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# A Carbon Calculator for use by Climate-Friendly Youth in New Brunswick

## Guidance Documentation

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# Guidance Document for a Carbon Calculator for Climate-Friendly Youth in New Brunswick



## Importance of this Calculator

The extracurricular activities of youth involve things such as going to team sport events, group meetings, or activities such as taking a school trip. These activities usually take place in generally close proximity to a youth's home, but sometimes involve longer distance "out of town" trips.

This document describes a carbon calculator meant to illustrate to youth the greenhouse gas (GHG) emissions resulting from these activities. In particular, the Carbon Calculator for Climate-Friendly Youth provides the youth of New Brunswick (i.e. children and young adults 11 to 18 years of age) a tool to estimate the GHG emissions resulting from their extracurricular activities, including those associated with travel and those associated with building use. It does so by analysing information input by the user on a person's travel and the use of any building facilities required for these extracurricular activities.

## Scope of Activity and Emissions

The Carbon Calculator for Climate-Friendly Youth includes emissions associated with:

a) The travel to the extracurricular event
b) The use of building facilities for the extracurricular event
c) The use of a hotel for overnight trips

# 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 Carbon Calculator for Climate-Friendly Youth has been designed to be user friendly with minimal data inputs. The user can analyze multiple "events" – such as if they attend both hockey practice and 4-H club meetings over the course of a year. They can also determine the emissions from one-time out-of-town trips, such as an out-of-town hockey tournament. To do so, they simply need to create a new record for each function/activity.[1]

## *Data Inputs – General Information*

Depending on the type of the trip, there are four or five pieces of information that are first required of the user of the calculator

**Field 1**: Name of event (i.e. Bantam A hockey practice). If there are multiple activities, the user will need to create a new record.

**Field 2**: Home address (departing address) (street name and number, town/city)

**Field 3**: Address of event (street name and number, town/city, province/state

**Field 4**: If the event is reoccurring or not

**Field 5**: Type of activity (options available from drop down list, including indoor sports activity, outdoors activity, indoor cultural activity, indoor education activity, other indoor activity

**Field 6**: If there is air conditioning used in buildings

**Field 7**: Number of people on team or in group (needed to proportion emissions)

***If a reoccurring event***

**Field 8**: Number of days per week the activity takes place

**Field 9**: Number of weeks per year the activity takes place

***If one time event***

**Field 8**: Number of days of activity

[1] It is important to note, if a youth uses different modes or vehicles over the course of a year, they should create unique records for each of these (i.e. 10 trips undertaken in a Ford Explorer with 3 other passengers being one record, 20 trips undertaken in a Ford Focus with 2 other passengers being a second record).

**Field 9**: If hotel accommodation is required (yes or no)

**Field 10**: If hotel accommodation is required, the number of nights of stay in the hotel

**Field 11**: If hotel accommodation is required, the number of rooms required

### *Data Inputs Associated with Travel Module*

The travel module estimates the emissions resulting from the transportation required for youth to attend the extracurricular activity. There are 4 data inputs possible for the local travel module.

**Field 1:** Departing address (automatically filled in using inputs from "event information" page, but also editable)

**Field 2:** Arriving address (automatically filled in using inputs from "event information" page, but also editable)

**Field 3:** mode of transportation (personal passenger vehicle, bus)

**Field 4:** estimated number of trips per year (automatically filled in using inputs from "event information" page, but also editable)

*If a car is used*

**Field 5:** the type of vehicle used

**Field 6:** the average number of passengers per vehicle

*If a plane is used*

**Field 5:** the type of plane (including large jets for intercontinental trips, large jets for continental trips, regional jets, turbo-prop planes, and small planes)

**Field 6:** seat type (economy or executive)
**Field 7:** trips per year

## Underlying Method and Data Sources

The Carbon Calculator for Climate-Friendly Youth includes estimates of GHG emissions from local travel, long distance travel, and building energy use. The methods and data sources for each of these sources vary, as explained and summarized in the sub sections that follow.

## *Local Travel*

Emissions from local travel activity are estimating using the following equations.

**Equation 1**: *Estimating Emissions from Daily Travel Activity – Personal Passenger Vehicles*

$PPV_{Emissions} = [(VKT_{VehicleType} * EmissionIntensity_{VehicleType}) / \# passengers]$

Where

$PPV_{Emissions}$ = Emissions from use of personal passenger vehicles attributed to youth's extracurricular activities
$VKT_{VehicleType}$ = Vehicle kilometres traveled (VKT) by vehicle type (annual)
$EmissionIntensity_{VehicleType}$ = emission intensity by vehicle type (emission intensity of activity)
# passengers = average number of passengers in vehicle

**Equation 2**: *Estimating Emissions from Daily Travel Activity – Urban Transit*

$PPV_{Emissions} = PKT * EmissionIntensity$

Where

PKT = Passenger kilometres traveled (PKT) on public transit
EmissionIntensity = emission intensity (kg CO2e per passenger kilometre traveled)

### *Estimating Activity*

Activity in regards to the use of personal passenger and public transportation vehicles should be estimated by multiplying the number of trips taken per week by the number of weeks per year the activity takes place, which in turn can be multiplying by the distance from the home location to the place of the activity or function.

### *Estimating Emission Intensity of Personal Passenger Vehicles*

To estimate GHG emissions for personal passenger vehicles, the Carbon Calculator for Climate-Friendly Youth 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 emission intensities.[2] This requires the user to select the model and profile of the car they are driving in order. The full list of vehicles and their representative emission intensities are included in Appendix A.

[2] See http://oee.nrcan.gc.ca/transportation/tools/fuel-consumption-guide/fuel-consumption-guide.cfm

*Estimating Emission Intensity of Public Transport*

For urban 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 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. GHG emissions from business travel are a function of passenger kilometres traveled and the GHG emission intensity of this travel. Since the type of vehicle or mode of travel has a significant impact on the GHG emissions associated with business travel, it is important to differentiate between the modes of transportation used for each trip. Options include airplane, bus, train, or personal passenger vehicle (the personal passenger vehicle category includes options for selecting the specific year and make of car (including minivan, SUV and truck).

## Long Distance Travel

The first step in estimating the emissions associated with a youth's long distance travel is establishing the passenger kilometres traveled (PKT) associated with the trip, by mode. The precise measure of distance traveled depends upon the mode of travel and the geographical location of the origin and destination of the travel.

### *Estimating Passenger Kilometres Traveled*

To determine the distance traveled as easily and accurately as possible, for all modes of travel the calculator relies on the web-based Google Maps application. [3] To do so, the calculator requires information on departure address and destination address for all trips and uses the mapping application to determine the total distance of the trip:

- **<u>For air travel:</u>** PKT by airplane are based on the great circle distance function. In this case the Google Maps application calculates the distance between the origin and destination points based on the great circle formula (this is the most direct route after accounting for the curvature of the earth). A similar approach is used for rail, with the assumption that rail transportation infrastructure follows closely the most direct route between major centres.

  A factor that influences the distance of any given flight are stop-overs, re-routes, head winds, refuelling stops, or other factors that can take a lane of its optimal flight path. Therefore, and as following the approach used by the International Civil Aviation Organization (ICAO), correction factors are applied to the estimated PKT based on the distance of each flight. These are provided in table 1:

**Table 1 Correction factors used to estimate flight distance**

| Flight Distance | Correction to Flight Distance |
|---|---|
| Less than 50 km | + 50 km |

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

| | |
|---|---|
| Between 550 km and 5500 km | + 100 km |
| Above 5500 km | + 125 km |

- **For personal passenger vehicles, rail and bus modes:** To generate estimates of PKT for personal passenger vehicle, rail and bus modes, a different functionality of the Google Maps application is used. Rather than relying on the great circle distance, the Google Maps application traces the road network from point of departure to point of destination, selecting the shortest distance along the road network.

### *Emission Intensities per Passenger Kilometre Traveled*

#### Personal Passenger Vehicle

The estimation of GHG emissions for the passenger vehicle is more complex due to the wide-range of cars and trucks available and the variations in GHG emissions intensities across vehicle type. In order to accurately reflect the complexities of GHG emissions for personal passenger vehicles, the calculator includes vehicle specific fuel consumption information (obtained from the Fuel Consumption Rating Guide produced by Natural Resources Canada). This requires the user to select the model and profile of the car they are driving.

#### 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 air travel is a function of a number of independent and interdependent 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 30,000 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 10% correction factor is applied to account for things like circling, adjustments of flight routes, headwinds, etc.

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 Hotel Business 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 (explained in more detail below).

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), flights on regional aircraft with turbo prop engines, and "personal" or business regional jets with 20 seats or less. These 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** | |

## Bus

For passenger bus transportation, the GHG emissions factor is 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 an emission intensity of 71.37 grams (0.07137 kg) of CO2e per passenger kilometre traveled on intercity-bus.

## Train

For passenger train transportation, the GHG emissions factor is generated from data available from Transport Canada's T-Facts website.4 For passenger rail transportation, this provides data

[4] http://www.tc.gc.ca/pol/en/T-Facts3/Statmenu_e.asp?type=pu&file=rail&Lang=

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 Usage Module

Two different approaches are used to estimate emissions from building usage; 1) if a set area is required for the event (e.g. a hockey rink required for hockey practice or indoor basket ball court required for a basketball practice), or 2) if space is required on a per person basis (i.e. hotel lodging, a visit to a cultural facility, etc).

The general approach for the first of these is to determine the emissions attributed to the total space requirements and then to divide this by the number of participants, while the second involves multiplying the space requirements for each activity participant with a GHG emissions factor that reflects the GHG emissions generated per square metre, per day. This emission factor is different for each of the four facility types provided in the calculator; (a) educational/school building facilities, (b) recreational/sport facilities, (c) culture facilities, and (d) hotels.

The estimation of GHG emissions for these different purposes can be represented by the formulae:

$$(1) \quad \mathbf{Build_{EUE} = Space * Time_{Occupancy} * EmInt_{SquareMetre,End\text{-}use)}}$$

$$(2) \quad \mathbf{Build_{EUE} = Attendee * Space * Time_{Occupancy} * EmInt_{SquareMetre,End\text{-}use)}}$$

Where:

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

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.

***Space requirements***

The space requirements for various *indoor* sporting and extracurricular activities are summarized in table 4 (for outdoor events, such as baseball, it is assumed there are no indoor space requirements).

**Table 4. Assumed floor space requirements for different building types and building use purposes**

| Activity | Estimation method (total space required or per capita space requirements0 | Metric (square metres for total space required, and square metres per capita else wise) |
|---|---|---|
| Indoor sports activity - hockey | Total space | 1,800 square metres of total space required (i.e. a hockey arena) |
| Indoor sports activity - basketball, floor hockey, etc | Total space | 1,800 square metres of total space required |
| Indoor cultural activity | Per capita | 100 square metres per capita |
| Indoor education activity | Per capita | 100 square metres per capita |
| Other indoor activity | Per capita | 100 square metres per capita |
| Hotel | Per capita | 300 square metres per capita |

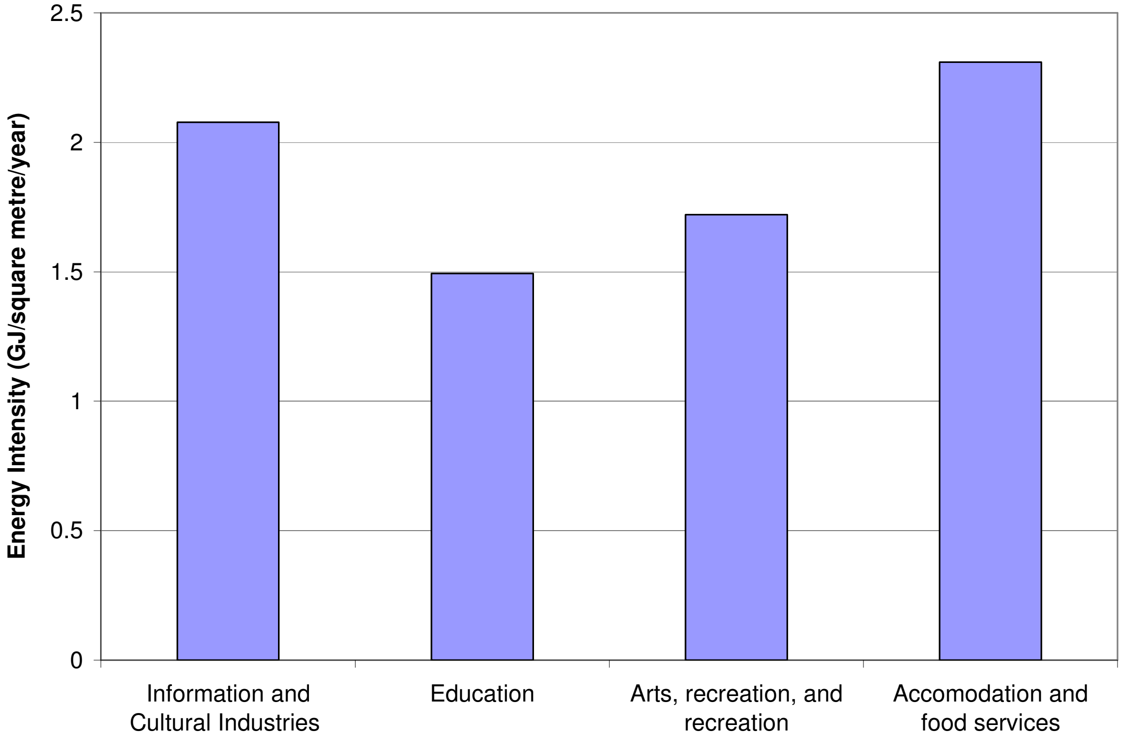
***Variations in energy use intensity based on time of year***

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 of building use. 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.

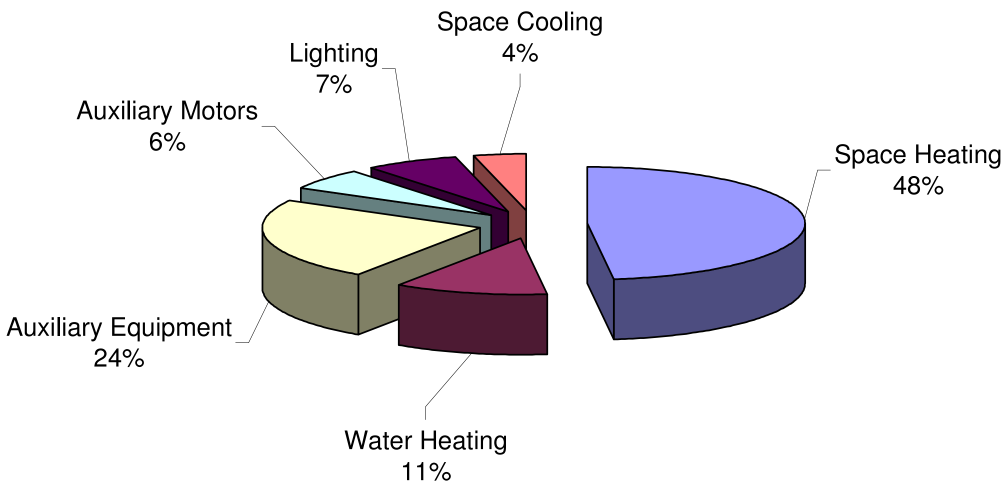
## *Energy and emission characteristics of different building types*

Analysis of the energy and emission characteristics of buildings that might be used for the extra-curricular activity of youth is undertaken for educational/school building facilities, recreational/sport facilities, culture facilities, and hotels. Each of these building types vary significantly in terms of their overall energy intensity and the end-uses requiring energy (see figure 1 which shows the energy intensity of each facility type, and figure 2 which shows energy use by end use).

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




Of the four facility types, accommodation and food services (i.e. hotels and restaurants) have the highest energy intensity, which education facilities have the lowest energy intensity.




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).

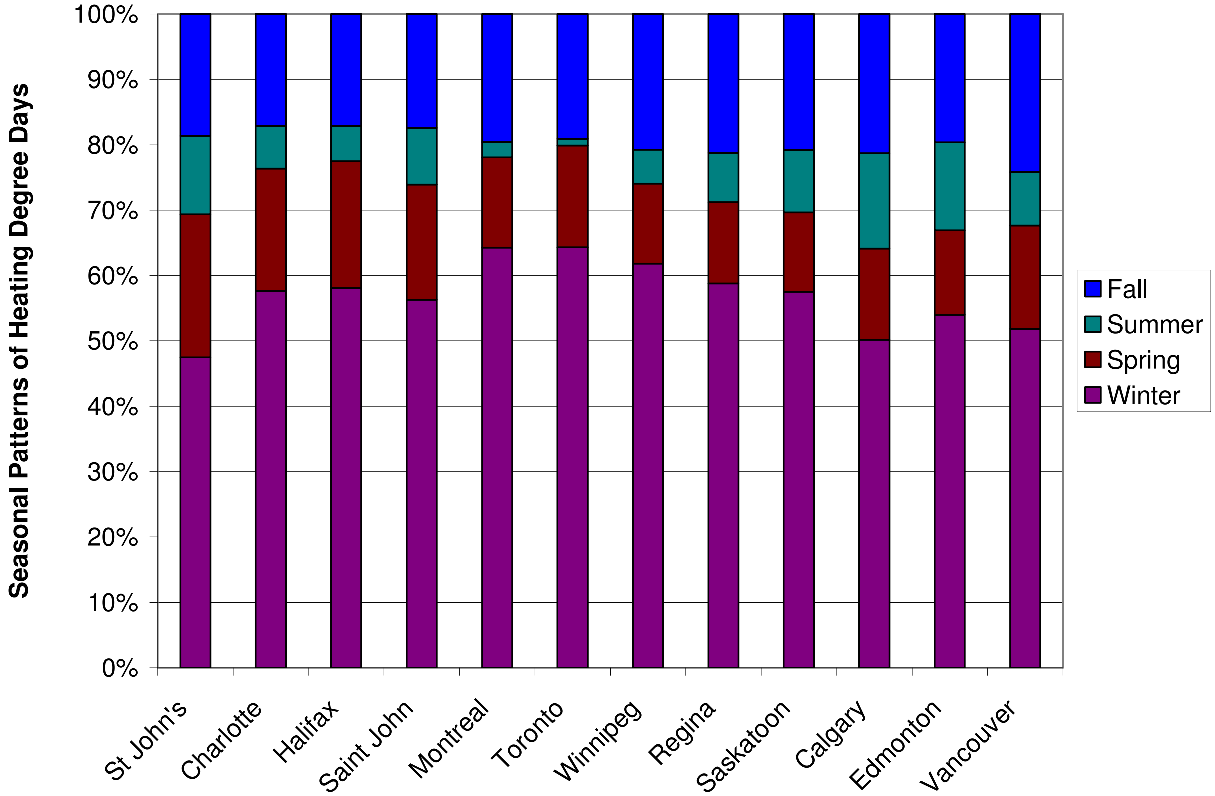
### *Factoring in seasonal patterns of energy use*

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 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).

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

**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 accomadation facilities (i.e. hotels) for each of Canada's provinces are provided (see table 2). This provides an example of the time- and region-specific emission intensities that are used in the calculator. The differences in emission intensities for the other building types reflect the differences in the underlying energy intensities of these buildings.

**Table 1 Estimated Provincial-level Emission Intensities for Various Accommodation Facilities – by Region and Month [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.