the difference. The lower emission factor is applied to IO's electricity consumption. The other fuel types have a relatively stable emission factor as compared to electricity.

Consumption for fuel types (other than electricity) remained relatively consistent over the 2006-10 reporting period. Fuel types, such as natural gas, are targeted in IO's long-term strategy (for example, HVAC improvements, and Building Automation System upgrades).

5.0 ENERGY REDUCTION STRATEGIES

The strategies discussed in this summary are derived from IO's Energy Master Plan (EMP). Created in 2010, the EMP establishes IO's short and long-term energy objectives over a 10 year strategy. These areas include:

- Goals & Targets
- Energy Efficiency
- Procurement
- Renewable Energy
- Awareness Programs
- Data Management
- Measurement & Verification
- Reporting

These programs, standards, and policies are delivered through the help of IO's service provider, CB Richard Ellis (CBRE). CBRE is an integral partner with IO in order to implement these strategies across the portfolio.

ENERGY CONSERVATION STRATEGY HIGHLIGHTS

Capital Focused Strategies:

Capital improvement projects and programs across the IO managed portfolio are implemented through IO's Capital Infrastructure Plan. This includes:

- **Capital Repair:** A 10-year replacement plan for capital reaching its end of useful life;
- **Greening:** A three-year plan to ensure long-term environmental sustainability of MOI-owned assets, including addressing climate change issues;
- **Renewable Energy:** A three-year plan to showcase renewable energy activities and show commitment to the Green Energy Act on MOI-owned property.

Capital projects can be a challenge within MOI's aging infrastructure portfolio. Many of the buildings will have old HVAC technology and poor thermal envelopes. Applying modern technology standards to these facilities will greatly improve performance.

Examples of technology items that remain an ongoing focus include:

- Reducing heating loop temperature requirements and installing condensing boilers;
- Installing part-load efficient chillers (variable frequency drives, modular, magnetic bearing, CO₂);
- Recovering heat from chillers (heat recovery chiller) and data centers;
- Using heat pumps for heat recovery from exhaust streams where appropriate;
- Using advanced lighting options;
 - Eg. Daylighting, Dimming, Occupancy Sensors;
- VFD on main HVAC fans, pumps and cooling towers; and
- Modernizing or adding sensors & controls.
- Minimizing unnecessary outdoor air; and
- Minimizing reheat / re-cooling.

Program Focused Strategies:

During the 2010/11 fiscal year, IO began implementing its EMP, with the following principal goals:

- To establish and support the management processes required to achieve IO's energy reduction targets, and to help the Government of Ontario reduce greenhouse gas emissions from its operations.
- To set and describe data collection, management, and reporting processes for energy to enable IO to meet new requirements under the *Green Energy Act* and associated directives.
- To provide an energy management framework for managing its property and land management services (PLMS), provided by CBRE in accordance with the Master Services Agreement.

By virtue of the EMP, IO identified and developed both short and long term energy conservation initiatives.

Short Term Energy Action Plan (2010-12):

Strategy	Actions to-date
• Target high energy consuming buildings (20% of portfolio consumes 80% of total energy), and buildings with increased consumption over last year	• Benchmark portfolio energy performance to identify and target high consumers for a short-term action plan.
• Regional Asset Management engagement - Presentation of energy action plan and milestones to IO regions • Training communications, awareness programs, collaborating and communicating best practices, successes and challenges	• Energy action plan presented • Monthly IO portfolio meetings with asset /area managers and service providers to discuss fine-tuning achievements, implementation of energy conservation measures

Complete portfolio meter mapping	- Determination of utility meters servicing multi building sites - Appropriate utility allocation across these sites
Fully commission and provide access to existing utility sub-metering system to asset/area managers and service providers	Identification of metering issues (software and connectivity issues).
- Perform BAS maintenance using service contractor. - Apply customized fine-tuning settings on Mechanical & Electrical building systems	- Building prioritized and targeted for fine tuning - Retro commissioning program established - A checklist for building systems fine tuning has been prepared and a building automation maintenance program has been designed and implemented
Implement operational low-cost / no-cost Energy Conservation Measures (ECMs) identified within energy audits and re/retro-commissioning projects	- Energy auditing program continues on high opportunity facilities and identified potential ECMs. - ECMs continue to be implemented through energy capital program
Develop and deploy building equipment performance standards	IO has developed minimum high performance energy standards for all ongoing capital investment
New Construction Performance Standards	IO delivers new construction projects on behalf of OPS to a minimum LEED certified.

Long Term Energy Action Plan (2012-ongoing):

IO's long term energy action plan focuses around its *Smart Green Portfolio initiative* (Enhanced Building Automation Systems). IO is organizing and initiating the program, along with supportive projects to integrate all existing Building Automation Systems (BAS) to be connected to the internet via a common communication protocol. All of the BAS systems within the managed portfolio would then be accessible from a centralized control location where trained operators can consistently monitor for exceptions or problems, notify operators of issues, and also implement control sequences tuned to balance function, comfort, and energy.

Smart design will:

- Reduce O&M costs;
- Support government initiatives and targets;
- Improve building efficiency (lower energy costs);
- Enhance the performance of all the buildings;
- Improve the operational performance over its life-cycle.

Stakeholder Engagement Strategies:

The participation of various stakeholders will be crucial to the realization of IO's energy efficiency goals. By positively influencing behaviours and practices, the Ontario Public Service will collectively achieve further energy savings and contribute towards achieving GHG reduction goals.

The principal goals of stakeholder engagement are to:

- Promote awareness of, and responsibility for, energy internally and externally within IO's managed portfolio;
- Increase awareness of IO's energy management programs; and
- Increase energy savings through behavioural changes.

IO is currently, and will continue to be, engaged in a number of stakeholder engagement practices for a variety of initiatives and purposes. The following outlines many of the current and expanding tools used:

- **Forums & Councils:** This is one of the primary ways in which IO communicates with its customers. The main outlets are the Chief Administrative Officer Forum and the Greening Government Task Force. These forums all hold regular meetings in which IO participates.
- **Posters & Newsletters:** Usage of signs, newsletters, emails and other forms of building-wide communication with tenants let them know when building changes take place and how they can help save energy. "Lobby News" is a newsletter released quarterly to tenants occupying IO managed property. It remains heavily focused on occupant energy saving strategies, along with updates on energy savings initiatives delivered or planned by IO/CBRE.
- **Events & Awards:** In conjunction with Ontario Public Services (OPS), IO continues to introduce and participate in energy awareness campaigns involving the managed portfolio and the tenants within; including Earth Hour and WWF National Sweater Day.
- **Building User Committees:** The Building User Committee (BUC) includes Operators, Facility Managers, and tenant representatives at a given facility. Quarterly meetings allow discussion around goal setting and solutions that balance technical strategies with the needs of people within the building. BUCs can assist by:
 - Identifying environmental goals and targets for the building;
 - Developing a building specific action plan;
 - Implementing environmentally beneficial measures;
 - Understanding, supporting, and implement building operating practices.

6.0 ONTARIO FACILITIES ENERGY CONSUMPTION DIRECTIVE – ENTERPRISE-WIDE SUMMARY 2006-2010

OVERVIEW

In the *Green Energy Act, 2009* (GEA), the Government of Ontario committed to ensuring that the government conserves energy and uses energy efficiently in conducting its affairs. In addition, it highlights the Ontario government's role promoting and expanding energy conservation by all Ontarians and in encouraging all Ontarians to use energy efficiently.

To address these commitments, the GEA sets out a number of principles, including:

1. Requiring ministries responsible for government owned facilities to report to the Minister of Infrastructure on energy consumption, greenhouse gas (GHG) emissions and water use associated with the facilities; and
2. Specifying other requirements as the Minister considers appropriate relating to energy and water conservation, energy efficiency, the adoption of renewable energy technologies, and the adoption of technologies and services that promote the efficient use of water and reduce negative impacts on Ontario's water resources.

Greenhouse Gas Emission Reporting

On January 1, 2013 the Ontario Facilities Energy Consumption Directive came into effect to outline reporting requirements on GHG emissions. The directive will illustrate how the government's energy consumption is tracking against its GHG targets (19% reduction by end of 2014 and 27% reduction by end of 2020 over 2006 baseline).

The requirements of the Directive demonstrate the following fundamental principles:

- 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.

7.0 Enterprise Progress 2010 Report - GHG Emissions

Reporting Entity	2006 Yearly GHG Emissions Tonnes	2010 Yearly GHG Emissions Tonnes	% Change in Emissions
MOI/IO owned - IO managed	119,854	96,607	(19)
MOI/IO owned - AFP	0	2,789	-
MCSCS - Jails	34,513	30,614	(11)
MCYS	5,407	5,807	7
MNR	4,048	3,073	(24)
MTO	302	307	2
EDU	9,477	8,699	(8)
Total	173,601	147,896	(15)

With the above reported dataset, the Enterprise-wide 2010 GHG emission reductions are 15% against the 19% 2014 target.

8.0 ROLES AND RESPONSIBILITIES

Most government operations are accommodated in facilities which are comprised of land, parking areas, landscaping, structures and buildings. For the purpose of the Directive, all energy consumption utilized at a facility will be allocated to buildings with the exception of provincial parks which will be tracked at the facility (or park) level. This will be reported on an annual basis.

A rolling five year Energy Consumption and GHG Emissions Report will be required from IO and each custodial ministry related to the government-owned facilities over which they have direct operational control.

Infrastructure Ontario

IO manages the majority of the province's portfolio on behalf of MOI. IO is a crown agency that oversees the day-to-day operations of the real-estate portfolio and implements Ministry policies for buildings, lands, and leases.

IO has three separate responsibilities outlined within the Directive:

- Reporting emissions publicly for MOI-owned facilities, this includes:
 - IO-Managed
 - Alternative Financing Procurement (AFP)
- Reporting on OPS Enterprise-wide status
- A 5-year energy conservation strategy

Infrastructure Ontario – Alternative Financing Procurement (AFP)

The AFP model brings together private and public sector expertise in a unique structure that transfers the risk of project cost increases and scheduling delays typically associated with traditional project delivery.

For the Directive, AFP sites are required to report their GHG emissions; however, IO does not have direct operational control of the facilities (managed by private service providers). The reporting result is a separate line item to track IO's AFP sector progress.

Custodial Ministries

Custodial ministries include those ministries that have day-to-day operational control over facilities in the portfolio. These ministries include:

Ministry of Transportation (MTO),
Ministry of Education (EDU),
Ministry of Child and Youth Services (MCYS),
Ministry of Community Safety and Correctional Services (MCSCS), and
The Ministry of Natural Resources (MNR).

Custodial Ministries have two primary responsibilities outlined within the Directive:

- Reporting emissions publicly for facilities managed on a day-to-day basis
- A 5-year energy conservation strategy (for each Custodial Ministry)

9.0 METHODOLOGY

World Resource Institute Protocol (WRI)

WRI is an international protocol for GHG accounting. IO will follow this accounting standard in its reporting of the enterprise GHG baseline. Examples of applied principles outlined within the WRI protocol include: tracking inventories, buying, selling, demolishing, and adding buildings.

Target Class vs. Non-Target Class Facilities

MOI/IO, with input from ministries, defined which buildings would be reported on.

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. This accounts for 96% of the total energy consumed by government-owned facilities.

Non-Target Class Facilities include leased and other government-owned facilities. These are facilities where the government does not have direct operational control of the facility or it may be difficult to conserve energy due to safety considerations or programmatic impacts and constraints. Although energy and water consumption associated with these facilities/buildings are not required to be reported, ministries are encouraged to include any success stories associated with conservation efforts at Non-Target Class facilities through annual reporting cycles, where appropriate. This accounts for only 4% of government-owned facilities.

Custodial Target Class Facilities		Custodial Non-Target Class Facilities	
MTO	Truck Inspection Stations	MTO	Patrol Yards, Remote Airports, Street Lights
MNR	Parks	MNR	Fish Hatcheries, Ranger Camps, Forward Fire Stations
EDU	Provincial Schools	EDU	none- all facilities are included
MCSCS	Adult Detention Centres	MCSCS	none- all facilities are included
MCYS	Youth Detention Centres	MCYS	none- all facilities are included
MOI	Offices, Courts, OPP Detachments, Data Centres	MOI	Communication Towers, Exhibits, Storage

Data Reporting Purpose

Preparation of Energy Consumption and GHG Emissions Plans will help articulate the government's energy and water conservation progress. Publication of the reports will provide a model and benchmark for the broader public sector. Reports also facilitate sharing of best practices and continuous improvement. Reports will include energy and water consumption in government-owned facilities, proposed measures to increase conservation efforts and progress since the previous Report.

The ministries that are impacted by the Directive are ministries that have direct operational control over government owned facilities.

Data Set: Notes & Comments per Ministry for 2006 – 2010 Reporting Period

MCSCS: 29 sites reported. Estimated data is used for eight energy accounts (which have incomplete electricity or natural gas data between 2006-2009. IO has a planned project scheduled in 2013-2014 to retrieve and populate actual data.

MCYS: 12 sites reported. 4 sites have come into operation after the 2006 Baseline year. 5 sites are agency operated.

EDU: 4 sites reported. Jules Leger Centre is included in IO-Managed data set.

MNR: 67 parks reported. Aggregated and reported on at a site level. Majority of reported data is from electricity consumption.

MTO: 34 sites reported.

IO - AFP: 2 sites reported. IO does not have operational control of these buildings, but maintains a responsibility to report on them.

- AFP sites are not required to report emissions on its hospitals.
- For the 2006 - 2010 report, two AFP sites have come online since 2009, the Durham Courthouse and Guelph Data Centre.
- AFP sites will register zero consumption for the 2006 Baseline year and will only add to the Enterprise-wide emission inventories as more sites are added (regardless of how energy efficient). Another four AFP sites are scheduled online in 2013.

IO-Managed: 96% of IO's fully managed building consumption is reported. This represents just over 450 buildings which range from large laboratories to small office buildings. All IO data post-2009 are tracked and supported by CB Richard Ellis (CBRE). CBRE is IO's property, management, and land service provider. Among CBRE's responsibilities include capturing and tracking inventories which directly supports IO's GHG reporting requirements.