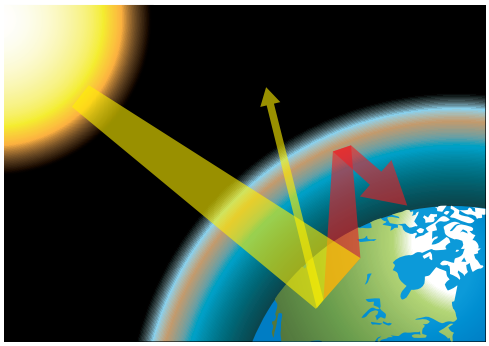
FACT SHEET: Emission Conversion - Fort Chipewyan

(Advanced)

Greenhouse gases (GHG's) trap heat in our atmosphere. The more GHG's present, the more warming that occurs. In order to calculate the amount of greenhouse gas emissions produced, we need to use emissions factors and conversion factors.



Greenplanet Energy Analytics

What are Emissions Factors?

An **emissions factor** is a value that tells you how much greenhouse gas is released into the atmosphere for a particular activity, such as extracting oil, burning gas, or manufacturing plastics.

Greenhouse gases are not all the same. Some absorb more energy and some stay in the atmosphere longer. This means certain GHGs cause more global warming than others. As well, activities will often give off more than one type of greenhouse gas. For example, the production of diesel releases not only carbon dioxide (CO_2), but also methane (CH_4) and nitrous oxide (N_20).

For easier comparison, we convert each of the gases into the equivalent of what it would be as carbon dioxide. This number is called the **Global Warming Potential** (GWP) f

Carbon dioxide is the most common GHG released by human activities, which is why it is used as our way of comparing greenhouse gas intensity.

Carbon dioxide has a GWP of 1 and the larger the GWP, the more that gas will warm the Earth compared to carbon dioxide over time (typically 100 years).

Methane, for example, has a GWP of 25, meaning 1kg of methane released has 25 times more warming over a 100-year period compared to 1kg of carbon dioxide.

Emissions are shown in units of **carbon dioxide equivalent (CO2e)**.

Typical Emissions Factors for Fort Chipewyan		
	Factor	**Units***
FOSSIL FUELS		
Electricity		
Upstream diesel production and processing	0.040	kgCO2e/kWh
Transportation to Fort Chip	0.007	kgCO2e/kWh
Electricity production (without solar farm)	0.758	kgCO2e/kWh
Electricity production (with solar farm)	0.590	kgCO2e/kWh
Total (with solar farm)	**0.638**	**kgCO2e/kWh**
Total (without solar farm)	**0.806**	**kgCO2e/kWh**
Diesel		
Upstream diesel production and processing	0.149	kgCO2e/L
Transportation to Fort Chip	0.028	kgCO2e/L
Burner tip combustion - Diesel	2.790	kgCO2e/L
Total	**2.967**	**kgCO2e/L**
Propane		
Upstream propane production and processing	0.0002	kgCO2e/L
Transportation to Fort Chip	0.028	kgCO2e/L
Burner tip combustion - Propane	1.540	kgCO2e/L
Total	**1.568**	**kgCO2e/L**
WOOD FUEL		
Cordwood		
Harvesting timber	6.72	kgCO2e/m3
Hauling to yard for processing	8.00	kgCO2e/m3
Processing - Cordwood	18.50	kgCO2e/m3
Total	**33.22**	**kgCO2e/m3**

Note: these sources are in different units and cannot be compared unless they are converted into equal units of measure.

Specific Point in Time vs Lifecycle Emissions

When we determine the emissions released, we need to consider whether we want to calculate the emissions during just a point in time during the activity or for the entire production.

For example, does the combustion of propane produce fewer emissions than the combustion of diesel? In this example you would compare combustion emissions only as a point in time.

If we want to know the total emissions produced, you will include all the emissions from extraction to production to final combustion, which is known as looking at the entire **lifecycle** (or 'cradle to grave').

For example, to determine the total emissions for propane vs diesel, we would compare the emissions for the extraction process, manufacturing process, burner tip combustion, any transportation involved, then add them all together.

For example, if you wanted to calculate the greenhouse gases produced by leaving a porch light on for one year in Fort Chipewyan, prior to the solar farm.

Step 1: Find the number of watts of the light bulb on the label

60W (an incandescent bulb)

Step 2: Calculate how many hours the light will be on

It is on 12 hours a day, 365 days/year

12 x 365 = 4,380 hours

Step 3: Determine the number of watt hours

Multiply the number of watts by the number of hours

60 x 4,380 = 262,800 Wh

Step 3: Convert watt hours to kilowatt hours

Divide watt hours by 1,000

262,800 / 1,000 = 262.8 kWh

Step 4: Find the Emissions Factor *from the chart on the previous page* for;

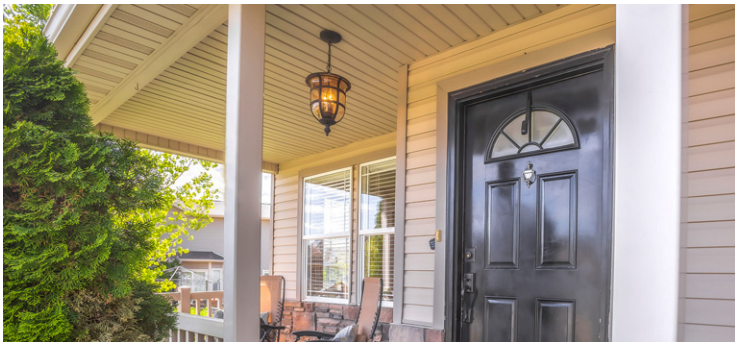
Total electricity (without solar farm)

0.806 kgCO2e/kWh

Step 5: Calculate annual total emissions

Multiply the number of kilowatt hours by kilograms of carbon dioxide equivalent per kilowatt hour

262.8 kWh x 0.806 kgCO2e/kWh
= 213 kgCO2e



stock.adobe.com/ca/free

Useful Links

Global Warming Potentials - Environment Canada
https://www.canada.ca/en/environment-climate-change/services/climate-change/greenhouse-gas-emissions/quantification-guidance/global-warming-potentials.html

Carbon Offset Emission Factors Handbook - Alberta Government
https://open.alberta.ca/publications/9781460146064

Greenhouse Gas (GHG) Emissions - Environmental Protection Agency, US
https://www.epa.gov/ghgemissions

What are Energy Conversion Factors?

Depending on the activity, you may need to convert a typical unit of measure in order to make comparisons. This is done by *using the chart provided below*.

For example, you may have the amount of diesel in litres (l), but want to compare it to your electricity, which is measured in kilowatt hours (kWh).

To do this, you would look up the energy conversion factor for litres of diesel in the chart to convert it to kWh.

If you know that a typical home in Fort Chipewyan consumes 9,000 kWh of electricity and 20,000 L of diesel;

Look up L of diesel in the chart (10.74) and multiply

10.74 x 20,000 L of diesel = 214,800 kWh.

This way you get a more comparable energy profile knowing that a typical home in Fort Chipewyan consumes;

9,000 + 214,800 = 223,800 kWh of energy.

Typical Energy Conversion Factors		
Conversion	**Factor**	**Unit**
Propane		
1 L	7.09	kWh
1 kWh	0.145	L
1 L	23700	BTU
1 GJ	39.07	L
1 m3	28.62	GJ
Natural Gas		
1 GJ	26.137	m3
1 GJ	26137	L
1 GJ	277.78	kWh
1 Kg	1.406	m3
1 m3	10.33	kWh
1 m3	35.494	BTU
Diesel / Heating Oil		
1 L	10.74	kWh
Gasoline		
1 L	9.63	kWh
Biomass		
1 hectare	2.47	acres
1 cord	2.15	tons
1 cord	5194	kWh

stock.adobe.com/ca/free