MAJOR REASONS FOR CLIMATE CHANGE:

URBANIZATION AND ENERGY CONSUMPTION

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MAJOR REASONS …

The major reasons for climate change include a mix of natural and, overwhelmingly, human-made (anthropogenic) factors:

1. Burning of Fossil Fuels;
2. Deforestation;
3. Industrial Activity;
4. Agriculture & Livestock;
5. Transportation;
6. Waste and Garbage;
7. Plastics;
8. Urbanization and Energy Consumption; and
9. Industrial Chemicals.

- **URBANIZATION AND ENERGY CONSUMPTION …**
  - Urbanization refers to the increasing number of people living in urban areas; and
  - While it can promote economic development, it has several environmental consequences:

LAND USE CHANGE AND HEAT ISLANDS …

- Deforestation and land clearing for cities reduce carbon sinks (like forests), increasing CO_2 in the atmosphere; and
- Urban areas absorb and retain more heat due to concrete and asphalt, creating urban heat islands, which raise local temperatures.

- **INCREASED RESOURCE DEMAND …**
  - Urban populations require more housing, transportation, water, and goods, leading to greater energy consumption and emissions; and
  - Construction and infrastructure development contribute to high GHG emissions (especially from cement and steel production).

- # TRANSPORTATION EMISSIONS …
  - Dense cities often experience traffic congestion, leading to higher fossil fuel combustion and vehicle emissions, especially where public transit is limited.

FOSSIL FUELS USE …

- Energy consumption is directly linked to the release of greenhouse gases (GHGs), particularly when derived from fossil fuels like coal, oil, and natural gas;
- Burning fossil fuels for electricity, heating, and transportation is the largest source of global CO_2 emissions; and
- Power generation remains heavily reliant on coal and gas in many parts of the world.

INDUSTRIAL & RESIDENTIAL USE …

- Urban industries and households require large amounts of energy for heating, cooling, and appliances; and
- The higher the standard of living, the greater the per capita energy use, especially in developed urban regions.

- # RENEWABLE ENERGY INTEGRATION …
  - Urban areas also have potential to lead in renewable energy adoption (e.g., solar panels, energy-efficient buildings), though implementation varies.

- **REDUCE THE IMPACT …**
  - **Urban Planning Solutions:**
    - Promote public transportation, walkable cities, and mixed-use development; and
    - Expand green spaces and urban forests to offset emissions and cool cities.
  - **Energy Transition:**
    - Shift to renewable energy sources (solar, wind, hydro).
    - Improve energy efficiency in buildings and appliances; and
    - Support smart grids and energy storage technologies.

- **POLICY AND GOVERNANCE …**
  - Enforce emissions regulations and green building codes; and
  - Invest in sustainable infrastructure and climate-resilient urban design.

- # EXAMPLES

- **BEIJING, CHINA …**
  - **Issue:** Rapid urbanization and industrialization led to severe air pollution and high carbon emissions;
  - **Impact:** The city experiences extreme urban heat island effects and frequent smog; and
  - **Response:** China launched programs like "Green Cities" and invested in electric public transport and afforestation.

- **LAGOS NIGERIA …**
  - **Issue:** One of the fastest-growing cities globally, but with poor infrastructure;
  - **Impact:** Uncontrolled urban sprawl leads to deforestation, flooding (due to poor drainage), and rising emissions; and
  - **Response:** The city is attempting to build climate-resilient infrastructure, but implementation is slow due to funding and planning challenges.

- **LOS ANGELS, USA …**
  - **Issue:** High levels of car ownership and urban sprawl;
  - **Impact:** Major contributor to transportation-related GHG emissions and significant heat island effect; and
  - **Response:** Efforts to expand public transportation, implement cool roofs, and encourage urban greening.

- # INDIA'S POWER SECTOR …
  - **Issue:** Heavy dependence on coal-fired power plants;
  - **Impact:** India is among the top global emitters of CO_2, with significant contributions from energy production; and
  - **Response:** The government has set ambitious targets to reach 50 percent renewable energy capacity by 2030.

- **DUBAI, UAE …**
  - **Issue:** High energy demand for air conditioning due to extreme desert heat;
  - **Impact:** Significant carbon footprint per capita, with high reliance on fossil fuels; and
  - **Response:** Investment in large-scale solar farms (e.g., Mohammed bin Rashid Al Maktoum Solar Park) and energy-efficient building regulations.

- **GERMANY …**
  - Issue: Historically an industrial energy consumer;
  - Impact: High emissions until recent decades; and
  - Response: Launched Energiewende (Energy Transition), which significantly increased the share of wind and solar energy, and reduced emissions from coal.

- **JAKARTA, INDONESIA…**
  - **Urbanization Impact:** Rapid growth, sinking land, and unplanned development have led to massive flooding and deforestation;
  - **Energy Consumption:** Electricity mostly from coal; high emissions per urban area;
  - **Climate Impact:** Sea level rise threatens the city; Jakarta is relocating its capital to reduce risk; and
  - **Response:** Renewable energy projects and new urban planning in the planned capital, Nusantara.

CANADA

URBANIZATION AND ENERGY CONSUMPTION …

- The impact of urbanization and energy consumption on climate change in Canada is profound and growing; and
- As more Canadians live in cities and consume energy for housing, transportation, and services, urban areas have become key contributors to greenhouse gas (GHG) emissions, intensifying climate change.

URBANIZATION AND ENERGY IN CANADA …

- Over 82 percent of Canadians live in urban areas (as of 2024);
- Cities consume over 60 percent of the country's energy and are responsible for more than half of national GHG emissions;
- Urban growth leads to:
  - Increased demand for electricity, heating, and transportation;
  - Expansion of urban sprawl, causing deforestation and land-use change; and
  - Greater use of cement, steel, and glass, all energy-intensive materials.

REGION-SPECIFIC IMPACTS

1. WESTERN CANADA …

- **ALBERTA:**
- High urban emissions due to coal and natural gas power generation (though coal is being phased out);
- Urban growth tied to oil and gas industries → large homes, high car dependency; and
- Cold winters increase demand for fossil fuel-based heating.

1. WESTERN CANADA …

- **BRITISH COLUMBIA:**
  - One of the most sustainable urban centers, but emissions are rising;
  - Most electricity is clean (hydropower), but natural gas is widely used for heating; and
  - High housing density in Vancouver helps reduce per capita emissions, but suburban growth challenges that.

2. CENTRAL CANADA …

- **ONTARIO:**
- High urban sprawl around Toronto → more cars, long commutes, heat islands;
- Most buildings rely on natural gas for heating, contributing to winter emissions;
- Transit use is high in core areas but low in outer suburbs; and
- Some clean energy (nuclear, hydro) helps offset electricity emissions.

2. CENTRAL CANADA …

- **QUEBEC:**
- Urban energy use mostly powered by hydroelectricity (low GHG);
- Heating systems still often use oil or natural gas in older buildings; and
- Efficient public transport systems help reduce per capita emissions.

3. NORTHERN CANADA …

- Urban areas rely heavily on diesel generators and imported fuels for electricity and heating;
- Shorter building season → limited retrofitting and construction improvements; and
- Warming climate is degrading infrastructure built on permafrost.

4. ATLANTIC CANADA …

- Older building stock with poor energy efficiency;
- Urban sprawl limited by geography, but heating oil and propane use is still common; and
- Low-density cities and towns make public transit less viable.

CLIMATE CHANGE IMPACTS OF URBANIZATION …

- **Urban Heat Islands:** Paved surfaces and buildings retain heat, increasing local temperatures;
- **Air Pollution:** Smog from vehicle and heating emissions contributes to health and environmental issues;
- **Flooding:** Urban expansion reduces green space and absorbent surfaces, worsening stormwater runoff; and
- **Infrastructure Strain:** Energy demand spikes during heat waves and cold snaps.

KEY CHALLNGES …

- **Energy Inefficiency:** Many Canadian buildings are poorly insulated and outdated;
- **Fossil Fuel Dependence:** Natural gas is still the dominant heating fuel;
- **Suburbanization:** Low-density sprawl increases car use and infrastructure emissions; and
- **Grid Carbon Intensity:** Varies by region – clean in BC and Quebec, dirtier in Alberta and Saskatchewan.

QUESTIONS & ANSWERS