

# Climate Change Museum

Generally Eclectic

# Climate Change Museum

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## INTRODUCTION

Museums exist around the world, and cover a diverse range of subjects. In Canada's case, there are national museums of civilization, science and technology, natural history, art gallery, war, and human rights. There are no major museums dedicated to climate change generally, including the specific subject of global warming.

Of all the issues facing the populations of the world today, climate change is the most important. Without a major focus, the future of homo sapiens and other species around the globe will deteriorate dramatically within the next century.

Climate change and global warming are also topics about which populations around the globe are remarkably uninformed. This is particularly true in Canada and the United States.

Based on this, a National Museum of Climate Change and Global Warming is put forward for Canada, and perhaps other countries.

## CONCEPTS

Here are some concepts on which a Canadian National Museum of Climate Change and Global Warming could be based.

1. The Canadian National Museum of Climate Change and Global Warming should be developed with the view that it will be part of a network of climate change and global warming museums that includes national, regional, city and other museums, with a free flow of exhibits, ideas and concepts.
2. The museum should be a museum based on science. As a science museum, it should be based on the following principles:
  - A. It should be based on theories, studies, and similar sources from peer reviewed respected academic journals or equivalents.
  - B. It should address not only our current understandings but also how these understandings were derived.
3. It should focus on the global warming aspect of climate science. The focus should be on the radiative balance and related issues, so that the key causes of global warming do not get lost in the details of climate science.
4. It should not be a "political" museum. This will protect the museum in the long term from political debates, changes in governing parties, and public controversies. Specifically, this means:
  - A. Discussion of international and national emission targets should not be addressed. These targets are inherently political, based on political judgments about what is doable within a time-frame.
  - B. It should not address projected emissions. These are based on assumptions about greenhouse gas emissions going forward, and these assumptions are inherently political (e.g. business as usual, drastic immediate reductions). What happens in the future is a result of political decisions in the present.

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- C. It should not address public policies, policy options, and policy issues, including:
  - a. Mitigation Strategies.
  - b. Economics of climate change.
  - c. Environmental laws.
  - d. Sectoral policies.
  - e. National responsibilities for past emissions.
- D. It should not address the climate change denial industry and deliberate misinformation campaigns, but should draw attention to legitimate scientific differences and debates.
- 5. To be relevant to the location of Canada's national museum, and the locations where other major museums are developed, the museum has to provide relevant regional and local information, while emphasizing the universal character of the science. For example, impacts would be largely regional. Most exhibits would be relevant anywhere in the world or within a country and should be designed that way. Where the science has regional implications, the regional components should be designed so that the regional components are easily shareable with relevant modifications in the specifics.
- 6. Canada's National Museum of Climate Change and Global Warming should be designed for the online world, so that the information can be shared via internet for those not able to travel to the Museum.
- 7. As climate science is continuing to evolve, the Canadian National Museum needs to be designed so that exhibits can be updated regularly and there is room to display new scientific findings.
- 8. While the federal government typically funds Canada's national museums, a National Museum of Climate Change and Global Warming is potentially fundable at least in part by Canadian citizens and corporations through donations and crowd funding. It should be designed to accommodate this funding, provided the funding is not allowed to bias the content.
- 9. Canada's museum managers are experts in developing exhibits and presenting materials in interesting, and often interactive, ways. They should be allowed to demonstrate their skills within a science-based framework.

An example of science-based design is provided below.

| Canadian National Museum of Climate Change and Global Warming |                        |                                                                |
|---------------------------------------------------------------|------------------------|----------------------------------------------------------------|
| Hall A: Earth's Energy Budget                                 | Main Entrance          | Hall G: The Science of Climate Change                          |
| Hall B: Lessons from the Past                                 |                        | Hall F: Getting to Zero Emissions and Beyond: the Technologies |
| Hall C: The Workings of the Climate System                    | Hall D: Climate Models | Hall E: Impacts of Global Warming                              |

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## MAIN ENTRANCE

1. Tickets
2. Directions to relevant halls
3. Shop
4. Washrooms
5. Purpose Statements
6. Concepts/Definitions
  - A. Global Warming: The long-term rise in the average temperature of the Earth's climate system.
  - B. Climate Change: Occurs when changes in Earth's climate system result in new weather patterns that remain in place for an extended period of time.
  - C. Climate System: are made up of Earth's water, ice, atmosphere, rocky crust, and all living things.
  - D. Climate:

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## HALL A: EARTH'S ENERGY BUDGET

**Content Summary:** The earth's climate is a delicate balance between energy in and energy out. Earth's Energy Budget is the accounting for the balance between the energy that Earth receives from the Sun, and the energy the Earth radiates back into outer space after having been distributed throughout Earth's climate system. See Wikipedia's [Earth's Energy Budget](#)

## TOPICS

1. Incoming Radiant Energy
  - A. Sun's Energy Output
  - B. Earth's Orbit and Tilt
2. Earth's Internal Heat and Other Small Effects
  - A. Geothermal Heat Flux
  - B. Human Production of Energy
  - C. Photosynthesis
3. Outgoing Energy
  - A. Atmospheric Composition
    - a. Aerosols
      - I. Pollutants
      - II. Volcanic Dust
    - b. Greenhouse Gases
      - I. Natural via Carbon Cycle
      - II. Human Generated
      - III. Animal Husbandry
  - B. The Albedo (reflectivity) of Surface Properties
    - a. Plate Tectonics and Land Surface Colours
    - b. Water, Ice and Snow
    - c. Human Land Use
  - C. Cloud cover
  - D. Vegetation and Land Use patterns
4. Calculating the Balance

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## HALL B: LESSONS FROM THE PAST

**Content Summary:** The workings of the Earth's Energy Budget can be understood by looking at how it determined Earth's climate history in the distant and recent past. Scientists have devised a number of mechanisms to explore the nature of past climates. A Lessons from the past will help in the understanding of future climates.

## TOPICS

1. Climates Prior to the Industrial Revolutions. For key content, see Wikipedia's [Paleoclimatology](#)
2. Modern Climates

## CLIMATES PRIOR TO THE INDUSTRIAL REVOLUTION: PALEOCLIMATOLOGY

1. Proxy Techniques
  - A. Ice in Glaciers, Ice Caps and Ice Sheets
  - B. Dendroclimatology
  - C. Sedimentary Analysis
  - D. Sclerochronology
  - E. Landscapes and Landforms
2. Timing of Proxies
3. Historic Climates
  - A. Faint Young Sun Paradox (start)
  - B. Huronian Glaciation (~2400 Mya Earth completely covered in ice probably due to Great Oxygenation Event)
  - C. Later Neoproterozoic Snowball Earth (~600 Mya, precursor to the Cambrian Explosion) Andean-Saharan glaciation (~450 Mya)
  - D. Carboniferous Rainforest Collapse (~300 Mya)
  - E. Permian–Triassic Extinction Event (251.4 Mya)
  - F. Oceanic Anoxic Events (~120 Mya, 93 Mya, and others)
  - G. Cretaceous–Paleogene extinction event (66 Mya)
  - H. Paleocene–Eocene Thermal Maximum (Paleocene–Eocene, 55Mya)
  - I. Younger Dryas/The Big Freeze (~11,000 BC)
  - J. Holocene climatic optimum (~7000–3000 BC)
  - K. Extreme Weather Events of 535–536 (535–536 AD)
  - L. Medieval Warm Period (900–1300)
  - M. Little Ice Age (1300–1800)
  - N. Year Without a Summer (1816)
4. Lessons Learned
  - A. Climate change is an ongoing process.
  - B. Humans evolved in a favourable and uncommon climate period.
  - C. Climate change is not always pleasant, illustrated by looking at past climates on the location of the museum.
  - D. Climate change has led to mass extinctions.
  - E. The speed of climate change can be rapid.

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## **MODERN CLIMATES**

1. Detecting Climate Change
  - A. [NOAA Base](#)
  - B. [Air](#)
  - C. [Land](#)
  - D. [Sea](#)
2. Recent Minor Events
  - A. Mount Pinutubo
  - B. Mount St. Helenes
  - C. 9/11 and Airplanes
3. Climate Trends since 1850



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## HALL C: THE WORKINGS OF THE CLIMATE SYSTEM

**Content Summary:** The workings of the Earth's Climate Systems interact with themselves and each other in complex ways, with some workings reinforcing warming processes and others countering them. Historically, these workings have created a cyclical pattern of patterns alternating between warmer and colder. But it is not inevitable that these processes are cyclical. Venus is an example where the warming process got out of control.

## TOPICS

1. Elements
  - A. The Atmosphere: the layer of gases, commonly known as air, that surrounds the Earth and is retained by Earth's gravity. See Wikipedia's [Atmosphere](#).
  - B. The Hydrosphere: The combined mass of water found on, under, and above the surface of a planet earth. See Wikipedia's [Hydrosphere](#)
  - C. The Cryosphere: An all-encompassing term for those portions of Earth's surface where water is in solid form, including sea ice, lake ice, river ice, snow cover, glaciers, ice caps, ice sheets, and frozen ground (which includes permafrost). See Wikipedia's [Cryosphere](#)
  - D. The Lithosphere: the rigid, outermost shell of Earth that is defined by its rigid mechanical properties. See Wikipedia's [Lithosphere](#)
  - E. The Biosphere (living things) See Wikipedia's [Biosphere](#)
2. Flows of Energy and General Circulation
  - A. Energy and General Circulation
  - B. Hydrological Cycle: See Wikipedia's [Water Cycle](#)
  - C. Biochemical Cycles
    - a. Carbon Cycle. See Wikipedia's [Carbon Cycle](#)
    - b. Nitrogen Cycle. See Wikipedia's [Nitrogen Cycle](#)
3. Changes within the Climate System
  - A. Internal Variability
  - B. External Climate Forcing
    - a. Incoming Sunlight
    - b. Greenhouse Gases
    - c. Aerosols and Volcanoes
    - d. Land Use Changes
4. Responses and Feedbacks
5. Tipping Points in the Climate and the Case of Venus: See Wikipedia's [Tipping Points in the Climate System](#) and [The Atmosphere of Venus](#)

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## HALL D: CLIMATE MODELS

**Content Summary:** Modeling attempts to capture relationships among variables in equations in a quantitative way. Models help us understand and predict events. Models are used everywhere in modern society. Climate models help us understand and quantify what is happening, to disentangle what is causing what, and to predict what will happen.

## TOPICS

1. Utility of numerical models in investigating how the climate system works and how it will respond to continued greenhouse gas buildup.
2. How models are constructed
3. Model types: See Wikipedia's [Climate Model](#)
  - A. Quantitative versus qualitative
  - B. Types of quantitative models
    - a. Simple radiant heat transfer models
    - b. Vertically radiative-convective models
    - c. Horizontally radiative-convective models
    - d. Coupled atmosphere–ocean–sea ice global climate models: General circulation models
    - e. Box models for flows across and within ocean basins
    - f. Others
4. Validating climate models
5. Reliability and key factors affecting reliability
6. Uses of models
  - A. Detecting climate change
  - B. Estimating and Interpreting climate sensitivity
    - a. The concept of climate sensitivity
    - b. Identifying the specific forces that caused recent climate change (attribution)
  - C. Predicting the future
    - a. Surface temperature projections
    - b. Projected changes in global precipitation and drought
    - c. Atmospheric and oceanic circulation change
    - d. The melting cryosphere
    - e. Sea level rise projection
    - f. Tropical cyclone and hurricane projection
    - g. Extreme weather projections
7. The importance of both observation and models in understanding the climate system and how they feed off of each other
8. What the models tell us

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## HALL E: IMPACTS OF GLOBAL WARMING

**Content Summary:** Climate change will affect us all, and not necessarily in a positive way. The potential impacts of climate change have been studied extensively. Some impacts are global in scope, while others are regional and local. See Wikipedia's [Effects of Global Warming](#)

## TOPICS

1. Type of Impact
  - A. Sea level rise and coastal impacts
  - B. Disruption of the global food supply
  - C. Unlivable areas
    - a. Heat
    - b. Water supplies
  - D. Ecosystems and biodiversity
  - E. Shifting water and food resources
  - F. Severe storms
  - G. Human health impacts
  - H. Security concerns

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## HALL F: GETTING TO ZERO EMISSIONS (AND BEYOND): THE TECHNOLOGIES

**Content Summary:** Preventing climate change and global warming requires that humans stop adding to the greenhouse gases in the atmosphere, the sooner the better. Getting to zero emissions is essential. Technologies will help. Current national emissions provide a framework for looking at technologies and setting priorities. While getting emissions to zero, nations need to look beyond zero emissions to mechanisms for pulling greenhouse gases from the atmosphere.

### TOPICS

1. Reversing the Damage
  - A. Geo-engineering
2. Reducing Green House Gases by Sector. See Generally Eclectic's [Getting to Zero - The Canadian Case \[PDF\]](#)
  - A. Replacing Fossil Fuel as an Energy Source
    - a. Solar
    - b. Wind
    - c. Tidal
    - d. Thermal
    - e. Hydro
    - f. Hydrogen and Fuel Cells
    - g. Nuclear
    - h. Electrical Grids
  - B. Transportation
    - a. Batteries
    - b. Vehicles and Trucks
    - c. Railroads
    - d. Airplanes
  - C. Industrial Processes
  - D. Buildings
  - E. Agriculture
  - F. Waste

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## HALL G: THE SCIENCE OF CLIMATE CHANGE

**Content Summary:** Climate change science is a new and evolving science.

### TOPICS

1. History of Climate Change Science: See Wikipedia's [History of Climate Change Science](#)
2. Profiles of Climate Change Scientists: See Wikipedia's [History of Climate Change Science](#) and related references.
3. Scientific Concepts: Truth, Differences, etc.