

**Guidance
Document**

Personal Transportation GHG Calculator

Version 2: August 2009



Guidance Document for Manitoba Green Registry: Personal Transportation GHG Calculator

IMPORTANCE OF THIS CALCULATOR	2
SCOPE OF ACTIVITY AND EMISSIONS	3
REQUIRED USER INPUTS	3
UNDERLYING METHOD AND DATA SOURCES	3
ESTIMATING ACTIVITY	4
ESTIMATING GHG EMISSIONS	4
USING THE CALCULATOR	5
APPENDIX A. EMISSION FACTORS FOR PERSONAL TRANSPORTATION	6

Importance of this Calculator

The personal transportation required for day-to-day activities such as; commuting to work or school, going shopping, and other trips of a personal nature, can accounts for a significant component of the individual Canadian’s greenhouse gas (GHG) emissions or carbon footprint. In fact, personal transportation may account for upwards of half of an individual’s GHG emissions. Changing personal transportation habits can lead to a real and meaningful reduction in GHG emissions.

The **Manitoba Personal Transportation GHG Calculator** allows individuals to estimate the GHG emissions resulting from their personal transportation decisions. The tool uses the online form found at www.greenregistry.org to collect information about the user’s personal transportation over the course of a calendar year and calculate the related GHG emissions using relevant GHG emission factors. These results can be interpreted to help the user understand the options for reducing GHG emissions from their transportation activities.

Scope of Activity and Emissions

The calculator includes the GHG emissions associated with all personal trips that might take place over one year. It is important to note that the **Manitoba Personal Transportation GHG Calculator** does not include vacation travel as these are unique special events. A separate **Manitoba Vacation Travel GHG Calculator** is also available for vacation travel.

Three different modes of transportation are included in the calculator, namely; personal passenger vehicle (i.e., car or light truck), and two types of public transportation, bus and rail. Carbon dioxide (CO₂), methane (CH₄), and nitrous oxide (N₂O) are the three types of GHG emissions from the combustion of fossil fuels used to power these vehicles and are all included in this calculator. In order to present a single metric for GHG emissions from personal transportation the three types of GHGs are normalized to their carbon dioxide equivalence (CO₂e) and the total GHG emissions of all three gases are presented as CO₂e.

Required User Inputs

The **Manitoba Personal Transportation GHG Calculator** online form has been designed to be as user friendly as possible and allow the user to input the necessary information as easily as possible. There are three different possible sources of GHG emissions considered in the routine travel module, these are; GHG emissions associated with the use of personal passenger vehicles (cars and light trucks), and GHG emissions associated with the use of public transportation by bus or train.

Input 1: The trip length based on distance between departure and arrival locations.

Input 2: The mode of transportation used for the trip. An option is provided to add additional trips if multiple modes are used over the course of the week. The modal types included are the personal passenger vehicle (i.e. car or light truck), commuter bus, or train. The vehicle types considered are all those contained within the Fuel Consumption Ratings Guide published by Natural Resources Canada.

Input 2(a): When the personal passenger vehicle is chosen as the mode, the number of passengers, type of vehicle, model year, engine type and fuel type are required. A list is provided and populated based upon the vehicle types contained in the Fuel Consumption Ratings Guide.

Input 3: The trip frequency.

Input 4: the number of weeks of vacation per year when this routine trip does not occur.

Underlying Method and Data Sources

The **Manitoba Personal Transportation GHG Calculator** involves the multiplication of the activity (passenger kilometres traveled, or PKT) by a GHG emission intensity for that activity (GHG emissions from fuel burned per PKT). Although the overarching approach to calculating the GHG emissions is the same, each mode relies on different analytical steps and data sources.

Estimating Activity

For all forms of personal transportation, the first step is producing an estimate of the passenger kilometres traveled (PKT). This activity is calculated by multiplying the number of weekly trips by the average length of the trip. This is then summed for the year, accounting for time away on vacation. (e.g., if the user indicates three weeks of vacation per year, the number of weekly trips will be multiplied by 49 weeks and the average length of the trip).

Estimating GHG Emissions

The calculator includes GHG emissions from common personal transportation activities. GHG emissions from routine transportation activity are estimated using the following equations and GHG emission factors found in Appendix A.

Equation 1: Estimating GHG emissions from personal transportation activity

$$PT_{\text{Emissions}} = PKT_{\text{VehicleType}} * \text{EmissionIntensity}_{\text{VehicleType}}$$

Where:

PT_{Emissions} = Emissions from use of personal passenger vehicle, train or bus.

PKT_{VehicleType} = Personal kilometres traveled by vehicle type (activity).

EmissionIntensity_{VehicleType} = GHG emission intensity by vehicle type (GHG emission intensity of activity) as found in Appendix A.

For trips using public transit, the GHG emission factors for trains and buses is derived from data available from the transportation tables contained in the Comprehensive Energy Use Database provided by the Office of Energy Efficiency. The estimation of GHG emissions from the personal passenger vehicle is complicated due to the wide-range of cars and trucks that could be involved and the variations in GHG emissions intensity by vehicle type. To accurately reflect the complexities of GHG emissions for personal passenger vehicles, the calculator uses vehicle-specific fuel consumption based upon information contained in the Fuel Consumption Rating Guide produced by Natural Resources Canada in order to produce vehicle specific GHG emission intensities.¹ This requires the user to select the year model and profile of the car they are driving.

Central to the estimation of GHG emissions from personal transportation is the use of GHG emissions intensities provided on a unit of CO₂e per PKT basis. GHG emissions intensities for PKT are especially relevant for modes which carry multiple passengers, such as trains, rail and buses. GHG emissions associated with vehicle movements must be appropriately apportioned to all passengers.

¹ See <http://oee.nrcan.gc.ca/transportation/tools/fuel-consumption-guide/fuel-consumption-guide.cfm>

Using the Calculator

The **Manitoba Personal Transportation GHG Calculator** is extremely flexible and allows users to estimate GHG emissions from their unique transportation patterns. This is an important tool for measuring the contribution personal transportation choices make to an individual's carbon footprint. The Manitoba landscape and economy is such that most people must make frequent and often extended trips in their daily lives. Understanding the GHG emissions arising from the way we get around is a valuable step in understanding and addressing climate change in Manitoba. GHG emissions from personal transportation are a large part of our individual carbon footprint and the Province of Manitoba's overall carbon footprint. With the various transportation options available, this is also an area where significant improvements can be made.

The **Manitoba Personal Transportation Calculator** produces a relatively accurate and precise estimate of GHG emissions from personal transportation due to the accuracy of GHG emissions intensity ratings available from the Government of Canada for the different types of vehicles. This baseline measurement is the starting point for planning how to reduce GHG emissions as the calculator links to incentive programs and recommended actions for reducing transportation-related GHG emissions. Users can select the options that are appealing to them and see the results reflected in a lower carbon footprint over time. Making good transportation decisions is an important aspect of Manitoba's climate change strategy and a way for residents to reduce their carbon footprint while saving money.

Appendix A. Emission Factors for Personal Transportation

Table 1. GHG Emission Factors for Transportation Fuel Use

Primary Fuel	CO ₂ e (tonnes/litre)
Motor gasoline	0.00250
Diesel fuel oil	0.00279
Light fuel oil	0.00274
Heavy fuel oil	0.00314
	CO ₂ e (tonnes/m ³)
Natural gas	0.00189

Source: 2006 National Inventory Report, Environment Canada

Table 2. Fuel Consumption Ratings and Emission Intensity for Typical Personal Vehicles

Type of Vehicle	Fuel consumption (L/100 km)			Emission Intensity CO ₂ e (tonnes/100 km)	
	City	Highway	Blended	Gas	Diesel
Sub-compact (Honda Civic)	8.2	5.7	6.8	0.0001632	0.0001836
Compact (Mazda 3)	9.2	6.7	7.8	0.0001872	0.0002106
Mid-size (Chevrolet Malibu)	12.2	7.8	9.8	0.0002352	0.0002646
Full-size (Ford Crown Victoria)	13.4	8.6	10.8	0.0002592	0.0002916
Station Wagon (Volkswagen Passat Wagon)	12.7	8.3	10.3	0.0002472	0.0002781
Pickup Truck (Dodge Dakota)	14.4	9.8	11.9	0.0002856	0.0003213
Special Purpose (SUV) (Cadillac Escalade)	17.7	10.8	13.9	0.0003336	0.0003753
Minivan (Chrysler Town & Country)	12.2	7.9	9.8	0.0002352	0.0002646
Large Van (GMC Savana)	15.4	11.2	13.1	0.0003144	0.0003537

Source: Natural Resources Canada Vehicle Fuel Efficiency Guide 2009

Table 3. GHG Emission Factors for Public Transit

Mode	Emission Intensity CO ₂ e (tonnes/PKT)
Bus	0.00007137
Train	0.00019020

Source: The Office of Energy Efficiency: Comprehensive Energy Use Database

The OEE provide estimates of GHG emissions and passenger kilometre traveled by urban bus in Canada. Analysis of this data suggests a GHG emission intensity of 71.37 grams (0.07137 kg) of CO₂e per passenger kilometre traveled.