August 2009

Climate Friendly Government of New Brunswick Meetings

A Carbon Calculator

Guidance Documentation

Prepared for the Climate Change Secretariat
Prepared by Canadian Standards Association

Paul Steenhof
Paul.steenhof@csa.ca

Guidance Document for New Brunswick Government Meetings Carbon Calculator

IMPORTANCE OF THIS CALCULATOR 2

SCOPE OF ACTIVITY AND EMISSIONS 3

REQUIRED USER INPUTS 3

GENERAL DATA INPUTS 3
DATA INPUTS ASSOCIATED WITH MEETINGS TRAVEL MODULE 4
DATA INPUTS ASSOCIATED WITH BUILDING MODULE .... **ERROR! BOOKMARK NOT DEFINED.**
DATA INPUTS ASSOCIATED WITH PROCUREMENT AND WASTE MANAGEMENT MODULE .. **ERROR! BOOKMARK NOT DEFINED.**

UNDERLYING METHOD AND DATA SOURCES 4

TRAVEL MODULE 4
Estimating Activity *4*
Estimating Emissions *5*
Air Travel *5*
Personal Vehicle Travel *9*
Bus Travel *10*
Train Travel *10*
BUILDING MODULE 10
PROCUREMENT AND WASTE MANAGEMENT MODULE 14

USING THE CALCULATOR 16

Importance of this Calculator

A government organized meeting can have a large carbon footprint when the greenhouse gas (GHG) emissions from attendee travel, buildings, materials, and waste are considered. There are options that exist, however, to reduce emissions throughout the planning and delivery phases of the meeting. The calculator provides the means for meeting organizers of government meetings to both understand the breadth and scale of emissions resulting from the meetings they organize and the impacts on emissions that could result from taking appropriate action to make the meeting as climate friendly as possible.

The Climate Friendly Meetings Calculator allows meeting organizers to measure the GHG emissions resulting from a range of different meeting-related activities. It does so by analysing information input by the user on the travel required for participants to attend the meeting, the location of the meeting facility, the length of the meeting, and the materials consumed and waste produced. In particular, the Climate Friendly Meetings Calculator calculates the total GHG emissions for any specific event and then provides the user with options for reducing the GHG emissions (in terms of a future meeting) or offsetting GHG emissions from a previously held meeting.

Scope of Activity and Emissions

The Climate Friendly Meetings Calculator includes three different sources of GHG emissions:

a) GHG emissions associated with traveling to the meeting;
b) GHG emissions associated with building energy use (both in terms of the primary fuel used for things like space heating and secondary emissions from electricity)
c) GHG emissions associated with consumption of materials and the disposal or recycling of waste.

Required User Inputs

The GHG emissions estimates produced by the calculator are based on the information entered by the user. In order to be as accessible and transparent as possible, the Climate Friendly Meetings Calculator has been designed to be user friendly with minimal data inputs. There are three basic categories of user inputs required in order to generate estimates of GHG emissions associated with meetings.

General Data Inputs

There are a number of general pieces of information that are required from users of the calculator:

Field 1: the name of the meeting;

Field 2: the location of the meeting;

Field 3 and 4: the date and duration of the meeting.

Field 5: number of meeting attendees.

Field 6: if a delegate package is included

Field 7: if there is space cooling in the facilities used for the meeting

Field 8: if there is composting at the meeting

.

Data Inputs – Travel Module

The travel module includes GHG emissions calculations for four different ways to travel to a meeting: airplane, bus, rail or personal passenger vehicle. Although the overarching approach to calculating these GHG emissions is the same (i.e. multiplication of passenger kilometres traveled by the appropriate emission intensity of this travel), each mode relies on different analytical steps and data sources.

Submitting a spreadsheet summarizing the travel of all meeting attendees

To properly analyze the travel emissions of a meetings' attendees, this user is required to upload a spreadsheet that contains the travel details of each attendee that includes the following parameters: their length of stay at the meeting, their originating address, and their mode of travel ('car', 'bus', 'train', or 'plane'). In the case of plane travel, you must also provide the type of plane ('longhaul, 'large', 'regional', 'turboprop' or 'small') and the seat class ('economy' or 'executive'). A more complete description of these steps is provided in the documentation for this calculator.

A CSV file is available for download which you can use as a template to submit your data on delegate travel.

An example CSV file is also available for download which demonstrates the data from a hypothetical meeting with the following delegate details: 7 attendees in total, 1 traveling by car, 1 by train, 1 by bus, 4 by plane on different planes and plane types.

Underlying Method and Data Sources

The Climate Friendly Meetings Calculator includes estimates of GHG emissions from three different sources associated with the meeting; participant travel, building energy use, and materials consumption and waste disposal.

Travel Module

The travel module includes GHG emissions calculations for four different ways to travel to a meeting: airplane, bus, rail or personal passenger vehicle. Although the overarching approach to calculating these GHG emissions is the same (i.e. multiplication of passenger kilometres traveled by the appropriate emission intensity of this travel), each mode relies on different analytical steps and data sources.

Estimating Activity

For all forms of travel, the first step is determining the number passenger kilometres traveled associated with the meeting. The precise measure of distance traveled depends upon the mode of travel and the geographical location of the attendee's origin and the meeting facility. To determine the distance traveled, the calculator relies on the web-based Google Maps application.[1] This allows the user to enter the address from which their trip started and the address of the meeting and let the mapping application determine the total distance of the trip.

The passenger kilometres traveled (PKT) by airplane is based on the distance between the origin and destination points using the great circle formula (this is the most direct route when accounting for the curvature of the earth). A similar approach is used for rail since no geocoded information is available on the location of railways in Canada.

To generate estimates of PKT for bus and personal vehicle transportation modes, a different functionality of the Google mapping application is used. Rather than relying on the great circle distance, the mapping application traces the road network from origin to destination, selecting the shortest distance along the road network.

Estimating Emissions

Central to the estimation of the GHG emissions associated with meeting travel are the use of GHG emissions intensities (i.e. the amount of carbon dioxide equivalency (CO_2e) per PKT). GHG emissions intensities for PKT are especially relevant for modes which carry multiple passengers, such as airplanes, trains, and buses. Otherwise, GHG emissions associated with vehicle movements would be allocated to one passenger, whereas they should be distributed proportionally across all passengers. The process to generate PKT emission intensities differs for each mode and draws upon a range of data sources and methodologies.

Air Travel

The GHG emissions resulting from a trip by airplane are a function of both distance traveled and the GHG emission intensity of the specific trip. The GHG emission intensity of a specific trip, in turn, is a function of a number of factors which in some cases are known and in some cases must be assumed, including:

1. Trip length:

    The length of a flight dictates the type and size of the aircraft used and the total amount of fuel used in the flight. In particular, since more fuel is required to lift an airplane to 3,000 feet (termed the landing and take-off cycle, or LTO) than is required during the 'cruise' phase of the flight, shorter trips will be more GHG emission intensive when measured on a flight or a passenger kilometre traveled (PKT) basis. The length of a trip can be determined based on the origin and destination of a trip and using the great circle formula to determine the distance between these points. This assumes that an aircraft flies directly between these two airports. A correction

[1] http://maps.google.com/

factor is applied to account for things like circling, adjustments of flight routes, headwinds, etc. This correction factor is dependent on flight length, as summarized:

Table 1 Flight correction factors

Flight Distance	Correction to Flight Distance
Less than 50 km	+ 50 km
Between 550 km and 5500 km	+ 100 km
Above 5500 km	+ 125 km

2. Aircraft type and size:

   It is also important to note that there are large variations in the fuel burn rates (FBRs) and the subsequent GHG emission intensities within the different categories of aircraft. For example, for flights above 1,600 km, the aircraft used might be a Boeing 767 300 series, an Airbus 343, or a Boeing 767 299 series, all of which have different seat configurations and technical efficiencies. In order to provide a suitable metric for the Climate Friendly Meetings Travel Module, a representative sample of aircraft within each distance range has been taken in order to generate an average FBR and GHG emissions intensities based on a series of distance categories.

3. Airplane engine type:

   While jet engines are still dominant for most continental and intercontinental flights, turbo prop engines are now rising in use with the emergence of such air carriers as Porter Airlines and passenger preference for the higher energy efficiencies associated with turbo prop engines (industry literature suggests that for similar size airplane, turbo prop engines can be between 30% and 40% more efficient than aircraft powered by jet engines). The type of the airplane engine specific to the flight taken (jet engine versus turbo prop engine) is determined by the user of the calculator.

4. Airplane age:

   Due to technological improvements, change in materials, improvements in aerodynamics, amongst other factors, and a drive to become more cost efficient and competitive, there are continuous improvements in the efficiency of newer airplanes. The effects of aircraft age on emissions are reflected by the FCR used in estimating these (i.e. this is not a required user input).

5. Proportion of passengers to freight

   The proportion of passengers to freight on any given flight will influence the emission intensity of passenger travel. If passengers are carried on a flight, then all the emissions generated by the movement of the aircraft is distributed to the passengers. However, in the freight is also moved, in order to be accurate, the emissions associated with the freight must be allocated proportionally based on the weight of this freight. In Canada, as is the case in other countries, it is generally the wide bodied aircraft that carry the most freight as a proportion of total weight of the passenger/freight load. The allocation of emissions to passengers and freight is made according to statistics available from ICAO where it is assumed that wide bodied aircraft (used for long haul) may have freight contributing to upwards of 20% of their total load, and narrow bodied aircraft having freight contribute less than 5% to total load.

6. Class of seat:

   Each class of seat on an aircraft is responsible for a certain amount of emissions based on the “foot print” of that seat – i.e., how much space is taken up. Namely, since seats in first/executive/business class can require up to twice the space of those in economy class, these seats account for more GHG emissions on a per passenger basis.

7. Seat configuration of aircraft:

   The configuration of seats on an airplane will have important implications for the GHG emissions intensity of air travel. In particular, the more passengers on an airplane, the lower the GHG emissions intensity on a per passenger basis. Since flights with business class seats can carry fewer passengers than a flight with only economy class seating, the average GHG emission intensity of each seat on that flight would be higher than compared to a plane with all economy seating.

8. Airplane occupancy:

   The occupancy of a flight has an inverse relationship with the emission intensity of air travel since the more seats that are occupied on an airplane, the lower the average GHG emissions intensity of that flight per passenger. The same holds true in terms of fuel consumption, and is why airline companies continuously try to increase occupancy rates by strategic flight scheduling, etc. Aircraft occupancies have been steadily rising in Canada over the last number of years, and recent estimates are that occupancies are over 80% on most domestic flights. Nonetheless, to be conservative, a value of 75% for all flights is used in this calculator.

In order to simplify the complexities associated with estimating GHG emissions resulting from air travel, flights are categorized by those greater than 1,600 km, those equal to or less than 1,600 km, and those less than 500 km in line. Flights equal to or below 1,600 km are further broken down by flights on large planes with both executive and economy seat classes, flights on large planes but with only economy class, flights on smaller regional aircraft with jet engines (e.g. the CRJ), and flights on regional aircraft with turbo prop engines. Aircraft used for short haul flights are assumed to have emission characteristics reflective of such aircraft as the Dash 8.

The parameters that characterize these different categories, and in turn, influence the emission intensity of each are summarized in table 2.

Table 2 Parameters affecting the emissions associated with air travel, by trip[length and type of aircraft

Flight distance (km)	Example of aircraft type	FBR (kg/km)[a]	Number of seats[b]		Footprint of seat (pitch * height) ($inches^2$)[b]	
			Economy	*Executive*	*Economy*	*Executive*
> 1,600	Boeing 767 300 series	5.26	173	30	605	1 230
<1,600 and >500	Airbus 320	3.36	120	20	544	777
<1,600 and >500	Boeing 737 300 series (only economy class)	3.01	137		544	
<1,600 and >500	Canadian regional jet	1.67	50-70		544	
<1,600 and >500	Regional turbo prop aircraft[c]	1.02	50-70		544	
<=500	Dash 8	0.49	37		544	

Table notes:

a) Fuel burn rates are for the cruise cycle, and are from the EMEP/CORINAIR Emission Inventory Guidebook (EIG)
b) The number and size of seats on each type of aircraft is taken from www.seatguru.com.
c) For regional turbo prop aircraft, industry data indicated that these aircraft are 30%-40% more fuel efficient than comparable regional jets (http://www.q400.com/q400/en/turbo.jsp).

The resulting GHG emission intensities for passenger travel on flights are shown in table 3.

Table 3 Emission intensities for air travel used in the air travel calculator

Flight distance (km)	Configuration	Cruise emission intensity* (kg CO2/PKT)		LTO emission intensity* (kg CO2/seat)		Passenger to freight ration (%)	Passenger emission intensity (kg CO2/PKT)	
		Economy	*Executive*	*Economy*	*Executive*	*All*	**Economy**	**Executive**
> 1,600	Economy and executive	0.10	0.18	28.82	54.74	80.00%	**0.16**	**0.29**
<=1,600	Large aircraft: economy and executive	0.09	0.14	23.98	34.17	85.00%	**0.15**	**0.21**
<=1,600	Large aircraft: Only economy class	0.14		25.55		95.00%	**0.18**	
<=1,600	Small regional jet (e.g. CRJ-2)	0.21		17.52		95.00%	**0.25**	
<=1,600	Turbo prop (e.g. NexGen Q400)	0.13		10.73		97.00%	**0.15**	
Under 500 km	Smallest regional jet (e.g 30 seater Dash 8)	0.10		12.51		100.00%	**0.13**	

Personal Vehicle Travel

The estimation of GHG emissions from users who choose to take a personal passenger vehicle is also complex due to the wide-range of cars and trucks that could be involved and the variations in GHG emissions intensity by vehicle type. For example, to accurately reflect the complexities of GHG emissions for personal passenger vehicles, the Climate Friendly Meetings Calculator includes information on vehicle-specific fuel consumption based upon information contained in the Fuel Consumption Rating Guide produced by Natural Resources Canada[2]. This requires the user to select the model and profile of the car they are driving in order to calculate an accurate estimation of GHG emissions. However, similar for air travel, a simplified methodology is used for this calculator.

The Office of Energy Efficiency of Natural Resources Canada provides national- and provincial-level information on vehicle travel in Canada.[3] For personal passenger vehicles, they specifically provide data for small and large cars, and light trucks. This includes, for example, information on the total number of vehicle kilometres traveled, and the GHG emissions associated with this. Aggregating this information together therefore provides an average emission factor for the average personal passenger vehicle driven in Canada in terms of emissions per unit of travel.

Bus Travel

For passenger bus transportation, the GHG emissions factor used was generated from data available from the transportation tables contained in the Comprehensive Energy Use Database provided by the Office of Energy Efficiency. Specifically, the OEE provide estimates of GHG emissions and passenger kilometre traveled by intercity-bus in Canada. Analysis of this data suggests a GHG emissions intensity of 71.37 grams (0.07137 kg) of CO2e per passenger kilometre traveled on intercity-bus.

Train Travel

For passenger train transportation, the GHG emissions factor used was generated from data available from Transport Canada's T-Facts website.[4] For passenger rail transportation, this provides data on total passenger PKT, as well as the fuel consumption associated with this activity. This allowed the calculation of GHG emissions, resulting in a GHG emissions intensity of 190.2 grams (0.1902 kg) of CO_2e per PKT.

Building Module

The general approach to estimating GHG emissions associated with use of meeting facilities and (if attendees require overnight accommodation) hotel buildings is to multiply the space requirements for each attendee with a GHG emissions factor that reflects the GHG emissions generated per square metre, per day. For attendees that require overnight accommodation, it is assumed that the average attendee will require 400 square metres of building space, including guest room and meeting facilities. For attendees that do not require overnight accommodation, it is assumed that the average attendee will require 100 square metres of building space in terms of meeting facilities. The GHG emissions estimate includes all GHG emissions attributed to space and water heating, cooling, lighting, and auxiliary equipment in the meeting facility.

---

[2] See http://oee.nrcan.gc.ca/transportation/tools/fuel-consumption-guide/fuel-consumption-guide.cfm
[3] See http://www.oee.nrcan.gc.ca/corporate/statistics/neud/dpa/data_e/databases.cfm?attr=0
[4] See http://www.tc.gc.ca/pol/en/T-Facts3/Statmenu_e.asp?type=pu&file=rail&Lang=

Another important element to consider in the estimation of emissions from building usage is that the buildings energy requirements will vary significantly depending on the season. Namely, space heating requirements are significantly higher in the late fall, winter, and early spring in nearly every region of Canada. In addition, the emission intensities vary significantly if a facility operates air conditioning units in the summer months. Nonetheless, although space cooling requirements are important in most southern locales in the summer months, the energy use profile of a building is that most of the annual energy requirements are for space heating during the heating season.

The estimation of GHG emissions can be represented by the formula:

$$\mathbf{Build_{EUE} = Attendee * Time_{Occupancy} * EmInt_{SquareMetre,End\text{-}use} * Space}$$

Where:

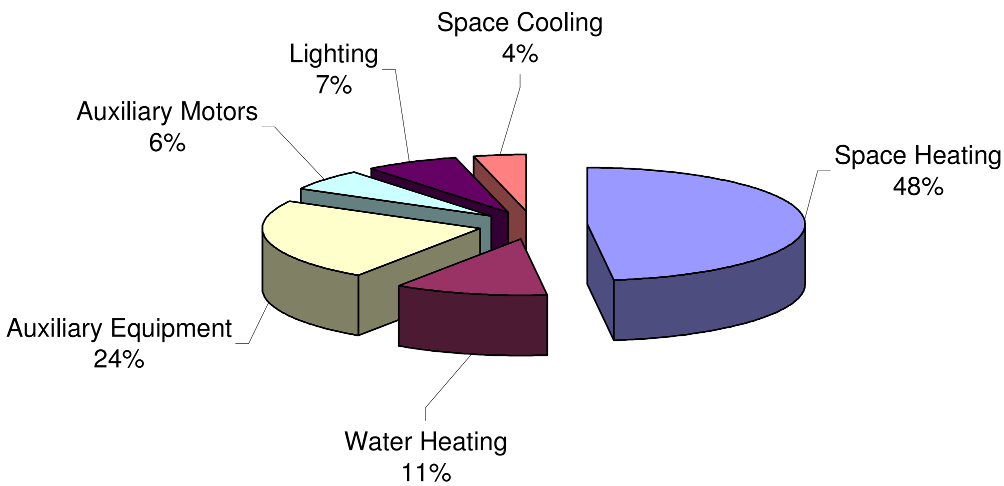
$Build_{EUE}$ = Buildings energy use emissions
Attendee = Number of attendees
$Time_{Occupancy}$ = Length of occupancy
$EmInt_{Time}$ = Emission intensity, by time of year
Space = the area of building space required per attendee

The primary source for the data used to develop GHG emissions intensities by time and floor area are data tables on energy and GHG emissions associated with the accommodation and food services sub-sector in Canada available from the Comprehensive Energy Use Database maintained by the Office of Energy Efficiency. This source provides estimates of the GHG emissions associated with primary fuels used in these buildings for all energy end uses, as well as data on electricity demand. This information is provided at the provincial and territorial level for the time period from 1990 to 2006. This data allows for the generation of GHG emissions intensities that reflect regional differences in energy and emission intensities of building facilities.

Energy use characteristics of buildings

The energy use characteristics of buildings that might be used for government meetings are assumed to follow closely to the “food and accommodations” category used by the OEE since this category includes hotels, restaurants, and conference facilities. To illustrate the energy use characteristics of these buildings, the breakdown for food and accommodation facilities in Atlantic Canada are shown (see figure 1).

Figure 1 Energy Use Characterizations of Food and Accommodation Facilities in Atlantic Canada in 2006 (adapted from the Office of Energy Efficiency)



In 2006, space heating contributed to approximately 48% of the energy required for the operation of these facilities. This was followed by the energy required to run auxiliary equipment (fridges, etc), water heating, lighting, auxiliary motors, and space cooling. It should be noted that for more southern locations (e.g. Toronto), the percentage of total energy use attributed to space cooling is much higher (upwards of 10% of the buildings total).

Factoring in seasonal patterns of energy use

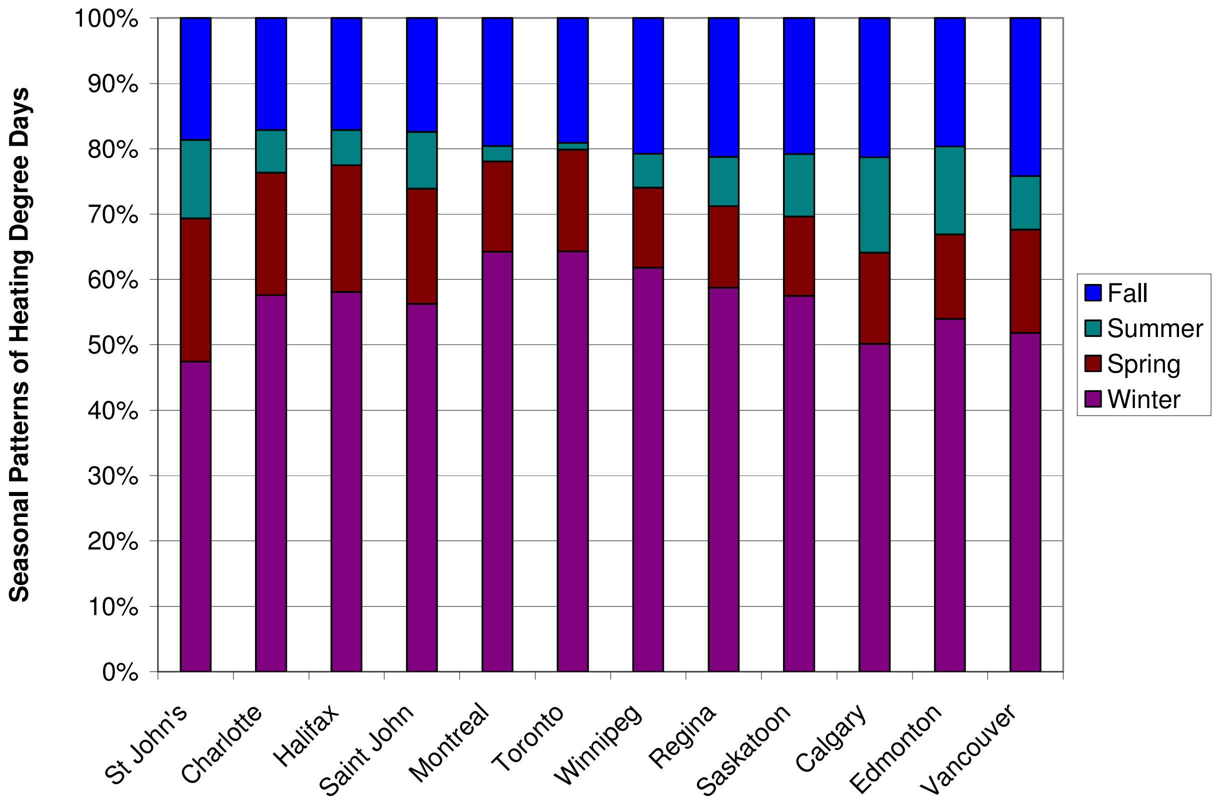
As suggested, weather has a significant impact on a buildings energy use according to the time of year and energy end-use in terms of the requirements for space cooling and heating.

To help estimate how energy use in a building might vary over the course of the year, data on heating degree days and cooling degree days available from Environment Canada was used a basis.[5] Here, it was assumed that energy totals for space heating follow the pattern of heating degree days, while energy totals for space cooling follow cooling degree days where the average

[5] See http://www.weatheroffice.pyr.ec.gc.ca/Climate/default_e.html

temperature is equal to or exceeds 24 degrees Celsius. The seasonal pattern of heating degree days is shown for select cities in Canada (see figure 1).

Figure 2 Seasonal Breakdown of Heating Degree Days



As expected, the majority of heating degree days take place in winter months (December to March), followed by the fall (September to November), spring (April to May), and summer months (June to August). The most southern locales (e.g. Toronto and Montreal) are characterized by consistently warm summer months with few attributable heating degree days, while more northern locales or cities with temperate maritime climates (e.g. St. John's).

Resulting Emission Intensities for Building Operations

Using the data sources and methods outlined, monthly emission intensities for buildings where government meetings might be held for each of Canada's provinces are provided (see table 2).

Table 2 Estimated Provincial-level Emission Intensities for Buildings Housing Government Meetings[6]

Emission intensities, no space cooling (kg CO2/m2/day)

	BC	ALB	SASK	MB	ON	QC	NB	NS	PEI	NFLD	Northern territories
JAN	0.497	1.234	0.809	0.542	0.720	0.543	0.891	1.089	1.054	0.480	1.234
FEB	0.488	1.192	0.747	0.472	0.684	0.473	0.854	1.042	1.036	0.475	1.192
MARCH	0.360	1.017	0.628	0.394	0.613	0.412	0.758	0.927	0.901	0.454	1.017
APRIL	0.337	0.807	0.475	0.197	0.427	0.228	0.632	0.791	0.736	0.363	0.807
MAY	0.185	0.715	0.428	0.162	0.336	0.156	0.540	0.696	0.632	0.296	0.715
JUNE	0.151	0.660	0.357	0.081	0.224	0.063	0.430	0.559	0.507	0.223	0.660
JULY	0.090	0.599	0.330	0.069	0.211	0.056	0.342	0.485	0.423	0.100	0.599
AUG	0.079	0.631	0.345	0.074	0.211	0.055	0.338	0.481	0.413	0.107	0.631
SEPT	0.176	0.716	0.402	0.114	0.233	0.084	0.400	0.539	0.478	0.162	0.716
OCT	0.273	0.809	0.485	0.201	0.356	0.190	0.503	0.642	0.589	0.257	0.809
NOV	0.443	0.970	0.607	0.329	0.483	0.310	0.620	0.784	0.731	0.328	0.970
DEC	0.471	1.075	0.689	0.407	0.651	0.455	0.753	0.933	0.881	0.392	1.075

Emission intensities, with space cooling (kg CO2/m2/day)

	BC	ALB	SASK	MB	ON	QC	NB	NS	PEI	NFLD	Northern territories
JAN	0.497	1.234	0.809	0.542	0.720	0.543	0.891	1.089	1.054	0.480	1.234
FEB	0.488	1.192	0.747	0.472	0.684	0.473	0.854	1.042	1.036	0.475	1.192
MARCH	0.360	1.017	0.628	0.394	0.613	0.412	0.758	0.927	0.901	0.454	1.017
APRIL	0.337	0.807	0.475	0.197	0.427	0.228	0.632	0.791	0.736	0.363	0.807
MAY	0.185	0.715	0.428	0.162	0.336	0.156	0.541	0.696	0.632	0.296	0.715
JUNE	0.151	0.671	0.363	0.081	0.262	0.063	0.438	0.572	0.507	0.223	0.671
JULY	0.091	0.626	0.343	0.069	0.406	0.057	0.358	0.511	0.453	0.102	0.626
AUG	0.079	0.638	0.349	0.074	0.382	0.055	0.352	0.507	0.437	0.108	0.638
SEPT	0.176	0.717	0.403	0.114	0.271	0.084	0.401	0.539	0.478	0.162	0.717
OCT	0.273	0.809	0.485	0.201	0.356	0.190	0.503	0.642	0.589	0.257	0.809
NOV	0.443	0.970	0.607	0.329	0.483	0.310	0.620	0.784	0.731	0.328	0.970
DEC	0.471	1.075	0.689	0.407	0.651	0.455	0.753	0.933	0.881	0.392	1.075

[6] Since no data was available for Canada's northern provinces, to be conservative, the highest emission intensity (Alberta) was used. Meanwhile, the emission intensities for each of the Atlantic Provinces (i.e. New Brunswick, Newfoundland, Prince Edward Island, and Nova Scotia) reflect the average energy intensities for buildings in Atlantic Canada since provincial-specific statistics were not available, but with emissions (and subsequent emission intensities) reflecting the emission intensity of electricity and climate (i.e. HDDs and CDDs) for each province.

Procurement and Waste Management Module

Meeting organizers may have some control over what materials are consumed at the meeting and the amount of waste generated.

In order to use this module, the meeting organizer will have to input data on the amount of material used and how waste is managed. Meetings for example often include some sort of delegate package. One internet source, Geoff's Woodwork[7], suggests such documents might weigh in the order of ten kilograms. Therefore, providing 100 meeting attendees with a large meeting package might consume a total paper weight of 1 metric tonne. Whether or not this material is produced from recycled material should be accounted for and the emission effects communicated to meeting organizers.

Meeting organizers can also account for the waste generated by the meeting. The calculator includes the ability to account for the GHG emissions for waste material that is recycled, sent to the landfill, or in the case of organics, composted. The data inputs are in terms of the volume of waste generated which is then converted to a weight measurement. For food waste, during an average meal, one person may generate about 100 grams of food scrap. For 100 attendees then, this would equate to ten kilograms of organic food scrap that may be either composted or sent to the landfill.

The GHG emissions impacts of sending waste to landfill are estimated by considering only the GHG emissions resulting from the anaerobic degradation of waste in the landfill. The calculator does not account for the GHG emissions from originally producing products or the GHG emissions from producing replacement products for those send to landfill. This way, GHG emissions are not double counted across the life cycle of a product, with GHG emissions associated with product manufacturing allocated appropriately to the entities involved (e.g., from the extraction and refining of virgin material, manufacturers, transportation, etc.). Meanwhile, estimates of the GHG emissions reductions achieved through recycling or composting organics consider the full lifecycle of the source reduction and the GHG emissions associated with recycling material that would otherwise be sent to the landfill.

Using this method, meeting organizers can better understand the full impacts of waste management options. For example, sending waste to landfill results in GHG emissions from the processes of anaerobic digestion. Reducing consumption (i.e., source reduction by using less) and recycling what is used will both eliminate the need to produce associated products from virgin materials, thus reducing upstream energy use and GHG emissions. Nonetheless, recycling does require energy inputs and does result in GHG emissions, which in turn have to be estimated and included for this waste management option. Some propose that recycling is in fact more energy and GHG emissions intensive than producing materials from virgin sources. Full analysis, however, and the metrics that account for the full life cycle indicate that recycling, as with source reduction, has significant GHG emissions reductions benefits.

[7] See http://www.geoffswoodwork.co.uk/book%20weights.htm

The respective GHG emissions intensities for a variety of waste management activities are provided in the table below. The first column shows the GHG emissions impacts of source reduction (relative to landfill disposal), the second column shows the GHG emissions impacts of recycling (relative to landfill disposal), the third column shows the GHG emissions impacts of composting (relative to landfill disposal), and the last column shows the GHG emissions impacts of sending waste to landfill.

Table 3. Emission effects of different waste management practices, by type of material (kg CO2e/kg of waste)[8]

	Net Source Reduction Emissions	Net Recycling Emissions	Net Composting Emissions	Net Landfilling Emissions
Newsprint	-3.81	-2.81		-1.22
Fine Paper	-5.93	-3.33		1.18
Cardboard	-5.22	-3.34		0.29
Other Paper	-5.51	-3.36		0.71
Aluminum	-4.55	-6.49		0.01
Glass	-0.4	-0.1		0.01
HDPE	-2.74	-2.27		0.01
PET	-3.5	-3.63		0.01
Other Plastic	-3.01	-1.8		0.01
Food Scraps			-0.24	0.9

Table notes: For newsprint, it is assumed that carbon is sequestered into the landfill.

Using the Calculator

The Climate Friendly Meetings Calculator is an important tool for measuring this aspect of an meetings carbon footprint. The Calculator can produce a meaningful estimate of the GHG emissions from a meeting with details on delegate travel but without precise data on the venue. This baseline measurement is the starting point for planning how to reduce GHG emissions for future events or for offsetting a meeting. Users can select the options that are appealing to their organization and see the results reflected in a lower carbon footprint of the meeting. Managing GHG emissions from government organized meetings is a useful first step in New Brunswick's climate change strategy and a way for departments to reduce their carbon footprint and distinguish their event from others.

[8] From http://www.recycle.ab.ca/Download/GHG_Impacts_Summary.pdf