A

PROJECT REPORT

ON

CLIMATE CHANGES

SUBMITTED TO

DEPARTMENT OF CHEMISTRY

GOVERNMENT DEGREE COLLEGE TEKKALI

2024-25

SUBMITTED BY

P. SRAVANI, II Major Chemistry

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UNDER THE GUIDENCE OF

Sri V. Luke Paul, Lecturer in Chemistry

DEPARTMENT OF CHEMISTRY

GOVERNMENT DEGREE COLLEGE, TEKKALI

SRIKAKULAM DT. ANDHRA PRADESH

GOVERNMENT DEGREE COLLEGE, TEKKALI

Re-Accredited with NAAC "B" Grade

Affiliated to Dr.B.R.Ambedkar University, Srikakulam

Certificate

Certified with

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have successfully completed the project on the topic "Climate Changes" under my supervision in a satisfactory manner for the partial fulfilment of B.Sc. II Year Degree for the academic year 2024-25.

Date: 24/01/2025

Project Guide

Department In-charge

DECLARATION

We the undersigned students of B.Sc (II) Major Chemistry hereby declare that, the project work we are submitting is our original work.

Name of the student	*Signature*
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M. DHANA LAKSHMI, II Major Chemistry	M. Dhana Laxmi
P. ESWAR, II Major Chemistry	P. ESWAR

Date:

Place: Tekkali

Acknowledgement

It gives a great pleasure to express deep sense of gratitude to our project guide Sri V.Luke Paul, Lecturer in Chemistry, Department of Chemistry, Government Degree College, Tekkali.

We are sincerely thankful to our Principal Dr.T.Govindamma and Department In-charge Dr.B.Sateesh Kumar.

We are very much thankful to our teaching and non-teaching staff for their help in doing the project.

Finally we thank to all those who directly and indirectly rendered their kind cooperation and encouragement for completion of this project successfully.

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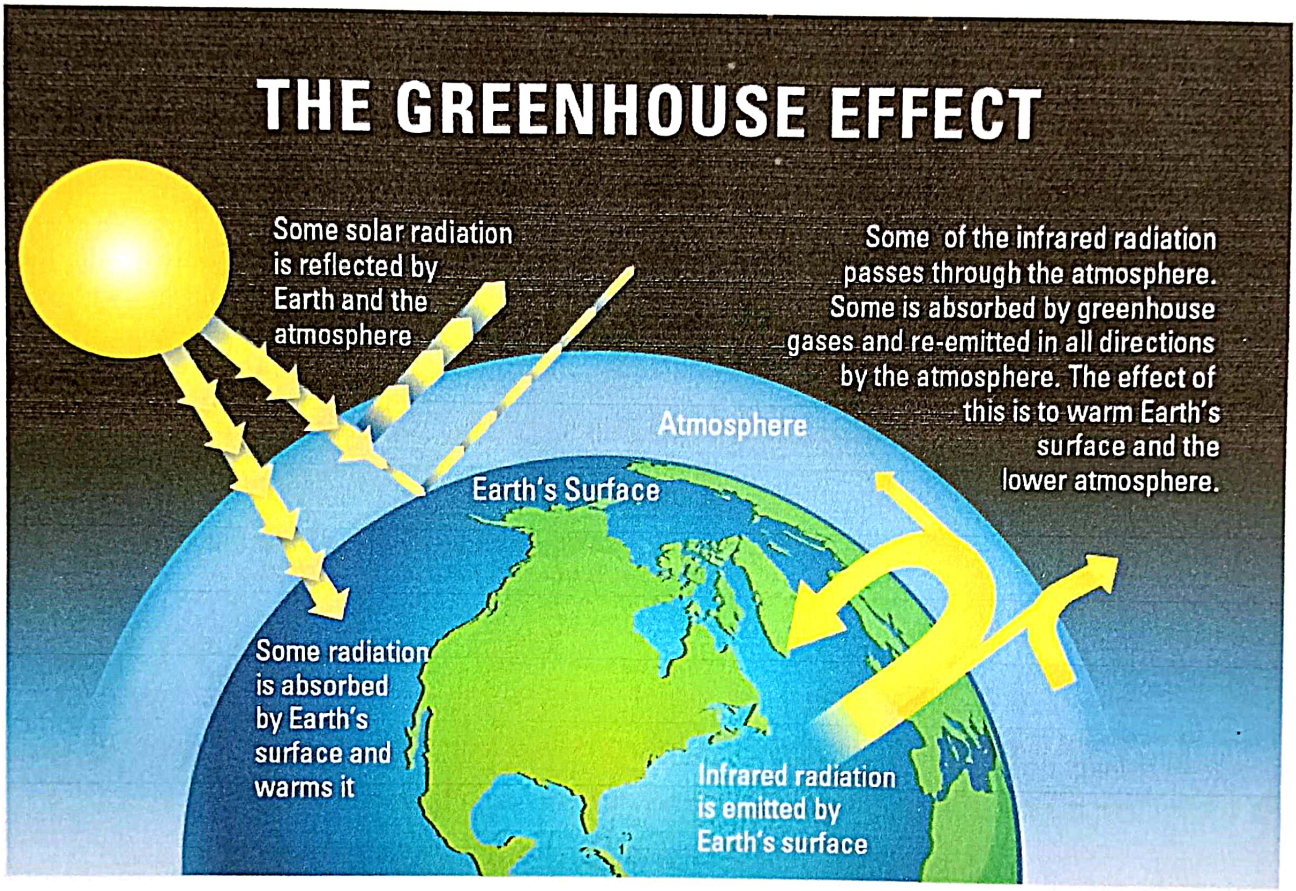
Greenhouse gases (GHGs) are gases in Earth's atmosphere that trap heat. They let sunlight in but prevent some of the heat that the sunlight brings from leaving the atmosphere. This "greenhouse effect" helps keep Earth warm enough to support life—but an excess of these gases leads to **global warming and climate change**.



Ref: https://royalsociety.org/news-resources/projects/climate-change-evidence-causes/basics-of-climate-change/

Major Greenhouse Gases

1. **Carbon Dioxide (CO_2)**
   - **Source**: Burning fossil fuels (coal, oil, gas), deforestation, and cement production
   - **Lifespan in atmosphere**: Up to 1,000 years
   - **Main contributor to human-caused climate change**
2. **Methane (CH_4)**

- **Source**: Agriculture (especially livestock), landfills, natural gas leaks
- **Lifespan**: ~12 years
- **More potent than CO_2 (about 25x stronger per molecule over 100 years)**

3. **Nitrous Oxide (N_2O)**
   - **Source**: Fertilizers, industrial processes, burning of biomass
   - **Lifespan**: ~114 years
   - **Around 300x more potent than CO_2**
4. **Fluorinated Gases** (e.g., HFCs, PFCs, SF_6)
   - **Source**: Industrial activities (coolants, solvents, manufacturing)
   - **Lifespan**: Can range from a few years to thousands
   - **Most potent GHGs, but present in small quantities**
5. **Water Vapor (H_2O)**
   - **Source**: Naturally occurring; influenced by temperature
   - **Lifespan**: Days
   - **Amplifies warming through feedback loops**

Why Greenhouse Gases Matter

- **Climate change**: GHGs trap more heat, raising global temperatures.
- **Extreme weather**: Linked to more heatwaves, droughts, floods, and hurricanes.
- **Rising sea levels**: Due to melting glaciers and thermal expansion.
- **Ecosystem disruption**: Affects food supply, wildlife, and human health.

Rising Greenhouse Gas Concentrations Since the Industrial Revolution

Since the Industrial Revolution, the atmospheric concentrations of key greenhouse gases—**carbon dioxide (CO_2)**, **methane (CH_4)**, and **nitrous oxide (N_2O)**—have increased significantly due to human activities.

- **Carbon dioxide (CO_2)** levels have risen from **316 parts per million (ppm)** in 1959—the first full year of data from the Mauna Loa Observatory in Hawaii—to over **411 ppm** in 2019. Similar trends have been recorded at monitoring stations around the world.

- Since **preindustrial times**, CO_2 concentrations have increased by more than **40%**, with **over half** of that increase occurring **since 1970**.
- **Methane (CH_4)** levels have risen by more than **150%**, and **nitrous oxide (N_2O)** levels by about **20%** over the same period.

All three gases contribute to global warming, but **carbon dioxide plays the largest role** due to its abundance and long atmospheric lifespan.

What We Know from the IPCC Reports

Human-Caused Climate Change Is Undeniable

- It is **unequivocal** that **human activities** have warmed the atmosphere, ocean, and land.
- **Widespread and rapid changes** have occurred across Earth's climate system—including the atmosphere, oceans, cryosphere (frozen regions), and biosphere (living ecosystems).
- Many aspects of the current climate are **unprecedented** in hundreds to thousands of years.

Climate Change and Vulnerability

- **Approximately 3.3 to 3.6 billion people** live in regions that are **highly vulnerable** to climate change.
- **Vulnerability varies greatly** within and between regions, depending on social, economic, and environmental factors.

Risks of Surpassing 1.5°C of Warming

- If global warming **exceeds 1.5°C**, even temporarily, **severe and irreversible risks** to both human and natural systems are likely to increase.
- The **IPCC Special Report on Global Warming of 1.5°C** (2018) found that:
    - **Limiting warming to 1.5°C**, compared to 2°C, would **greatly reduce risks** to health, livelihoods, ecosystems, and infrastructure.

- For example:
  - **Sea level rise by 2100** would be **~10 cm lower** at 1.5°C than at 2°C.
  - The **Arctic Ocean** might be ice-free **once per century** at 1.5°C, versus **once per decade** at 2°C.
  - **Coral reefs** would decline by **70–90%** at 1.5°C, but **over 99% would disappear** at 2°C.

What Limiting Warming to 1.5°C Requires

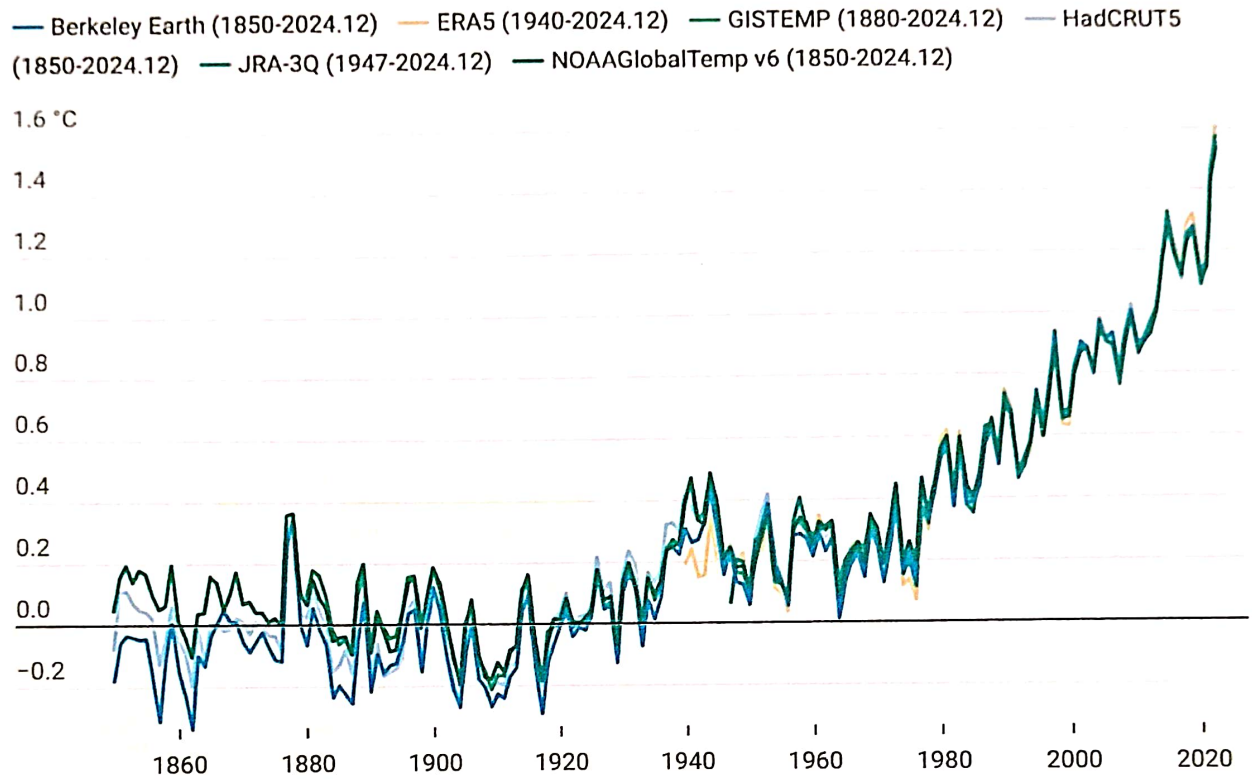
- Deep and urgent cuts in **carbon dioxide (CO_2) emissions**:
  - **45% reduction by 2030** (from 2010 levels)
  - Achieving **net zero emissions by 2050**
- "**Rapid and far-reaching transitions**" across all sectors:
  - **Energy, land use, industry, buildings, transport**, and **cities**
- Achieving these changes can also promote a **more sustainable and equitable society.**

Ref: https://www.un.org/en/global-issues/climate-change

2024 was a landmark year in climate change, likely becoming the first calendar year to exceed 1.5°C above pre-industrial levels. Global mean near-surface temperature reached 1.55 ± 0.13 °C above the 1850-1900 average, making it the warmest year on record. This warming is driven by increasing greenhouse gas levels and is contributing to extreme weather events and accelerating ice loss and sea-level rise.

Global mean temperature 1850-2024

Difference from 1850-1900 average



Annual global mean temperature anomalies relative to a pre-industrial (1850–1900) baseline shown from 1850 to 2024

Chart: WMO • Created with Datawrapper

- **Global Temperature:**

  2024 was the warmest year in the 175-year observational record, surpassing the previous record set in 2023. The global average surface temperature was 2.32 Fahrenheit (1.29 degrees Celsius) above the 20th-century average.

- **Greenhouse Gases:**

  The year saw a continued increase in greenhouse gas concentrations, with CO2 concentrations higher than at any time in at least 2 million years.

- **Extreme Weather:**

The year was marked by extreme heatwaves, droughts, and other severe weather events, highlighting the impacts of climate change on various regions.

- **Sea Level Rise:**

  Global mean sea level reached a record high in the satellite record (from 1993 to present).

- **Ocean Warming:**

  The ocean continues to absorb a significant portion of the Earth's excess heat, leading to record-high ocean temperatures.

- **Ice Loss:**

  Glaciers continue to lose mass at an accelerating rate, and sea level rise is also accelerating.

- **Climate Tipping Points:**

  There's increasing concern about the potential for climate tipping points, such as the disintegration of ice sheets and the weakening of ocean currents, which could lead to catastrophic impacts.

What Can Be Done?

- **Reduce fossil fuel use** (renewable energy, electric vehicles)
- **Improve energy efficiency**
- **Protect and plant forests**
- **Change agricultural practices**
- **Limit industrial emissions**
- **Support climate policies and innovation**