How to Measure, Track and Report Your Impact

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You can't manage what you don't measure! Tracking and measuring your impact is the cornerstone to any effective initiative, as this will allow you to determine how your initiative actually performed, and provide you with tangible results and data in order to better manage your actions and improve your efforts. From small activities to large communities, climate change mitigation is measured and reported on by greenhouse gas (GHG) emissions savings. This workshop will show students a step-by-step method for how to quantify the greenhouse gas (GHG) emissions impacts of their community initiatives.

How do you calculate GHG emissions?

$$\text{GHG Emissions} = \text{Activity} \times \text{Energy intensity} \times \text{Emission Factor}$$

What is an Activity?

An activity is a quantity of GHG producing behaviour, such as:

- Driving *x* distance
- Using a lightbulb for *y* amount of time
- Eating *z* quantity of food

Some activities are easier to quantify than others. Think about how you will quantify your activity before you decide what to do. The above examples are relatively simple activities to quantify. While others are certainly possible and accepted, they may require some additional research.

What is Energy Intensity?

Energy intensity is the amount of energy or fuel used per duration/ distance/ size for a particular activity, such as:

- Litres per km (L/km)
- Kilowatt per hour (kWh)
- Cubic meter per hour (m^3/h)
- Gigajoule per square meter (GJ/m^2)
- British thermal unit per square meter (BTU/m^2)

See Tables 1, 2, and 3 for some common energy conversions and intensities.

What is an Emission Factor?

An emission factor is the amount of GHG produced by one unit of fuel or energy, such as:

- Electricity – 20 gCO_2e/kWh
- Natural Gas – 1899 gCO_2e/m^3
- Gasoline Vehicle – 2317 gCO_2e/L
- Diesel Vehicle – 2748 gCO_2e/L

See Tables 4 and 5 for some common emission factors related to electricity and transportation.

For consumption-based activities…

$$\text{GHG emissions} = \text{quantity} \times \text{carbon intensity}$$

Consumption-based activities, such as food and waste consumption, present some unique challenges. See Table 6 for the carbon intensities of various types of foods.

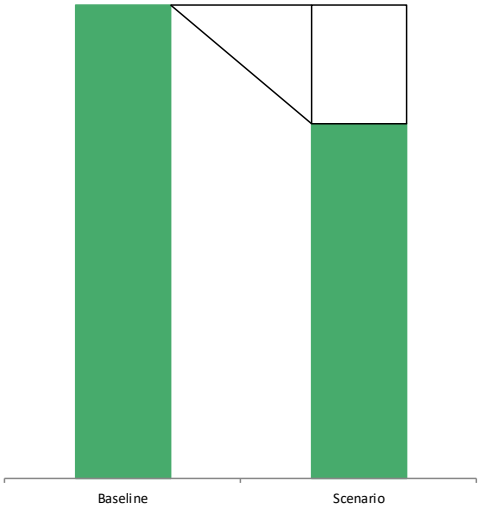
So…how do you calculate the impact of your program?

1. **Choose a program**
   Typically, a GHG reduction program will change one or more of these three things:
   - Amount of activity
   - Energy intensity
   - Carbon intensity

2. **Calculate Baseline GHG**
   If you made no change to your behaviour, how much GHG would you produce?

3. **Calculate Program GHG**
   When you implement your initiative, how much GHG will you produce?

4. **Impact = Baseline GHG – Program GHG**
   What is the difference between the baseline and the program GHG totals?



Reporting your impact

The way in which you report your impact is crucial to communicating your results with the community. It is important that you report your results clearly and with sufficient details so that the community knows exactly what your impact was and how you achieved these results.

Some tips for reporting your impact:

- Of the seven different GHGs, each one has a different global warming potential (GWP). This means that the same amount of each gas will contribute a different amount to global warming. As a result, GHGs are most often reported in CO_2 equivalents (CO_2e).
- The magnitude of your impact will depend on how long you continue your initiative for. However, in order to compare results, it is important that results are all reported in a standard unit, such as on a per year basis. Please report your impact on an annual basis.
  - For example, if you continue your initiative for one month, you will multiple your impact by 12 in order to report how much impact you would have in one year.
- It is important that you keep a detailed record of all of your data and calculations. In the case of an error, this will ensure that you can go back and find where you went wrong. Your calculations should be written or typed out with enough detail and clarity that someone else would be able to look at them and follow along, step by step.

Use some of the data below to help you with estimating the emissions impacts for your actions.

Energy Intensity Values

1. Common Energy Conversions

Energy Source	GJ	ekWh
1 cubic meter (m^3) Natural Gas	0.0373	10.36
1 kilowatt hour (kWh)	0.0036	1
1 Liter (L) Propane	0.0255	7.09
1 Liter (L) Gasoline	0.0346	9.61
1 Liter (L) Diesel	0.0387	10.75

2. Common Vehicle Fuel Efficiencies

Type of Vehicle	Fuel Consumption (L/100Km)
Sedan	9.6
Luxury Sedan	12.2
Sports Car	14.3
Van	10.7
Pickup Truck	14
SUV	12.3
Diesel Bus	78.4

3. Common Power Use for Household Appliances

Appliance	Watts (J/s)
Air conditioner	1,400
Dehumidifier	257
Ceiling fan	125
Heater	1,500
Humidifier	177
Hair Dryer	1,000
Blender	400
Coffee Maker	894
Dishwasher	1,200
Microwave Oven	1,450
Freezer	341
Refrigerator	440
Clothes Dryer	4,900
Washer	512
42" Plasma TV	320
Computer	500
Hot Tub	5,000
Lightbulb	Look on bulb

Emission Factor Values

4. Vehicle Fuel Emissions Coefficients

Mobile Combustion	GHG Coefficient	unit
Gasoline Vehicles	2317	g CO2e/L
Light Duty Diesel Vehicles	2728	g CO2e/L
Heavy Duty Diesel Vehicles	2748	g CO2e/L

5. Ontario Average GHG Intensity for Electricity

	GHG Coefficient	unit
Electricity	20	gCO2e/kWh

Consumption-based activity values

6. GHG Emissions for Common Foods

Food	kg of CO2e emissions per Kg of Food
Lamb	39.2
Beef	27.0
Cheese	13.5
Pork	12.1
Farmed Salmon	11.9
Turkey	10.9
Chicken	6.9
Canned Tuna	6.1
Eggs	4.8
Potatoes	2.9
Rice	2.7
Peanut Butter	2.5
Nuts	2.3
Yogurt	2.2
Broccoli	2.0
Tofu	2.0
Dry Beans	2.0
Milk	1.9
Tomatoes	1.1
Lentils	0.9

If you cannot find the appropriate values for your initiative, additional data and guidance on estimating emissions can be found at the sources below:

2019 NRCan Fuel Consumption Guide	https://www.nrcan.gc.ca/sites/www.nrcan.gc.ca/files/oee/pdf/transportation/tools/fuelratings/2019%20Fuel%20Consumption%20Guide.pdf
NRCan Survey of Household Energy Use	https://www.nrcan.gc.ca/energy/efficiency/17097
Statistics Canada Energy Information Portal	https://www.statcan.gc.ca/eng/topics-start/energy
UNFCCC National GHG Inventory Reports	https://unfccc.int/process-and-meetings/transparency-and-reporting/reporting-and-review-under-the-convention/greenhouse-gas-inventories-annex-i-parties/national-inventory-submissions-2019
GHG Protocol, Policy and Action Standard	https://ghgprotocol.org/policy-and-action-standard
IPCC Emission Factor Database	https://www.ipcc-nggip.iges.or.jp/EFDB/main.php