



Appendix E

How We Estimated the Government's Scope 1, 2 and 3 Emissions in Chapter 7

Contents

E1	Scope 1, 2 and 3 Emissions	2
E2	Emissions from Energy Use	2
E3	Emissions from Anaesthetic Gas Use	3
E4	Embodied emissions from infrastructure construction	3
E5	Emissions from employee commuting	4
E6	Data Missing from the ECO's Estimate	4
E7	Uncertainty	5



E1 Scope 1, 2 and 3 Emissions

As described in Chapter 7, governments and other organizations/institutions tend to categorize their greenhouse gas (GHG) emissions into Scope 1, 2 and 3 emissions. Scope 1 emissions are under the direct control of a reporting organization. In contrast, Scope 2 and 3 emissions are indirect, with the former depicting the emissions from producing the energy consumed by the organization, and the latter representing other indirect emissions that are caused by the activities of the organization.

E2 Emissions from energy use

To produce our estimate of the GHG emissions from the Ontario Public Service (OPS) and Broader Public Sector (BPS), the ECO began with the Scope 1 and 2 emission estimates from 2014 that were compiled by the Treasury Board Secretariat for the OPS (including emissions from facilities, vehicle use and air travel). We also used the most recent data (2014) collected from BPS facilities via O.Reg. 397/11 to include the GHG emissions from BPS electricity and fuel use.¹

Unfortunately, BPS data on GHG emissions exclude those from air travel and vehicle fuel use. In order

to incorporate these emissions in the footprint, the ECO produced estimates by assuming BPS and OPS employees have similar travel patterns. There are approximately 65,000 full-time equivalent public servants employed by the OPS,² whereas BPS employees number about 727,000.³ These GHG estimates, which are based on an extrapolation of OPS emissions data, are highly uncertain.

The reported 2014 data on GHG emissions from OPS owned facilities does not distinguish between those from fossil fuel combustion (Scope 1) and electricity use (Scope 2). Therefore, the ECO assumed the percentage breakdown of Ministry of Infrastructure facility emissions that originate from fossil fuel combustion (83%), and electricity use (17%), are the same as those for all OPS owned facilities.⁴

The reported data on OPS and BPS owned facilities excludes emissions from leased facilities. Unlike the reported OPS and BPS owned facility emissions, which are Scope 1, the emissions from the leased buildings are categorized as Scope 3. The ECO estimated that leased floor space makes up 15% of total floor space used by the OPS and BPS.⁵ We assumed the energy use/emission profiles for both owned and leased facilities are similar.



E3 Emissions from anaesthetic gas use

The venting of anaesthetic gases from health care facilities is a Scope 1 emission of the BPS.⁶ Out of the several types of inhaled anaesthetics in use, only nitrous oxide (N₂O) anaesthetic gas emissions are reported in Canada's National Inventory Report (NIR). These emission estimates are encompassed within the *Other Product Manufacture and Use* emission category of the NIR. Overall Ontario N₂O emissions in this category were 93,000 tonnes of CO₂e (2014 data),⁷ with anaesthetic gases responsible for 82% of this figure – approximately 76,260 t CO₂e.⁸ Although inhaled anaesthetic gases are also used in institutions outside the BPS, such as dental clinics and veterinaries, the majority of these gases are likely used in BPS establishments.

The ECO recently undertook research to estimate the climate impact of the anaesthetic gas used in Ontario. We asked suppliers and distributors of anaesthetic gas for the amounts supplied in the province in 2016. Unfortunately, the ECO did not receive enough replies to ensure a representative estimate. Therefore, we have based our 116,000 kt CO₂e estimate on the following assumptions:

- There is a 25% capture rate of anaesthetic gases other than N₂O in Ontario;⁹
- The mean climate impact of anaesthetic gas per use is 176 kg CO₂e;¹⁰
- The percentage of general anaesthetics used in Ontario that consists of inhaled anaesthetic gas is the same as in the United States - 79%;¹¹
- The annual number of surgeries in Ontario¹² is the same as the annual number of uses of anaesthetics.

E4 Embodied emissions from infrastructure construction

The embodied emissions from infrastructure construction (e.g., the production of concrete and steel), are considered Scope 3 emissions. These emissions are not yet reported, even though the Government of Ontario (OPS and BPS) is responsible for about 15% of construction spending in the province. The ECO's estimate of Scope 3 emissions from the OPS and BPS constructed assets (owned or leased) is based on the following data:

- NIR data (2014) for Ontario on the GHG emissions from the light construction, cement, and iron and steel economic subsectors;¹³
- Global percentage of steel used for construction;¹⁴
- Financial data from Statistics Canada on the amount spent on construction in Ontario in 2014 (\$74.223 billion);¹⁵ and
- OPS spending data (2014/2015) on construction (\$1.571 billion), as well as provincial government spending (2014/2015) on infrastructure (\$11.156 billion), which includes the OPS spending.¹⁶

Our estimate of the embodied emissions from provincial infrastructure construction makes the following assumptions:

- It is represented by the *light construction, cement, and iron and steel* economic subsectors in Ontario;
- Production in these economic subsectors are primarily for consumption in the province;
- The fraction of Ontario iron and steel production for construction is approximately the same as the fraction of global production;



- Construction emissions are approximately proportional to construction spending; and
- Waste management emissions are relatively minor.

Using these data and assumptions, the ECO estimates that the Ontario government's infrastructure construction is responsible for 2.2 million t CO₂e. These emissions make up approximately 1% of Ontario's GHG emissions. The construction associated with the BPS is responsible for most of these emissions (about 86%, based on the proportion of infrastructure funding allocated to the BPS).

E5 Emissions from employee commuting

The ECO's estimate of the Scope 3 emissions from OPS and BPS employee commuting energy use is based on the following data:

- The number of full-time equivalent public servants employed by the OPS – approximately 65,000;¹⁷ and the BPS – approximately 727,000;¹⁸
- Statistics Canada data from the 2011 National Household Survey on the transport mode breakdown of employed Canadians in Ontario census metropolitan areas (CMAs) who commute to work;¹⁹
- Statistics Canada data on the median commuting distance of employed Canadians who travel to work in CMAs in Ontario;²⁰
- Statistics Canada population data on Ontario's CMAs,²¹ which is required to produce a weighted average of the median commuting distances and transport mode breakdown; and
- Natural Resources Canada data on the GHG emissions from various modes of transportation.²²

In the estimate of employee commuting emissions, the ECO made the following assumptions:

- The number of employees who work from home is negligible;
- The commuting modes of Ontario government employees are the same as for the average commuter in Ontario CMAs;
- The median commuting distance of Ontario government employees is the same as for the average commuter in Ontario CMAs; and
- The average employee has six weeks away from work (vacation plus designated holidays).

E6 Data missing from the ECO's estimate

The following information is missing from both the OPS and BPS estimates:

- embodied emissions of procured products, other than infrastructure construction;
- emissions associated with employee travel for business purposes that are either by non-air modes (i.e., taxis, buses, trains and car rentals) or using transport vehicles owned outside of the OPS and BPS;
- upstream emissions associated with internet use and server storage (where the servers and associated infrastructure are not owned by the government); and
- upstream fuel use emissions.

The embodied emissions of procured products may be considerable, especially those from the waste management stage (e.g., methane production from landfilled material). Paper consumption, which is approximately 60 kg of office paper/OPS employee/yr,²³ and computer use (see Chapter 7) may also be responsible for substantial emissions.



E7 Uncertainty

The unreported GHG emission estimates are based on average/median practices (e.g., median commuting practices, average construction practices). Understandably, there is a high degree of uncertainty associated with the unreported GHG estimates for the OPS and BPS. There is uncertainty associated with the assumptions and missing data detailed above.

What can be done to improve the representativeness of the estimates of Scope 1, 2 and 3 emissions (other than the collection of the previously identified missing information)? Here are some important techniques:

- ensure that the embodied emissions of all infrastructure procurement are measured/estimated;
- estimate the embodied emissions of goods and services with the potential to be significant contributors to the GHG footprints of the OPS/BPS (i.e., products which are GHG intensive and/or procured in large quantities, such as office paper);
- collect and consolidate data on the GHG emissions from BPS vehicle fleets;
- undertake a survey of OPS and BPS employees to find out the mean distance of their daily commute, and the modes of transport that they use; and
- undertake a survey of all Ontario hospitals to find out how much of each volatile anaesthetic gas is vented annually.



Endnotes

1. Ontario Regulation 397/11 requires public agencies to report annual energy consumption and greenhouse gas emissions for their operations. The data from municipal buildings and infrastructure was excluded from the ECO's estimate because municipalities are not considered a component of the BPS.
2. "OPS Workforce Demographics", online: Government of Ontario <<https://www.ontario.ca/data/ops-workforce-demographics>> [Accessed August 14, 2017]
3. Ontario Ministry of Finance, *Commission on the Reform of Ontario's Public Services. Report* (Toronto, Ontario Ministry of Finance, 2012) at 363.
4. "2015 Energy consumption and greenhouse gas emission report", online: Government of Ontario <https://www.ontario.ca/page/2015-energy-consumption-and-greenhouse-gas-emission-report>. [Accessed October 18, 2017]
5. Environmental Commissioner of Ontario, *Building Momentum. Results. Annual Energy Conservation Progress Report – 2012, vol 2* (Toronto, ECO, 2013) at 30.
6. Anaesthetic gas use in dental clinics and veterinaries would be an exception, as these institutions are not considered components of the BPS.
7. Environment and Climate Change Canada, *National Inventory Report 1990-2014: Greenhouse Gas Sources and Sinks in Canada*. Part 3 (Ottawa: ECCC, 2017) at 56. The report claims that 93 kt CO₂e of N₂O are emitted in Ontario from the "other product manufacture and use" category.
8. Environment and Climate Change Canada, *National Inventory Report 1990-2014: Greenhouse Gas Sources and Sinks in Canada*. Part 1 (Ottawa: ECCC, 2016) at 117.
9. "News, Articles and Information. Blue-Zone Technologies Ltd. News. December 07, 2016. Canadian Patent Awarded for MedTech Research and Development", online: Deltasorb Anesthetic Collection Service <<http://www.blue-zone.ca/news>>. [Accessed August 14, 2017]
10. Jodi D. Sherman *et al.* "Estimate of Carbon Dioxide Equivalents of Inhaled Anesthetics in the United States" (2014) American Society of Anesthesiologists Abstract.
11. *Ibid.*
12. The annual number of surgeries per year in Ontario (948,000) is estimated using data on the number of surgeries per 100,000 in Canada in 2012 (6778 surgeries per 100,000) ("Number of surgical procedures (per 100,000 population). The Lancet Commission on Global Surgery", online: The World Bank <http://data.worldbank.org/indicator/SH.SGR.PROC.P5?end=2012&locations=CA-US&name_desc=false&start=2012&view=chart>. [Accessed August 14, 2017]), and Ontario 2016 population data ("Population by year, by province and territory (Number)", online: Statistics Canada <<http://www.statcan.gc.ca/tables-tableaux/sum-som/l01/cst01/demo02a-eng.htm>>. [Accessed August 14, 2017])
13. Environment and Climate Change Canada, *National Inventory Report 1990-2015: Greenhouse Gas Sources and Sinks in Canada*. Part 3 (Ottawa: ECCC, 2017) at 82.
14. Globally, about 56% of steel is used for construction (Julian M. Allwood & Jonathan M. Cullen, "Sustainable materials with both eyes open." Cambridge, England: UIT Cambridge Ltd., 2012) at 31). The ECO's GHG estimate also assumes that only 56% of the emissions from this sector are associated with construction.
15. Use of 2014 statistics ("Capital expenditures for construction by sector, by province and territory (Ontario)", online: Statistics Canada <<http://www.statcan.gc.ca/tables-tableaux/sum-som/l01/cst01/busi01g-eng.htm>>. [Accessed October 6, 2017]
16. Ministry of Infrastructure, *BUILD ON 2017 Infrastructure Update* (Toronto: MOI, 2017) at 12.
17. "OPS Workforce Demographics", online: Government of Ontario <<https://www.ontario.ca/data/ops-workforce-demographics>> [Accessed August 14, 2017]
18. Ontario Ministry of Finance, *Commission on the Reform of Ontario's Public Services. Report* (Toronto, Ontario Ministry of Finance, 2012) at 363.
19. Statistics Canada. *Commuting to Work*, Catalogue no. 99-012-2011003, National Household Survey (NHS), 2011 (Ottawa: Minister of Industry, 2013) at 4-5.
20. The most recent Statistics Canada data on commuting distances is from 2006. The National Household Survey Report no longer addresses the median commuting distance but the duration of the commute. The 2006 data addressed the median commuting distances of Ontario workers in 15 census metropolitan areas (CMAs) in Ontario (<http://www12.statcan.gc.ca/census-recensement/2006/as-sa/97-561/table/t10-eng.cfm>). The ECO extrapolated the change in median commuting distances from 2001 to 2006 to provide an estimate of these distances in each of the 15 Ontario CMAs in 2016. The ECO multiplied these 2016 commuting distance estimates by the relative weight of each CMA in terms of their 2016 population sizes (available at: <http://www.statcan.gc.ca/tables-tableaux/sum-som/l01/cst01/demo05a-eng.htm>).
21. Statistics Canada, *Population of census metropolitan areas*, Table 051-0056 (Ottawa, Statistics Canada, 2017).
22. "Transportation Sector. Ontario. Table 8: GHG Emissions by Transportation (2007-2014 data)", online: Natural Resources Canada <<http://oeenrncan.gc.ca/corporate/statistics/neud/dpa/showTable.cfm?type=CP§or=tran&juris=on&rn=8&page=0>>. [Accessed August 14, 2017]
23. Data on office paper recycling in 2015/2016 was provided to the ECO from the MOECC. The MOECC claims that over 4 million kg of office paper was recycled. Based on this claim, the ECO has assumed that four million kg of office paper are consumed by the OPS annually.