People for Energy and Environmental Literacy

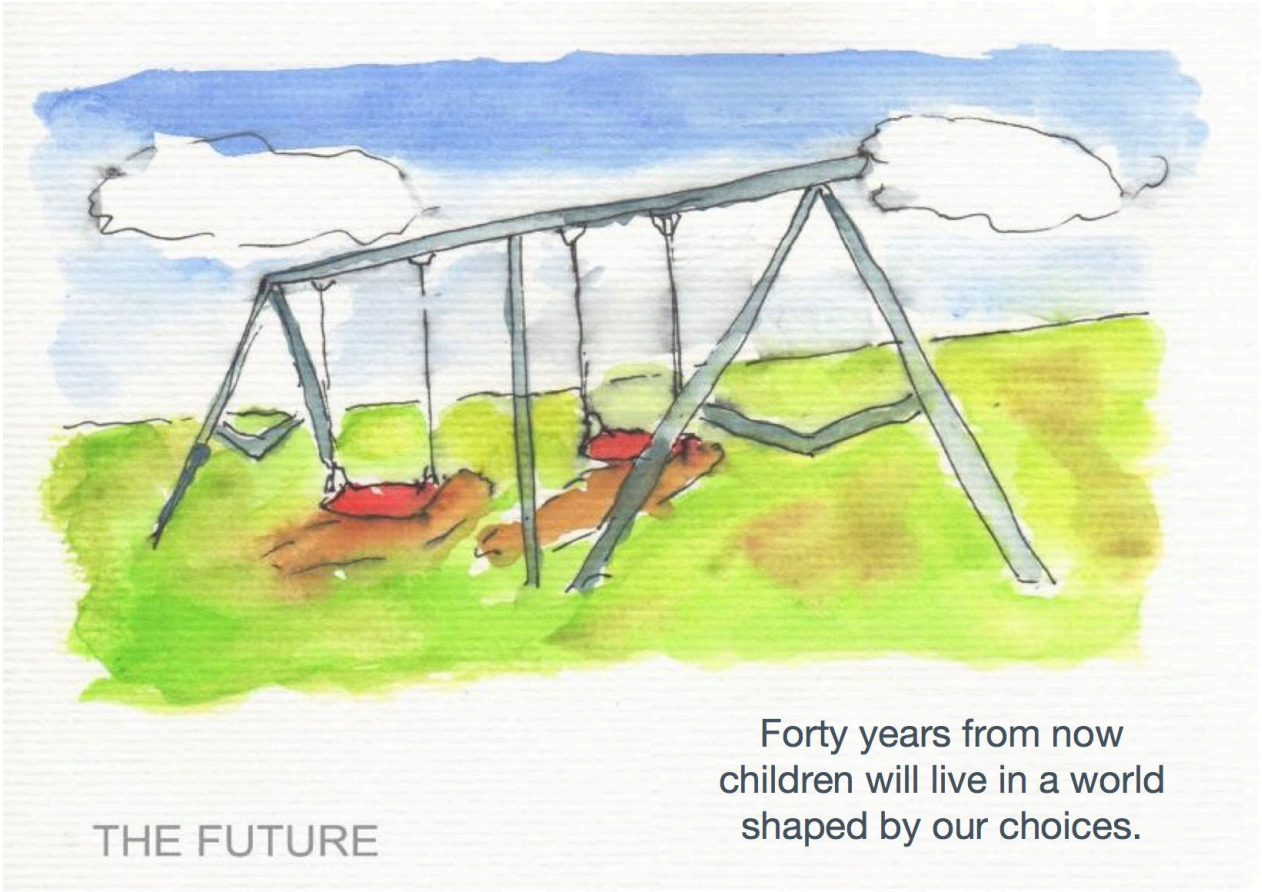
What on Earth is Climate Change?

Climate Change 101

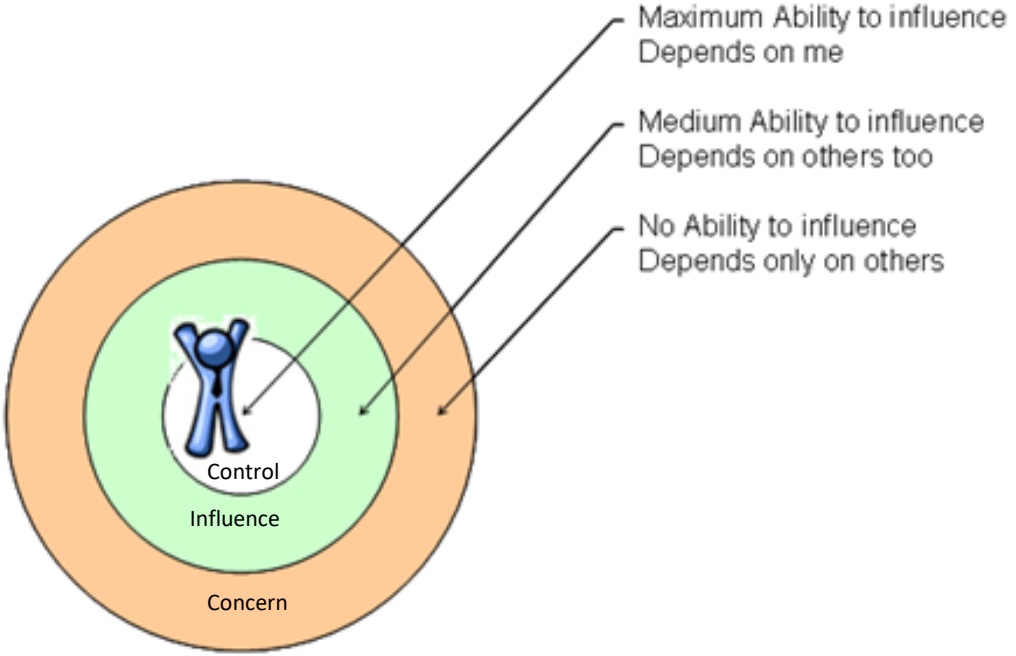
PEEL is supported by the Community Environment Action Program from the Government of Alberta. This project is offered in partnership with GreenLearning Canada Foundation, provider of free online education programs about energy, climate change and green economy.

Alberta

Climate Change 101: Language, science, and big ideas for educators


THE FUTURE
Forty years from now
children will live in a world
shaped by our choices.

Circle of concern, control and influence



Circle of concern represents external factors such as the things we may not have direct control over.
Circle of influence represents the things that I can influence and others can do something.
Circle of control represents things I can actually do

My Circle of Influence and Control

- Circle of Control:
  - Me, my actions, my thoughts
- Circle of Influence:
  - My family
  - My friends
  - My school
  - My community
  - My city
  - My province
  - My country

Something is different….

- Kids your age in Alaska (Grade 3-8)
  - Three minute video – White Christmas Quinhagak, Alaska.

    Video was made by the fourth grade students.

- https://www.youtube.com/watch?v=zVF6DQGh8Ic

Overview of Climate Science

- Bill Nye The Science Guy. (Grades 9-12)
  - 5 minute video, Climate 101 with Bill Nye. Bill Nye narrates this short film on the basics of climate change.

- https://www.youtube.com/watch?v=3v-w8Cyfoq8
- https://youtu.be/k5_zpjerQFo

The Greenhouse Effect

- The Greenhouse Effect
  - Video from US Environmental Protection Agency
  - Published April 3, 2015
  - Two minute video summary on the topic of the Greenhouse Effect

- https://www.youtube.com/watch?v=VYMjSuIe0Bw

Terminology

Greenhouse Effect

- The greenhouse effect keeps the Earth warm by trapping heat in the atmosphere.

Greenhouse Gas

- Gases that trap heat in the atmosphere.

Terminology

Global Warming

- The unusually rapid increase in Earth's average surface temperature over the past century due to rising levels of greenhouse gases released by people burning fossil fuels.

Climate Change

- A long-term change in the Earth's climate
- Climate change is a long term shift in weather conditions
  - Change in wind, precipitation, length of seasons, strength and frequency of extreme weather events such as droughts and floods, wild fires.
  - Impacts will vary locally.

Causes of Climate Change

Natural Factors

- Ocean currents
- Solar radiation
- Volcanic Activity

Human Factors

- Depleting ozone layer
- Increase in greenhouse gases from burning fossil fuels
- Using up forests and reducing the number of wetlands

Primary Forms of Energy Use and Supply

Energy Storage – A game changer?

Transportation | **Heat** | **Electricity**

OIL

RENEWABLE FUEL

Biomass

GAS

RENEWABLE ENERGY

Hydro, Solar, Wind, Geothermal, Biomass, Tidal/Wave

COAL

What is a Tonne of Carbon Dioxide?

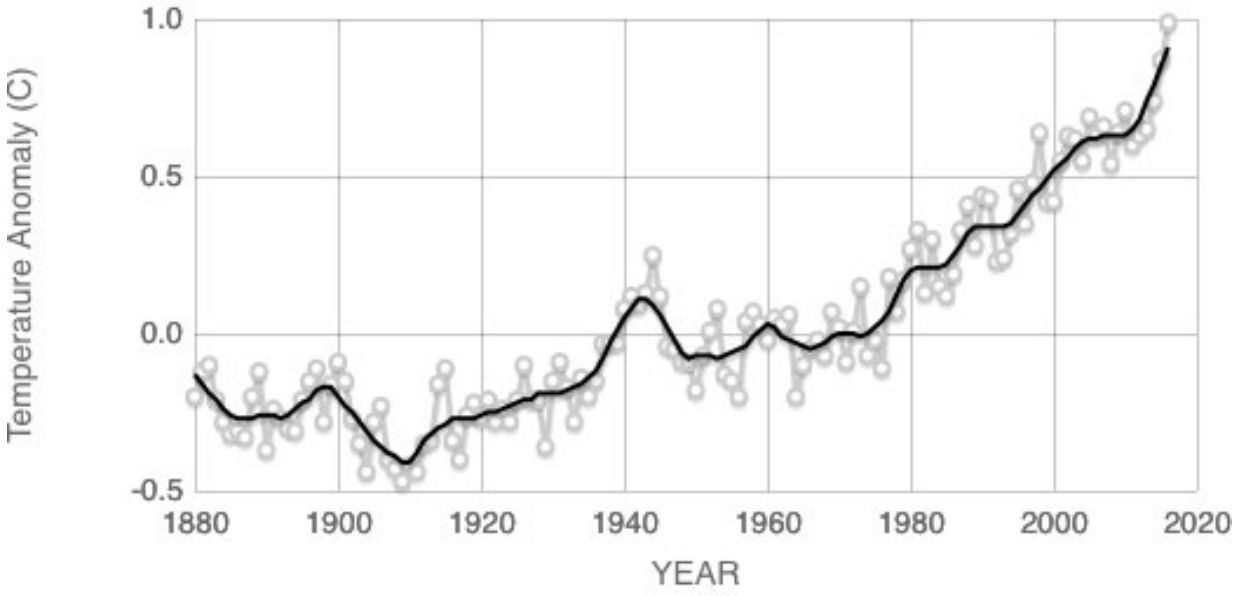
- We cannot see it, or hear it, or taste it!
- What if we could see it?
  - This three-minute video of New York City 2010 Greenhouse Gas Emissions are visualized as one-ton spheres of carbon dioxide gas.
  - Video is designed by Carbon Visuals and Environmental Defense Fund. Emissions are at the rate of approximately 1.72 tons per second.
  - City of New York is on track to reduce emissions by 30% by 2017 compared to 2010.
- https://www.youtube.com/watch?v=DtqSIplGXOA

Evidence of Climate Change

Increased average global temperature	• Global warming
More extreme weather	• Flood, droughts, fire, higher snow fall • More major storms
Melting ice sheets	• Greenland and Antarctica Ice Sheets
Rising sea level	• Caused from melting ice sheets
Ocean Acidification	• Oceans are becoming more acidic

The Earth's average temperature is increasing

- The chart shows the Earth's land-ocean temperature since 1880, compared to the 1951-1980 average temperatures.
- Most of the warming has occurred since the 1960s.
- The 10 warmest years have been in the past 12 years.



Source: climate.nasa.gov

Insured Losses from Extreme Weather Events

Insurance Bureau of Canada has pegged the Fort McMurray fire as the costliest insured natural disaster in Canadian history, with an estimated $3.77 billion.

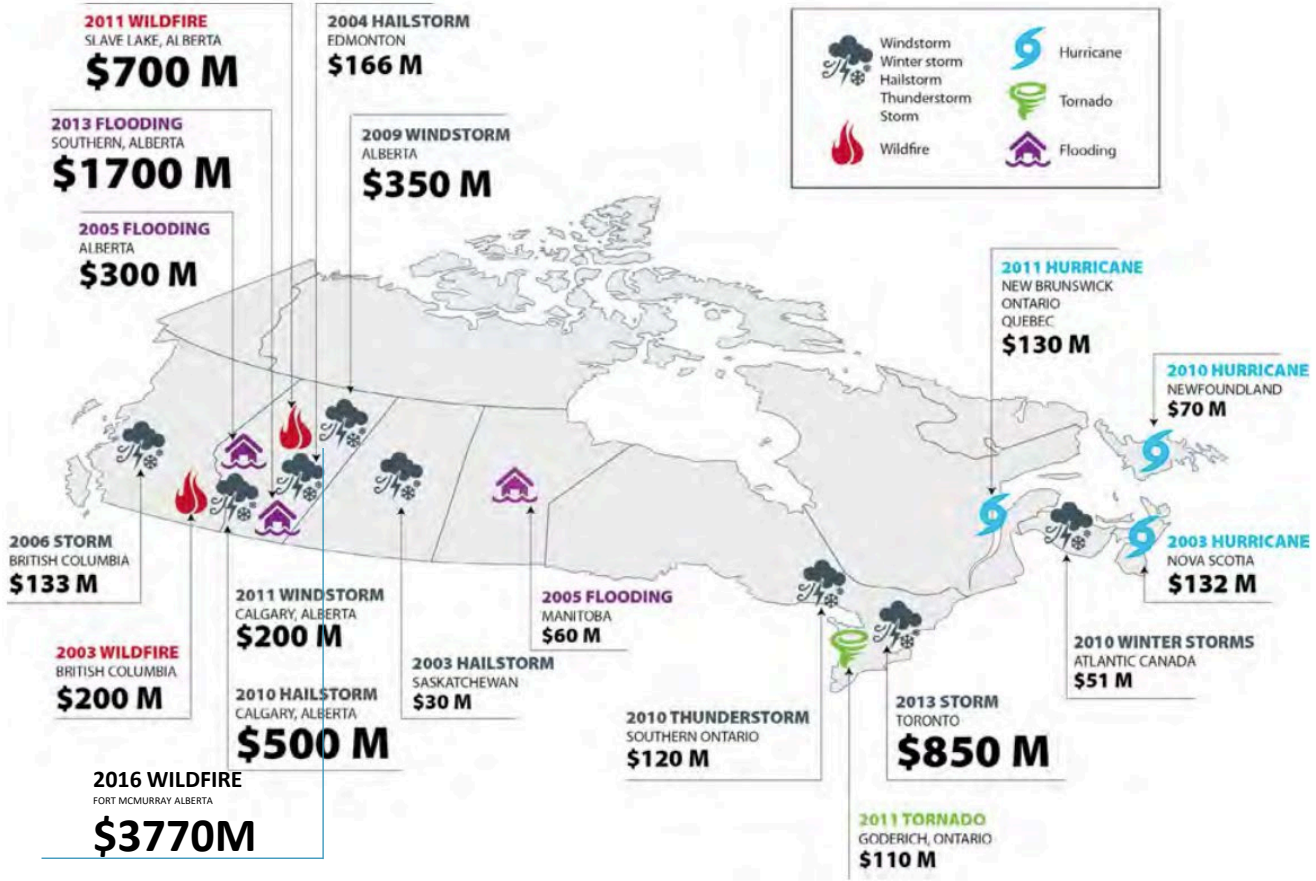


FIGURE 3: Insured losses from extreme weather events in Canada *(Sources: IBC, 2008, 2011b, 2013a, b; McBean, 2012).*

Looking for Evidence: Greenland's Ice Sheets

- NASA's Earth Minute: Greenland Ice Sheets
  - A two minute video about Greenland Ice Sheets.
  - Greenland is warming almost twice as fast as Antartica, which is causing the ice to melt and raise global sea levels. NASA is monitoring this.
- https://www.youtube.com/watch?v=yLm7PSsvW8g

Elephant Foot Glacier, Greenland

Evidence: The oceans are getting more acidic

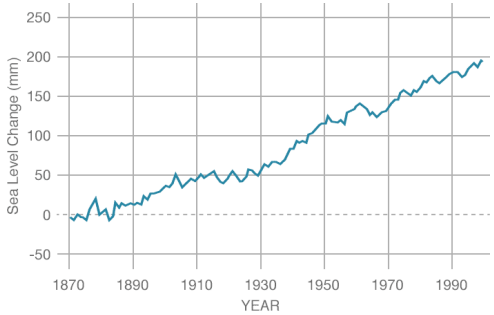
- The oceans absorb carbon dioxide (CO_2) from the air. (About 25% of the CO_2 from the air)
- Problem:
  - This changes the chemistry of the sea water making it more acidic.
  - This impacts corals, and shellfish as they cannot make their shells as a result.
- This is called ocean acidification.

Evidence: Sea Level rise

- Sea level is rising at an increasing rate.
  - Global sea levels have been rising over the past century
  - Rate has increased in the recent decades.
  - In 2014, global sea level was 6.6 centimeters (2.6 inches) above the 1993 average.
  - Sea level continues to rise at a rate of about 0.3 cm (1/8”) per year.

- Two causes
  - Expansion of sea water as the oceans warm from increasing global temperature
  - Melting ice sheets over land which adds water to the ocean.

Risk is to people who live on or within 100 kilometers of a seashore. (39% of the world’s population) (That’s about 2.8 billion people)

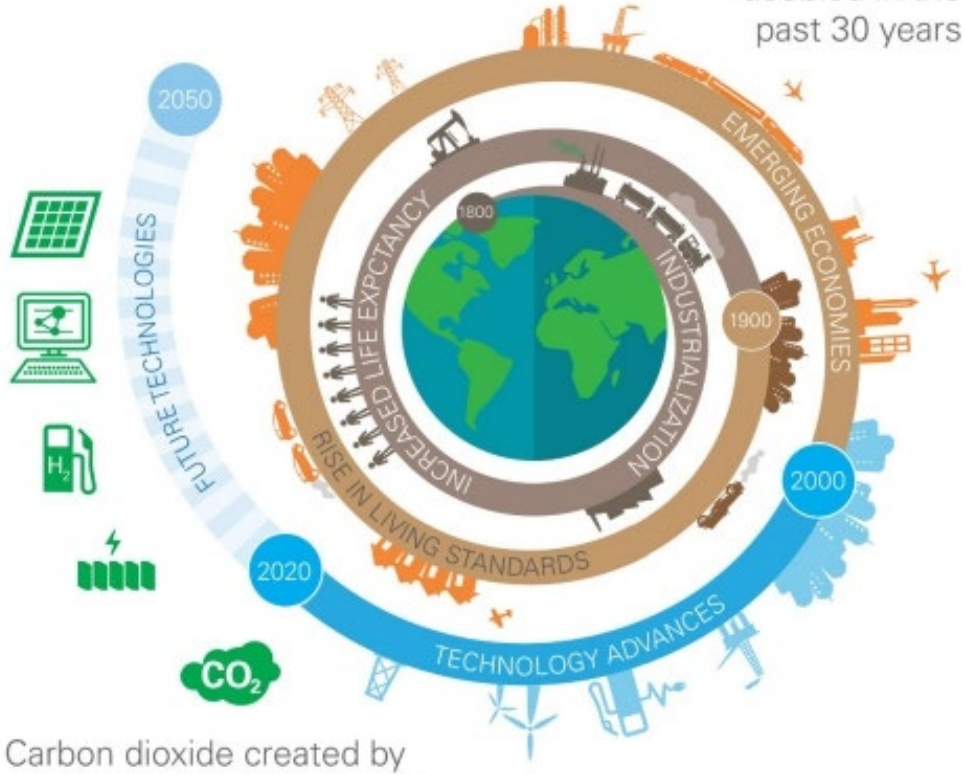


NASA – CSRIO

Rise of Carbon Dioxide Levels over Time

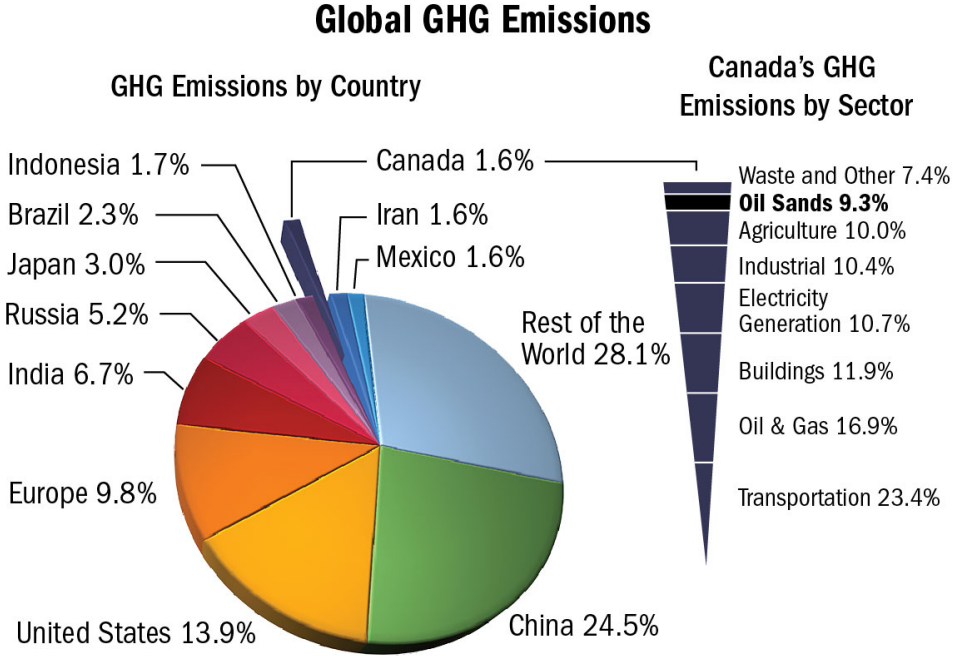
Carbon dioxide is measured in parts per million (or ppm for short). In 2017, the highest level of CO2 was 412 ppm of CO_2 in the atmosphere.

Energy consumption has doubled in the past 30 years



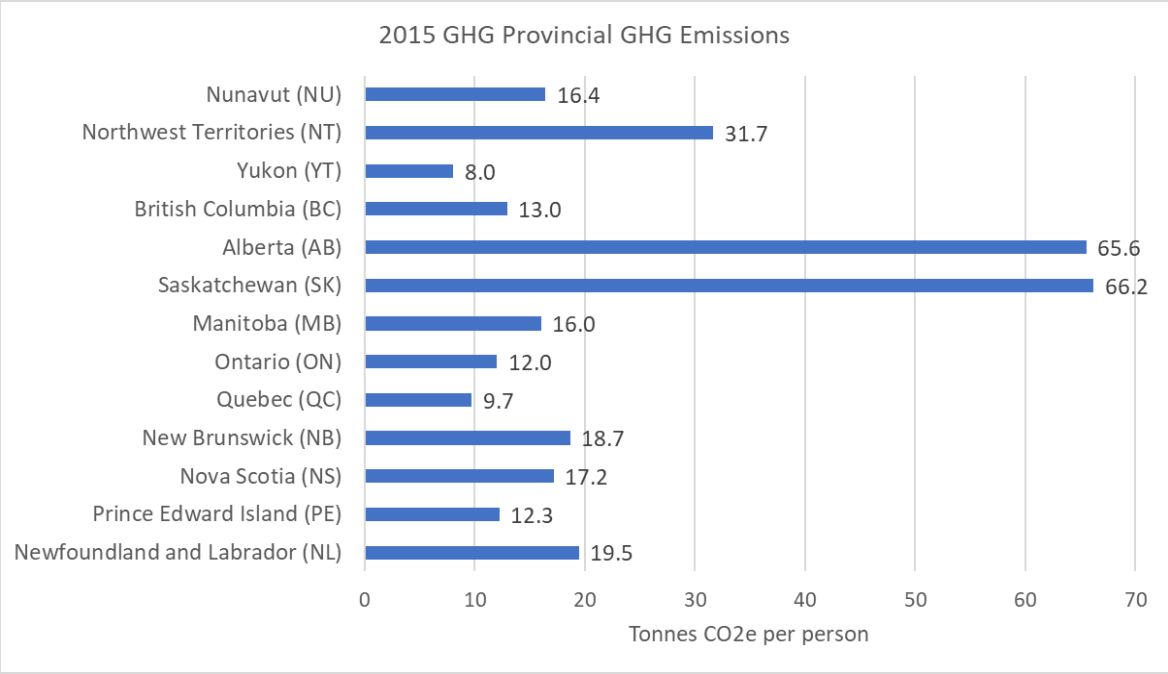
Carbon dioxide created by consuming fossil fuels will continue to be a major issue

Where are all these global greenhouse gas emissions coming from?



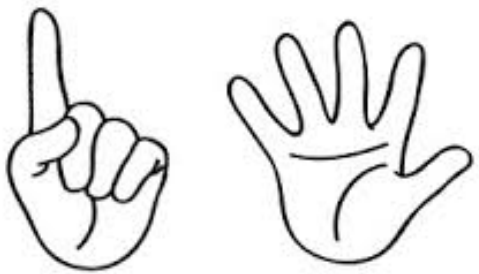
Sources: World Resources Institute 2014, CAIT Climate Date Explorer and Environment Canada, *National Inventory Report 1990-2014 Greenhouse Gas Sources and Sinks in Canada*

Canada's Emissions per Person Per Year



Canada's emission's are 21 tonnes per person in 2015.

World Average Greenhouse Gas Emissions per Person

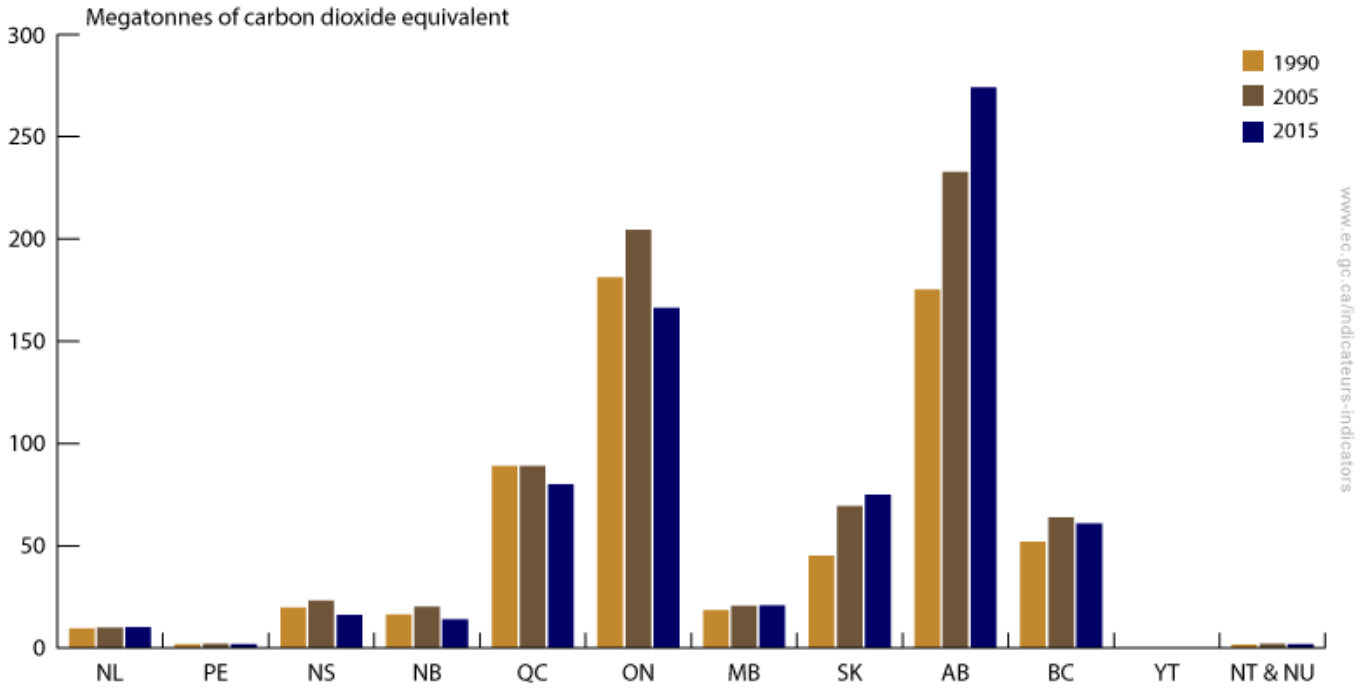


6 Tonnes CO_2 equivalent Per Person Per Year

Reference: 2013 data

Population in 2013 – 7.1 billion

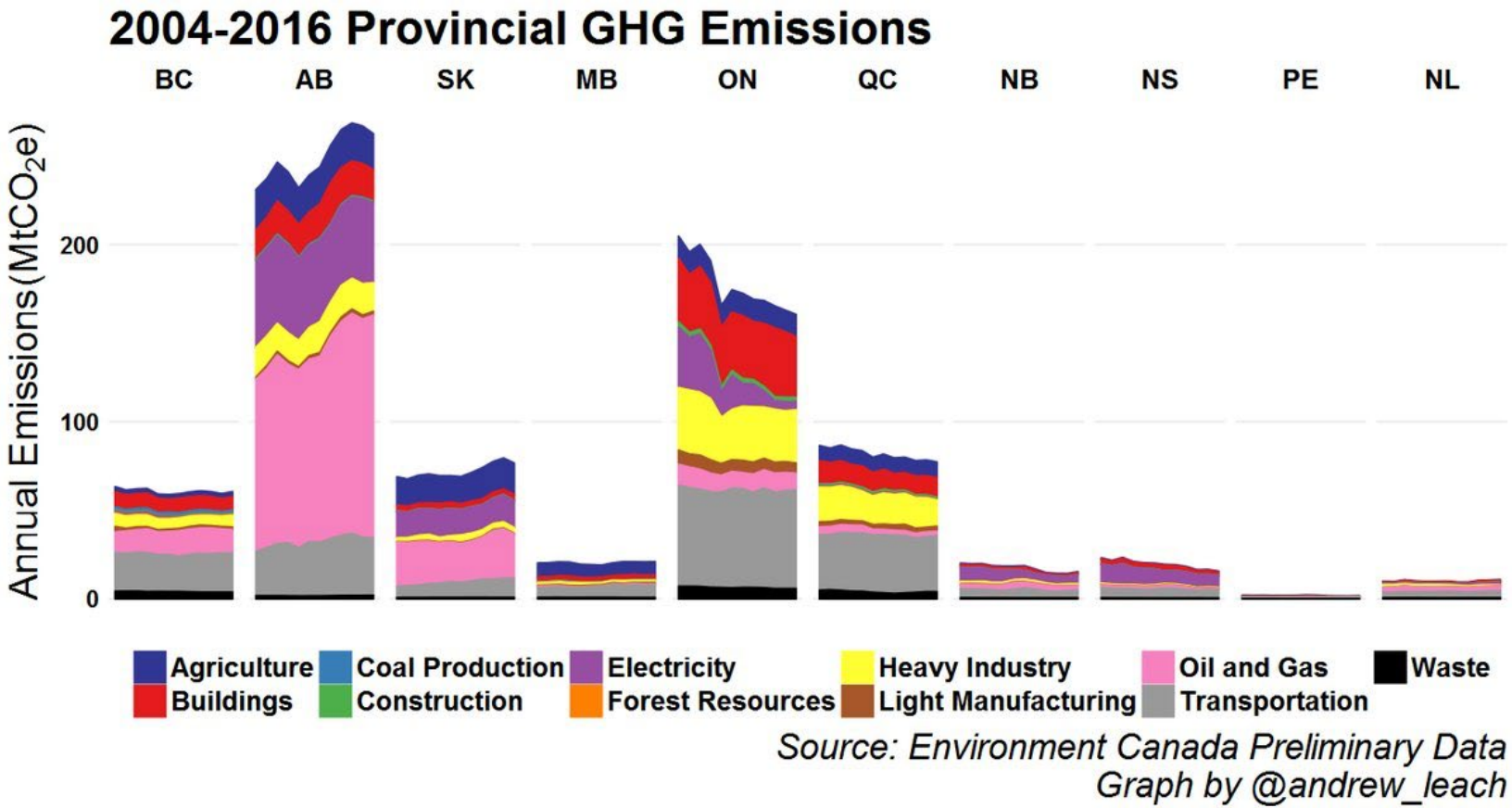
Canada's Greenhouse Gas Emissions (mega tonnes carbon dioxide equivalent) for 1990, 2005 and 2015



Alberta was the highest contributor in 2015, followed by Ontario, Quebec, Saskatchewan and British Columbia; the total from all other provinces and territories contributed less than 70 Mt.

Ontario started off as the highest-emitting province in 1990, but was surpassed by Alberta in 2005 and 2015.

Ref: Environment and Climate Change Canada, Greenhouse Gas Emissions by Province and Territory


2004-2016 Provincial GHG Emissions
BC
AB
SK
MB
ON
QC
NB
NS
PE
NL
Annual Emissions (MtCO2e)
200
100
0
Agriculture
Buildings
Coal Production
Construction
Electricity
Forest Resources
Heavy Industry
Light Manufacturing
Oil and Gas
Transportation
Waste
Source: Environment Canada Preliminary Data
Graph by @andrew_leach

Congress of the Parties 21 – Paris (COP 21)

- In December, 2015 a commitment called the **Paris Agreement** was presented at the United Nations Climate Change Conference.
- The Paris Agreement recognized the **urgency for all countries to do their best** to mitigate climate change.
- **Canada agreed** to sign on to this obligation.
- 146 countries signed
- One (1) did not - USA

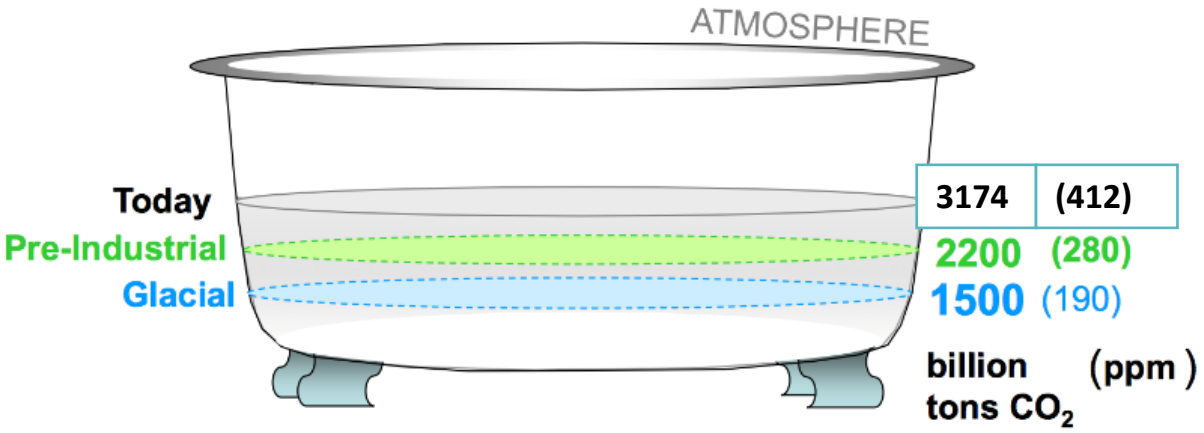
Let's stay well below 2 degrees C

And try to limit the increase 1.5 degrees C

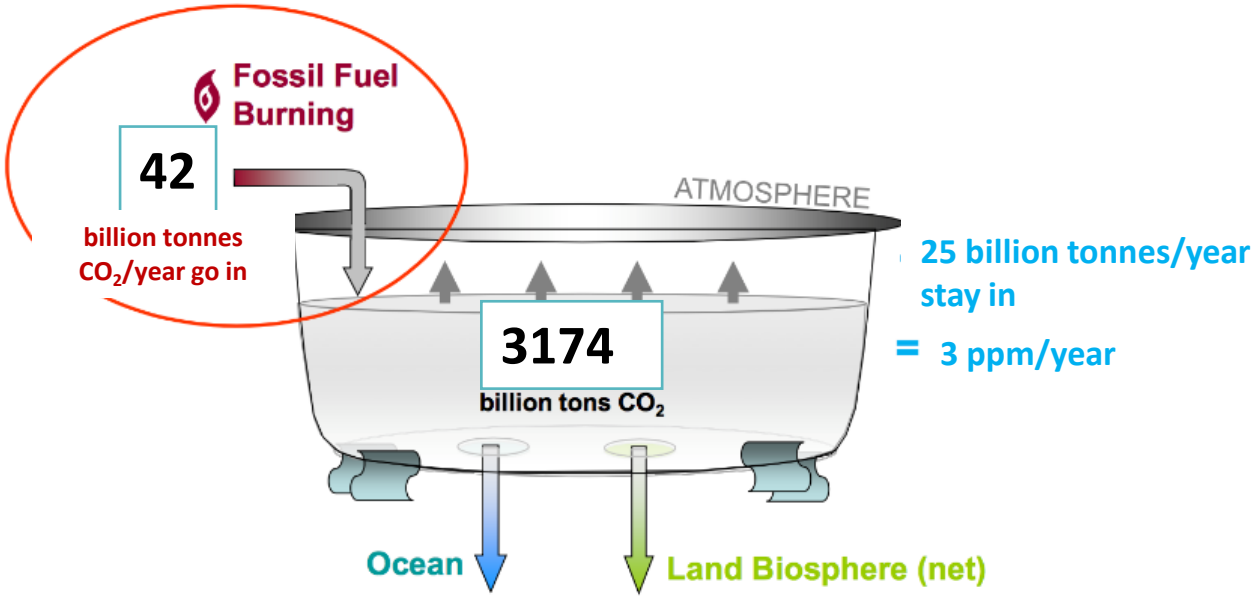
UNFCC COP 21
PARIS AGREEMENT

Climate Solutions Simulator

Our atmosphere is like a bathtub



Sources and sinks of CO_2



2013 data

POPCORN ACTIVITY

Objective: *Teachers and students will develop an understanding of global carbon emissions and sinks; identify climate change as a global issue with a call for local action.*

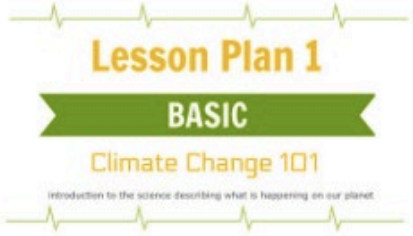
Guiding Question:

How many years will it take to reach a 2 degree Celsius change (490 ppm) at current rates?

Materials and Timeline:

- 1 popcorn kit (on loan from PEEL)
- 1 lesson plan (available for download at www.teachpeel.ca)
- 13 participants
- 2 x 40 minutes (slide deck, set-up, activity, debrief)

- https://www.youtube.com/watch?v=zm8wvpB6q84&feature=youtu.be



Intended for all students who are not familiar with or need a refresher on the topic of climate change.

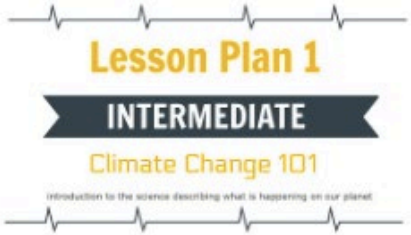
LESSON 1 - BASIC PLANS HERE

www.teachpeel.ca

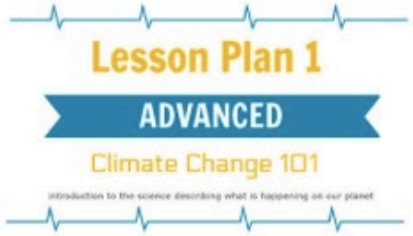
Order popcorn activity kit HERE

Includes all BASIC content + additional activity options for students with greater familiarity or more time to focus on the topic.

LESSON 1 - INTERMEDIATE PLANS HERE



Leveled Activities



Includes all INTERMEDIATE content + advanced activity options. Recommended for advanced junior high or high school students.

LESSON 1 - ADVANCED PLANS HERE

Action Begets Hope

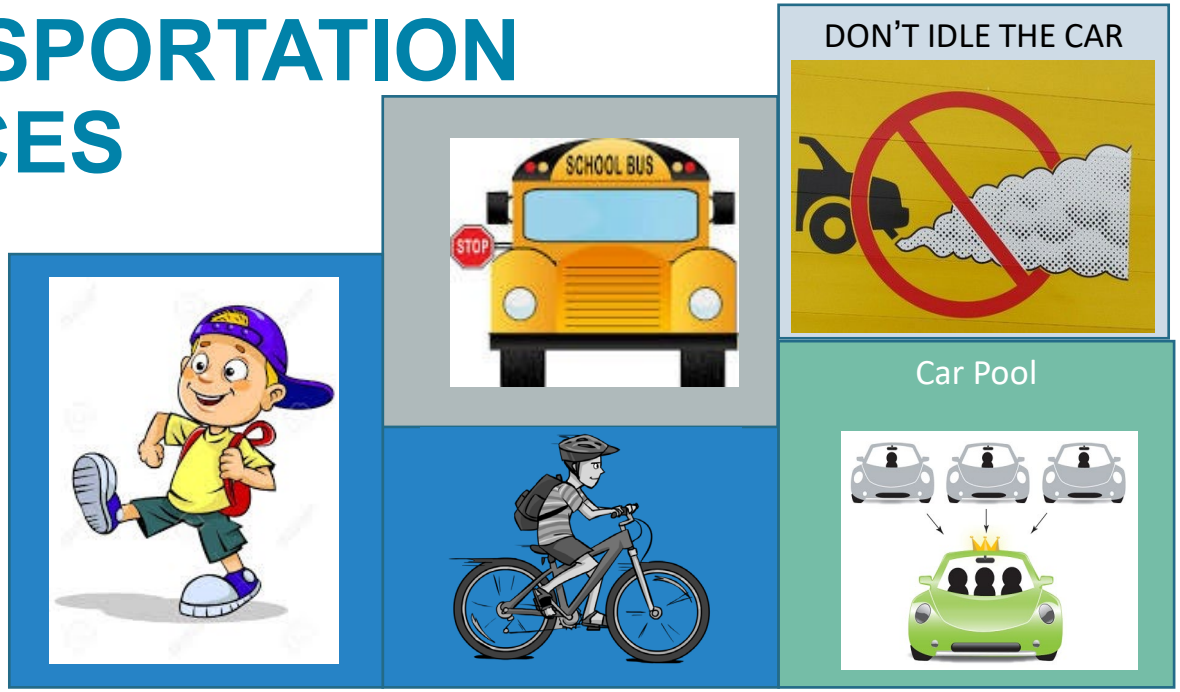
“The one thing we need more than hope is action. Once we start to act, hope is everywhere. So instead of looking for hope, look for action. Then, and only then, hope will come.”

Greta Thunberg

16-year-old


Make
1
Change...
what will you do?!
I will
teach
others
- Ms. McGARRIGLE
I will start
writing my MLA
about environmental
concerns I have.

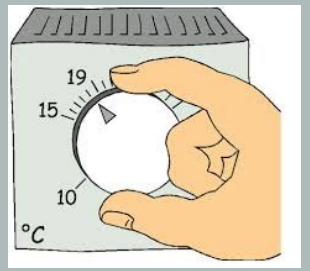
TRANSPORTATION CHOICES



HEATING CHOICES

Wear a sweater and slippers at home

Turn down the thermostat



ELECTRICITY CHOICES

Turn off the lights

Play outside more often!

WASTE CHOICES

Don't Waste Water

Don't Waste Food

RECYCLE